1935.

QUEENSLAND.

THIRTY-FIFTH 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 Act of* 1900").

PRESENTED TO PARLIAMENT BY COMMAND.

BRISBANE:
BY AUTHORITY: DAVID WHYTE, GOVERNMENT PRINTER.

A. 42—1935.

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THIRTY-FIFTH 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-fifth Annual Report of the Bureau of Sugar Experiment Stations for the year ended 31st October, 1935.

H. W. Kerr.

Director.

Brisbane, 15th November, 1935.

General.

The early spring months of 1934 were cool and dry, and crops made little progress until the beneficial rains of October. Higher temperatures, combined with thunderstorm rains during November, favoured the young cane, but the incidence of very hot, dry conditions in late December caused a serious growth check. These conditions persisted, in the far Northern districts until January ; at that period crops were very backward, and prospects for a satisfactory 1935 crushing were far from bright, but favourable rains from February onwards were accompanied by a phenomenal recovery, and crop yields are, in the circumstances, excellent. In the Burdekin district, drought conditions were even more protracted, and this area has experienced one of the driest years on record.

Portions of the Mackay district were favoured by good rains throughout the summer, but the southern portions of the area suffered severely throughout the season, and light crops have been harvested.

In the Southern areas, growing conditions after mid-February were quite satisfactory, but prematurely cool conditions in late April checked crop growth.

In general, the year was not a favourable one for cane growth, and the tonnages harvested during 1935 are therefore remarkably good. In the Mackay and Southern districts, the large proportion of cane stood over from the previous season has had a pronounced influence on the estimated crop tonnages in that area ; and it is of interest to record that the highest total crop estimates for the State for the 1935 season were presented by Fairymead and Bingera mills—both in the Southern district.

Report of Director—continued.

The following are the individual mill estimates submitted in October, 1935, together with the actual figures for the 1934 crop :—

Crop Estimates for 1935, and Actual Yields for 1934.

Mill.	Estimate, October, 1935.	Actual Yield, 1934.
	Tons.	Tons.
Mossman	103,000	84,418
Hambledon	170,000	172,476
Mulgrave	205,000	178,986
Babinda	190,000	132,723
Goondi	125,000	138,129
South Johnstone	174,000	200,531
Mourilyan	140,000	157,221
Tully	169,000	221,821
Victoria	220,000	225,385
Macknade	185,000	174,186
Invicta	61,692	121,143
Pioneer	120,720	210,477
Kalamia	175,700	240,886
Inkerman	177,000	254,283
Proserpine	160,000	139,566
Cattle Creek	63,000	68,275
Racecourse	157,000	135,668
Farleigh	188,586	132,547
North Eton	57,635	69,520
Marian	140,000	120,533
Pleystowe	174,000	137,178
Plane Creek	115,400	136,488
Qunaba	77,000	70,378
Millaquin	148,000	137,925
Bingera	175,000	149,899
Fairymead	147,000	121,700
Gin Gin	50,000	45,026
Isis	159,500	181,231
Maryborough	32,400	24,547
Mount Bauple	32,000	33,396
Moreton	76,000	44,849
Rocky Point	18,000	7,262
Eagleby	2,500	1,338
Total	4,189,133	4,269,991

NOTE.—The estimates presented by Bingera, Fairymead, and other Southern mills do not represent the total tonnages available, but the proportion which will actually be crushed.

Report of Director—continued.

Estimate of Sugar Yield for 1935 Crop.

The estimated cane tonnage which will be harvested in Queensland during the 1935 season is 4,189,133 tons. The sugar content of the cane is higher than that of 1934, when 6·97 tons of cane were required to make one ton of sugar; allowing 6·95 tons, the estimated sugar yield is 602,753 tons, or allowing 6.90 tons, the estimated yield is 607,121 tons. In addition, it is estimated that the New South Wales crop will amount to 35,000 tons of sugar, giving a total Australian production of sugar from cane of approximately 640,000 tons.

Figures of the 1934 Crop.

The yield of raw sugar in Queensland for 1934 was 612,570 tons of 94 n.t. This is 26,000 tons below the 1933 crop, which was an all-time record. The reduction in yield was confined entirely to those areas north of Townsville; the Central and Southern district crops showed a marked increase over those of 1932 and 1933.

The " geographical " distribution of the crop during the past three years has varied within very wide limits, as is shown by the following data :—

Sugar Production, 1932–34.

