1938.

QUEENSLAND.

THIRTY-EIGHTH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS.

REPORT OF THE DIRECTOR

TO

THE HON. THE SECRETARY FOR AGRICULTURE AND STOCK

(*As required by "The Sugar Experiment Stations Acts*, 1900 *to* 1934").

PRESENTED TO PARLIAMENT BY COMMAND.

BRISBANE:
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THIRTY-EIGHTH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS.

Director's Report.

TO THE HONOURABLE THE SECRETARY FOR AGRICULTURE AND STOCK.

SIR,—I have the honour to submit the Thirty-eighth Annual Report of The Bureau of Sugar Experiment Stations, covering the period 1st July, 1937, to 30th June, 1938.

H. W. Kerr.

Director.

Brisbane, 12th September, 1938.

General.

Growing conditions for the 1938 crop could not be classed, generally, as better than average. Following beneficial winter rains in 1937, soil moisture conditions were favourable for germination of the young crop, but there followed a dry early spring season in all districts. Drought conditions were broken by useful storms in the southern areas during October, but it was not until November-December that precipitations gave an impetus to the crop in the central and northern districts. Good summer rains promoted a continuance of crop growth generally, but a further dry spell in late summer brought about a further growth check, which substantially spoiled early crop prospects, and made it appear that a low harvest would eventuate.

However, unusually favourable rains, accompanied by mild temperatures, followed in the autumn and winter months in all areas except Cairns-Mossman; and prolonged late growth has appreciably improved prospects for cane tonnages of the standard of those harvested in 1936 and 1937.

At the present time it would appear that the crops of Southern Queensland will constitute all-time records in many mill areas. The proportion of the crop which will be harvested in these parts is, however, doubtful; growers in the southern districts now cultivate canes which will standover successfully, and in this way excess production in one year may be employed to supplement the effects of a poor succeeding season, and peak crops may thus be assured from year to year.

Report of Director—continued.

Crop Yield, 1937—Crop Estimate, 1938.

The following table shows the individual mill crushings for the 1937 season, and the estimated crops to be treated during the 1938 harvest :—

1937 Crushing.	Mill.	1938 Estimate.
Tons.		Tons.
149,915	Mossman	104,747
287,445	Hambledon	223,000
305,740	Mulgrave	262,000
257,228	Babinda	243,000
196,463	Goondi	193,000
273,744	South Johnstone	262,977
192,361	Mourilyan	183,000
293,615	Tully	299,297
312,036	Victoria	275,000
255,754	Macknade	266,000
111,561	Invicta	101,260
206,227	Pioneer	199,530
254,650	Kalamia	233,000
259,711	Inkerman	269,000
167,178	Proserpine	170,000
73,180	Cattle Creek	77,353
161,887	Racecourse	170,000
139,406	Farleigh	153,000
87,654	North Eton	88,000
151,392	Marian	160,000
181,117	Pleystowe	181,400
167,450	Plane Creek	185,000
44,622	Qunaba	85,000
112,935	Millaquin	180,000
142,646	Bingera	206,000
120,495	Fairymead	177,653
20,968	Gin Gin	45,000
79,599	Isis	240,000
26,639	Maryborough	29,000
19,233	Mount Bauple	45,000
66,113	Moreton	135,000
13,495	Rocky Point	18,000
475	Eagleby	2,500
5,132,934	Total ..	**5,462,717**

Report of Director—continued.

Estimates of Sugar Yield, 1938 Crop.

The preliminary estimate of the cane crop which will be available for harvest in Queensland during the 1938 season is 5,462,717 tons. Of this quantity, it is probable that a substantial tonnage will be allowed to stand over, especially in the southern cane areas, and it is forecast that some 5,218,317 tons will actually be crushed. In view of the late cane growth in most areas, it is probable that the sugar content of the crop will be somewhat below normal; allowing 7 tons of cane to make 1 ton of sugar, the anticipated yield of 94 n.t. sugar is 745,474 tons.

The estimated yield from the three New South Wales mill areas is 337,240 tons of cane, or about 42,000 tons of sugar, giving a total Australian production of approximately 790,000 tons.

STATISTICS OF THE 1937 CROP.

The yield of raw sugar in Queensland for the 1937 crop was *763,325 tons of 94 n.t. This is an all-time record, exceeding that of the previous record of 1936 (744,648 tons) by some 18,677 tons.

The following table shows the geographical distribution of the crop for the past five seasons, as between "northern" and "southern" cane districts:—

Sugar Production, 1933-37.

District.	1933.	1934.	1935.	1936.	1937.
	Tons.	Tons.	Tons.	Tons.	Tons.
North of Townsville	311,825	233,457	258,958	333,615	373,692
South of Townsville	326,909	379,113	351,368	410,646	389,633
Total	638,734	612,570	610,326	744,261	763,325

The tonnage produced in the areas north of Townsville exceeded the previous record yield of 1936, but the production in the southern districts was a reduction on the 1936 values, due to droughty conditions in the areas from Bundaberg south.

Area Harvested and Acreage Yields.

The total area harvested in 1937 was 249,683 acres. The acreages under plant, ratoon, and standover cane were as follows:—

	Acres.
Plant Cane	95,275
Ratoon Cane	140,600
Standover Cane	13,808
Total	249,683

This represents an increase of 4,531 acres over the area harvested in 1936.

The yield of cane per acre crushed was 20·56 tons, while the average sugar yield was 3·06 tons per acre. While the cane yield is slightly below that of 1936, the yield of sugar per acre is a record figure.

* This is in excess of the figure quoted on page 6, as it includes "farmers' sugar" in addition to that acquired by the Board.

Report of Director—continued.

The following were the yields of cane and sugar per acre in the respective sugar districts:—

Acreage Yields by Districts.

District.	Tons Cane per acre.	Tons 94 n.t. Sugar per acre.
Mossman–Ingham	24·85	3·68
Lower Burdekin	29·59	4·64
Proserpine	15·68	2·42
Mackay–St. Lawrence	14·16	2·18
Bundaberg-Gin Gin	16·41	2·16
Maryborough–Childers-Gympie	12·26	1·61
Nambour–Beenleigh	19·01	2·47
State Average	20·56	3·06

The following table gives the crop statistics for Queensland for the past ten years:—

Table showing Acres Cultivated and Harvested, Yields of Cane and Sugar, Acre-Yields, and Quality of Cane, 1928-1937.

Year.	Acres Cultivated.	Acres Harvested.	Total Yields.		Yields Per Acre.		Tons Cane to 1 ton Sugar.
			Cane.	Sugar.	Cane.	Sugar.	
			Tons.	Tons.	Tons.	Tons.	Tons.
1928	283,476	215,674	3,736,311	520,620	17·32	2·41	7·18
1929	291,660	214,880	3,581,265	518,516	16·67	2·41	6·91
1930	296,070	222,044	3,528,660	516,783	15·89	2·33	6·83
1931	309,818	233,304	4,034,300	581,276	17·29	2·49	6·94
1932	291,136	205,046	3,546,443	514,085	17·30	2·51	6·90
1933	311,910	228,154	4,667,028	638,734	20·46	2·80	7·31
1934	303,926	218,426	4,269,991	612,570	19·56	2·80	6·97
1935	314,700	228,515	4,220,267	610,326	18·47	2·67	6·92
1936	338,686	245,152	5,171,516	744,261	21·10	3·04	6·94
1937	*	249,683	5,132,934	763,325	20·56	3·06	6·73
True Average for 10 Years	226,088		4,188,852	602,100	18·53	2·66	6·97

* Not available.

These figures present, in a striking manner, the substantial improvement in yields of cane and sugar per acre which has been effected over the past ten years. For two successive years the yield of sugar per acre has exceeded 3 tons, which is in striking contrast to the value of 1·5 tons per acre, which was regarded as a normal figure at the beginning of the century. For the ten-year period, also, the average tonnage of cane required to make 1 ton of sugar has been less than 7 tons. These improved figures represent a combination of better farm work and more refined factory operation.

Average Area Harvested per Farm.

The following figures show the average acreage *harvested* by cane planters in Queensland for the 1937 crop:—

	Acres.
Cairns to Townsville	44
Ayr to Mackay	34
Bundaberg to Bauple	18
Nambour to Beenleigh	7
State average	30

The average area harvested per planter was 30 acres, which is the same as that of the previous year.

Report of Director—continued.

Molasses Produced.

The following figures supplied by the Government Statistician show the manner in which the molasses produced in 1937 was disposed of:—

	Gallons.
Sold to distilleries	7,071,109
Burnt as fuel	5,576,764
Used or sold for feed	3,914,113
Sold or used for other purposes	157,496
Used as manure	3,363,624
Run to waste	466,481
Total	20,549,587

It is of interest to present the data for molasses disposal for the past ten years in graphical form (Fig. 1). This illustrates the radical changes which have taken place in the utilization of this by-product. It is probable that future years will record increases in the proportions used in distilleries, as stock-feed, and as fertilizer, while there will doubtless follow a reduction in the proportion burnt as fuel, as the work of mill boiler stations is more nearly perfected. The quantity now run to waste is negligible, and its utilization for other purposes would probably be uneconomic.

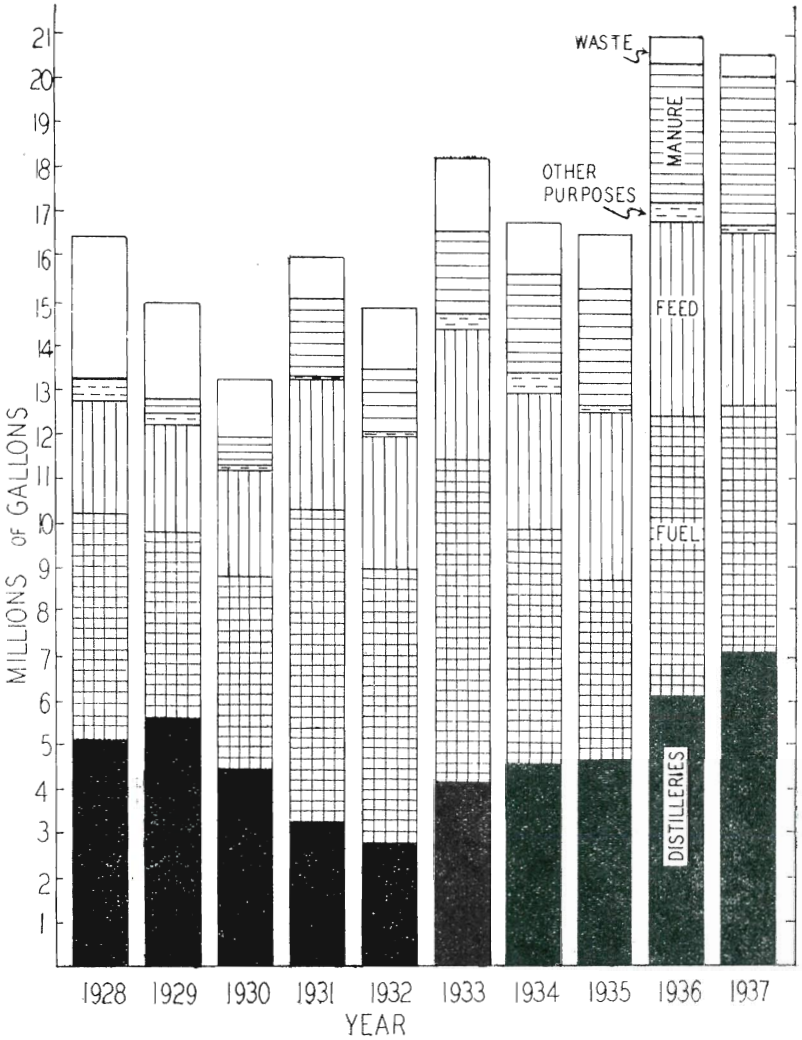

FIG. 1.—Illustrating the trends in molasses utilization over the past ten years. The amount now run to waste is insignificant.

Report of Director—continued.

MAFFRA BEET FACTORY.

The following data in respect of the Maffra Sugar Factory, Victoria, are supplied through the courtesy of the Manager:—

Crop Yields, 1938 Season.

Area harvested	4,046 acres
Beet purchased	48,594 tons
Beet sliced	47,330 tons
Average sugar content	15·48 per cent.
Sugar produced	5,625 tons
Price paid for beet	40/-
Average yield beet per acre	12·0 tons
Average yield refined sugar per acre	1·39 tons

1937 SUGAR VALUES.

The proportion of the sugar manufactured in Queensland which was required for consumption and use in the Commonwealth of Australia was declared at 58·9232 per cent., and that for export at 41·0768 per cent. These proportions are exclusive of the "excess" sugar produced by mills in excess of their allotments under the Peak Year scheme. The excess sugar produced for the 1937 season was 183,869 tons, as compared with 149,618 tons for the 1936 crop. This is by far the greatest tonnage of excess sugar produced in one year.

The price payable for the sugar required for consumption and use in Australia was declared at £24 per ton of 94 net titre. This was a decrease of 2s. per ton on the home consumption price of the previous season. The net value per ton of 94 net titre sugar sold abroad was £8 6s., which is substantially better than that recorded for 1936, and is the highest average obtained since 1932. The average price paid to those Queensland mills which did not produce "excess" sugar was £17 11s. per ton, compared with £17 1s. 4d. for the previous season. The average value of *all* sugar was £15 6s. 5d.

The following table summarises production and consumption figures and sugar values since the year 1924, when the first large surplus was produced:—

Year.	Total Sugar Production at 94 n.t.	Tons Sugar Exported.*	Average Australian Price.	Average Export Price.	Average Price, No. 1 Pool Sugar.	Average Price, *all* Sugar.
	Tons.	Tons.	£	£	£	£
1924	409,136	74,000	26·0	21·0	26·0	26·0
1925	485,585	219,000	26·5	11·3	19·5	19·5
1926	389,272	74,777	26·5	14·9	24·5	24·5
1927	485,745	152,384	26·5	12·1	22·0	22·0
1928	520,620	186,703	26·5	10·5	20·9	20·9
1929	518,516	197,000	27·0	9·9	20 3	20·3
1930	516,783	203,605	27·0	8·3	19·7	†19·5
1931	581,276	291,802	27·0	9·4	18·3	18·0
1932	514,027	189,733	25·0	8·3	19·3	18·8
1933	638,734	305,687	24·0	8·0	17·2	16·2
1934	612,570	277,336	24·0	7·6	16·5	15·5
1935	610,326	298,202	24·0	7·9	16·9	16·2
1936	744,261	409,400	**24·1**	7·95	**17·1**	15·2
1937	762,794	430,523	24·0	8·3	17.55	15·3

* Bagged sugar. † Peak Year Scheme first operated in 1930.

Total Value, 1937 Sugar Crop.

The total value of the 1937 Queensland crop was £11,686,640—an all-time record.

Report of Director—continued.

ECONOMIC REVIEW.

The Queensland sugar crop for the 1937 season attained the record value of 763,000 tons, exceeding that of 1936 by some 18,700 tons. It was, therefore, necessary to export over 440,000 tons, which is about 30,000 tons in excess of the Australian quota allotted by the International Sugar Conference in April, 1937. Fortunately, the quota year did not commence until the 1st September, 1938, by which time a substantial proportion of the export sugar had been shipped.

The average net price realised for sugar exported during 1937-38 was, it is pleasing to note, substantially better than that of recent years, and was the best since 1932-33. As a consequence, No. 1 Pool sugar netted £17 11s. per ton, though the average value of *all* sugar, including excess, was £15 6s. 5d., which is but slightly in advance of the 1936 figure, and is the second lowest received by the industry since 1914.

Considering all factors, then, it must be agreed that the industry was able to get through what might have proven a very difficult period, tolerably well; moreover, due to the unusually dry and favourable harvesting season, the crop was exceptionally rich in sugar, and 1 ton of 94 n.t. raw sugar was manufactured from 6¾ tons of cane—a factor which operated in favour of reduced costs to the producer.

The 1938 harvesting season commenced with an outlook which is not nearly so hopeful. The early estimate forecasts a sugar crop substantially identical with that of 1937; but the yield of sugar per ton of cane will certainly not be so favourable as that of the previous year, and an export quota considerably above the Australian allotment must again be disposed of. Fortunately, a reduction in overseas freights has been announced, though this will be off-set in a measure, by a slight increase in freights on domestic sugar. But the most disquieting aspect of the position is the sharp decline in world's parity which has eventuated since the 1937 crop was sold.

With the consummation of the International Agreement, some measure of confidence in the future was at last restored, and in July, 1937, the ruling sugar price in London was 6s. 6d. per cwt. In spite of uncertainties respecting the American zone, and delays in forecast sugar legislation in the United States of America, this average price was maintained throughout the ensuing three months. During October the International Sugar Council met; there was a growing feeling that quotas had been fixed at a too high level, as the anticipated consumption increase had not eventuated. Towards the close of the year, a decline in general commodity values was reflected in sugar prices, which fell as low as 5s. 9d., and it was felt that early action was necessary to reduce all quotas subject to such adjustment, by the limit of 5 per cent., in order to co-ordinate supply and demand, and prevent any further decline in values. Early in February, prices touched 5s. per cwt., but later recovered somewhat.

The International Council met in April, 1938, and attempted to gauge the extent by which quotas would exceed the free market requirements. It was decided that a 5 per cent. reduction was necessary, and this was duly imposed; further, it was agreed that the Council should assemble in July, to review the situation again. The opinion was expressed that the reduction was not adequate, and that further restriction would be necessary, to restore the confidence of purchasers. At the end of June, prices were still around 5s. per cwt., and evidently the market was awaiting the next move of the Council.

That, briefly, is a summary of the operations of the International Sugar Agreement during the first year of its existence. It was not responsible for any spectacular rise in sugar values, as many had hoped; on the other hand, it probably prevented a serious slump such as was recorded for other commodities. As the first complete plan which attempts to deal internationally with the production of such a commodity, it is a very interesting experiment, and there are no grounds for anticipating that it will not prove successful.

From the point of view of the Queensland industry, the problems of regulation of production and the consequent enhancement of average prices therefore present a more important aspect than ever. As forecast in recent reports, the average sugar production per acre continues to advance in spite of seasons which could scarcely be regarded as entirely favourable. Doubtless the wider adoption of methods of intensive production will continue to

Report of Director—continued.

operate, for therein lies the obvious means of reducing production costs per ton of cane, in a country which enjoys high wages and living standards. This is typified by the increase in the area of cane land which is being cropped under irrigation; recent records show—

Year.	Cane Land Irrigated. (Acres)
1932	24,000 (approx.)
1934	27,000 (approx.)
1936	43,723

The greatest expansion has taken place in the southern areas of uncertain rainfall, where the acreage now irrigated is almost one-half of that similarly treated in the Burdekin delta.

These developments must be regarded as a healthy sign, indicating the attainment of a sound, permanent agricultural system; but if the acreage cultivated to the crop is not co-ordinated with the production per acre, the future is fraught with serious difficulties. The present net area assigned for sugar production in Queensland is approximately 350,000 acres, which, with an average production equal to that attained in 1937 (3·06 tons of sugar per acre), would yield a sugar crop of 1,070,000 tons. This feature should give producers cause for concern, particularly as the present overseas quota for Australia is fixed at 412,000 tons of 94 n.t. sugar; but irrespective of this important factor, the price consideration alone would be disastrous.

The position is fully appreciated by leaders of thought in the industry, but the issue is somewhat obscured by the complementary problem of tonnage allotment to the individual mill areas, under the 1929 Peak Year Scheme; this, it is contended in certain quarters, has operated unduly harshly in respect of some areas, and a review of the position is being sought. Until this matter can be disposed of, the attainment of production regulation will be most difficult. The chief obstacle is, of course, that any re-allocation of tonnage between the various mills would result in no increase in total wealth production, but some would gain at the expense of the others.

There is, therefore, little cause for wonderment that the Conference of all interests convened by the Premier (The Honourable W. Forgan Smith) in March last, was not able to agree upon any formula which would be acceptable to a substantial majority of mill areas. By a margin of 36 votes to 30, the so-called Equalisation Plan was adopted; this scheme provides for the establishment of a maximum net price for No. 1 pool sugar, with a distribution of any funds over this amount as an added payment per ton of "excess" sugar. The chief weakness of the plan lies in the fact that its successful operation depends on an improvement in overseas sugar prices, while it would prove least effective when the position is most acute.

This, then, is the Queensland position at the inception of the 1938 harvest. Those interested in obtaining some benefits from a re-allocation of the sugar quota are determined that the matter shall not be allowed to rest; and until the problem is disposed of, there will exist little prospect of an effective co-ordination plan, which will relate production to home consumption needs and export quota limitations.

Work of the Bureau.

The detailed reports of the officers in charge of the several Divisions will be found in the subsequent pages of this Report. The following comments summarise some of the more important general aspects of the activities of the Bureau for the year under review:—

Advisory Board.

Meetings.—During the year the Board met on two occasions—on the 8th October, 1937, and 18th May, 1938; both meetings were held in Brisbane.

Personnel.—On the 1st September, 1937, Mr. B. Courtice presented his resignation as a Board member, in order to contest the Federal Senate elections. The vacancy thus created was not filled, in view of the early retirement of the Board as a whole.

The constitution of a new Board was undertaken in March, 1938. Mr. J. Smith was renominated as millers' representative by the A.S.P.A., Ltd., and Mr. V. Thorp by the Queensland Society of Sugar Cane Technologists. Mr. N. H. Wellard was jointly nominated by the sugar organisations as northern growers' representative, but these bodies were unable to agree on a joint nomination of a Southern Queensland growers' representative. In accordance with the Act, it will now be necessary for the Honourable the Minister for Agriculture to appoint his nominee to the vacancy.