—	1932.	1933.	1934.
	Tons.	Tons.	Tons.
North of Townsville	299,343	311,825	233,457
South of Townsville	214,741	326,909	379,113
Total	514,084	638,734	612,570

The total area harvested in 1934 was 218,426 acres. The yield of cane per acre crushed was 19·56 tons.

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 to Ingham	19·04	2·64
Lower Burdekin	33·79	5·22
Proserpine	14·05	2·10
Mackay to St. Lawrence	14·70	2·24
Bundaberg, Gin Gin, &c.	21·96	2·72
Maryborough, Childers, &c., to Gympie	19·54	2·80
Nambour and Beenleigh	14·69	2·04
State Average	**19·56**	**2·80**

In his 1934 Report, the Registrar-General shows the average acreage grown by cane-planters in Queensland to be as follows :—

	Acres.
Cairns to Townsville	50
Ayr to Mackay	48
Bundaberg to Bauple	31
Nambour to Beenleigh	11
State Average	41

The average per planter is 41 acres, which is one acre lower than that of the previous year.

Report of Director—continued.

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, 1925–1934.

Year.	Acres Cultivated.	Acres Harvested.	Total Yields.		Yields Per Acre.		Tons Cane to 1 Ton Sugar.
			Cane.	Sugar.	Cane.	Sugar.	
			Tons.	Tons.	Tons.	Tons.	
1925	269,509	189,466	3,668,252	485,585	19·36	2·56	7·55
1926	266,519	189,312	2,952,662	389,272	15·45	2·06	7·52
1927	274,838	203,748	3,555,827	485,745	17·45	2·38	7·32
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
True Average for 10 Years					17·80	2·48	7·18

Molasses Produced.

The following figures supplied by the Registrar-General show the manner in which the molasses produced in 1934 was disposed of :—

	Gallons.
Sold to distilleries	4,573,037
Burnt as fuel	5,339,489
Used or sold for feed	3,035,598
Sold for other purposes	444,680
In stock	1,673,607
Used as manure	2,227,905
Run to waste	1,162,715
Total	18,457,031

It is of interest to compare the distribution figures for the past four years, in order to gauge the trend towards improved utilization of this by-product :—

Year.	1931.	1932.	1933.	1934.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Distillery use	20	19	23	27
Burnt as fuel	44	42	40	32
Used for feed	18	20	16	18
Used as manure	11	9	10	13
Other purposes	1	1	2	3
Run to waste	6	9	9	7

A notable feature is the increased utilization of molasses by distilleries and for manurial purposes, while the amounts burnt by the mills for fuel, and run to waste, have show a definite contraction.

MAFFRA BEET FACTORY.

During the past season the Maffra Sugar Factory, Victoria, manufactured 4,580 tons of sugar from 38,660 tons of beets. The average yield of beets per acre was 13·17 tons.

Report of Director—continued.

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 54·6635 per cent., and that for export at 45·3365 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 season was 69,659 tons as compared with 72,097 tons for the 1933 crop.

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 an increase of 1s. 6d. on the home consumption price of the previous season. The net value per ton of 94 net titre sugar sold abroad was £7 11s. 3d., which is the lowest figure yet recorded. The average price paid to those Queensland mills which did not produce "excess" sugar was £16 10s. 11d. per ton of 94 net titre, compared with £17 4s. 3d. for the previous crop. The average value of *all* sugar was £15, which is the lowest since 1914.

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

Year.	Total Sugar Production 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

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

The total value of the 1934 crop was £9,488,275 as compared with £10,328,690 for the 1933 season.

CONCESSIONS TO THE FRUIT INDUSTRY.

The Chairman of the Fruit Industry Concessions Committee (Mr. A. R. Townsend), in his Fourth Annual Report (1935), states that the assistance granted by the sugar industry to the Australian fruit processors was as follows :—

The amount paid by way of Domestic Sugar Rebates totalled £62,614, and represented a consumption of 28,461 tons of sugar in the manufacture of fruit products. Export Sugar Rebates totalled £62,599. Expenditure on export assistance was £105,084.

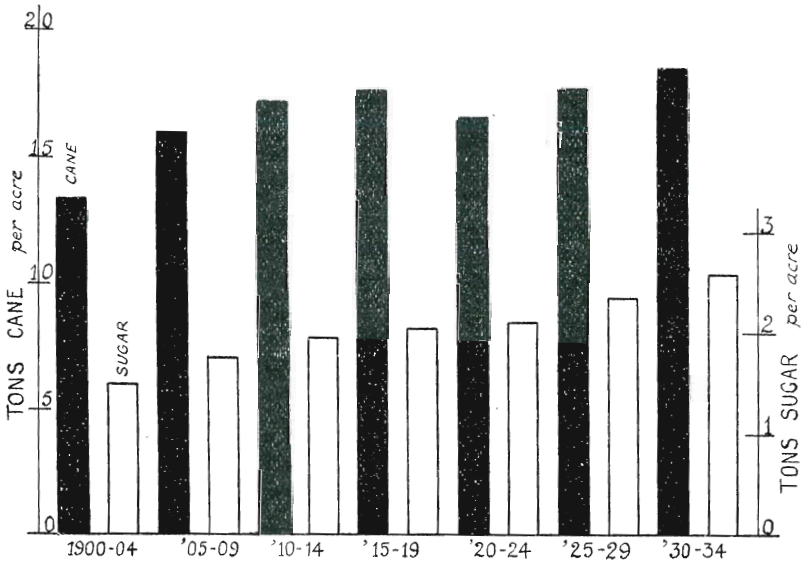
The Report showed that of the Domestic Sugar Rebates, 45 per cent. was paid away in Victoria, nearly 23 per cent. in New South Wales, 13 per cent. in Tasmania, and 9 per cent. in Queensland; while of Export Sugar Rebates, 50 per cent. went to Victoria, nearly 25 per cent. to New South Wales, 18 per cent. to Tasmania, and 5 per cent. to Queensland. Due to the continuance of abnormally low sugar prices on the world's free markets, the export rebate on manufactured fruit products averaged £20 6s. per ton, as against £13 11s. for the previous twelve months.

In the terms of the new sugar agreement, the Committee will provide for the continuance of the concessions, and an increase in its revenue from £200,000 to £216,000 per annum.

ECONOMIC REVIEW.

The economics of the sugar industry have not altered substantially since the presentation of the 1934 Report. The tonnage of sugar manufactured during the 1935 season should approximate closely to that of the previous year and be but little inferior to the record yield of 1933. Once again a high proportion of the output must be sold abroad, to return what it will on the world's free market; London values have been uniformly low practically throughout the harvesting season, and little (if any) improvement over 1934 export returns may be anticipated. The 1934 average value of No. 1 Pool sugar was £16 10s. 11d. per ton—the lowest recorded since 1914.

Only by the closest attention to farm and mill efficiency is the producer able to meet, in some measure, the shrinkage in crop values which have been a disconcertingly consistent feature of the past few years. The resulting intensification of production in recent times is clearly demonstrated by the crop statistics for the past thirty-five years, which are summarised graphically in Fig. 1.



While cane yields have fluctuated somewhat during the period under review, they show a distinct upward trend. The improvement in sugar yields is, however, most striking. From an average of 1.5 tons per acre over the period 1900-04, the figure has increased consistently until for the final period (1930-34), it attained the value of 2·6 tons; while for the 1933 and 1934 crops the yield was 2·80 tons per acre. An analysis of the causes contributing to this improvement shows that it is due in almost equal proportions to improved field practices and increased mill efficiency.

The end of this steady increase in acreage yields—which appear to be largely independent of the season—is not yet in sight. Each year more farms are brought under irrigation, and farmers are applying their knowledge of fertilizers and their use to greater advantage than ever before; while the full possibilities of the newer, disease-resistant, high-yielding varieties have still to be realised.

All these factors contribute their quota to a permanent downward trend in production costs; but, unfortunately, they are largely defeating their purpose through the failure of the grower to reduce the area planted to the crop, in proportion to the increased acreage returns; and this simple and obvious remedy for the present ills of surplus production becomes annually more difficult of accomplishment. Reduced costs are possible only where the production per grower exceeds a definite minimum tonnage, the magnitude of which must increase as the value of sugar falls. Moreover, the farmer finds it necessary to provide for his growing family; and whereas formerly, his sons were able to acquire blocks of new land on which to cultivate cane, the present assignment restrictions now necessitate further subdivision of the existing farm. That the number of canegrowers in Queensland is steadily increasing is evident from the following statistics:—

Year.	No. of Canegrowers.
1932	7,231
1933	7,386
1934	7,426

Report of Director—continued.