Disease Control.—A subject which received the closest attention of the Board during the year was that of the more efficient control of cane diseases. It was the opinion of the Board that this could only be made effectual by bringing the matter under the Sugar Experiment Stations Acts, and the Minister agreed that the necessary amending legislation would be drafted accordingly. The preparation of the several clauses has been given most careful consideration, and it is anticipated that, if the amending Bill is passed during the forthcoming parliamentary session, the project of cane disease control can at last be satisfactorily accomplished. That this is to be desired is evidenced by the recent rather rapid increase in the incidence of disease, due to the introduction of varieties susceptible to disease which were of minor importance with the older standard canes.

Staff.—The Board devoted its attention to matters of staff, notably in respect of the field extension organisation and the Mill Technology branch. In order to strengthen the existing field service, it was agreed to appoint during the ensuing year three cadets for training as instructors in cane culture, if suitable men are available. The Mill Technology branch was reinforced by the appointment of further two assistants, but the resignation of the advising engineer and head of the branch (Ir. J. Eigenhuis) in April was a very definite loss. It was considered by the Board that applications should be invited, both in Australia and abroad, for a successor to this position.

Estimates of Expenditure.—The estimates of expenditure of the 1938-39 financial year were discussed and finalised at the May meeting of the Board. The Board has given careful attention to many matters which should lead to increased efficiency in the service provided by the Bureau, and has not hesitated to agree to the increased expenditure, to be met by the industry, where such additions would necessitate this provision.

By-products.—The better utilization of sugar mill by-products was the subject of careful deliberation by the Board. There appeared to be little prospect of development in respect of rayon from bagasse, or the utilization of molasses, in the solidified form, as stock-feed. But it was agreed that the wider utilization of molasses as a raw material for alcohol production merited attention. A resolution was carried by the Board at its October meeting urging that consideration be given by the State and Commonwealth Governments to the erection of a power alcohol plant, to be established in proximity to an existing sugar mill, in order that data might be obtained respecting the production of power alcohol from cane and mill by-products. The question was subsequently considered by the Australian Agricultural Council, which reported that the proposal could not be endorsed, as it was not "economically sound."

Work of the Bureau—continued.

Pest Boards' Conference.—A further meeting of representatives of all Cane Pests Destruction Boards was held at Meringa in May, 1938, under the ægis of the Bureau. It is considered that the policy of bringing together annually these representatives from all cane districts serves a very useful purpose, and the Board has decided that the continuance of these meetings is highly desirable.

Fibre in Cane.—The Board considered the report presented by the Director, following investigations into the determination of fibre in cane. It was agreed that further studies be made during the coming financial year.

Farmers' Field Days.—The annual Farmers' Field Day was held at Bundaberg on the 29th June, 1938. This was very well attended by growers from the southern cane areas.

Arrangements for a similar function to be held in Mackay during July have also been completed.

Staff Changes.

Mr. E. J. Barke was transferred to the Burdekin district as Instructor in Cane Culture. Mr. R. W. Mungomery assumed the responsibility of Officer in Charge of the Meringa Station, and Mr. G. A. Christie was later transferred to that centre to take over chemical duties associated with the Station.

Messrs. A. H. Praeger and J. L. Clayton were appointed as Assistant Mill Technologists, and Ir. J. Eigenhuis resigned as head of the Mill Technology Division, in April, 1938. This resignation was an unfortunate loss to the Mill Technology staff, which gave promise of moulding into a very efficient unit, in the hands of Ir. Eigenhuis.

Experiment Stations.

The three experiment stations, established at Meringa, Mackay, and Bundaberg, have now become very useful and well-equipped centres for the investigation of local problems and the carrying-out of routine service for the canegrowers in the respective areas.

Publications.

The "Cane Growers' Quarterly Bulletin" continues to serve as a very useful publication for the dissemination of up-to-date information and advice to canegrowers.

The following Technical Communications completed the 1937 series:—

No. 9. —" The Sugar Bureau pH Meter," by E. R. Behne and J. Eigenhuis.
No. 10.—" The Ultimate Analysis of Bagasse," by F. H. C. Kelly.
No. 11.—" The Combustion Value of Bagasse," by R. W. G. Hessey.
No. 12.—" Preliminary Investigation into the Fugalling of Final Massecuites," by E. Mitchell and E. R. Behne.

The early numbers of the 1938 series are as follows:—

No. 1.—I. " Furnace Investigations, 1937 Season," and
II. " Revision of Some Stoichiometric Formulæ of Technical Communication No. 5, 1937," by G. H. Jenkins.
No. 2.—" Continuous Electrometric pH Control," by J. Eigenhuis.
No. 3.—" Circulation in Calandria Vacuum Pans," by E. R. Behne.

These publications are keenly appreciated, and enable the officers of the Mill Technology Division, particularly, to present the results of their researches in a convenient and accessible form to the technologists in the mills, for whom the results are intended.

Queensland Society of Sugar Cane Technologists.

The 1938 Conference of the Society, which was held at Bundaberg in February last, was an outstanding success. The research staff of the Bureau was well represented, in accordance with the direction of the Honourable the Minister, and these officers contributed subtsantially to the proceedings and discussions of the Conference.

The Society selected Mr. N. J. King as its agricultural delegate to the International Conference to be held in Louisiana in October, 1938. The Director (Dr. H. W. Kerr) was elected President of the Society for the ensuing year.

Work of the Bureau—continued.

Balance Sheet.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FROM 1ST JULY, 1937, TO 30TH JUNE, 1938.

Receipts.	£	s.	d.	Disbursements.	£	s.	d.	£	s.	d.
To Balance, 1st July, 1937	17,105	4	0	By Salaries				9,573	2	11
,, Assessments	16,041	8	0	,, Contingencies—						
,, Endowment	7,000	0	0	Salaries and Wages..	1,792	0	6			
,, Bundaberg Station	841	11	5	Travelling Expenses, Hires, Fares, and Freights ..	2,263	4	2			
,, Mackay Station	646	8	8	Chemicals, Apparatus, Furniture, and Books	788	8	7			
,, Meringa Station	554	10	1	Cars and Maintenance	763	19	1			
,, Sundries	46	13	9	Printing, Advertising, and Stationery ..	1,394	8	10			
				General Expenses ..	820	16	9			
								7,822	17	11
				,, Bundaberg Contingencies ..				2,341	15	10
				,, Mackay Contingencies ..				2,674	16	5
				,, Meringa Contingencies ..				1,847	9	8
				* ,, Balance, 30th June, 1938				17,975	13	2
	£42,235	15	11					£42,235	15	11

* Balance does not include amount held, refund of levy Weil's disease control.

C.C.S. Formula.

For the benefit of overseas readers of this report, we would point out that the measure of available sugar in cane (so-called Commercial Cane Sugar or C.C.S.) is defined as follows :—

$$\text{C.C.S. in juice} = \text{Brix in juice} - \frac{\text{Impurities in juice}}{2}$$

and C.C.S. in cane is calculated by the formula :—

$$\text{C.C.S.} = \frac{3P}{2}\left(1 - \frac{5+F}{100}\right) - \frac{B}{2}\left(1 - \frac{3+F}{100}\right)$$

where—P = pol in first expressed juice
B = brix in first expressed juice
F = fibre in cane.

Division of Soils and Agriculture.

Staff.

During the year Mr. E. J. Barke was transferred from the position of Chemist in Charge of the Meringa Station to that of Instructor in Cane Culture, Ayr. The consequential vacancy was filled by appointing Mr. R. W. Mungomery Acting Officer in Charge at Meringa, while Mr. G. A. Christie was transferred to that centre for the purpose of assisting with chemical and general agricultural duties.

The need for increases in the personnel of the extension service has been expressed by the Advisory Board, which has agreed to the appointment of further three cadets to this Branch, should suitable officers be available. It is hoped that this resolution can be given effect to during the coming financial year.

Extension Work.

The farm experimental work continues to be a major feature of the extension service. The trials thus set out serve a twofold purpose—(1) to provide the desired information regarding soil plantfood deficiencies or varietal superiority, (2) to serve as demonstration plots to support our recommendations.

The release of several new cane varieties for farm trial plantings in the northern and central districts has increased the normal duties of the field officers in those parts. Farmers are strongly in support of this policy, which enables us to obtain specific information regarding the characteristics of our new seedling canes before they are released for general plantings.

The results of all trials are given wide publicity through the medium of the "Cane Growers' Quarterly Bulletin." The January issue of this journal is devoted exclusively to a presentation and discussion of fertility and varietal trials.

Soil Survey.

For the past ten years, a project has been sustained which aimed at establishing the value of laboratory soil testing as a means of determining plantfood deficiencies. The results of this work have just been reviewed, and it is now pleasing to report that the simple and rapid tests devised by the Bureau are eminently satisfactory and reliable for the purpose.

This finding paves the way for an intensive soil-survey scheme, which will enable tests to be made of soil samples from all farms, leading eventually to a thorough knowledge of the plantfood or fertilizer needs of every canefield in the State. Such an ambitious plan calls, of course, for more man power than the Bureau can summon for the work. But it is hoped that a co-ordinated scheme may be drafted, whereby co-operative mill executives will instruct certain of their officers to carry out the field-sampling phase of the project, while the testing can be carried out at our Experiment Stations.

The initiation of the plan on a general scale was conducted in the Innisfail district during the past month.

In response to the appeal to canegrowers through the medium of the Quarterly Bulletin, larger numbers of farmers are now submitting soil samples for test purposes, and the chemical staff is operating under pressure to cope with the rush of work which this entails.

Sugar Technologists' Conference.

The 1938 Conference of the Queensland Society of Sugar Cane Technologists, held at Bundaberg, was attended by several officers of this branch. An innovation was introduced when an attempt was made to give attending farmers some insight into the chemical properties of the soil, and the manner in which laboratory tests are conducted. This demonstration lecture was very well received, and the Director has been asked to repeat the lecture at the Mackay Field Day. The Assistant Director gave an interesting address, assisted by demonstration material, in which he emphasised the value of legumes in any system of permanent agriculture. Extensive experiments with different species of legume are being conducted at the Experiment Stations, and it is hoped that one or two may be obtained which require a longer growing period than Poona pea, but which are at least equally suitable for Queensland conditions.

Division of Soils and Agriculture—continued.

Legume Inoculation.

Arrangements have been made to supply cultures of root-nodule organisms to canegrowers, during the coming spring, so that they may be able to treat their legume seed prior to planting, and assure favourable conditions for the inoculation of the plants with a highly efficient strain of bacteria.

Seedling Propagation.

This project, though necessarily slow and tedious, is a most important phase of Station activity, and at the present time a steady stream of promising canes is being supplied for farm trial purposes. It is hoped that the Queensland canegrower may eventually be supplied with a series of superior cane varieties, all of which will be resistant to the pests and diseases which are now most troublesome in their areas.

Alternative Crops.

With the present production of excess sugar, and notably since a quota limitation has been imposed on exports, the desirability of finding alternative crops to which available canelands may be devoted is a matter requiring the closest consideration.

The plan of crop rotation, combined with stock fattening, has been continued at the Mackay Experiment Station. This project would appear to offer very good prospects of success. It possesses a dual value, in that it offers an economical means also of restoring fertility to the older canelands of the State.

The breeding of cross-bred lambs at Mackay appears to be a success, and, contrary to oft-expressed views, this plan could be developed with profit even under wet coastal conditions.

Work of the Stations.

The detailed statements of work carried out at the three Experiment Stations—located at Meringa, Mackay, and Bundaberg—appear elsewhere in this report. To date the new Meringa and Mackay Stations have been undergoing development, so that the experimental results reported at this time will be augmented in the future.

Work of the Brisbane Laboratory.

Mr. C. R. von Stieglitz, Chemist.

Routine Analysis.—The following is a summary of the routine analyses performed at the Brisbane laboratory for the period 30th June, 1937, to 30th June, 1938:—

Soils	528
Waters	153
Green manures	61
Sand culture media	28
Sugar-canes	16
By-products	16
Limes	11
Rat baits	7
Miscellaneous	4
Total	824

The number of samples received shows a great increase over previous years, due largely to the increasing numbers of farmers who are availing themselves of the opportunity of obtaining fertilizer advice based on analytical data. That this advice is greatly appreciated is evidenced by the large increase of private samples (190 for 1936-7 as against 328 for 1937-8) and by the fact that the same farmers are submitting samples of their fields in successive years.

Laboratory Training for Field Officers.—From time to time various members of the field staff have been instructed in the technique necessary for the simpler analytical methods in order to give them an insight into laboratory procedure.

Mr. G. A. Christie spent such a period of four months during the year in the Brisbane laboratory and will thus be enabled to handle many routine soil samples at Meringa which otherwise would be despatched to Brisbane.

Division of Soils and Agriculture—continued.

Investigational Work.—The results of investigational work are embodied in the following publications:—

"The Relationship between Pol and Sucrose in Pure Solutions and Cane Juice," by C. R. von Stieglitz and L. C. Home,

"Further Notes on the Electrometric Method for the Determination of Reducing Sugars," by C. R. von Stieglitz and L. C. Home.

The first presents comparisons of pol and sucrose in both pure solutions and cane juices to which had been added known amounts of dextrose and lævulose. It was shown that most of the discrepancies which occur between pol and sucrose in mill practice could be explained by variations in the ratio of dextrose to lævulose in the juice.

The second paper is a study of the electrometric method for reducing sugars. This method with certain modifications was found most satisfactory for sugar products, and a detailed description is given of the reagents and technical procedure necessary for its successful operation.

Data in relation to the correlation of laboratory methods with fertilizer response in the field have been compiled from the results of several years, and a technical communication on this subject is awaiting publication.

Intensive soil sampling for analytical purposes has been continued, and the results will be embodied in a paper to be presented to the Conference of the International Society of Sugar Cane Technologists to be held in Louisiana in October, 1938.

Investigations concerning the effect of different soil amendments on the chemical and physical properties of certain soils subject to irrigation with saline water are proceeding, and will be continued in the coming year, as well as studies of soil nitrogen availability.

A soil fertility survey of certain areas has been commenced in co-operation with the field staff. Analytical results of this survey will be mapped and should provide valuable data on the distribution of available plant nutrients in the various soil types. This work will be extended to different areas as facilities are available for handling the analytical work.

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NORTHERN SUGAR EXPERIMENT STATION, MERINGA.

Mr. R. W. MUNGOMERY, Acting Officer in Charge.

METEOROLOGICAL.

The year under review was a particularly bad one from a growth point of view, for not only was the rainfall for the 1937-38 season much below average, but, in addition, it was most irregularly distributed. Of the 53·98 inches of rain which fell during this period, almost 36 inches were registered within the space of one month, between the end of January and the end of February, when the usual heavy monsoonal rains set in. The remainder of the period was abnormally dry with occasional relief by way of showers. The result was that the crops received several checks in growth, and on many occasions they were wilting badly. This unfavourable weather throughout the year was reflected in the estimated harvest for the Mulgrave Mill, in which area this Sugar Experiment Station is included, being reduced by approximately 16 per cent. on the previous year's crop, and by approximately 28 per cent. on the 1936 crop. As this mill area embraces a considerable amount of river-flat country which is not so adversely affected by dry weather, it will be apparent that the tonnage reduction on the higher lands, such as those comprising the Meringa Sugar Experiment Station, greatly exceeds the percentages quoted.

Details of the weather conditions and their effect on crop growth throughout the year are as follows:—

After the dry, cold, windy conditions which prevailed throughout June, 1937, a change to showery weather occurred in mid-July and rain persisted until the end of that month, when a commencement was made with planting operations. Further light falls of rain were recorded in August, but for the most part this month was very dry with cold boisterous south-easterly winds, and temperatures did not commence to rise appreciably until the latter part of the month. A useful downpour occurred during September which helped the young cane to become established, but the soil moisture was insufficient to promote any vigorous growth. From then onwards until mid-November droughty conditions prevailed. During this period wallabies made inroads into the Station canefields causing patchy damage despite attempts to poison them, and it was not until the occurrence of the late November storm rains, which caused a spring in the grass in the surrounding forest country, that their attacks wholly ceased. Thereafter the wilted crops soon regained their normal green aspect and continued to grow slowly throughout December until another dry period in January again caused the crops to wilt. Up to this time the crops presented a very backward appearance, but with the advent, late in January, of heavy continuous monsoonal rains growth became very rapid and continued into mid-March. From then onwards until the end of June, 1938, the rainfall was sparse and growth extremely slow. As a result of the dry conditions prevailing during these latter months, crops are this year expected to have a relatively high sucrose content.

Considering the vicissitudes experienced during the normal growth period, the estimated yields can be regarded as very satisfactory.

The following are the rainfall records taken at this Experiment Station since the year 1916:—

Year.	Rainfall in inches.	Year.	Rainfall in inches.
1916	100·73	1928	66·33
1917	66·81	1929	102·28
1918	69·15	1930	107·61
1919	57·53	1931	98·82
1920	94·86	1932	76·31
1921	122·84	1933	96·06
1922	64·90	1934	91·44
1923	53·29	1935	59·91
1924	95·67	1936	88·81
1925	76·98	1937	46·33
1926	59·12	1938 (6 months)	43·92
1927	90·16	Average (22 years)	81·18

Work of the Northern Sugar Experiment Station, Meringa—continued.

Abstract of Meteorological Observations made at the Northern Sugar Experiment Station, Meringa, from the 1st July, 1937, to 30th June, 1938.

Month	Rainfall in Inches.	Number of Wet Days.	Highest Shade Maximum.	Lowest Shade Maximum	Mean Shade Maximum.	Highest Shade Minimum.	Lowest Shade Minimum.	Mean Shade Minimum.	Mean Diurnal Range.	Mean Temperature, 9 a.m.	Mean Relative Humidity, 9 a.m.
July, 1937	3·16	12	83·5	68·0	78·1	68·0	48·0	59·2	28·9	70·2	76·2
August, 1937	·55	10	87·4	74·7	81·4	65·0	45·3	55·2	26·2	71·5	71·4
September, 1937	1·08	9	90·1	80·0	85·7	70·0	54·1	60·7	25·0	75·8	73·8
October, 1937	·13	4	93·8	86·0	90·8	70·5	49·1	61·7	29·1	81·3	60·5
November, 1937	2·66	12	97·6	81·2	91·8	74·4	60·2	67·9	23·9	83·6	63·4
December, 1937	2·48	8	101·7	87·8	94·0	78·9	66·5	70·8	23·2	85·7	58·5
January, 1938	18·76	14	101·2	83·9	92·9	80·6	67·1	73·3	19·6	83·6	77·3
February, 1938	18·88	18	96·8	85·5	91·8	77·0	60·0	72·2	19·6	82·3	78·0
March, 1938	2·68	9	97·5	87·0	92·3	76·2	60·0	68·6	23·7	83·0	75·7
April, 1938	·51	6	97·0	81·3	89·8	72·5	58·7	65·9	23·9	80·9	73·6
May, 1938	1·89	16	88·6	80·0	84·7	70·0	61·0	65·4	19·3	76·6	84·0
June, 1938	1·20	12	87·7	76·5	82·1	69·0	55·0	62·3	19·8	74·0	79·8
Totals	53·98	130	..	..	..	..	..	..	..	..	..

1937 Crop.

Harvesting commenced on the 10th August and terminated on the 10th September, the amount of cane sent to the Mulgrave Mill representing 325 tons. The chief reason for the short harvest was the desirability of eliminating Downy Mildew disease from affected seedlings, mainly of P.O.J. parentage, into which the disease had spread with alarming rapidity during the previous season. Only blocks of resistant varieties in which no disease had been found were ratooned, and all susceptible varieties were ploughed out and the area planted to legumes. Any volunteer ratoon stools were carefully rogued. In this way, aided by dry weather conditions, it was possible to make a thorough clean-up of the disease. For the above reason, the clean-seed project, involving the supply of Badila to growers for building up their planting stocks, was temporarily discontinued.

The following table summarises the crop data for the year:—

	Tons.
Cane sent to mill	325
Cane used for plants	3
Total	328
	Tons.
Badila	111
Miscellaneous Seedlings	217
Total	328
	Tons.
Plant cane	179
Ratoon cane	149
Total	328
	Acres.
Area under cane	**10**
Average tons per acre	**32·8**

New Plantings and Land Clearing.

The new land brought under cultivation during the previous year was planted partly with Badila, 1·3 acres, and partly with S.J.4, 2·75 acres. A further amount of 2½ acres was cleared and ploughed, and this has been reserved for plantings of seedling Q.10 and Badila. Another strip of forest country comprising over an acre has been felled and grubbed. As the work of opening up this new country progressed, it was found that some of the soils exposed are rather uneven, and consequently this land will be utilized for building up stocks of new varieties, whilst the more even land will be employed for seedling propagation and yield observation trials with promising seedlings. In addition, the roadway which previously divided the station property has been closed, and this will allow a further area to be brought under the plough, while facilitating the application of irrigation water to the young seedlings.

During the year, fences were erected on the southern and part of the northern boundaries of the station, and the property is now entirely enclosed.

Work of the Northern Sugar Experiment Station, Meringa—continued.

Seedling Work and Selections.

Of the 1936-37 seedlings, i.e., the "I" series, 127 were selected and planted in 5 randomised plots of 2 setts each, whilst 19 "G" and 4 "H" seedlings were planted out in 4 randomised plots of 10 setts each.

As a result of the 1937 cross-pollination work, approximately 4,000 seedlings, representing 25 different crosses, were planted out in the field, and these will be subjected to a rigorous selection programme during July. This work is more fully detailed elsewhere in this Report in the special section containing the Report of the Committee on Seedling Raising.

Trials with Leguminous Crops.

During the year trial plantings of different legumes were made with a view to determining their usefulness under North Queensland conditions. Those under trial comprised different varieties of clover, lespedeza, soybean, crotalaria, and cowpea.