The average sugar tonnage which each grower may contribute to the mill " peak " is, therefore, diminishing in proportion. This is a serious matter in certain mill areas where the average quota per grower is less than 300 tons of cane, which is definitely below the economic minimum on which a farm may be conducted efficiently, and a system of permanent agriculture maintained.

The possibility of any early improvement in world sugar values is still remote, and each year the available free market for the export production of countries such as Australia is contracting. In August last, the signatories to the Chadbourne Agreement agreed not to attempt to prolong the plan which expired this year. The plan failed to achieve its full purpose, due to the action of those countries outside the Agreement, which increased their production in proportion to the restricted output. Certainly visible stocks have been very substantially reduced during the currency of the Agreement. It is realised, however, that something further must be done to stabilise the industry. The United States of America recently took measures to restrict domestic and insular production to actual requirements, while a trade treaty was entered into with Cuba, which country gained an increased sugar preference in the American market. In London, the International Sugar Council called a Conference in March last, which was attended by representatives of the important sugar-producing countries of Europe, and also of the United States. Although this Conference failed to formulate a generally acceptable and constructive plan, appreciation of the need for concerted action is evidenced by the desire for a further Conference at an early date. As a preliminary the British Government has arranged for a full discussion of the relationships between the Home country and her sugar-exporting Dominions, with a view to formulating a policy for the British Empire. The Conference will be held early in 1936, and Australia will be represented by a nominee of the Federal Government, while the Premier of Queensland (The Hon. W. Forgan Smith) will personally attend on behalf of the Queensland sugar interests. The present preference granted to Dominion sugar by the Government of the United Kingdom will continue until August, 1937—that is, for a further Queensland crop year. Any unfavourable modification of the present policy would be accompanied by serious results for at least a section of the Queensland sugar-growers ; though it is not profitable to produce sugar at present overseas values, the loss of the British market and preference would necessitate the immediate reduction of production to the bare domestic requirements of this country ; the consequences of such precipitate action need no recapitulation.

The announcement by the Federal Prime Minister that the Australian Sugar Agreement will be renewed for a further period of five years brings to the industry a measure of reassurance, and demonstrates in no uncertain manner that the Federal Parliament is appreciative of the national importance of the sugar producer. It now rests with the industry to take such measures as will effect a sustained policy of rationalisation, and thus establish the business of sugar production on a firmer economic basis.

Work of the Bureau.

The detailed reports of the officers in charge of the several Divisions of the Bureau are recorded in the subsequent pages of this report. The following comments summarise the more important aspects of the year's accomplishments :—

Advisory Board.

The Advisory Board of the Bureau of Sugar Experiment Stations met on four occasions :— On the 13th March, 1935, in Brisbane ; on the 20th June, in Rockhampton ; on the 13th September, in Gordonvale ; and on the 28th October, in Brisbane. Matters of major importance were dealt with at these meetings, and the decisions of the Board are definitely playing a very important part in shaping the policy and guiding the activities of the Bureau.

The Board has paid very close attention to staff matters, and steps have been taken to make such appointments as will provide a balanced staff of competent officers in all fields of sugar technology. The weaknesses on the mill technology staff have been overcome to a large extent by the decision to appoint a Consulting Mill Engineer, and a further Assistant Mill Technologist. The question of the efficiency of pest control was also dealt with, and the Board decided that a meeting of representatives of North Queensland Pest Boards should be called in Townsville, under the Chairmanship of Mr. A. F. Bell, to formulate plans for future co-ordinated effort. It was also agreed that Mr. W. A. McDougall, Assistant Entomologist, be delegated the duties of an intensive study of the life history and habits of the rat, for the purpose of devising more adequate measures of control.

A question which has also received careful consideration is that of the utilization of by-products in the Industry, and extensive enquiries are being pursued for the purpose of obtaining information on the more adequate utilization of these materials.

Staff Changes.

The position of Consulting Mill Engineer was filled by the appointment of Mr. J. Eigenhuis, of Java, for a period of three years. Mr. Norman Smith was appointed Assistant Mill Technologist, vice Mr. D. L. McBryde, who has acted in the capacity of Chemist in charge of the Mackay Experiment Station since May last, when Mr. F. Keogh was transferred to the Chemical Laboratory of the Department of Agriculture.

Mr. D. R. L. Steindl was appointed Assistant to Pathologist, vice Mr. W. Cottrell-Dormer, resigned.

Mr. C. G. Story was appointed Cadet on the Agricultural staff, and has devoted the past year to training in agricultural matters generally, in association with the laboratory and field officers of the staff.

Headquarters' Accommodation.

The Brisbane offices and laboratories of the organisation are now accommodated on the first floor of the Department of Agriculture Building, William Street. The transfer of the pathological staff from their ground floor offices has made for more satisfactory utilization of floor space, and a mill technology laboratory has been created.

Transfer of Experiment Stations.

During the year the building programme at Meringa was finalised. This Station is now equipped with adequate laboratory space for chemist and entomologists, a glasshouse has been provided for seedling work, and an irrigation plant for watering seedling canes and irrigation experimentation. It has been possible also to electrify all power units from the Cairns Hydro-Electricity supply. The Station was officially opened on Friday, 13th September, 1935, by the Minister for Agriculture and Stock (The Hon. F. W. Bulcock), in the presence of the Advisory Board, on the occasion of the visit of the Delegates to the International Society of Sugar Cane Technologists' Fifth Congress.

Good progress has also been made with respect to the transfer of the Mackay Station to its new site on portion of the Palms Estate, Te Kowai. The buildings are practically completed, and early in the new year the Station will be in full working order. The old Station was disposed of as a special lease, and the improvements, which were the property of the Bureau, were taken over by the lessee for a cash consideration. The new Station presents many problems which are common to a large area of the Mackay canelands, and it is felt that much useful work will be done at this centre.

Work of the Bureau—continued.

The Bundaberg laboratory has been equipped to enable the resident Soil Chemist to carry out routine and investigational chemical work ; this officer is also making a special study of irrigation matters, with particular reference to the duty of water. New stables and implement buildings will be constructed during the current financial year, utilizing as far as practicable materials from the existing collection of outhouses and farm buildings.

Conference of the International Society of Sugar Cane Technologists.

An event of great importance to the Queensland Industry was the Fifth Congress of the International Society of Sugar Cane Technologists, which was held in Brisbane from the 27th August to the 3rd September, and was followed by a tour of the sugar districts which occupied a fortnight. The Conference was in every way successful, and overseas delegates appeared to form a very favourable impression of the industry, and the manner in which its technological researches are being conducted. It is difficult to estimate the true value of the visit of so distinguished a group of technical workers, who bring with them the breadth of experiences gained in overseas canelands. Certainly it was a unique experience and an inspiration to our younger scientific men, who will benefit greatly from the contacts they have made, and the discussions in which they have participated.

Publications.

The first bulletin of the Mill Technology Series was issued during the year ; it was prepared by Mr. D. L. McBryde, and was entitled "Notes on Raw Sugar Manufacture." The Synopsis of Mill Data for 1934 was prepared and issued to those mills participating in the Mutual Control.

"The Cane Growers' Quarterly Bulletin" has appeared regularly, and the publication is keenly appreciated by the canegrowers. It is a most useful medium for the transmission of the results of our researches to the farmer, and a copy is posted to each canegrower in Queensland.

Balance Sheet.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FROM 1ST JULY, 1934, TO 30TH JUNE, 1935.

Receipts.	£	s.	d.
To Balance, 1st July, 1934	12,672	5	4
„ Assessments	8,896	19	8
„ Endowment	7,000	0	0
„ Bundaberg Station	549	9	1
„ Mackay Station	325	5	8
„ Johnstone Station	672	11	11
„ Meringa Station	8	9	0
„ Sundries	74	12	3
	£30,199	12	11

Disbursements.	£	s.	d.	£	s.	d.
By Salaries				7,471	19	11
„ Contingencies—						
Salaries and Wages	1,336	0	9			
Travelling Expenses, Hires, Fares, Freights, Allowances	2,532	3	11			
Apparatus, Furniture, Books, Installations	823	16	10			
Printing, Advertising, Stationery	1,314	18	11			
General Expenses	1,031	13	7			
				7,038	14	0
„ Bundaberg Contingencies				1,572	16	2
„ Mackay Contingencies				1,519	12	0
„ Johnstone Contingencies				349	10	2
„ Meringa Contingencies				2,365	7	1
„ New Station, Mackay				318	9	6
„ Balance, 30th June, 1935				9,563	4	1
				£30,199	12	11

C.C.S. Formula.

For the benefit of foreign readers of this report the formula used for arriving at the commercial cane sugar (C.C.S.) in Queensland cane is given below :—

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

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

Division of Soils and Agriculture.

Farm Trials.