The clovers and lespedezas proved quite unsuitable, the former giving very poor germinations and the latter proving too slow in growth, while their low habit does not allow them to compete successfully with the vigorous weed growth experienced here. They will, accordingly, be excluded from future plantings.

Of the soybeans, the variety Otootan produced the heaviest crop, but during the summer months this variety did not set seed. *Crotalaria juncea* proved to be a vigorous grower; however, the production of seed for further plantings becomes a problem with this species, since its seed pods appear almost invariably to be attacked by caterpillars feeding internally within the pods. Although the species *Crotalaria goreensis* was somewhat dwarfed in growth, at least in the planting of this season, it is a prolific seeder and stocks of seed should be ample for future plantings.

The cowpea varieties Poona, groit, and giant all yielded good crops. Poona and groit are relatively quick-maturing varieties and have a definite value under certain conditions when crops of this nature are required. Nevertheless, it is thought that the more slowly maturing variety (giant) will be more suitable for growing during the wet season period, when it is desirable to have a cover crop on the land to prevent erosion and packing of the soil.

Trials with Fodder Grasses.

A number of different fodder grasses were under trial during the year with a view to providing suitable fodder for that portion of the year when cane tops are not available. White Panicum (*Echinochloa crus-galli*) during the wet summer period yielded good crops, which were relished by the stock. However, one disability was its unsatisfactory growth during the cooler winter months. *Panicum coloratum* also produced good crops throughout the season, but it proved a shy ratooner when cut during rainy weather. The data with regard to fine-stemmed Guinea grass are not so complete; still, it appears to have considerable promise as a grass for intermittent cutting.

Two species of Digitaria, *D. vallida* and *D. Pole-Evansii*, which were also under trial, appear to be more suited as grazing grasses rather than as grasses that can be cut for fodder purposes.

Staff Changes.

Towards the end of April, Mr. G. Christie was transferred from Head Office and took up duties at this Station, where he will undertake the analytical work and later general agricultural duties connected with this Station.

Laboratory Work.

The usual analytical work involved in the sampling of new canes under trial was carried out, but the analyses of growers' soil samples for fertilizer requirements and lime recommendations were temporarily undertaken by the Head Office staff.

Improvements and Maintenance.

General improvements on the Station have been effected from time to time as opportunity permitted. The buildings were bird-proofed, the roofs painted for preservation purposes and to reduce temperatures during the hot summer months, and a bathroom constructed for the use of the staff. A number of concrete benches for the accommodation of potted seedlings were built and placed in position. Cattle grids at the Station entrance were strengthened, the drives and roadways re-formed and drained, and the drainage from the buildings improved. A ramp was constructed to facilitate the work of greasing and adjusting the Station motor vehicles.

In addition, an experimental fuzz drier was built to enable cane seed to be dried efficiently during those periods of rainy weather which often occur during the cross-pollination campaign.

CENTRAL SUGAR EXPERIMENT STATION, MACKAY.

Mr. D. L. McBryde, Chemist in Charge.

METEOROLOGICAL.

From April, 1937, until the end of the year, a very dry spell was experienced in the Central District, and rainfalls recorded for each month of this period were below the averages of previous records. The total fall for this nine-month period was only 10·69 inches against an average of 27·38 inches for the period since 1920.

As a consequence of this light precipitation, the 1937 crop yielded less than the early estimates, but the lesser tonnages were offset to some extent by the high average sweetness of the crop.

Abstract of Meteorological Observations made at the Sugar Experiment Station at Mackay, from 1st July, 1937, to 30th June, 1938.

Month.	Inches Rain.	Wet Days.	Average Rainfall.	Shade Temperatures :— Maximum. High.	Maximum. Low.	Maximum. Mean.	Minimum. High.	Minimum. Low.	Minimum. Mean.
1937.									
July	0·50	6	1·43 (*a*)	79·0	63·0	72·0	62·0	40·2	53·7
August	0·48	10	0·93 (*a*)	81·0	68·0	74·0	61·0	36·5	51·2
September	0·42	10	1·74 (*a*)	84·0	75·0	79·1	63·0	45·0	56·1
October	1·54	5	1·71 (*a*)	88·5	79·0	83·7	72·5	51·0	60·5
November	2·35	8	3·05 (*a*)	91·2	75·0	85·7	73·0	57·0	66·9
December	1·96	4	7·52 (*a*)	97·0	80·0	87·9	78·0	65·0	70·4
1938.									
January	5·17	13	14·16 (*b*)	99·0	69·0	84·0	76·0	67·0	75·7
February	11·56	12	11·04 (*b*)	96·8	79·5	86·3	76·0	62·0	71·2
March	17·82	18	10·59 (*b*)	90·0	74·0	84·2	72·5	62·0	68·8
April	·05	3	4·96 (*b*)	92·5	76·5	84·2	69·5	43·0	62·7
May	4·11	16	3·29 (*b*)	81·0	70·5	78·0	70·5	55·0	63·2
June	1·35	9	2·61 (*b*)	78·5	66·5	73·6	64·0	46·0	55·7
Totals	47·31	114	63·03	..	..	..	..	..	..

(N.B.—Average Rainfalls—(*a*) = 37 and (*b*) = 38 years).

Annual Rainfall since 1920 at the Sugar Experiment Station, Mackay.

Year.	Rainfall Inches.	Year.	Rainfall Inches.
1920	57·27	1930	55·81
1921	95·89	1931	30·01
1922	34·47	1932	48·48
1923	25·23	1933	71·94
1924	53·37	1934	37·57
1925	54·80	1935	45·15
1926	34·69	1936	97·37
1927	83·87	1937	56·60
1928	72·28	1938 (6 months)	40·06
1929	64·03	**Average (18 years)**	**56·60**

Weather conditions were thus highly unfavourable until the end of 1937, and it was considered that a subnormal crop would be harvested. The favourable sequence of beneficial rains during the early months of 1938, however, more than offset the poor start which the crop had made; moreover, there was a general absence of soil water-logging, such as was experienced during the 1936 and 1937 wet seasons.

Observations on water level fluctuations in the laboratory well showed that the level remained stationary until the third week of March, by which time 20 inches of rain had been recorded. During the cyclonic storm period which followed, the water level rose to within 7 feet of the surface, from which it gradually receded, after the ensuing two days, to the normal mark of 17-18 feet from the ground surface.

As was anticipated, crops survived the succeeding months without growth check, despite dry periods. Growing conditions during May were decidedly favourable; the rainfall (4·11 inches) exceeded the average for the month, while night temperatures were also abnormally high. Present crop estimates place the district yield somewhat above that of the 1937 harvest, though it is expected that crops will be late in attaining maturity.

Work of the Central Sugar Experiment Station, Mackay—continued.

Experimental Blocks Harvested during 1937.

1. Fertility Trial—5 × 5 Latin square, qualitative, 1st ratoon crop.
2. Varietal Trial—Mackay Seedlings *v.* Q. 813, 4 × 4 Latin square, 1st ratoon crop.

Experiment Initiated during 1937.

1. Observational Trial, E. Seedlings *v.* Q 813.

FERTILITY TRIAL (1st Ratoon Crop).

Block.—B2.
Variety.—Q. 813.
Harvested.—October, 1937.
Age of Crop.—11 months.
Experimental Plan.—5 × 5 Latin square.
Plots.—1/15 acre.

Treatments.

N—200 lb. sulphate of ammonia per acre.
P—300 lb. superphosphate per acre.
K—150 lb. muriate of potash per acre.

All phosphate and potash and one-half of the sulphate of ammonia were applied at ratooning time, while the balance of the sulphate of ammonia was applied as top dressing in January, 1937.

GROWTH NOTES.

The cane ratooned well and made good growth until checked by dry conditions early in April. The cane suffered in certain parts from light grub attack. Throughout the season, the plots receiving sulphate of ammonia were much ahead of the C and PK plots.

Crop Yields.

	C.	NP.	NK.	PK.	NPK.
Cane per acre, tons	**11.4**	**16.6**	**19.1**	**11.7**	**19.5**
C.C.S. in cane, per cent.	17·5	16·6	16·4	17·2	16·5

DISCUSSION.

Though the yields for the plant cane were erratic and non-informative, the results for the ratoon crop confirm the opinion repeatedly expressed, that for the alluvial soils of Mackay, applications of sulphate of ammonia are extremely valuable, especially for ratoon cane. Some measure of potash deficiency also appears to exist on this block.

Work of the Central Sugar Experiment Station, Mackay—continued.

VARIETAL TRIAL (First Ratoon Crop).

Plan and Yields.

C 83 46.3	Q 813 30.2	C 57 32.3	C 85 32.8
C 85 39.8	C 57 34.5	C 83 39.9	Q 813 28.5
C 57 33.8	C 85 40.3	Q 813 28.1	C 83 41.1
Q 813 34.7	C 83 43.5	C 85 38.8	C 57 36.6

Block.—B2.
Harvested.—September, 1937.
Age of Crop.—11 months.
Experimental Plan.—4 × 4 Latin square.
Plots.—0·102 acre.

Fertilizer applied.—All plots were uniformly fertilized at the following rates per acre:—

At ratooning—
100 lb. sulphate of ammonia.
300 lb. superphosphate.
150 lb. muriate of potash.

Top dressing.—In January, the cane was top dressed with sulphate of ammonia, 100 lb. per acre.

GROWTH NOTES.

All varieties ratooned well, and made good growth until checked by dry conditions early in April.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ $\log_e$ (Mean Square).
Rows	3	23·34	7·78	..
Columns	3	43·72	14·57	..
Varieties	3	330·82	110·27	2·3516
Errors	6	30·13	5·02	0·8067
Total	15	428·01	..	..

Crop Yields.

	Q. 813.	C. 57.	C. 83.	C. 85.
Cane per acre, tons	**30.4**	**34.3**	**42.7**	**37.9**
Cane, percentage mean yield	83·7	94·4	117·6	104·4
C.C.S. in cane, per cent.	**16.6**	**18.4**	**16.5**	**16.4**

Standard Error = 3·09 per cent.

Summary of Yields—Plant and First Ratoon Crops.

Variety.	Plant Cane.		First Ratoon Cane.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per Cent.	Tons.	Per Cent.
Q. 813	**32.0**	**16.6**	**30.4**	**16.6**
C. 57	**30.6**	**17.6**	**34.3**	**18.4**
C. 83	**40.0**	**16.4**	**42.7**	**16.5**
C. 85	**32.8**	**16.8**	**37.9**	**16.4**

DISCUSSION.

The results are of interest, in that they demonstrate that it has been possible to produce three new seedling canes, all of which are superior to the standard, Q.813; this is particularly true in respect of the first ratoon crop.

Work of the Central Sugar Experiment Station, Mackay—continued.

Unfortunately, varieties C.83 and C.85 are too highly susceptible to downy mildew disease to warrant their release for farm trial purposes, but variety C.57 (now known as Q.20) has been planted in several propagation plots throughout the Mackay district, and from these plots releases may be made for the 1939 planting. The cane is very sweet, and may prove a useful variety over a range of soil conditions.

Rotational Experimental Block.

The plant crop from the first plot of this block (C) was harvested during 1937. It had been planted to variety C.83, and yielded 26·2 tons of cane per acre at 15·7 C.C.S. It was thirteen months old when harvested.

The second and third plots were planted in October, 1937, and May, 1938, respectively.

Attention has been concentrated on improvement of the surface drainage conditions of this block. Each section has been carefully graded prior to planting, so that little now remains to be done in this connection. It is anticipated that this improvement will in itself improve the yielding capacity of the land from year to year due to the better conditions for both crop root growth and bacterial activity.

The balance of the block (5 plots) has been kept under grass, on which sheep are pastured. The animals have made good progress during the past year, and it must be concluded that this class of land is quite suitable for lamb production. Although the number of lambs dropped has, to date, been rather small, the young animals have displayed very satisfactory development. The wethers were slaughteerd at the age of 20 weeks, while the ewes are running with the flock. The average dressed weight of the wether lambs was 33½ lb., and both in appearance and quality the carcases were entirely satisfactory for the local trade.

The sheep were shorn in October, 1937, yielding an average of 4½ lb. of wool per head, of a value of 5s. 2d. These yields should improve, as many of the animals were then two and fourth-tooth ewes.

Little trouble has been experienced with either internal or external parasites. The animals were drenched twice and dipped once. Two or three of the ewes became lightly fly-blown, but crutching and jetting eliminated the trouble. No evidence of foot-rot was noted.

Feed was plentiful at all times. A supplementary ration composed of molasses and meal, was fed during the drier months before and after the lambing season, but this was discontinued as soon as the first spring of grass occurred. The ration consisted of—

1 oz. sterilized bone meal,
12 oz. linseed (later peanut) meal,
32 oz. molasses,

per sheep per week.

The main grass species is Panicum muticum (para grass) and this is supported by increasing amounts of couch grass and sentive plant (*mimosa pudica*). That this pasture has a high carrying capacity, under Mackay conditions, is evidenced by the fact that the paddock (area 8 acres) carried the equivalent of 37 sheep for the entire year. This includes allowance for other animals running in the paddock.

Legume Trials.

Trial plantings of lucerne, soybean, and lespedeza varieties were quite disappointing. Weed growth inhibited the lucerne, while soybean and lespedeza did not thrive even where irrigated.

Drainage Improvement.

One of the factors which influenced the decision to acquire the present area for Experiment Station purposes, was its admittedly defective natural drainage. This condition has now been substantially improved. Depressions have been filled by scooping, while all surface drainage water courses carry definite grades from the higher end to the discharge outlet. The discharge pipes under the main road have been enlarged, to cope with the flow of water during periods of heavy rainfall, and the main drain to the swamp has also been given attention in co-operation with the canegrower whose farm it traverses.

The blocks reserved for seedling propagation (A.2 and B.2) have also been graded to facilitate irrigation. This has entailed the transference of many hundreds of tons of soil to remove slight ridges and fill hollows.

Work of the Central Sugar Experiment Station, Mackay—continued.

Farm Trials.

A number of farm fertility trials, involving general fertilizer treatments in addition to a specialised investigation with magnesium sulphate, were conducted during the year. This work was carried out with the assistance of the field officer associated with the Station (Mr. S. O. Skinner). Five varietal trials were similarly set out, for harvest during the 1938 season.

Station Stock.

The horses have maintained excellent condition on the standard ration reported in 1937. During the year, peanut meal was substituted for linseed; due to its higher content of protein, the ration was reduced from 16 to 12 oz. per beast per feed. The reduction in cost thus effected was substantial—from 4d. to 2½d. per day.

Station Buildings.

A new double garage was erected to the rear of the laboratory building, and the old shed removed to the stableyard to provide extra storage space.

Irrigation Plant.

The original installation was modified to provide sufficient pressure for a trial overhead irrigation system which has just been installed. If such a system should prove successful, it will facilitate the irrigation of young seedlings, while permitting of the production of fodder crops on a small area of the Station.

Laboratory Work.

The laboratory work was confined to the testing of cane juices; the following summarises the number of samples tested:—

	No. of Samples.
Maturity tests—	
Farmers' cane	102
Station cane	49
Standard tests—	
Farmers' cane	6
Show canes	53
Station canes	153
Total	363

Although farmers have been advised that samples of soil will be tested at the Mackay Station, to determine the need for liming, the response has not been satisfactory. Only fifteen samples were submitted during the year.

1937 Crop.

Block.	Variety.	Class of Cane.	Tonnage Harvested.	Tons per Acre.
A. 1	Seedlings	First ratoon	9	18·0
A. 2	Seedlings	Spring plant	44	14·8
B. 2	Varieties and Q. 813	First ratoon	91	20·2
B. 3	Q. 813	Spring plant	33	20·1
B. 3	Q. 813 and P.O.J. 2725	First ratoon	185	24·6
C. 1	C. 83	Spring plant	55	26·2
Total and average			**417**	**21.7**

Area harvested = 19.2 acres.

SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG.

Mr. N. J. KING, Chemist in Charge.

METEOROLOGICAL.

A reasonably favourable spring gave a good start to the crops in the Bundaberg and adjacent districts. Late July and late August rains supplied sufficient moisture for spring planting, and the vigorous development of ratoons. A dry September was succeeded by good October storms, and November-December rains were sufficient to keep crops moving rapidly. January rains were above average, and were accompanied by still, humid conditions. A dry February and early March prevented the production of crops which would have been well in excess of all previous records. In late March a monsoonal disturbance gave the south its delayed "wet season," and right through to the end of April growing conditions were excellent and temperatures above normal. Late May rains also produced considerable growth, upsetting all previous estimates, and the district will now be in the position to harvest record crops in all mill areas.

Crops.

In consequence of the dry season 1936-1937 and the harvesting in 1937 of most of the crops, the proportion of stand-over cane this year is lower than usual. It is to be expected therefore that the sugar content of the cane will be low when crushing begins. It is in such a year as this that the value of a proportion of standover cane is appreciated. Present-day sugar prices do not allow of profitable harvesting of cane at low c.c.s. figures, particularly where cane cartage costs must be added. The climatic and pest conditions of Southern Queensland are suitable for standover crops, and P.O.J. 2878 is the ideal standover variety. It is in the interest of all growers to standover a proportion of this variety each year, and to be thus enabled to begin the season with mature cane of good sugar content.

Rainfall Records.

The following are the rainfall records taken at this Station since the Experiment Station began operations in 1914. To conform with the year covered by the Report the rainfalls are given for the year beginning in July and ending in June:—

1914-1915	31·99	1926-1927	68·18
1915-1916	28·54	1927-1928	74·69
1916-1917	58·08	1928-1929	31·16
1917-1918	49·85	1929-1930	43·16
1918-1919	24·24	1930-1931	47·19
1919-1920	28·20	1931-1932	22·88
1920-1921	45·16	1932-1933	36·81
1921-1922	44·97	1933-1934	71·45
1922-1923	37·14	1934-1935	40·01
1923-1924	34·16	1935-1936	44·24
1924-1925	50·96	1936-1937	31·65
1925-1926	37·62	1937-1938	44·40

Abstract of Meteorological Observations made at Southern Sugar Experiment Station, Bundaberg, from 1st July 1937, to 30th June, 1938.

Month.	Rainfall.	No. of Wet Days.	Highest Shade Max.	Lowest Shade Max.	Mean Shade Max.	Highest Shade Min.	Lowest Shade Min.	Mean Shade Min.	Mean Diurnal Range.	Mean Temp. 8 a.m.	Mean rel. Humidity 8 a.m.
1937.											
July	1·65	8	76	60	70	59	35	48	22	55·6	84·6
August	1·33	3	76	66	71	59	38	48	22	60	83
September	0·10	1	84	73	78	66	43	56	22	..	..
October	3·67	8	88	71	81	71	50	60	21	73·5	81
November	2·22	9	89	81	83	72	56	64	18	76·5	79
December	3·48	8	91	76	86	77	60	68	18	80	79
1938.											
January	9·36	12	92	78	85	77	63	68	17	79	83
February	1·50	4	95	83	87	77	62	70	17	80	87
March	8·58	12	89	72	84	74	61	68	16	77	84
April	1·68	4	92	71	81	67	40	59	22	70	84
May	8·42	13	81	71	78	70	48	60	18	66	91
June	2·41	6	77	65	71	57	37	49	22	57	87
Totals	44·40	88	..	..	..	..	..	..	..	..	..

Work of the Southern Sugar Experiment Station—continued.

New Experiments Initiated during the Year.

(1) **Observational Yield Trial**—
Nine advanced seedlings, with Co. 419, 30 S.N. 361, 28 S.N.G. 47, against Co. 290.

(2) **Varietal Trials**—
5 × 5 Latin square, four seedlings *v.* Co. 290.

(3) **Rotational Trial**—
Comparing long *v.* short fallow, with legumes, and change in cane variety.

(4) **Soil Treatment Trial**—
Trash + legumes *v.* legumes *v.* no trash or legumes in the rotation.

Experiments Harvested during 1937.

(1) **Irrigation Trial**—
P.O.J. 2878 *v.* P.O.J. 2725, quantity of N, first ratoon crop.

(2) **Varietal Trials**—
(*a*) Gumming resistant varieties, first ratoon crop.
(*b*) Gumming resistant varieties, plant crop.
(*c*) P.O.J. 2878 *v.* Co 290, single and double planting, first ratoon crop.
(*d*) New seedling canes *v.* Co. 290 and P.O.J. 213, plant crop.

(3) **Cultivation Trials**—
(*a*) Cultural operations with varying interspace, second ratoon crop.
(*b*) Trash conservation trial, plant crop.

(4) **Fertilizer Trials**—
(*a*) Time of application of nitrogen, second ratoons.
(*b*) Quantitative potash trial, plant crop.

IRRIGATION AND QUANTITATIVE NITROGEN TRIAL (First Ratoon Crop).

Plan and Yields.

POJ 2725.			POJ 2878.	
2N	0N	4N	3N	1N
47.3	47.5	56.4	42.3	33.9
4N	3N	2N	1N	0N
42.5	40.2	51.8	38.9	35.0
1N	2N	0N	4N	3N
49.1	38.6	48.0	35.2	33.4
0N	1N	3N	2N	4N
39.5	45.7	43.0	36.1	33.6
3N	4N	1N	0N	2N
44.5	51.4	53.6	34.5	33.4

Block.—A1.
Varieties.—P.O.J. 2725 and P.O.J. 2878.
Harvested.—September, 1937.
Age of Crops.—14 months.
System of Replication—
5 × 5 Latin square (for nitrogen).
1 block (15 plots)—P.O.J. 2725.
1 block (10 plots)—P.O.J. 2878.
Plots—0·055 acre.

TREATMENTS AND GROWTH NOTES.

After harvesting the plant crop the trash and tops were rolled into alternate interspaces. Ratooning was carried out in the alternate bare interspaces with a single-tyne subsoiler three times per interspace. Sugar Bureau No. 3 Ratooning Mixture was applied evenly to all plots at the rate of 5 cwt. per acre. Sulphate of ammonia at the rate of 120 lb. per acre was given as a top dressing to all except the 0N plots during September. The 2N, 3N, and 4N plots received a further 120 lb. per acre in October, the 3N and 4N a further 120 lb. per acre in November, and finally a similar dressing was applied to the 4N plots in December. So as to conserve the trash and irrigate at the same time, recourse was had to irrigating only in alternate interspaces. Water furrows were opened up immediately after ratooning. Irrigation had to be suspended in January owing to water shortage, so that the crop was irrigated for only six months. At all times the P.O.J. 2725 was seen to be ahead of the P.O.J. 2878.

Work of the Southern Sugar Experiment Station—continued.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	$\frac{1}{2}$ Log_e (Mean Square).
Rows	4	106·63	26·66	..
Columns	4	871·49	217·87	..
Treatment	4	56·81	14·20	0·1753
Errors	12	157·30	13·11	0·1354
Total	24	1,192·23	..	..

Crop Yields.

	0 N.	1 N.	2 N.	3 N.	4 N.
Cane, tons per acre	**40.9**	**44.2**	**41.4**	**40.7**	**43.8**
Cane, percentage of mean yield	96·9	104·8	98·1	96·5	103·8
C.C.S. in cane, per cent.	16·6	16·0	16·1	16·1	15·7
C.C.S., tons per acre	**6.79**	**7.07**	**6.67**	**6.55**	**6.88**

Varietal Results.

Variety.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	Per Cent.	Tons.
P.O.J. 2725	**46.6**	16·5	**7.69**
P.O.J. 2878	**35.6**	15·5	**5.52**

DISCUSSION.

The results from the use of sulphate of ammonia are inconclusive, as was the case with the plant cane. The main feature of the trial in this regard is that the red volcanic soil, when cropped under conditions of natural rainfall, is not seriously depleted of its available plant-food supply, provided modest applications of mixed fertilizer, combined with green manuring, are employed consistently. The amounts of cane removed per acre for both plant and ratoon crops were substantial, as is shown by the following table:—

Summary of Crop Yields—Plant and First Ratoon Crops.

Treatment.	Plant Cane.			First Ratoon Crop.		
	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	Per Cent.	Tons.	Tons.	Per Cent.	Tons.
0 N.	**57.7**	12·6	**7.27**	**40.9**	16·6	**6.79**
1 N.	**56.1**	12·6	**7.07**	**44.2**	16·0	**7.07**
2 N.	**59.5**	13·2	**7.85**	**41.4**	16·1	**6.67**
3 N.	**61.6**	12·9	**7.95**	**40.7**	16·1	**6.55**
4 N.	**55.0**	13·1	**7.21**	**43.8**	15·7	**6.88**

Even one-side watering of the ratoons, during the first six months of growth, has proven just what this land is capable of, given a timely application of irrigation to the crop in dry periods.

For both crops, variety P.O.J. 2725 has demonstrated its superiority over P.O.J. 2878 under irrigation. The crop increase was in each case over 10 tons of cane per acre, while the C.C.S. was consistently more than one unit better than that of the "Wonder" cane.

OBSERVATIONAL VARIETAL TRIAL (Plant Crop).

Plan and Yields.

A 2 17.9	A 1 18.0	Co 290 15.8	C 4 17.9
Co 290 17.1	C 9 14.8	POJ 213 22.8	Co 290 15.9
C 1 15.9	Co 290 15.8	Q 2 20.8	A 3 19.7
Co 290 15.4	C 11 18.7	C 8 20.1	Co 290 15.5
C 6 26.0	POJ 213 24.0	Co 290 16.6	C 12 26.8

Block.—Old lucerne block.

Harvested.—October, 1937.

Age of Crop.—14 months.

Plots.—0·0306 acre.

CULTIVATION.

During the autumn of 1936 this block, which had been under lucerne almost continuously since 1915, was ploughed out. After two more ploughings and harrowings the varietal trial was planted in August, 1936. Due to very dry conditions an extremely bad strike was obtained and the block was almost entirely replanted in October, 1936. This time it was irrigated for a strike. No further irrigation water was applied.

GROWTH NOTES.

Growth was fairly good during December, February, and March, but drier conditions later caused cessation of growth. These conditions lasted until the time of harvesting. All cane was fertilized uniformly in the drill with 3 cwt. of Sugar Bureau No. 3 Planting mixture per acre, and later top dressed with sulphate of ammonia at the rate of 280 lb. per acre.

In harvesting, the outer rows of each plot were discarded as guard rows, and the tonnages calculated from the six inner rows.

Crop Yields.

Variety.	No. of Plots.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
		Tons.	Per Cent.	Tons.
Co. 290	7	16.0	14·1	2.26
P.O.J. 213	2	23.4	13·8	3.23
A. 1	1	18.0	13·4	2.41
A. 2	1	17.9	15·4	2.76
A. 3	1	19.7	14·7	2.90
C. 1	1	15.9	14·4	2.29
C. 4	1	17.9	13·4	2.40
C. 6	1	26.0	14·8	3.85
C. 8	1	20.1	16·6	3.34
C. 9	1	14.8	11·8	1.75
C. 11	1	18.7	13·9	2.60
C. 12	1	26.8	14·5	3.89
Q. 2	1	20.8	16·3	3.39

DISCUSSION.

This trial represents the first field plantings of selected new seedling canes propagated on the Bundaberg Experiment Station. It will be observed that there is but one plot of each new variety, interplanted with several plots of standard canes (Co. 290 and P.O.J. 213).

The purpose of the observational trial is to afford a further opportunity to select seedlings on their habit of growth and performance, and to provide stocks of the most promising for more rigorous field trial the following year.

Any conclusions drawn from such a trial must therefore be accepted with reservations; but it would appear that varieties C.6 and C.12 are superior to the standards of this trial in both cane yield and C.C.S. value. The future progress of these canes will be awaited with interest.

It will be observed that variety Q.2 was included in the trial also. It yielded a fair tonnage and the C.C.S. was good; but it is too susceptible to gumming disease to warrant its retention in these parts.

VARIETAL TRIAL (First Ratoon).

Plan and Yields.

	Inter-space.		
I.	4′	Co 290 12.9	POJ 2878 8.6
	5′	POJ 234 14.5	POJ 2725 20.6
	5′	POJ 2878 8.1	Co 290 14.9
	4′	POJ 2725 21.0	POJ 234 14.4
II.	4′	Co 290 15.8	POJ 2725 19.7
	5′	POJ 2878 8.8	POJ 234 13.2
	4′	POJ 234 14.3	POJ 2878 8.3
	5′	POJ 2725 20.0	Co 290 13.9
III.	5′	POJ 2878 7.4	POJ 2725 18.0
	4′	POJ 234 13.5	Co 290 12.1
	5′	Co 290 12.1	POJ 234 16.5
	4′	POJ 2725 19.3	POJ 2878 5.6

IV.

Block.—B6.

Harvested.—October, 1937.

Age of Crop.—13 months.

System of Replication.—6 randomised blocks.

Plots.—0·091 acre.

V.

CULTIVATION.

Subsequent to harvesting the plant crop, the block was ratooned with the subsoiler, three times per interspace. All plots were uniformly fertilized with Sugar Bureau No. 3 Ratooning Mixture, at the rate of 4 cwt. per acre. Later, a top dressing of sulphate of ammonia was made, at the rate of 280 lb. per acre.

VI.

GROWTH NOTES.

The ratoons came away vigorously, in spite of the very dry spring experienced. Of the varieties, P.O.J. 2725 was the most vigorous ratooner, with P.O.J. 234 next in order. During the entire period of growth, P.O.J. 2725 maintained a good lead. P.O.J. 2878 was always the poorest cane under these very trying conditions.

Work of the Southern Sugar Experiment Station—continued.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	$\frac{1}{2}$ Log$_e$ (Mean Square).
Blocks	5	10·42	2·08	..
Varieties	3	431·75	143·92	2·4845
Interspace	1	0·26	0·26	..
Errors	14	17·96	1·28	0·1234
Totals	23	460·39	..	..

Crop Yields.

Variety.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	Per Cent.	Tons.
P.O.J. 2725	**19.8**	17·4	**3.45**
P.O.J. 234	**14.4**	16·1	**2.32**
Co. 290	**13.6**	15·5	**2.11**
P.O.J. 2878	**7.8**	15·2	**1.19**

Standard Error = ± 0·46 tons cane.

Summary of Crop Yields—Plant and First Ratoon Crops.

Variety.	Plant Cane.		First Ratoon Crop.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per Cent.	Tons.	Per Cent.
P.O.J. 2725	**31.4**	14·9	**19.8**	17·4
P.O.J. 234	**23.9**	15·2	**14.4**	16·1
Co. 290	**28.4**	14·1	**13.6**	15·5
P.O.J. 2878	**16.9**	13·9	**7.8**	15·2

DISCUSSION.

The results for the plant cane indicated the superiority of P.O.J. 2725 over all other varieties; the ratoon crop yields confirm this result in no uncertain fashion, under the drought conditions which prevailed. This superiority exists also in respect of C.C.S. in cane. It is thus an interesting fact that P.O.J. 2725 has demonstrated its decided value under either very dry conditions or those where soil moisture conditions are highly favourable (irrigation).

Neither plant nor ratoon crop showed any decided influence of interspace distance on the crop yield.

Work of the Southern Sugar Experiment Station—continued.

POTASH TRIAL (Plant Crop).

Plan and Yields.

NPK	NP	NP2K	NP	NP2K	NPK
11.4	12.1	14.4	14.6	12.0	13.8
NP	NP2K	NPK	NP2K	NPK	NP
13.4	12.2	11.9	13.2	15.2	12.1
NP2K	NPK	NP	NPK	NP	NP2K
14.4	12.5	12.9	12.7	13.4	13.3

Block.—E2.

Variety.—Co. 290.

Harvested.—September, 1937.

Age of Crop.—18 months.

System of Replication.—2–3 × 3 Latin squares.

Area of Plots.—0·066 acre.

CULTIVATION.

After harvesting the previous crop the stubble was ploughed out and the block sown with Poona pea. A fair crop of material was ploughed in and the block was cross ploughed and harrowed prior to planting. An excellent strike was obtained.

FERTILIZER TREATMENTS.

The cane was fertilized as follows:—

N = 225 lb. sulphate of ammonia (top dressing) per acre.
P = 225 lb. superphosphate per acre.
1K = 150 lb. muriate of potash per acre.
2K = 300 lb. muriate of potash per acre.

To avoid errors due to lateral feeding, guard rows were planted between column of plots, these being fertilized with NP only.

GROWTH NOTES.

Growth was poor throughout the entire season. The lack of the usual wet season resulted in the cane suffering throughout the best growing months, December to March.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ $\log_e$ (Mean Square).
Rows	5	2·69	1·35	..
Columns	5	3·13	1·57	..
Treatment	2	0·33	0·17	0·2652
Errors	5	13·51	2·70	1·6479
Total	17	19·66	..	..

Crop Yields.

	NP.	NPK.	NP2K.
Cane, tons per acre	13.1	12.9	13.3
C.C.S., in cane	15·1	15·0	14·9
C.C.S., tons per acre	1.98	1.94	1.98

DISCUSSION.

This experiment was laid down in an attempt to study the potash requirements of the Woongarra red volcanic loam. It has been demonstrated on several occasions that this soil type frequently exhibits potash deficiencies, and on the basis of this experience, all manures employed on the Bundaberg Station are rich in this plantfood. After consistent use of such mixtures for a period of years, combined with light cropping, positive results from potash are now seldom encountered. It was therefore decided to set out a permanent trial, in which certain of the plots would receive no potash, and others "single" and "double" dressings of muriate of potash for each crop.

The plant crop results, reported above, are rather disastrous, due to the unfavourable seasonal conditions. The yield was exceptionally light, and the differences between treatments were small and not significant.

Work of the Southern Sugar Experiment Station—continued.

VARIETAL TRIAL (Plant Crop).

Plan and Yields.

POJ 2878 18.3	Co 290 13.8	POJ 234 14.1	POJ 2940 14.8	POJ 2883 18.7
POJ 2875 21.4	POJ 2883 20.0	POJ 2875 20.0	POJ 2878 22.3	POJ 234 14.1
POJ 2725 31.6	POJ 2940 17.8	POJ 2883 20.6	Co 290 14.4	POJ 2878 20.5
POJ 234 14.3	POJ 2878 19.7	Co 290 14.6	POJ 2725 18.1	POJ 2875 20.0
POJ 2883 22.4	POJ 2725 20.3	POJ 2940 27.7	POJ 234 19.0	Co 290 16.5
POJ 2940 17.8	POJ 234 18.8	POJ 2878 19.0	POJ 2875 24.1	POJ 2725 22.1
Co 290 15.8	POJ 2875 25.2	POJ 2725 20.0	POJ 2883 26.5	POJ 2940 21.9

Harvested.—September, 1937.

Age of Cane.—19 months.

System of Replication.—5 randomised Blocks.

Plots.—0·0434 acre.

TREATMENT.

Subsequent to ploughing out the previous crop in spring 1935, the block was seeded with Poona pea. A fair crop was ploughed in during January, 1936. After rotting was completed the block was cross-ploughed and harrowed. Planting was carried out during February, 1936, and all plots were fertilized uniformly with 4 cwt. of Sugar Bureau No. 3 Planting Mixture per acre. A top dressing of 190 lb. of sulphate of ammonia per acre was made during October, 1936.

GROWTH NOTES.

A very good strike was obtained, but slow growth eventuated. During the spring the cane was suffering badly from drought, and little relief was experienced until December. Spasmodic rains during the ensuing three months culminated in very good March rains which were responsible for what growth occurred. The dry season was reflected in the small tonnage per acre, and also in the good sugar content.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ $\log_e$ (Mean Square).
Blocks	4	20·16	5·04	..
Varieties	6	216·05	36·01	1·7919
Errors	24	222·33	9·26	1·1139
Total	34	458·54	..	..

Crop Yields.

	Co. 290.	P.O.J. 234.	P.O.J. 2725.	P.O.J. 2940.	P.O.J. 2878.	P.O.J. 2883.	P.O.J. 2875.
Cane per acre, tons	15.0	16.1	18.8	20.0	20.0	21.6	22.1
Cane, percentage mean yield ..	78·6	84·4	98·5	104·8	104·8	113·2	115·7
C.C.S. in cane, per cent. ..	16.3	16.2	17.6	16.8	15.3	16.3	15.6

Standard Error = ± 7·1 per cent.

Work of the Southern Sugar Experiment Station—continued.

DISCUSSION.

This trial marks an attempt to test the relative values of the chief gum-resistant canes on the red volcanic lands of Bundaberg. The season was one which would definitely test drought resistant qualities, and the results obtained are not necessarily indicative of what would happen in a normal or a wet year. This is supported by the fact that Co. 290 gave the lowest yield of cane per acre. P.O.J. 2875 produced the heaviest tonnage under these conditions, but it was not significantly superior to P.O.J. 2725, 2940, 2878, or 2883. The performance of the lastnamed cane is very interesting, notably when considered in relationship to its C.C.S. content. It is a good standover type, and it would be released for widespread plantings except for the fact of its susceptibility to Fiji disease. It will be held in reserve, lest P.O.J. 2878 has to be discarded due to disease.

VARIETAL TRIAL—SINGLE V. DOUBLE PLANTING (First Ratoon Crop).

Block.—A2.
Harvested.—October, 1937.
Age of Crop.—12 months.
System of Replication—5 randomised blocks.
Plots.—0·0694 acre.

Plan and Yields.

POJ 2878 Single 12.2	Co 290 Double 14.4	POJ 2878 Single 16.6	Co 290 Double 17.1	Co 290 Single 15.1
POJ 2878 Double 19.8	Co 290 Single 13.0	POJ 2878 Double 13.0	Co 290 Single 14.0	Co 290 Double 15.8
Co 290 Double 14.9	POJ 2878 Single 14.8	Co 290 Double 14.8	POJ 2878 Single 11.7	POJ 2878 Double 11.5
Co 290 Single 14.6	POJ 2878 Double 16.6	Co 290 Single 15.5	POJ 2878 Double 15.5	POJ 2878 Single 11.5

TREATMENTS.

Planting—
Single.—Three-eye plants dropped singly with 6 inches between ends of setts.
Double.—As for single, but 2 setts placed side by side.

Cultivation.—Trash from the plant crop was conserved in alternate interspaces. The bare interspaces were ratooned with the subsoiler three times per interspace and fertilizer was applied to all plots at the rate of 4 cwt. of Sugar Bureau No. 3 Ratooning mixture per acre. All plots were top dressed with 280 lb. of ammonium sulphate per acre.

GROWTH NOTES.

Growth was very poor until December when some relief was afforded by medium rains. From December to March fair progress was sustained but rains were far too light to ensure a reasonable crop. The Co. 290 suffered more in the dry periods than did the P.O.J. 2878, but the latter variety did not respond so rapidly to the rains. No great differences were noticeable at any stage of the crop growth.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ $\log_e$ (Mean Square).
Blocks	4	8·06	2·02	..
Single v. Double	1	10·37	10·37	1·1695
Varieties	1	1·89	1·80	0·2939
Errors	13	63·44	4·88	0·7926
Total	19	83·67	..	..

Work of the Southern Sugar Experiment Station—continued.

Crop Yields.

	Planting.		Varieties.	
	Single.	Double.	Co. 290.	P.O.J. 2878.
Cane per acre, tons	**13.9**	**15.3**	**14.9**	**14.3**
Cane, percentage mean yield	95·2	104·8	102·0	98·0
C.C.S. in cane, per cent.	15·1	15·2	14·8	15·4
C.C.S., tons per acre	**2.10**	**2.33**	**2.21**	**2.20**

Standard Error = 4·2 per cent.

DISCUSSION.

With the plant crop, Co. 290 was markedly superior to P.O.J. 2878 on cane yield, but with the droughty season experienced by the ratoons, there was little difference in yield between the two varieties.

The influence of double planting over single was felt with the plant cane, and has persisted through the ratoons. The *total* gain for both crops has been 3·7 tons of cane per acre, thus emphasising the desirability of this practice with varieties which are liable to give a poor germination.

CULTURAL AND INTERSPACING TRIAL (Second Ratoon Crop).

Inter-space.	Non-Subsoiled.	Subsoiled.		Non-Subsoiled.	
4′ 6″	18.0	16.7	20.3	19.8	Autumn Plant.
4′ 0″	17.4	17.3	19.7	20.5	
4′ 0″	20.0	20.9	20.0	22.4	
4′ 6″	19.7	20.8	21.7	18.5	
4′ 0″	10.5	9.7	8.7	7.2	Spring Plant.
4′ 6″	9.9	11.7	11.0	10.8	

Blocks.—B4 and 5.
Variety.—P.O.J. 2878.
Harvested.—September, 1937.
Age of Cane.—13 months.
System of Replication.—6 randomised blocks.
Plots.—0·168 acre.

TREATMENTS.

Cultivation—

(*a*) Subsoiling *v.* non-subsoiling prior to planting.
(*b*) Interspace distance—4 feet 6 inches *v.* 4 feet.

The plant and first ratoon crops from this experiment included also surface cultivation *v.* no surface cultivation. As no results were obtained in the first two crops this feature was eliminated from the trial this year. The number of plots is therefore only half of that previously.

CULTIVATION.

After harvesting the first ratoon crop in August, 1936, all plots were ratooned with the subsoiler three times per row. A regular fertilizer application of 4 cwt. of Sugar Bureau No. 3 Ratooning mixture per acre was made, followed by a later top dressing with sulphate of ammonia at the rate of 280 lb. per acre.

GROWTH NOTES.

As in all other trials this season the growth was poor owing to the drought. A remarkable feature of this trial, however, is the difference in crop growth (even in the second ratoon stage) between the autumn and spring planted portions of the block.

Work of the Southern Sugar Experiment Station—continued.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	$\frac{1}{2}$ Log$_e$ (Mean Square).
Blocks	5	528·50	105·70	..
Subsoiling	1	0·60	0·60	0·8959
Interspace distance	1	0·88	0·88	1·0874
Errors	16	22·36	1·40	1·3194
Total	23	552·34	..	..

Standard Error = 2·09 per cent.

Crop Yields.

	Subsoiled.	Non-Subsoiled.	Interspace.	
			4′ 6″	4′ 0″
Cane, tons per acre	**16.5**	**16.2**	**16.6**	**16.2**
Cane, percentage of mean yield	101·2	98·8	101·2	98·8

C.C.S. in Cane (average) = **15·1** per cent.

DISCUSSION.

This experiment marks an attempt to determine the influence of cultivation treatment on the yield of P.O.J. 2878, on red volcanic loam. For plant, first and second ratoon crops, all treatments have been without significant influence on yield. It must therefore be concluded that the value of cultivation operations on red volcanic soils—beyond that of weed control—is *nil*; and this applies equally to deep cultivation as well as to surface tillage.

The main point of interest in the experiment is the superiority of autumn over spring planting. This benefit is reflected also in the yields of the first and second ratoon crops, as the following figures show:—

	Plant Cane.	First Ratoons.	Second Ratoons.
	Tons.	Tons.	Tons.
Autumn plant	**27.9**	**23.0**	**19.6**
Spring plant	**19.0**	**17.6**	**9.9**
Gain for autumn plant	**8.9**	**5.4**	**9.7**

PERMANENT TRASH TRIAL (Plant Crop).

Plan and Yields.

No Trash.	Trash.	Trash.	No Trash.
18.2	**19.5**	**18.7**	**19.0**

Block.—E3a.

Variety.—P.O.J. 2725.

Harvested.—August, 1937.

Age of Crop.—18 months.

Plots.—0·382 acre.

TREATMENTS.

After harvesting the first ratoon crop in 1935, the trash and tops from the "trash" plots were ploughed in. All material on the "no trash" plots was burnt. The entire block was then seeded with Poona pea and a fair crop was ploughed in during January, 1936.

Work of the Southern Sugar Experiment Station—continued.

GROWTH NOTES.

The cane was planted in February, an excellent strike being obtained. Unfavourable growing conditions then obtained until mid-summer. No pronounced wet season eventuated until the late March rains. At no time was any noticeable difference in growth of plots apparent.

FERTILIZER TREATMENT.

Fertilizer was applied equally to all plots. At planting, Sugar Bureau Mixture No. 3 was applied in the drill at the rate of 4 cwt. per acre, and a top dressing of 190 lb. of sulphate of ammonia per acre was made during November, 1936.

Crop Yields.

	Trash.	No Trash.
Cane per acre, tons	**19.1**	**18.6**
C.C.S. in cane, per cent.	16·3	16·7
C.C.S., tons per acre	**3.11**	**3.11**

DISCUSSION.

This experiment was initiated in 1933, for the purpose of studying the cumulative effects of trash conservation over a period of years. The plan is to burn all residues on the "no trash" plots; the trash and tops from all crops on the trash plots are conserved as a surface mulch and finally ploughed under after the last ratoon crop has been harvested.

This crop marks the third successive harvest since the trial was laid out. It is the first time, also, that the trash plots have shown a crop increase over those on which the trash has been burnt.

NITROGEN TRIAL—TIME OF APPLICATION (First Ratoon Standover Crop).

Plan and Yields.

Blocks.				
I	2	4	3	1
	32.4	25.5	19.6	30.4
II.	3	2	1	4
	33.2	23.7	24.3	29.5
III	1	3	4	2
	34.2	29.5	29.2	31.0
IV	4	2	3	1
	35.8	35.0	31.2	29.6
V	1	3	2	4
	31.9	29.2	28.6	25.7
VI	3	1	4	2
	313	284	25.1	29.2

Block.—E. 4.
Variety.—P.O.J. 2878.
Harvested.—August, 1937.
Age of Crop.—24 months.
System of Replication.—Six randomised blocks.
Plots.—0·111 acre.

TREATMENTS.

Cultivation—

After harvesting the plant crop, the trash was rolled into alternate interspaces. The fertilizer applications were:—

(1) 360 lb. amm. sulph. per acre immediately trash was rolled.
(2) 180 lb. amm. sulph., as for No. 1.
180 lb. amm. sulph., 4 weeks later.
(3) 120 lb. amm. sulph., as for No. 1.
120 lb. amm. sulph., mid-September.
120 lb. amm. sulph., late October.
(4) 120 lb. amm. sulph., early October.
120 lb. amm. sulph., mid-November
120 lb. amm. sulph., late December,

GROWTH NOTES.

Ratooning was carried out as usual in the clear interspaces. This crop made reasonable growth in its first year owing to the fair December and March rains. It was stood over so that some mature cane would be available for harvesting early the following season. During the 1936-1937 year little extra growth took place. A very dry spring, and the absence of the

Work of the Southern Sugar Experiment Station—continued.

usual wet season militated against growth. Heavy rains in late March and a fairly open winter relieved matters in the latter portion of the season. At 12 months of age all plots were further top dressed with sulphate of ammonia at the rate of 150 lb. per acre.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	½ Log_e (Mean Square).
Blocks	5	98·62	19·72	..
Treatments	3	9·01	3·00	0·5493
Errors	15	231·40	15·43	1·3680
Total	23	339·03	..	..

Crop Yields.

	Treatment 1.	Treatment 2.	Treatment 3.	Treatment 4.
Cane, tons per acre	**29.8**	**30.0**	**29.0**	**28.5**
C.C.S. in cane, per cent.	14·8	15·1	15·1	15·1
C.C.S. per acre, tons	**4.41**	**4.53**	**4.38**	**4.30**

DISCUSSION.

The time of application of sulphate of ammonia has had but slight influence on the standover ratoon yields. A similar position existed in the case of the plant cane.

Considering both crops together, it would appear that early applications of sulphate of ammonia are better than late, insofar as they affect tonnage and C.C.S. of annual crops. With standover crops, the early application favours increased cane tonnages, but the delayed maturity in such crops, brought about by late dressings of nitrogenous manures, provides a better C.C.S., unless the cane is harvested very early in the season.

Laboratory Work.

Analyses carried out during the year included:—

Experiment Station canes	221
Farm trial canes	82
Farmers' canes	254
Gin Gin show canes	308
Maryborough show canes	45
Bundaberg show canes	145
Irrigation waters	77
Total	1,132

During the year part of the fibre investigation programme of work was carried out at this station by officers of the Cane Prices Board.

1937 Crop.

	Tons	cwt.	qr.
Cane sent to mill	512	19	0
Cane used for plants	8	0	0
Cane used for samples	2	5	0
	523	**4**	**0**

Total area harvested	**23.34 acres.**
Tonnage per acre harvested	**22.41**

Autumn plant	4·82 acres.
Spring plant	3·59 acres.
Ratoons	14·93 acres.

REPORT OF COMMITTEE ON SEEDLING PROPAGATION.

Mr. Arthur F. Bell, Assistant Director, *Chairman.*

Seedling propagation and selection is carried out at the three regional field stations of the Bureau and is based upon a programme considered annually by a Committee consisting of the officers in charge of each Station, the Assistant Pathologist, and the writer. The meetings of the Committee are held, for convenience, during the period of the annual conferences of the Queensland Society of Sugar Cane Technologists.

Selected seedlings of promise at any one station are transferred to quarantine in Brisbane and later distributed to the other districts for trial, so that the results of the seedling raising activities at each station are available to the whole State. The sugar industry of the northern and central districts, particularly, has been built almost exclusively on the cultivation of low fibred "noble" canes, but the most pressing requirements now demanded of new canes in these districts are resistance to beetle borer damage and strong rooting systems which will enable them the better to withstand cane grub attack. Under Queensland conditions the first essential in improved borer resistance is increased hardness of rind while, generally speaking, the parental strains which will produce strong rooting systems also transmit higher fibre and hardness of rind. It therefore appears inevitable that the cane varieties of the future will be harder and have a higher fibre content than the majority of the varieties they displace. Such varieties, moreover, will be more suitable for standing over for harvesting as a two-year crop if the necessity arises—a very desirable quality—should there be instituted any system of rigid control of maximum farm production.

1938 Cross Pollination Season.

For the second year in succession abnormally dry conditions have been responsible for restricted arrowing in the Cairns district. During the current year the monsoonal wet season was of very short duration, terminating in February, and thereafter almost droughty conditions prevailed. The paucity of arrows was to some extent compensated by the generally mild dry winter favouring a good production of pollen by such male parents as developed arrows. The standard varieties Oramboo, Korpi, M. 1900 Seedling, and Q. 813 failed to arrow, while only odd arrows were obtained from E.K. 28, S.C. 12/4, S.W. 499, D. 1135, P.O.J. 2878, and Badila. The following crosses were carried out during the season:—

Female Parent.	Male Parents.
P.O.J. 100	"X" 9
P.O.J. 213	Co. 290, P.O.J. 2940, and Co. 356
P.O.J. 2364	Co. 356, 20 S. 16, E.K. 28, and N.G. 15
P.O.J. 2725	"X" 12, Co. 356, 20 S. 16, Co. 290, Q. 26, "X" 1, Q. 1098, "X" 3, S.C. 12/4, H.Q. 409, S.W. 499, "X" 2, "H" 257, Q. 2, E.K. 28, N.G. 15, and "X" 8
P.O.J. 2727	7 R. 428
P.O.J. 2747	7 R. 428
P.O.J. 2878	"X" 5, "X" 7, and Co. 290
U.D. 1	"X" 5
U.D. 62	Q. 1098 and "X" 9
Co. 270	Q. 1098
Co. 281	7 R. 428 and P.O.J. 2940
Co. 290	P.O.J. 2878, "X" 1, "X" 9, and Q. 1098
Co. 515	"X" 12, "X" 5, N.G. 15, and P.O.J. 2940
"X" 7	"X" 1, "X" 9, and P.O.J. 2878
Uba	Q. 1098
S.J. 4	"X" 1, Co. 290, P.O.J. 2940, "H" 249, P.O.J. 2878, and Q. 2
N.G. 15	"X" 1, "X" 2, "X" 3, "X" 7, Co. 356, S.W. 499
	Experimental Crosses.
P.O.J. 213	H. 109
P.O.J. 2725	Q. 1098, H.Q. 409, "X" 1, 20 S. 16, and Q. 2
P.O.J. 2875	H.Q. 409
P.O.J. 2878	S.W. 499
P.O.J. 2364	Q. 2
Co. 290	"X" 1
N.G. 15	"X" 1
S.J. 4	"X" 1 and Co. 290
Uba.	Q. 1098

The varieties designated "X" and "H" are seedlings from previous years which have not as yet been advanced to the status of "Q" varieties. The so-called experimental crosses refer mainly to crosses made for the purpose of testing relative performance of arrows in SO_2 and H_3PO_4 solution, to ascertain the effect of shading, or for the testing of methods of seed storage. A number of "selfings" were also carried out for the purpose of checking the validity of "crosses" and also for breeding purposes such as accentuation of various characteristics, including arrowing.

Report of Committee on Seedling Propagation—continued.

The bulk of the crosses were again made with the female arrow growing in the field while the grouped male arrows were maintained in a solution of 0·01 per cent. SO_2 and 0·01 per cent. H_3PO_4. After harvesting, the arrows, when necessary, were artificially dried in an electrically heated forced draught of air at about 90–95 deg. Fahr.

Owing to the sparse and erratic arrowing it was not practicable to complete many of the crosses planned for this season, and to a considerable extent the crosses utilized have been empirical. It is considered advisable, at least in the present state of our knowledge, to aim at a fairly broad range of crosses, repeating those which show promise but without undue emphasis on any particular cross or crosses. It seems probable that too much emphasis is placed on the "proven cross" concept since, in the final analysis, the proof must be based on a comparison of the number of seedlings attaining commercial or near-commercial planting; the occasions when such comparisons can be considered valid must be somewhat infrequent.

1937 Series Seedlings.

Various circumstances made it necessary to restrict the number of seedlings planted at the Meringa Station; a total of some 13,000 were planted individually in the field at the three stations and are now approaching the time of selection. Of the crosses listed in last year's report 22 were represented in field plantings at Meringa, 15 at Mackay, and 10 at Bundaberg. Parallel germinations of "selfed" arrows of the more important female parents were carried out at Meringa in order to indicate the probable magnitude of the proportion of selfs in any reputed cross.

Little success was achieved with crosses in which P.O.J. 213 was a female parent, in spite of the application of "mass pollination" methods; as the Fiji disease resistance of this variety is particularly high, derivatives therefrom might be of considerable value in Southern Queensland. Co. 290 also has high Fiji disease resistance and reciprocal crosses with this variety, and P.O.J. 2878 produced some attractive looking seedlings; the Fiji disease resistance of these will be watched with interest. Some interest also attaches to a hybrid between Co. 515 (half sorghum) and P.O.J. 2940.

Selected Seedlings.

Past practice has provided for the planting of 10 setts of first selection seedlings and four plots of 10 setts each of second selection seedlings. Work in connection with root disease studies had impressed upon us the normally wide range of variation in production of stools from visually equivalent setts of the same variety and stimulated doubt as to the desirability of such small samples. In consequence, some stool-sett plantings were set out and the weight of the resultant stools determined individually. Under the conditions of these experiments it was found that the Standard Error of the Mean of all (approximately 40) stool weights was such as to indicate that 10-stool samples could only serve to differentiate with certainty differences in yielding capacity of seedlings of the order of 40 per cent. or more. It has been decided tentatively to combine the second and third plantings and to plant 40-sett plots of each selected original seedling. It is believed that the 40-sett plot in four rows of 10 stools will permit of a much more reliable visual selection of habit as well as vigour. A communication dealing with this aspect of seedling selection has been prepared for presentation to the Sixth Conference of the International Society of Sugar Cane Technologists. Selections from the 40-stool plots will proceed to yield observation and yield trials on the stations, and thence to farm trials.

Selected seedlings at present under trial on the stations do not call for special comment, with the possible exception of No. 18 of the 1935 series germinated at Mackay. This is a Co. 290 derivative, which shows good early promise, although its disease reactions have not been determined as yet.

Q. Seedlings.

The seedling Q.2 was approved for commercial planting for the 1937 season in the far northern district, and a considerable area has now been planted to this variety. Its chief virtues are its erect habit, free trashing, and resistance to beetle borer attack and flood damage. It is a latish maturer with medium to good sugar content, and produces a good plant crop under conditions of satisfactory moisture, but does not usually ratoon satisfactorily if cut before mid-September.

Report of Committee on Seedling Propagation—continued.

Farm Latin Square trials with the varieties Q. 4, Q. 10, and Q. 12 are now being harvested, and of these only Q. 10 will be retained; it has been set out on a number of further farm trials in order to to obtain direct comparisons with Q. 2 and a standard cane in each case. This cane has performed well during the past season in comparison with either S.J. 4 or Clark's Seedling. Q. 13 and Q. 19 have been advanced to farm yield trial in competition with Q. 10 and standards. Q. 13 is at present showing indications of being the more promising of the two; it appears to possess the qualities of excellent germination and high sugar content, but its ability to ratoon has yet to be tested. Three vigorous hard rinded canes Q. 21, Q. 26, and Q. 27 have been set out in farm observation trials, and next year will be included in farm yield trials if they maintain sufficient promise, although, up to the present, they have developed only a moderate sugar content.

In the Central Division the seedling Q. 20 is now being set out in some twenty farm plots and trials, this being the first seedling bred at the Mackay Station to reach this status. It is a medium cropper, but has consistently returned a high sugar content. Q. 22–25 were further tested at Bundaberg during the season; of these Q. 25 appears definitely the best, but unfortunately it has also given indications of marked susceptibility to Fiji disease, and its further propagation must, therefore, be suspended.

Varietal Statistics.

In Table I. have been set out the tonnages crushed during 1934-7, and the percentage of the crop which they constitute, for all varieties aggregating more than 0·05 per cent. of the State's production. The much more pronounced district trends are set out in Table II., where the component varieties are shown to the nearest 1 per cent. in each of the four geographical districts. It is not proposed to discuss these tables in detail, but it will be noted that seven varieties constitute some three-fourths of the crop, while Badila remains pre-eminent and more or less static at about 38 per cent. The greatest changes have taken place in the southern district, where Q. 813, D. 1135, M. 1900 Seedling, Black Innes, and Uba are being replaced by P.O.J. 2878, P.O.J. 213, and Co. 290.

TABLE I.—QUEENSLAND CANE VARIETY CENSUS, 1934-37.

Tons of Cane Crushed and Percentage of State's Total Crop for each Variety constituting .05 per cent., or more, of this Crop. Varieties listed in order of relative importance for the 1934 season. Tonnages listed as "mixed" in mill returns have been apportioned to named varieties.

Variety.	1934.		1935.		1936.		1937.	
	Tonnage.	Per Cent.	Tonnage.	Per Cent.	Tonnage.	Per Cent.	Tonnage.	Per Cent.
Badila (N.G. 15) ..	1,569,500	36·8	1,501,100	35·6	1,963,200	38·0	2,105,900	41·0
M. 1900 Seedling ..	417,300	9·8	478,900	11·35	662,100	12·8	541,900	10·6
Clark's Seedling (H.Q. 426)	321,900	7·55	275,700	6·5	359,000	6·9	374,400	7·3
E.K. 28	290,700	6·8	197,800	4·7	283,900	5·5	303,500	5·9
D. 1135	259,500	6·1	236,100	5·6	181,000	3·5	109,800	2·1
Q. 813	240,000	5·6	242,400	5·75	244,300	4·7	183,600	3·6
H.Q. 409	210,000	4·9	245,500	5·8	302,200	5·8	341,900	6·7
B. 208	120,200	2·8	63,000	1·5	49,100	0·9	35,300	0·7
P.O.J. 2714	100,800	2·35	120,200	2·8	111,900	2·2	78,800	1·5
P.O.J. 213	89,200	2·1	123,200	2·9	152,400	2·95	107,100	2·1
Black Innes (M. 189)	77,300	1·8	54,000	1·3	35,100	0·7	13,200	0·25
S.J. 4	59,600	1·4	132,600	3·1	190,900	3·7	192,700	3·8
H.Q. 285	57,300	1·35	53,600	1·3	42,400	0·85	26,400	0·5
Uba	57,700	1·35	79,200	1·9	43,000	0·85	24,300	0·5
Korpi	56,000	1·3	39,100	0·9	54,900	1·1	75,700	1·5
P.O.J. 2878	54,700	1·3	102,800	2·4	176,200	3·4	218,000	4·25
Co. 210 and 213 ..	45,700	1·05	48,400	1·15	22,500	0·4	13,500	0·25
Oramboo	35,100	0·8	48,000	1·1	44,000	0·9	38,500	0·75
Pompey (7 R. 428)	30,900	0·7	28,200	0·7	54,600	1·05	81,600	1·6
Mahona (N.G. 22) ..	23,300	0·55	14,500	0·3	9,800	0·2	4,300	0·1
Q. 1098	10,400	0·25	6,900	0·2	12,500	0·2	3,000	0·05
B. 147	6,000	0·15	7,500	0·15	24,700	0·5	21,300	0·4
P.O.J. 234	5,700	0·15	11,500	0·3	25,200	0·5	27,100	0·5
Malagache	6,800	0·15	4,800	0·1	3,100	0·05	..	..
N.G. 16	6,500	0·15	4,200	0·1	5,600	0·1	3,000	0·05
Nanemo	4,000	0·1	2,300	0·05	..	..	4,000	0·1
S.J. 2	2,500	0·05	6,100	0·15	11,400	0·2	23,100	0·45
Co. 290	..	..	2,800	0·1	43,900	0·85	106,100	2·1
P.O.J. 2725	..	..	..	..	5,900	0·1	10,400	0·2
Q. 2	..	..	..	..	..	..	6,700	0·1
S.J. 7	..	..	..	..	..	..	5,200	0·1

Report of Committee on Seedling Propagation—continued.

TABLE II.—DISTRICT CANE VARIETY CENSUS, 1934-37.

Varieties which have constituted one per cent., or more, of District Crops, Grouped according to Country of Origin. Returns recorded to the nearest one per cent.

District	North of Townsville.				Burdekin and Giru.				Central.				Southern.			
Variety.	1934.	1935.	1936.	1937.	1934.	1935.	1936.	1937.	1934.	1935.	1936.	1937.	1934.	1935.	1936.	1937.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Badila (N.G. 15)	65	61	60	59	38	49	51	55	16	15	12	13	..	1	..	1
Korpi	1	..	..	1	5	5	6	6	..	..	..	..	1	1	1	2
Oramboo	..	..	..	..	1	1	1	..	..	..	1	1	3	4	4	4
Mahona (N.G. 22)	..	..	..	..	..	..	..	..	..	..	..	..	3	2	1	..
N.G. 16	..	..	..	..	..	..	..	..	..	..	..	..	1	1	1	1
Clark's Seedling (H.Q. 426)	7	7	8	8	13	9	9	8	11	10	9	9	..	..	..	..
H.Q. 409	12	14	12	13	..	..	..	..	..	..	..	..	..	..	..	..
H.Q. 285	..	..	..	..	..	..	..	..	2	1	1	1	5	4	3	3
Q. 813	3	2	3	2	..	..	..	..	12	11	9	8	10	10	8	6
Q. 1098	..	..	..	..	..	..	..	..	..	..	..	..	1	1	2	1
S.J. 4	3	7	8	7	..	..	1	2	..	..	..	..	..	..	..	..
S.J. 2	..	..	..	..	..	..	..	1	..	..	1	2	..	..	..	..
P.O.J. 2878	1	1	1	2	..	..	..	..	..	..	2	2	5	10	17	22
P.O.J. 2714	..	..	..	..	1	..	..	1	7	8	6	5	4	5	4	3
P.O.J. 213	..	..	..	..	..	..	..	..	2	2	2	1	8	11	17	15
P.O.J. 234	..	..	..	..	..	..	..	..	..	..	..	..	1	1	3	4
E.K. 28	..	..	..	..	23	18	23	22	12	11	11	12	..	..	..	..
M. 1900 Seedling	..	..	..	..	..	..	..	..	33	38	46	45	13	11	9	6
Black Innes (M. 189)	1	..	1	..	..	..	..	..	1	1	..	..	7	4	2	1
D. 1135	4	4	3	2	..	..	..	..	1	1	..	..	22	18	12	8
B. 208	..	..	..	..	15	13	8	5	..	..	..	..	..	..	..	..
Uba	..	..	..	..	..	..	..	..	..	..	..	..	7	9	5	4
Co. 210 and 213	..	..	..	..	..	..	..	..	..	..	..	..	5	5	3	2
Co. 290	..	..	..	..	..	..	..	..	..	..	..	1	..	..	5	15
Pompey (7R. 428)	2	2	2	3	..	..	..	..	..	..	..	..	..	..	..	..

It is of interest to note the composition of the crops according to the country of origin of the component varieties; such data for the 1937 crop were as follows:—

	Per cent.
New Guinea	43·5
Queensland	23
Java	14·5
Mauritius	11
West Indies	3·5
India	3
Fiji	1·5

It will be seen that two-thirds of the crop was produced from varieties obtained from New Guinea by local expeditions or from seedlings raised in this State; approximately one-fourth of the crop was produced from Queensland bred seedlings.

Experimental.

Reference has already been made to the results of stool-sett plantings which have furnished interesting data on the range of normal variation of yield from setts taken from original seedling stools. Further plantings along these lines have been carried out and will be harvested shortly.

The question of guard rows is an important aspect of varietal trials. To eliminate appreciable errors in yield determination due to intervarietal competition it is apparent that two rows on either side of each plot must be rejected. Such practice is obviously extravagant of space and, in a commercial harvesting system, somewhat difficult of complete supervision. We have approached this problem on the theoretical basis of providing a single row of a "neutral" variety between each column of plots, the hypothetical variety being one which is tall enough

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to combat competition by a vigorous variety but not sufficiently spreading in habit to be itself a serious competitor of a less vigorous variety. It has been found that under Southern Queensland conditions the use of a single row of the variety P.O.J. 234 very greatly reduced competitive effects, and encourages us in the belief that a still more suitable variety may eliminate all serious errors.

Data have been accumulated on the relation of plant stool size to ratoon stool size, and indicate a strong positive correlation.

Fuzz storage experiments commenced last year have been restricted as to range of crosses on account of the paucity of arrowing during the past two seasons. Such as have been completed indicate that fuzz may be stored without serious loss in viability for periods of six to nine months at temperatures of 32 deg. and 55 deg. F. There did not appear to be any particular gain in favour of 32 deg. as compared with 55 deg., although, of course, an intermediate temperature might have produced a slight improvement. No advantage appeared to accrue at either temperature as a result of filling the containers with CO_2 before sealing. All fuzz was stored over calcium chloride. In this case the term "viability" is used in respect of seedlings which persist after germination rather than seeds which merely germinate; fuzz stored at room temperatures will frequently give good germination, even after several months' storage, but the bulk of the seedlings therefrom usually die within one or two weeks. These experiments are being continued and extended; a complicating factor is introduced by the necessity for transferring fuzz to the Mackay and Bundaberg Stations, and hence raises the question of intermittent *v.* continuous storage.

With a view to increasing the proportion of cross pollination in which both parents are maintained wholly in solution some experiments have been carried out with varying solution strengths. The best solution so far tested has been the mixture of 0·01 per cent. SO_2 and 0·01 per cent. H_3PO_4. Current experiments are also testing the effect of varying proportions of shade and sunlight, during cross pollination, upon the number of seedlings germinated per unit of weight of fuzz; this work is being carried out to determine the suitability of the existing forest land on Meringa Station for the location of crossing frames.

Tentative description forms for varieties have been prepared, and descriptions of approved varieties are being compiled by field officers. It is proposed to repeat the descriptions in different localities over two or three years in the hope of achieving that very difficult, but necessary, task—an adequate and readily usable description of all-important commercial or breeding varieties.

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Report of the Division of Entomology and Pathology.

Mr. Arthur F. Bell, Assistant Director.

Entomological investigations are carried out by Messrs. R. W. Mungomery (Entomologist) and J. H. Buzacott (Assistant Entomologist) at Meringa, and W. A. McDougall (Assistant Entomologist) at Mackay; summaries of their reports are included. Mr. McDougall has directed his chief attention to a study of the rat problem; a good deal of interesting and valuable information on life history, habits, &c., has been obtained, but we are still very much in the dark as to the factors controlling plague years. Fiji disease has received a great deal of attention in the Southern District, and Mr. D. R. L. Steindl (Assistant Pathologist) has been seconded to Bundaberg to assist in control measures. Mr. C. G. Hughes (Assistant Pathologist) again was seconded to Meringa to supervise cane breeding operations; this year he was assisted by Mr. G. A. Christie, who will gradually assume control of this phase of work. A considerable advance has been made in the testing and provision of cultures of nitrogen-fixing bacteria for the inoculation of green manure crops, and cultures are being sought by farmers.

Cane Pests Boards' Conference.

The fourth annual conference of delegates of Cane Pest Destruction Boards was held at Meringa on 25th May, the attendance constituting a record. Matters connected with the control of pests such as grubs, borers, rats, &c., which are under investigation by officers of the Bureau or Supervisors of Cane Pests Boards, formed the subject of the greater part of the discussions. On the motion of one of the interested Boards the question of the advisability of collecting beetles was discussed; after full discussion a resolution was adopted affirming the opinion of this Conference that payment for cane beetles is uneconomic as a method for control of this pest.

The Greyback Cane Beetle (*Lepidoderma albohirtum* Water).

During the season covered by this report, grub infestation varied considerably throughout the northern cane districts, some areas registering very light infestations, others moderate, whilst in a few isolated cases the infestations were particularly heavy. It will be recalled that during the critical time of beetle emergence and egg-laying in the years 1934 and 1935, hot, dry conditions decimated the beetle population in the Hambledon and Mulgrave areas. Since that time the pest has gradually increased to a point at which damage has once more become noticeable in these areas, but fortunately there appears to have been no substantial increase in damage this year over that of the preceding year. Abnormally dry conditions since March of this year have accentuated the effect of grub attack, however, and areas of extremely low infestation showed signs of leaf yellowing, whereas in normal years such infestations would not be noticeable. The same remarks apply to practically the whole of North Queensland, which experienced a particularly lean rainfall during the monsoonal period. In the Innisfail district heavy grub infestation has been on a considerably reduced scale, and it is thought that this district benefited greatly as a result of the delayed spring and early summer rains, which released the beetles in one major flight, and eliminated any great variation in grub stages. In the Burdekin district, and along the Townsville-Ingham line, heavy rainfalls favoured a large beetle emergence, and the resulting infestation on several farms was of a severe nature. However, in some sections of these areas dry conditions followed these emergences, and were not conducive to the development of the eggs and early larval stages; as a result, heavy infestations were recorded almost solely in fields which had been subsequently irrigated, whilst those which had not been irrigated remained comparatively free of the grub pest.

As reported last year damage in the Mackay district was particularly severe and it is conservatively estimated that some 40,000 tons of grub affected cane was delivered to the mills. During the current season growing conditions have been better and the pest neither so widespread nor intense, with the result that damage has been very greatly reduced, although several individual farmers will experience heavy losses. This year some instruction was given to farmers in the matter of field surveys, systematic digging of cane stools and recording grubs present; the results indicate the very patchy nature of infestation as compared with last year. This patchy nature of infestation is, however, the normal condition in the Mackay district.

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We have at times the somewhat surprising experience of finding fairly heavy grub infestation in fields in the immediate vicinity of which it was scarcely possible to locate a single beetle on the common feeding trees. This unusual feature occurred again this year; after the beetle emergence at Greenhill plantation comparatively few beetles were to be found on feeding trees growing close to the outside limits of the plantation. A search on the hills from 1 to 1½ miles away revealed that the beetles were present on the forest trees there in fair numbers, and evidently infestation occurred as a result of a later migration back to the canefields. Incidentally, this occurrence emphasises the futility of any collecting campaign instituted for the express purpose of reducing infestation. It also lends little promise to the scheme of encircling any area with favoured feeding trees to which the bettles might be attracted. In this case trees of *Ficus benjamini* (weeping fig) are growing at intervals around the plantation boundaries, yet comparatively few beetles were observed feeding on those trees. However, the trees are still young, and it will be interesting to watch results with this project in the coming years.

The total acreage fumigated this year in the main grub area from Tully to Cairns, for which statistics in past years have been available, amounted to 517 acres. The greater part of the fumigation work was carried out with the standard "carbon bisulphide and paradichlorbenzene mixture," but in some cases, especially in some of the lighter sandy loams, carbon bisulphide again gave very satisfactory results when used alone. The extent of the area fumigated is somewhat of the same order as that of last year, but actually much of this year's fumigation was made necessary by virtue of the extremely dry conditions rendering the unit damage per grub so great. This is exemplified by the fact that several fields or portions of fields were fumigated after the normal fumigation campaign had terminated—i.e., when it became apparent that these fields of low infestation would suffer considerable damage unless treated. In normal years, such fields would have been classed as carrying too low an infestation to warrant fumigating. Dry conditions also adversely affected the recovery of the fumigated fields.

Losses through grub damage in the Burdekin district in the 1937 season were of a high order in certain areas, chiefly as a result of a big reduction in the sucrose content of the cane growing in these grub-infested fields. Faced with the possibility of similar infestations and losses this year, the Pests Boards of that district interested themselves in soil fumigation, and as a result they provided a number of soil injectors for applying fumigant, and made them available to growers in their respective areas, together with fumigant at a reduced cost. On the Bureau's part, the services of Messrs. Buzacott and Knust were made available to the growers in those areas to instruct farmers and others in the method of conducting grub surveys and fumigation campaigns, and as a result several fields were fumigated. With the experience gained from this year's operations, growers there should now be in a better position to undertake this work in future years, if infestations of such a magnitude recur.

The comparatively severe grub damage of the past two years has prompted a critical review of grub control measures in the Mackay district. For the past forty-two years grubs and beetles have been collected and paid for. This so-called form of control has proved expensive; it is generally considered uneconomic and has been discarded in most Queensland cane areas. On latest advices the Mackay Pest Board has decided to fall into line and discontinue payment for grubs and beetles, at least for the coming season. Consideration is being given to the introduction of fumigation in limited areas and greater use should be made of strong rooting varieties which are able to withstand grub attack to a considerable extent.

Wireworms.

Following the heavy rainy season of 1937 it was anticipated in last year's Annual Report that infestations of the lowland wireworm, *Lacon variabilis* Cond., would be extensive in the Mackay area; this forecast proved correct, as also did that for the previous year. Up to the present it must be admitted that pre-seasonal warnings concerning the probable extent of damage to be expected from plantings, made at normal planting times, on "wireworm country," have not served to reduce the district losses by this pest to any great extent. This is chiefly due to the general dislike of very late plantings and the seasonal variations of pest incidence. The disadvantages of late plantings are appreciated; it could be pointed out, however, that in "wireworm years" many plantings made at normal times ultimately result in what are virtually late plantings, plus the added expense associated with the earlier unsuccessful plantings, heavy and repeated replanting, and ploughing out.

The 1937-38 summer rainfall records indicate some relief, in the Mackay districts, from wireworms during the coming planting season. It is expected that damage from this pest will be comparatively scarce and will be confined to very low-lying areas.

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It has been pointed out previously (Bureau Annual Report, 1935), during a succession of years when wireworm damage had not been severe throughout the area, that *L. variabilis* was actually and potentially the most serious insect pest of cane in the Mackay district. This pest warrants careful and continuous attention on those farms where the present knowledge of the pest's habits and past experience indicate its possible occurrence. Following the provision of the best possible field drainage during summer the planting of trial setts should be undertaken in order to obtain pre-planting information concerning the actual wireworm infestation of particular fields. The results from trial sett plantings, considered in conjunction with the general wireworm forecast for the year, may be used to determine when earlier planting may be attempted without undue loss. The possibility of placing this work on the more accurate and secure foundation of pest populations has been considered and will be effected as soon as facilities and other duties permit.

Rat Pests.

During the past season rat damage, in general, continued at the much reduced level of the previous year throughout Queensland canefields. The patchy nature of infestations was more in keeping with the normal state as distinct from the plague conditions of a few years ago. Many of the mill areas north of Townsville continued with general poisoning campaigns of different intensities depending somewhat upon the possible seriousness of rat infestations in their respective districts.

Investigations of several aspects of the rat problem in cane fields have been continued throughout the year in laboratory, rat dormitory, and field. Chief interest has been centred upon the field rat, the species known as *Rattus culmorum* T. and D. Another indigenous Rattus species (specific identification unknown) was found damaging cane near a mangrove creek, while the "pseudo-mouse," tentatively identified as *Thetomys gracilicaudatus* Gould, was trapped occasionally in the habitat of *R. culmorum*; both records are from the Mackay district. This pseudo-mouse, although the size of a small to medium field rat and as large as a full grown *Melomys littoralis*, has not been found to damage cane. *Melomys cervinipes* was again found damaging cane grown adjoining second growth rain forest in the Habana area of Mackay. This species is prevalent in the virgin rain forest of the Eungella Range.

In the course of field research work 2,333 rats were trapped from April, 1937, to December, 1937, and this trapping is being continued. Many of these rats were tagged, liberated, and recaptured—some being recaptured as often as nine times. Approximately 1,000 rats were used for studying the Median Lethal Doses of the common rat poisons, the quantitative and qualitative food and bait preferences, and individual rat behaviour. In regard to the last mentioned, data and specimens from both rat dormitory cages and field have been collected for future work in connection with the important subject of seasonal breeding.

Of the common rat poisons investigated—viz., thallous sulphate, yellow phosphorus, alkaloid strychnine, strychnine hydrochloride, strychnine sulphate, zinc phosphide, red squills, white arsenic (As_2O_3), and barium carbonate—it is considered that all but the first three could be discarded forthwith, for varying reasons, as unsuitable for Queensland cane-field conditions. The foods which have been used for bait bases could be listed in order of preference by the rats as follows:—Rolled oats, cracked corn, whole corn, wheatmeal, whole wheat, barley, and bread. Rolled oats stand out above the others; there is very little difference between the next four; barley is not a food particularly desired by the field rat, and there is always a very poor intake of bread. It has been found that thallous sulphate and alkaloid strychnine should not be used on bread, but it would be uneconomic and unnecessary to use phosphorus on a base other than bread unless an even cheaper bait base were available. The intake of thallous sulphate treated grain decreases with bait strength. It is considered that under present methods of distributing thallous sulphate treated grain in Queensland canefields—i.e., in packet form—a bait strength approximating to 1:300 would be most economical. At strengths of from 1:500 to 1:1000 there is an increasing amount of secondary feeding.

The unsoundness of using "take" as a criterion for comparing the effectiveness of different poisons, baits, or bait strengths in the field has become evident. Thallous sulphate treated wheat (1:500) usually exhibits a comparatively large intake per rat, while phosphorus, on bread, is not particularly attractive to the pests. Nevertheless, it has been found that, in reducing field populations, an obviously poor take of the cheap phosphorus bait, with its extremely high toxicity, has about the same effect as an excellent take of the less toxic thallous sulphate treated wheat. (The Median Lethal Dose of thallous sulphate for the field rat is approximately 35 milligrams per kilogram of body weight of rat.) It would appear that the addition of linseed oil to poison baits is unnecessary. This material is an excellent attractant for trapping purposes, but it is not an appetiser, however, and does not improve the normal intake of baits of poor palatability.

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Most of the mechanical difficulties associated with the problems of investigation of rat populations have been reasonably well overcome. A galvanised iron "live" trap working with a movable floor as the trigger, a suitable field chloroform chamber, scales, and a leg tag have been devised. Primarily, population experiment plots have been placed as grids. The fundamental idea ruling in this work is that if rats are tagged, released and recaptured, the chances of retrapping tagged rats depend upon population size. It seems evident, however, that the state of the population as well as size, is an important factor. Breeding is the chief natural disturbing element both in connection with population investigations and controls experiments, such as poisoning. Over the past twelve months a monthly record of average rat weight in the field and other field observations show that, under the natural conditions experienced during that period, the rat population decreased in weight very considerably from October to January. This decrease is due to the dying off of the older and heavier rats.

The possibilities of protecting cane other than by onslaughts on rat populations or in conjunction with them have been considered. The using of sulphurised linseed oil on cane as a deterrent was a complete failure. The self protection of the harder rind, large barrel canes has been apparent under most field conditions of the past two years. However, in Queensland plague conditions are of paramount importance and at this juncture definite information with regard to the forecasting of plagues, and the comparative degrees of self protection of hard canes during plagues is not available. Rind hardness is not an appreciable factor in rat resistance so far as thin barrelled canes, such as Co. 290 and P.O.J. 213 are concerned, since their reduced diameter causes collapse after very little feeding has taken place.

The Giant Toad (*Bufo marinus* L.).

The giant toad has continued to multiply since its introduction to this country three years ago, and it can now be stated that it is present in all sugar areas in Queensland where "white grubs" cause noticeable injury. In all areas from Ingham northwards prolific breeding has been taking place; toads are scattering far and wide from their original points of release and are becoming plentiful. Especially is this so in the Cairns-Gordonvale district where they are commonly seen around the fields, farm buildings, and street lights. Many of these are still small and immature, but judging by the number of large toads that should be present in this area towards the end of 1938, when the next beetle flight is due to occur, we should then be in a position to formulate some idea of their probable effect on the Greyback grub pest. During last season toads were observed eating Greyback beetles under natural conditions, but it is still a matter for determination as to whether they will take sufficient toll of this pest to depress permanently the population to such a point as will ensure comparative freedom from damage.

Young toads were observed during May of this year to be emerging from dams in the Isis district, indicating that breeding has commenced there. This is the first record of toads breeding in South Queensland. Large consignments of small toads were forwarded to the Burdekin, Mackay, and Bundaberg districts, and liberated chiefly in suitable localities adjacent to grub-infested cane areas.

Beetle Borer. (*Rhabdocnemis obscura* Boisd.).

In addition to studies of the method by which field populations of this pest are built up, the effect of various farm practices was also given attention. Certain of these practices, such as volunteering and rolling of trash, were found to be responsible for considerable increases in populations unless precautions were taken to ensure that the trash would completely dry out at an early date.

During the latter half of 1936, trials were inaugurated to determine the effect of the trashing of cane on its reaction towards borers. These trials were harvested during the 1937 crushing season and interesting results were obtained, although they proved to be not entirely in accord with hitherto generally accepted ideas. The cane in these trials was trashed far more thoroughly than would be possible in field practice from an economic point of view, but it was deemed necessary, at least in early trials, to determine the maximum effect obtainable from the treatment.

A slightly greater tonnage was recorded in plots which had been trashed three times and where borers had made severe depredations. This improved tonnage was probably due to the damage caused by the greater number of borers in untrashed cane rather than to any effect, *per se*, of trash removal. Undoubtedly far less borers were found in trashed than in untrashed plots and it is believed that this was due mainly to the fact that removal of trash deprived the beetles of their favoured sheltered positions.

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Contrary to generally expressed opinion, trashing had no effect on the rind-hardness of the cane nor was the C.C.S. affected in the plots although, had the plots been harvested later in the season, it is possible that a considerable difference in C.C.S. of trashed and untrashed cane would have been registered, owing to the more serious borer damage in untrashed plots. However, as in the case of the tonnage, the trashing, *per se*, does not appear to have affected the C.C.S. Field trashing as practised by farmers has generally been carried out only once during the life of the crop and then but a comparatively short time before harvesting. On this account a further series of trashing trials was initiated during the latter part of 1937 in order to determine the effect of (*a*) Early trashing, (*b*) Late trashing. When these trials are harvested in the coming season our knowlege of the possible effect of trashing should be reasonably complete.

Considered from every point of view, trashing might prove an economically practicable measure in reducing borer damage in certain places where the damage is very great; but, on the basis of our figures, it would not be economic in fields in which only an average borer infestation occurred. In our experience the only fields in which the measure would prove successful are certain ones where the abnormally high borer infestations have been largely due to certain cultural conditions, and it is considered that relief could be obtained more easily and cheaply by methods involving modification of these cultural conditions.

Varietal borer-resistance trials established during 1936 were harvested during the 1937 crushing season. Of the canes included in the trial, Q.2 proved very resistant to borers and Q.10 considerably more resistant than Badila, which latter is, of course, a susceptible variety. Q.4 and Q.12 also proved less susceptible to damage than Badila but more susceptible than Q.10.

Conjointly with population counts, rind-hardness tests were carried out on the varieties in the trials with a view to establishing a foundation for the correlation of rind-hardness with borer damage. A further Varietal Resistance Trial was established during the 1937 planting season, and will be harvested in a few months. At the present time the substitution of resistant varieties for the susceptible varieties now grown in areas where borers are plentiful, would appear to be the best solution of the borer problem.

Work on the rind-hardness of canes has proceeded with a view to finding an easy method with which to estimate the probable resistance of any variety to borer attack without adopting the present slow and laborious process of varietal resistance trials. We are now in a position to say that an erect, free-trashing habit in a variety, coupled with a medium to hard rind, constitutes resistance, and each of these factors appears to be important. For example, trashed Badila, although erect and trash-free, is still moderately susceptible to borers, although less susceptible than untrashed Badila. In this instance, the very soft rind would appear to be the reason for the damage; on the other hand, Q.1 and Q.12 are both at least as hard as Q.2, but on occasion they suffer a moderate amount of borer damage. Apparently this is due to the fact that whereas Q.2 is almost a complete self trasher the trash is inclined to cling to Q.1 and Q.12 under certain conditions. Q.2 has the necessary qualifications for practically complete borer resistance: it is erect, free trashing, and possesses a hard rind, and even in badly borer-infested country it is rare to find a borer in a stick of Q.2.

Rind-hardness tests have been carried out on large numbers of seedlings of different crosses in order that we may eventually be able to specify certain crosses as producing moderately hard progeny. Coincident with the work on rind-hardness, a study has also been made of the structure of the stalk of different varieties in order to determine factors which influence hardness of rind. Cross sections of different varieties revealed structural differences both in disposition and amount of sclerenchymatous tissue and the comparison of the sections has served to clarify to a certain extent some of the anomalies existing in the correlation of rind-hardness and borer resistance. For instance, lignified bundles have been found to extend much farther in from the rind in Q.2 than in some other varieties which show equal rind-hardness when tested by means of the penetrometer. As Q.2 is far more resistant to borers than these other varieties, it is believed that the thickness of the layer containing lignified bundles may be an important factor determining borer resistance.

Laboratory experiments indicated that considerably more eggs were laid in soft varieties than in hard, and, although but little larval mortality occurred, the development of larvæ was much slower in hard varieties. It was also found that (at least under laboratory conditions) most of the eggs were laid downwards in the actual leaf scar. Of the total eggs deposited, 82·4 per cent. were in the leaf-scar, 11·1 per cent. in the bud, 3·7 per cent. in root primordia, and 2·8 per cent. in the internode.

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Army Worms.

A rather unusual case of army worm damage occurred in the Little Mulgrave area during May-June of this year. Damage at that period of the year is somewhat unique, as it is more usual to find infestations in young ratoons during the late spring period, and by the time early autumn is reached the parasite complex has usually taken complete control of the pest. The infestation recorded above was mainly restricted to cane that had been damaged by a hailstorm in April; it was particularly severe, and the few leaves that had been formed since the hail damage were completely eaten. Thus these fields will have to be harvested early to avoid side-shooting and deterioration of the sucrose content. The species responsible for this outbreak was *Cirphis loreyi* Dup. Parasitism in this infestation was not particularly high, but the parasites bred from caterpillars collected in the field were *Sturmia inconspicuoides* Baran., and *Compsilura concinnata Sumatrensis* Towns.

Lepidiota Frenchi Blkb.

As is usual in years when a dry spring is experienced, grubs of *Lepidiota frenchi* Blkb. and the related species *Lepidiota consobrina* Gir. caused severe damage on some farms. It has been our opinion that it would not be profitable to use fumigation for the destruction of frenchi grubs, but in order to obtain concrete information on which to base our statements a small fumigation plot was established during November, 1937, in a block of cane showing bad frenchi damage and also infested with grubs of *L. consobrina,* and the cane was somewhat damaged when fumigated, although badly damaged spots were avoided when laying out the trial. Fumigants used consisted of carbon bisulphide and mixtures of carbon bisulphide and ortho-dichlorbenzene and carbon bisulphide and para-dichlorbenzene. Of these, the two mixtures checked the cane very badly; the carbon bisulphide caused no apparent check in growth, but there was no visible difference between cane fumigated with it and unfumigated cane and, although it killed the grubs, the fumigation did not prove a success economically.

It is apparent that the best recommendation for the minimisation of frenchi damage is to restrict ratooning somewhat and, after ploughing out, fallow for a year if possible. Infested land should be ploughed during the summer, when grubs are feeding in the upper soil levels, so that they may be exposed to predatory birds and animals and injury during the course of actual ploughing operations. A certain amount of damage, particularly in ratoon cane, was caused by frenchi grubs in the Mackay district in fields from Racecourse Mill to Walkerston and the north coast forest country.

Gumming Disease.

Gumming disease as a direct economic factor is now confined to the Mulgrave Mill area in North Queensland. True, it may still be found in the southern districts but it is there confined to odd and inconspicuous fields of rapidly disappearing old varieties and constitutes no threat to existing standard varieties.

The current season, with almost droughty conditions, has by no means favoured intensive spread of the disease in the Mulgrave area and, with the elimination of a great deal of the S.J.4 in the originally quarantined area the intensity of the disease has greatly declined. Nevertheless a slow outward spread continued to take place and during a survey made towards the end of 1937, the disease was found on six farms outside the then quarantine area. Consequently it has been deemed necessary to prohibit the growing of both S.J.4 and Clark's Seedling throughout the whole mill area. The control of this disease has been retarded by inadequacies in the present quarantine powers of the Diseases in Plants Acts and by the misdemeanours of a few individuals; it is hoped, however, that amending legislation will shortly bring both into line. New seedling varieties under test have greater gumming resistance than either S.J.4 or Clark's Seedling; indeed in a current resistance trial at Mulgrave the only varieties which have so far shown any death are Clark's Seedling and S.J.4. Of the new seedlings Q.10 would appear to have most promise and in current yield trials its growth compares very favourably with both S.J.4 and Clark's Seedling under a variety of conditions. Four seedlings raised by the C.S.R. Co., at Macknade—viz., Juno, Vulcan, Brutus, and Hector—were obtained in quantity last year and are now being tested in yield trials in the gum area.

The first stage of an investigation of alternate hosts of the gumming disease organism (*B. vascularum*) was concluded and it would appear that a wide range of plants is capable of acting as host to this organism, at least when artificially inoculated. Positive results were obtained from inoculation into various varieties of sweet and dent corns, sweet and grain sorghums, Soudan grass, Guinea grass, Bastard sorghum (*Sorghum verticilliflorum*), Para grass, Elephant grass, and Johnson grass. Certain of the sorghum varieties proved highly susceptible and stalks still oozed gum freely some six months after inoculation.

Report of the Division of Entomology and Pathology—continued.

Fiji Disease.

A serious outbreak of Fiji disease in the Bundaberg area was discovered last January when a number of farms were found to have obtained infected planting material from one of the plantations. Since the infected area was situated in the midst of an intensively farmed district where P.O.J. 2878 is a staple variety, the potentialities of the outbreak were obvious. With the co-operation of the Bundaberg District Canegrowers' Executive roguing gangs were put on and all apparently diseased cane was immediately dug out. Unfortunately the outbreak was discovered relatively late in the season when the cane (autumn plant) was well grown and some secondary spread will unquestionably have taken place. A scattered outbreak involving relatively few stools was found and dealt with near the Elliott River, while a more extensive outbreak was found in the somewhat isolated area of Waterview.

The farms involved in this season's outbreaks bring the number of known diseased properties to about 35 farms and 3 plantations. Arrangements have been made with the Bundaberg Executive again to supply a roguing gang which will operate under the supervision of Bureau officers, while "plough-out" orders will be issued in cases where infection has been relatively heavy.

In the Isis district, where P.O.J. 2878 constitutes more than 50 per cent. of the crop, small outbreaks have been found on some twenty farms but the incidence has been restricted to a few stools in nearly every case. In view of the importance of this variety to the district the Isis Mill and the Canegrowers' Executive have co-operated in supplying a roguing gang which will inspect all susceptible cane this season. The management of the Moreton Central Mill has shown full appreciation of the Fiji disease menace and during the slack season seconded a Cane Inspector to make surveys and advise farmers; his efforts will be supplemented during the crushing season by the appointment of a roguing gang.

With the exercise of the small necessary amount of care on the part of each individual the complete control of Fiji disease in the Bundaberg-Isis district should be an easy matter, at least in so far as non-irrigated areas are concerned. It is, however, always a difficult matter to obtain due appreciation of the potential seriousness of a hitherto unknown factor but it is greatly to be hoped that in this case the very wide publicity given to the disease may overcome the normal reluctance to accept potential seriousness. Fortunately the situation is properly viewed by the elected representatives of the growers who appreciate the unique value of P.O.J. 2878 to the southern districts and have given very valued co-operation in formulating disease control measures.

The seriousness of the situation may be gauged by the fact that we may state that there is available no Fiji disease resistant variety which has in any marked degree the special qualifications of P.O.J. 2878, and we have nothing of particular promise in current disease resistance trials. A visit was recently paid to New South Wales, where the C.S.R. Company is making every effort to combat a more serious situation, and arrangements were made to receive half a dozen of the more promising resistant seedlings.

It is anticipated that "masked" spread of the disease will have been unusually heavy this year, owing to the prolongation of the rainy season and lateness of winter in Southern Queensland. In consequence of these conditions leaf hoppers were extraordinarily plentiful at the end of June in locations where they would normally have been scarce in May. Inspection of ratoons and young plant cane should, therefore, be carried out with correspondingly increased intensity.

Chlorotic Streak.

Further hot water treatment trials were carried out at both Meringa and in Brisbane and both indicate that the temperatures at which this disease can be "cured" may be somewhat lower than was previously thought since exposures to as low as 45 deg. C. apparently inactivated the causal agency. Further trials are being carried out, including bud treatment. Further treatment along the lines of nutritional studies failed to indicate that the disease was caused by unbalanced plantfood supply although this factor may accentuate the disease.

Two further varietal resistance trials were laid down in the Babinda district in August, 1937, but will probably not yield much definite information until after ratooning later in the season, although some secondary spread has already eventuated; thirty-five varieties descended from various blood lines were included in each. In order to arrive at some idea of the approximate period during which secondary infection of this disease takes place monthly plantings of S.J.4 were made over the normal planting season of May-September, 1937. No symptoms have as yet appeared but the young ratoons will be compared with interest. Serial internode plantings have also been made of canes in resistance trials as soon as they produce symptoms with the object of determining extent of infection through a stalk. Plantings of diseased and healthy cane have also been established at an elevated locality.

Report of the Division of Entomology and Pathology—continued.

It is of interest to note that chlorotic streak diseased plants are favoured by the cane aphis *Aphis sacchari*, and heavy infestation may often be found even on very small diseased plants. This infestation is later followed by a dense growth of sooty mould which has attracted a good deal of attention from farmers, especially in the Babinda area.

Dwarf Disease.

This disease previously occurred in the varieties P.O.J. 2714 (particularly), Clark's Seedling, and Malagache in the Rosella district of Mackay. P.O.J. 2714 and Malagache have now virtually disappeared from this area and during the past two years there have been substituted plantings of Co. 290, P.O.J. 2878, and E.K. 28. Observations carried out during the current year indicate the susceptibility of both E.K. 28 and P.O.J. 2878. Three fields of P.O.J. 2878 on three farms were found to contain a fairly large percentage of dwarf disease and the variety is obviously unsuited for this section; incidentally, however, its further propagation has been prohibited on account of downy mildew disease. Further pot experiments with *Neomaskiella berghi* and *Aphis sacchari* in water logged soil failed to transmit the disease.

It should be noted that a good deal of primary infection was recorded in P.O.J. 2878 in a field on sandy creek flat soil. Although P.O.J. 2714 has been grown on the farm for a number of years the disease has never been observed and in this case it does not appear to have spread further from the P.O.J. 2878. A further point of interest is that the stunting in P.O.J. 2878, characteristic of the forest soil, was not observed on this sandy soil although leaf symptoms were normal.

Downy Mildew.

Downy mildew has made its appearance to a considerable extent in plantings of P.O.J. 2878 in the Mackay district and further growing of this minor variety has been prohibited in view of its liability to infect less susceptible standard varieties. An effort is being made to retain the variety in the grub infected areas where its very strong rooting system enables it to withstand grub attack to a marked extent. Some apprehension has also been caused by an increase of the disease in P.O.J. 2878 in the Bundaberg district and to a less extent in the Fiji disease resistant variety P.O.J. 213. Owing to the extensive cultivation of these two varieties in the southern districts a concentrated effort is being made to clear up this outbreak and strict attention to field sanitation will be enforced. The amount of the disease has again decreased in the Lower Burdekin with a reduction in the area of B. 208. A number of diseased fields of S.J. 16 were noted in this latter area, the susceptible S.J. 16 having been confused with S.J. 4; steps have been taken to correct this misapprehension.

The appearance of downy mildew and Fiji diseases in the new canes of the southern areas is indicative of the problems ever present in countries which are inflicted with a large number of the potentially more serious of the world's cane diseases. A decade ago gumming disease and to a less extent root disease were widespread in the southern districts and had greatly depressed crop yields. Following an intensive programme of variety testing a number of varieties highly resistant to these two diseases were developed and have assisted in building up production to new record levels. A decade ago Fiji disease and downy mildew were almost non-existent but have now made their appearance and create a problem in those varieties which in turn had solved the gumming and root disease problem. At the present juncture it is still a relatively simple problem to maintain complete control of downy mildew and Fiji diseases provided all are sufficiently seized with the potential seriousness of the situation and co-operate fully; if this co-operation be not accorded, however, it may be necessary to return to the planting of gumming susceptible canes in order to escape undue losses through Fiji and downy mildew diseases. Thus a policy of a pendulum swing may be imposed upon the industry and could, indeed, be adopted with advantage—provided variety control is complete.

Rind Disease.

Rind disease, one of the oldest known sugar-cane diseases, was an important economic factor in a considerable portion of the State during the spring of 1937. Following abnormally dry conditions over-maturity of certain varieties control of downy mildew and Fiji diseases supervened. S.J. 4 in the Cairns-Mossman area, 1900 Seedling at Mackay, and P.O.J. 2878 in the Bundaberg-Isis areas were particularly affected and losses aggregated some thousands of tons of cane. In general one to several internodes about one-third of the distance from the ground were affected in one or more stalks per stool.

Report of the Division of Entomology and Pathology—continued.

Generally speaking, the symptoms resembled those of severe red rot and the two diseases were more or less completely confused. It should be noted, however, that particular symptoms varied widely according to variety and locality, but isolations invariably gave the rind disease fungus and that only. Various other associated fungi were isolated from time to time but inoculation of these in association with *Pleocyta sacchari* failed to modify symptoms appreciably. A number of cases were found where the buds of growing cane were affected with this disease and this observation may serve to explain germination failures in some instances. A considerable range of variation in morphology of different isolates of the causal fungus was noted but this did not appear to be associated with any variability in virulence.

The present seasonal conditions indicate that rind disease should again be prevalent in the Cairns-Mossman district this year but in the Bundaberg-Isis district a prolonged and delayed rainy season has definitely delayed the maturity of the crop and a repetition of last year's experience is not expected.

Miscellaneous.

A certain amount of Pineapple disease was again observed in cold weather plantings. An extensive series of experiments has failed to confirm recommendations of earlier investigators that setts may be protected by dipping in Bordeaux mixture and other adhesive fungicides. Nor has soil treatment with a number of fumigants exhibited any marked effect, indicating that at least a frequent source of infection is infection of standing cane before it is cut for plants. It should be noted, however, that indications of beneficial effect have been obtained after steeping cuttings in some solutions. A considerable amount of laboratory work has been carried out in respect of temperature relations, cultural characteristics, and antagonistic effects of this fungus.

Seasonal investigations did not favour the development of the top rot stage of red stripe disease except in the Mackay district where there was some damage to 1900 Seedling and P.O.J. 2714. Little damage was reported for the Lower Burdekin district where the disease is now confined to poorly irrigated patches on badly graded farms or patches with a porous subsoil. A resistance trial carried out with newer seedlings indicated that Q. 2 is highly resistant, Q. 10 and Q. 19 reasonably so, while Q. 13 is rather susceptible but not so much so as Badila. The varieties Vulcan, and to a less extent Brutus, also proved susceptible and probably they should not be grown in areas subject to extensive top rot damage.

Leaf scald has not been particularly noticeable anywhere, with the exception of the wet, poorly drained area dividing the Babinda and Mulgrave mill areas. On this area the disease is endemic and the acute phase was commonly observed in Clark's Seedling. Our leaf scald trials are now being conducted in this area. This disease is considerably influenced by climatic conditions and in areas subject to recurrent droughty conditions it appears to persist only in very susceptible varieties. The occurrence of two dry years in succession in the Cairns-Mossman area has assisted greatly in cleaning up this disease.

Legume Investigations.

Legume culture has an important bearing on sugar-cane agriculture as presenting one of the few available alternate crops, albeit not, in general, a marketable crop. The Bureau is consistently advocating the increased cultivation of these crops and reference to experimental plantings with new varieties will be found under the various Station reports. Last year we commenced an investigation into the question of the provision of suitable strains of nitrogen-fixing bacteria for the inoculation of different crops. Cultures were collected from various sources, particular attention being paid to the cowpea group, soybeans, and lucerne. Some cultures were also isolated from well-grown local crops. The efficacy of these cultures was tested in the greenhouse, the particular plants being raised in sterile sand supplied with all plant nutrients other than nitrogen. Inoculation of seed was made with various cultures and the plants grown for several weeks. A wide range of relative efficiency of the various bacterial strains was observed, the efficiency expressing itself not only in weight of crop produced but also in the percentage nitrogen content of leaves.

As might, perhaps, have been expected, local tropical or subtropical isolates of bacteria proved more efficacious than overseas importations and suitable cultures have been established for the cowpea group, soybeans, and lucerne. These have now been made available to the canegrower at a nominal charge per culture and a considerable number of applications for cultures have been received. Of course the provision of a good efficient culture of nitrogen-fixing bacteria is not by any means the whole story and will not in itself ensure good crops. However, the actual inoculation of the seed is so simple that at least this phase of legume culture should not be left to chance.

Report of the Division of Entomology and Pathology—continued.

Variety Importations.

The following varieties appeared to be among the most promising of those available overseas and were imported recently:—

31–1389 (P.O.J. 2878 × 26 C. 270), ex Hawaii.
B. 726 (Ba. 11569 × ?), ex Barbados.
B. 2935 (Ba. 11569 × B. 6032), ex Barbados.

The variety B. 726 has shown considerable promise as an early maturing cane in the higher rainfall districts of Barbados and is now a standard cane in districts of intermediate rainfall. B. 2935 has been rapidly extended as a mid to late season maturing cane in the lower rainfall areas of this island. 31-1389 is a cane which grows rapidly in the early stages in Hawaii; it is reported to be drought resistant, with a rind hardness about that of P.O.J. 2878 and of about average juice quality.

In addition, we expect shortly to receive from the C.S.R. Company stocks of six seedlings raised on the Northern Rivers of N.S.W., viz., 30 S.N. 225, 451, 673, and 874, 33 S.N. 1160, and 30 G. 1759.

Division of Mill Technology.

Mr. E. R. Beinke, Assistant Mill Technologist.

Staff.

During the year several changes have been made in the staff of the Division of Mill Technology. Two immediate vacancies existed at the commencement of the year, and a third was created by the resignation of Ir. J. Eigenhuis, who relinquished his position on 22nd April, 1938, to enter the service of the Handelsvereeninging Amsterdam, at Soerabaya.

Three new appointments have been made to the position of Assistant Mill Technologist. Mr. G. H. Jenkins entered the service of the Bureau on 17th June, 1937, Mr. A. H. Praeger commenced work in the Division on 30th August, 1937, and Mr. J. L. Clayton was appointed as from 7th March, 1938.

Mutual Control.

The Sixth Annual Synopsis of Mill Data for mills in the Mutual Control, giving the figures for the 1937 season, has been published. Twenty-four mills are incorporated in the scheme. The calculation sheets for the 1938 season have been revised and issued to the mills.

Standardization of Apparatus.

Almost all mills have realized the advantages of tested apparatus, and the work of standardizing has been continued. The following is a record of the work undertaken:—

Brix Spindles.—Of 221 spindles tested, 196 conformed to official requirements. Of the remaining twenty-five, which received unofficial certificates, eight were of unofficial range, thirteen were beyond the limits of tolerance allowed, and four were of unofficial range with errors beyond the set limits of tolerance.

Polariscope Tubes.—Twenty-eight were tested, and one was found unsatisfactory.

Polariscopes.—Two instruments were checked and adjusted.

Pipettes.—Of thirty-seven pipettes tested, seven were rejected.

Burettes.—Eleven were tested, and one condemned.

Cylinders.—Eleven were tested, one being rejected.

Flasks.—One hundred and twenty-six were tested, and thirty-eight of these condemned.

Thermometers.—Eighteen thermometers were tested, all being satisfactory.

Laboratory Work.

Colorimetric Standard pH Sets.

Standard pH sets of phenol-red for a range pH 7·0 to 8·6 were made up and supplied to the mills, together with a supply of standard indicator solution.

Sugar Bureau pH Meters.

During the last season seventeen 1937 Sugar Bureau pH meters operated satisfactorily in the mills. At the end of the season the Bureau offered to supervise a minor improvement to the meters, and most of these were returned to Brisbane, where they were altered by the manufacturer and recalibrated by the Bureau. Further work has resulted in the development of an improved model of the pH meter, and seven of these 1938 meters will be in operation in mills during the coming season.

The Brisbane radio firm referred to in the last report has undertaken the manufacture and supply of pH meters complete with all accessories, and thus the task of the Bureau has been reduced to that of checking and calibrating the units.

At present attention is being directed to the automatic control of pH, and a suitable controller, based on the principle of the 1938 meter, has been devised, and will be tested during the coming season.

Slack Season Research by Mill Officers.

The opportunity of having a mill officer investigate sugar technology problems under the guidance of the Bureau officers during the slack season was accepted by Messrs. Gibson and Howes, of Bundaberg. Accordingly, Mr. L. Drinnen, Assistant Chemist, Bingera Mill, studied the "Volume and Surface Relationship of Raw Sugar," and the results of the work will be published shortly as a Technical Communication.

Division of Mill Technology—continued.

Technical Publications.

The members of the Technology Division of the Bureau presented five papers at the Ninth Annual Conference of the Queensland Society of Sugar Cane Technologists. They were as follow:—

Eigenhuis, J., "Instruments and Sugar Factory Control."
Eigenhuis, J., "Provisional Summary of the 1937 Research of the Division of Mill Technology, Bureau of Sugar Experiment Stations."
Behne, E. R., "Observations on the Elimination of Impurities."
Jenkins, G. H., "Automatic Bagasse Feeders."
Praeger, A. H., "Automatic Juice Liming Controlled by Juice Flow."

Technical Communications.

Technical Communications are the official technical bulletins of the Bureau. Since the last Annual Report the following have been published by this Division:—

1937.—Technical Communication No. 9—"The Sugar Bureau pH Meter," by E. R. Behne and J. Eigenhuis.
Technical Communication No. 10—"The Ultimate Analysis of Bagasse," by F. H. C. Kelly.
Technical Communication No. 11—"The Combustion Value of Bagasse," by R. W. G. Hessey.
Technical Communication No. 12—"Preliminary Investigation Into the Fugalling of Final Massecuites," by E. Mitchell and E. R. Behne.

1938.—Technical Communication No. 1—
Part I. "Furnace Investigations, 1937 Season";
Part II. "Revision of Some Stoichiometric Formulæ of Technical Communication No. 5, 1937," by G. H. Jenkins.
Technical Communication No. 2—"Continuous Electrometric pH Control," by J. Eigenhuis.
Technical Communication No. 3—"Circulation in Calandria Vacuum Pans," by E. R. Behne.

Numbers 10, 11 and 12 of 1937 represent the results of work done by mill officers at the Bureau under the scheme for encouraging slack-seasonal research.

Seasonal Investigations, 1938.

The annual meeting of the Mill Research Programme Committee was held on 1st March, 1938, during the Conference of the Queensland Society of Sugar Cane Technologists at Bundaberg. The chairman of the Committee, Mr. N. Bennett, manager of Racecourse Mill, opened the meeting, and Mr. V. Thorp, general manager of Moreton Central Mill, was elected chairman for the ensuing year. Mr. A. Shearer, chief chemist of Moreton Central Mill, was elected secretary to the Commitee. The following programme of investigations was adopted by the meeting:—

1. *Clarification.*—Further investigation into clarification will be directed towards the development of satisfactory lime-controlling apparatus for use in the automatic regulation of pH. The lime flow is to be controlled by (*a*) juice flow, (*b*) pH of juice. Suitable apparatus for experimental tests has been devised, and will be tested under mill conditions.

2. *Subsidation.*—The installation of new types of subsider in several mills has given opportunity for studying the comparative performance of various types of plant.

3. *Boiler Tests.*—Continuation of the work done on the boiler at Kalamia Mill in 1937 is desirable, in order to estimate the advantages of the final improvement to the boiler station in this mill.

4. *Pretreatment of Massecuites before Fugalling.*—The results of Technical Communication No. 12, 1937, suggest that a study of pretreatment of massecuites under mill conditions by dilution before fugalling would be of value. Suitable apparatus has been designed for installation in a selected mill.

5. *Incidental Work, Mill Visits, and Following up of Advices Given.*—In accordance with the policy of the Bureau, steps will be taken, whenever it is considered advisable and circumstances permit, to investigate the results from important advices given to the mills.

6. *Clarification by Sulphitation at Isis Mill.*—The final clause was inserted by the Mill Research Programme Committee, which decided that this subject be investigated, should time permit.

Division of Mill Technology—continued.

Mill Work of the 1937 Season.

Although the total quantity of cane crushed in the 1937 season was less than that treated in 1936, the yield of sugar was considerably greater, providing a new record for tons of 94 net titre sugar. Moreover, this difference was reflected in the quantity of cane required to produce one ton of 94 net titre sugar, the value (6·73) being the lowest yet recorded. These high tonnages and yields resulted from excellent crops in northern and central districts combined with an average crop in the southern district, where drought conditions prevailed.

In the following table, giving the average quality of cane in the three districts for the past eight years, it will be noted that the values for pol in cane for the northern and all districts are the highest yet recorded. This, of course, contributed largely to the excellent yields of sugar. The average fibre content of the cane is the lowest on record for southern, central, and all districts, whilst that for the northern was only slightly greater than the previous lowest value. The net result of the high pol and low fibre was a c.c.s. value approximately 0·5 greater than in 1936.

——	Season.	Pol in Cane	Fibre in Cane.	Purity, 1st Expd. Juice.
		Per cent.	Per cent.	Per cent.
Southern District	1930	14·58	15·00	89·91
	1931	15·01	15·40	88·25
	1932	13·32	15·16	84·95
	1933	13·55	15·21	87·65
	1934	14·67	14·59	89·74
	1935	14·56	14·47	88·60
	1936	15·31	14·32	88·83
	1937	15·05	14·04	88·14
Central District	1930	16·80	13·06	91·70
	1931	16·73	12·42	89·93
	1932	16·22	11·99	90·02
	1933	15·40	12·25	90·84
	1934	16·45	12·20	90·82
	1935	16·54	12·36	90·78
	1936	16·43	11·84	90·91
	1937	16·62	10·96	90·06
Northern District	1930	15·98	11·38	90·77
	1931	15·56	10·61	89·94
	1932	16·01	10·51	90·11
	1933	14·92	10·27	88·84
	1934	15·16	10·30	89·08
	1935	15·91	11·35	89·63
	1936	15·01	9·92	87·92
	1937	16·14	10·12	89·79
All Districts	1930	15·97	12·59	90·90
	1931	15·94	12·28	89·59
	1932	15·90	11·51	89·64
	1933	14·85	12·00	89·40
	1934	15·57	12·23	89·95
	1935	15·84	12·39	89·83
	1936	15·66	11·63	89·36
	1937	16·15	11·17	89·61

The effect of the lower fibre content of the cane was reflected in a higher pol extraction for practically the same lost cane juice per 100 fibre as compared with 1936 results. The quantity of added fuel per ton of cane remained substantially the same as in 1936, but, due to the smaller quantity of bagasse consequent on the lower fibre content, the total fuel used per ton of cane was approximately 4 per cent. less in 1937.

TONS OF CANE PER TON OF 94 N.T. SUGAR.

1928.	1929.	1930.	1931.	1932.	1933.	1934.	1935.	1936.	1937.
7·18	6·91	6·83	6·94	6·90	7·31	6·97	6·92	6·94	6·73

Further increase was noted in the crushing rate expressed as tons cane per hour, but when consideration is given to the lower fibre content of the cane, the tons of fibre per hour varied but little from the value for 1936.

The quantity of final molasses produced was slightly greater than that in 1936, and the purity somewhat higher, resulting in a slightly greater percentage pol loss in molasses.

Division of Mill Technology—continued.

The average co-efficient of work for all mills was practically the same as that in 1936, but slight drops were experienced in the northern and southern districts, whilst that for the central district increased slightly. Exactly similar behaviour was noted in the case of boiling-house efficiency, whilst the remarks apply equally well to pol recovery figures.

SOUTHERN DISTRICT.

——	1931.	1932.	1933.	1934.	1935.	1936.	1937.
Tons of cane	691,247	208,591	659,393	817,551	909,223	794,390	647,220
Tons of 94 n.t. sugar	91,546	23,747	77,229	107,676	117,467	109,142	85,131
Tons of cane per ton 94 n.t. sugar	7·551	8·784	8·538	7·593	7·74	7·28	7·60
Pol in cane	15·01	13·32	13·55	14·67	14·56	15·31	15·05
Fibre in cane	15·40	15·16	15·21	14·59	14·47	14·32	14·04
Purity—							
First expressed juice	88·25	84·95	87·65	89·74	88·6	88·83	88·14
Clarified juice	87·77	83·87	86·88	88·44	87·78	87·57	87·23
Syrup	87·37	83·59	87·38	88·73	88·1	87·97	87·42
Gallons molasses per ton cane	4·73	5·97	4·95	4·02	4·11	4·36	4·91
Apparent purity final molasses	40·90	39·06	40·96	41·24	39·72	40·07	41·23
Overall recovery	85·13	81·62	83·63	85·70	86·08	85·98	83·83
Recovery on mixed juice	90·45	87·42	89·74	89·59	91·995	90·64	87·81
Boiling house efficiency	95·54	94·09	95·11	96·12	96·94	95·41	92·82

CENTRAL DISTRICT.

——	1931.	1932.	1933.	1934.	1935.	1936.	1937.
Tons of cane	1,265,744	1,283,821	1,737,205	1,766,564	1,530,240	1,966,183	1,961,413
Tons of 94 n.t. sugar	189,440	190,995	249,680	271,437	233,901	301,893	304,502
Tons of cane per ton 94 n.t. sugar	6·682	6·722	6·958	6·508	6·542	6·51	6·44
Pol in cane	16·73	16·22	15·40	16·45	16·54	16·43	16·62
Fibre in cane	12·42	11·99	12·25	12·20	12·36	11·84	10·96
Purity—							
First expressed juice	89·93	90·02	90·84	90·82	90·78	90·91	90·06
Clarified juice	88·88	89·38	90·47	90·42	90·01	90·25	89·55
Syrup	89·20	89·52	90·52	90·41	90·06	90·54	89·84
Gallons molasses per ton cane	4·65	4·60	4·08	3·60	3·91	3·71	4·13
Apparent purity final molasses	40·45	39·50	40·28	38·91	39·52	37·22	35·93
Overall recovery	85·35	86·56	87·44	88·69	88·79	88·62	89·00
Recovery on mixed juice	91·35	91·77	92·38	93·53	93·79	93·20	93·25
Boiling house efficiency	95·63	96·02	96·26	97·47	97·8	97·08	97·54

NORTHERN DISTRICT.

——	1931.	1932.	1933.	1934.	1935.	1936.	1937.
Tons of cane	2,078,138	2,054,031	2,270,430	1,685,876	1,780,804	2,410,638	2,524,301
Tons of 94 n.t. sugar	300,289	299,343	311,825	233,457	258,958	333,613	373,692
Tons of cane per ton 94 n.t. sugar	6·920	6·862	7·281	7·221	6·877	7·23	6·76
Pol in cane	15·56	16·07	14·92	15·16	15·91	15·01	16·14
Fibre in cane	10·61	10·51	10·27	10·30	11·35	9·92	10·12
Purity—							
First expressed juice	89·94	90·11	88·84	89·08	89·63	87·92	89·79
Clarified juice	89·74	89·63	89·19	89·68	89·96	88·59	90·29
Syrup	90·02	90·30	89·23	89·64	89·89	88·58	89·85
Gallons molasses per ton cane	3·61	3·63	3·65	3·79	3·86	3·94	3·51
Apparent purity final molasses	35·33	37·33	35·21	37·78	36·53	31·66	34·62
Overall recovery	87·67	87·85	87·94	86·80	87·93	88·10	88·01
Recovery on mixed juice	92·40	92·43	92·71	91·62	92·86	92·58	92·44
Boiling house efficiency	96·72	96·67	97·60	96·34	97·34	97·97	96·80

ALL QUEENSLAND DISTRICTS.

——	1931.	1932.	1933.	1934.	1935.	1936.	1937.
Tons of cane	4,035,129	3,546,443	4,667,028	4,269,991	4,220,267	5,171,211	5,132,934
Tons of 94 n.t. sugar	581,276	514,085	638,734	612,570	610,326	744,648	763,325
Tons of cane per ton 94 n.t. sugar	6·942	6·885	7·307	6·970	6·915	6·94	6·73
Pol in cane	15·94	15·90	14·85	15·57	15·84	15·66	16·15
Fibre in cane	12·28	11·51	12·00	12·23	12·39	11·63	11·17
Purity—							
First expressed juice	89·59	89·64	89·40	89·95	89·83	89·36	89·61
Clarified juice	89·06	89·15	89·25	89·42	89·51	89·07	89·44
Syrup	89·23	89·42	89·41	89·48	89·57	89·27	89·41
Gallons molasses per ton cane	4·18	4·18	4·07	3·76	3·93	3·96	4·02
Apparent purity final molasses	39·19	38·31	38·55	39·20	38·33	35·54	36·62
Overall recovery	86·37	86·88	86·76	87·37	87·8	87·90	87·79
Recovery on mixed juice	91·79	91·86	91·88	92·49	92·98	92·52	92·20
Boiling house efficiency	96·27	96·31	96·39	96·82	97·36	97·18	96·65
Pol extraction	94·10	94·58	94·43	94·46	94·43	95·01	95·22
C.C.S. in cane	14·798	14·767	13·76	14·485	14·79	14·52	15·00
Coefficient of work	97·35	98·15	98·31	98·41	97·78	99·17	99·13

Division of Mill Technology—continued.

AVERAGE CRUSHING RATES (TONS CANE PER HOUR).

1933.	1934.	1935.	1936.	1937.
45·88	48·92	50·80	54·83	55·73

Crushing for the 1937 season commenced on 1st June and continued till 28th December. The first mill to start was Pioneer, and the last to finish was Macknade. The maximum harvesting period was 204 days at Victoria and Macknade, and the minimum, 60 days at Mt. Bauple.

——	1932.	1933.	1934.	1935.	1936.	1937.
Crop days	3,276	5,130	4,382	4,296	4,809	4,497

Brief Survey of Milling Results (1928-1937).

As 1938 represents the tenth year since the inception of the Mill Technology Division of the Bureau of Sugar Experiment Stations, the opportunity is taken briefly to review the milling results over this decade. The accompanying chart (Fig. 2) gives the annual variations in the main figures relating to this period. In several instances complete records were not taken during the earlier years, but all available figures have been given.

In every instance the trend revealed by the plotted values indicates that the average work of mills is improving, whilst the tonnages treated are increasing. Except for a drop in 1935, the co-efficient of work has increased steadily since 1932, whilst pol extraction has varied in a similar manner, indicating the close relationship between these two values. Pol recovery has increased since 1931, and the shape of the curve suggests that the upper limit has been reached with present capacities of equipment. Boiling-house efficiency, after increasing to 1935, fell considerably in the subsequent two years, as would be expected from a consideration of the extraction and recovery curves, with juice purities remaining practically constant.

The curve for total fuel figures shows a downward tendency, indicating that closer attention is being paid to heat economy in the factories.

The average crushing rate has increased from year to year, whilst the per cent. lost time has gradually decreased, the combined effect of these two factors being that the average length of the season has remained substantially constant in spite of the considerable increase in total tonnage of cane.

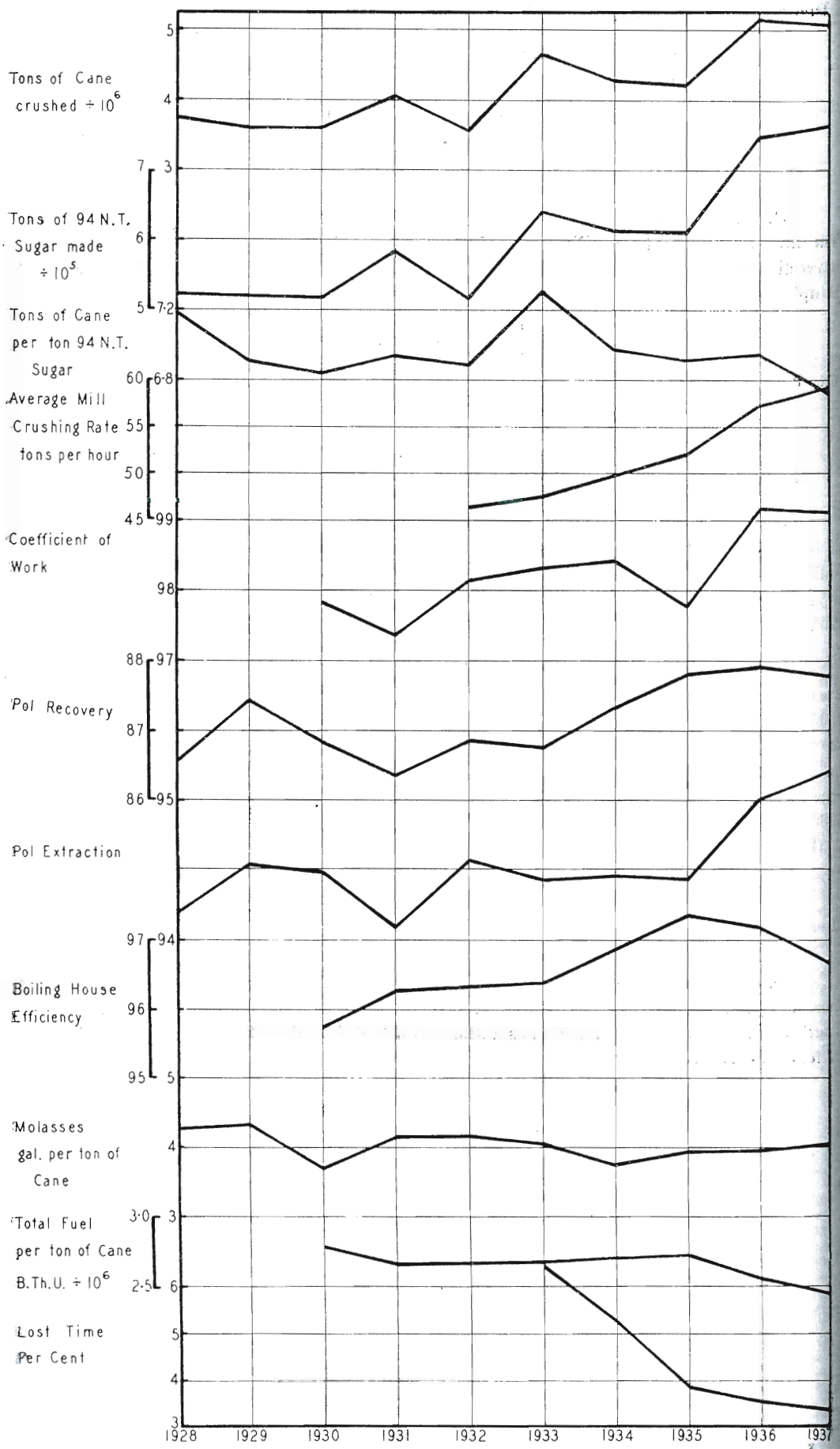

FIG. 2.—Illustrating trends in mill performance during the past ten years.

Division of Mill Technology—continued.

Figures for 1937 Season.

——	Northern.	Central.	Southern.	Totals and Averages.
Tons cane crushed	2,524,301*	1,961,413*	647,220*	5,132,934*
Tons sugar made (94 n.t.)	373,692*	304,502*	85,131*	763,325*
Net titre	97·28	97·11	96·60	97·10
Tons of cane per ton 94 n.t. sugar	6·76*	6·44*	7·60*	6·73*
C.C.S. in cane	15·01	15·48	13·82	15·00
Coefficient of work	98·63	100·26	95·18	99·13
Crushing rate	77·83	57·98	38·51	55·73
Lost time, per cent.	1·22	3·79	4·23	3·11
Fibre, per pent., cane	10·12	10·96	14·04	11·17
Pol, per cent., cane	16·14	16·62	15·05	16·15
First expressed juice—				
Brix	21·18	21·96	21·09	21·49
Purity	89·79	90·06	88·14	89·61
Clarified juice—				
Brix	17·29	16·91	15·50	16·81
Purity	90·29	89·55	87·23	89·44
Syrup—				
Brix	67·94	68·52	67·19	68·05
Purity	89·85	89·84	87·42	89·41
Last expressed juice—				
Purity	79·80	79·95	76·85	79·33
Clarified juice per 100 cane	98·14	104·39	105·71	101·76
Dilution, per cent. first expressed juice	22·50	29·86	36·06	27·84
Final bagasse—				
Pol	3·47	3·10	2·44	3·13
Dry substance	49·62	48·74	49·28	49·20
Pol extraction	95·21	95·44	95·47	95·22
Lost cane juice per cent. fibre	45·37	39·39	32·72	40·62
Final molasses—				
Gallons per ton cane	3·51	4·13	4·91	4·02
Brix	84·84	87·25	86·86	86·31
Apparent purity	34·62	35·93	41·23	36·62
True purity	47·25	47·44	48·39	47·58
Reducing sugars	14·90	14·07	9·36	13·34
Final mud—				
Tons per 100 tons cane	2·63	2·81	3·83	2·90
Pol	3·24	2·05	2·17	2·88
Sugar—				
Pol	98·69	98·68	98·59	98·67
Reducing sugars	·31	·27	·19	·27
Ash	·22	·26	·36	·26
Moisture	·35	·32	·28	·33
Dilution indicator	36·46	32·00	24·78	32·00
Pol balance—				
Sugar (recovery)	88·01	89·00	83·83	87·79
Bagasse	4·79	4·56	4·53	4·78
Molasses	4·11	5·09	7·61	5·10
Mud	·53	·35	·55	·52
Undetermined	2·56	1·00	3·48	1·81
Boiling house efficiency	96·80	97·54	92·82	96·65
Fuel—				
B.T.U.'s 1,000s. per ton cane—				
Wood	21·71	170·76	219·22	118·71
Coal	..	70·51	..	29·17
Molasses	145·46	50·46	9·92	81·91
Bagasse	2,037·02	2,187·11	2,757·16	2,231·25
Total	2,204·19	2,478·84	2,986·30	2,461·04
Crop days	1,795*	1,802*	900*	4,497*

* All mills. Remainder except C.S.R., Pioneer, and Inkerman Mills.

1936 1937

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Division of Mill Technology—continued.

Cane Milled and Sugar Yields, Season 1937.

Mill.	Tons Cane Crushed.	Tons 94 n.t. Sugar made.	Tons Cane per Ton 94 n.t. Sugar.	
			1937.	1936.
Mossman	149,915	23,523	6·373	7·161
Hambledon	287,445	41,723	6·889	7·577
Mulgrave	305,740	44,739	6·834	7·565
Babinda	257,228	36,697	7·010	7·275
Goondi	196,463	28,464	6·902	7·222
South Johnstone	273,744	40,464	6·765	7·156
Mourilyan	192,361	29,983	6·416	6·784
Tully	293,615	44,533	6·593	7·035
Victoria	312,036	46,509	6·709	7·069
Macknade	255,754	37,057	6·902	7·132
Total for Northern District ..	2,524,301	373,692	6·755	7·226
Invicta	111,561	17,360	6·426	6·369
Pioneer	206,227	32,966	6·256	6·265
Kalamia	254,650	40,298	6·319	6·492
Inkerman	259,711	39,889	6·511	6·437
Proserpine	167,178	25,796	6·481	6·589
Cattle Creek	73,180	11,195	6·537	6·758
Racecourse	161,887	24,538	6·600	6·544
Farleigh	139,406	21,173	6·584	6·716
North Eton	87,654	13,087	6·698	6·714
Marian	151,392	23,878	6·340	6·479
Pleystowe	181,117	28,218	6·418	6·547
Plane Creek	167,450	26,104	6·415	6·455
Total for Central District	1,961,413	304,502	6·441	6·513
Qunaba	44,622	5,665	7·877	7·429
Millaquin	112,935	14,647	7·710	7·508
Bingera	142,646	20,013	7·128	7·104
Fairymead	120,495	15,396	7·826	7·492
Gin Gin	20,968	2,509	8·357	7·327
Isis	79,599	10,509	7·574	7·210
Maryborough	26,639	3,535	7·536	6·949
Mount Bauple	19,233	2,450	7·850	7·195
Moreton	66,113	8,690	7·608	6·883
Rocky Point	13,495	1,676	8·052	8·055
Eagleby	475	41	11·585	9·931
Total for Southern District ..	647,220	85,131	7·603	7·278

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