The farm fertility trials, which have in recent years become an important phase of the work of our extension staff, were continued during the past year. In general, these are becoming more specialised in nature, as our knowledge of the important soil types increases. The continuance of more favourable growth conditions in the Southern areas has enabled us to carry a greater number of trials to a successful conclusion, and these have provided a fund of valuable information regarding plantfood responses.

It does appear, however, that the limited number of trials which an individual field officer can completely supervise, will necessitate the curtailment of fertility trials in the south, so that more attention may be devoted to varietal yield tests. The wealth of new varieties resistant to disease which has been acquired in recent years, demands careful study to enable us to select the best for a particular set of conditions, and eliminate those which are inferior. The superiority of the new canes over the old standard varieties, from a yield standpoint, is so striking that the latter must rapidly pass out of cultivation. It is indeed remarkable that the entire aspect of cane production should be so radically changed in the course of a few brief years, merely by a substitution of varieties. Of the new canes, Co. 290, P.O.J. 2878, and P.O.J. 2725 possess greatest promise, while others may show to advantage on further trial.

The results of all farm trials harvested during the present season will be recorded in the January number of "The Cane Growers' Quarterly Bulletin."

Irrigation Experimentation.

The first irrigation trial on a field scale, to be carried out by the Bureau, was harvested on the Bundaberg Station during the current season. This is merely the forerunner of a series of controlled experiments which should provide us with much valuable information concerning this phase of sugar-cane agriculture. Our water reserves are, unfortunately, not as extensive as one would desire, but they serve for a modest experimental block or two, in addition to taking care of the young original and selected seedling canes at that centre.

At the present time arrangements are being made for the installation of a rather larger pumping plant at Mackay, while the 3-inch pump at Meringa is operating successfully.

During the year the installation of a spray irrigation system was completed in the Burdekin district. Improved sprinklers, each capable of irrigating one-third acre, were employed, and reports to hand suggest that it gives a satisfactory spread. The trial block is intended as a means of studying the influence of variations in the rate of water application and fertilizer treatments, rather than as a spray system *per-se*. It is electrically operated, and is under the direct supervision of the Field Assistant, Mr. A. P. Gibson.

Trash Conservation.

The trash conservation trials reported at this time do not reveal any outstanding benefits from the practice; on the contrary, the trials at Bundaberg showed that the rolling of the trash from a heavy cane crop may actually prove deleterious to the succeeding ratoons, if the cane variety possesses weak ratooning qualities. As has been stressed previously, the value of the project cannot be established in the course of a year or two, but the permanent plots which are being set out should show whether the conservation of crop residues may be expected to rejuvenate old lands, after a period of ten or twelve years.

An interesting laboratory investigation on these lines was carried out during the past year by Mr. C. R. von Stieglitz, and reported in a paper presented to the Congress in August of the International Society of Sugar Cane Technologists. The addition of relatively large volumes of trash to a soil maintained under conditions which favour trash decomposition, definitely conferred upon the soils those properties which are usually associated with fertile, virgin land.

Seedling Propagation.

Although it has not yet been possible to plant out at our three Stations the numbers of seedlings that had been forecasted in earlier reports, the progeny which have now survived successive annual selections show decided promise. In the Northern areas, a number of the South Johnstone selections have been placed in farm trials, while at Mackay, the first series of promising new canes have been planted in a varietal trial on the Experiment Station. A small selection of superior types will shortly be employed in similar tests at Bundaberg.

Division of Soils and Agriculture—continued.

The transfer of activities to new centres in the Northern and Central Divisions has disturbed the even progress of the work at those locations, and the paucity of arrowing, combined with an unusually low proportion of viable seed available during the past winter, has interfered seriously with the programme of crosses which had been drawn up. It would be most unusual should such a combination of circumstances operate during the coming year.

Work of the Brisbane Laboratory.

Routine Analyses—

The following is a summary of the routine analyses performed at the Brisbane laboratory during the year ended 31st October, 1935 :—

	Number of Samples.
Soils	288
Waters	180
Water-slimes	25
By-products	11
Limes and fertilizers	11
Sugar Canes	14
Miscellaneous	10
Total	539

A considerable quantity of laboratory glassware and apparatus was standardized on behalf of the Division of Mill Technology, and a large number of chemical analyses were carried out in connection with the investigation on exhaustion of final molasses conducted by Mr. E. R. Behne.

Investigational Work—

The results of investigational work are embodied in four papers prepared during the year :—

"Notes on the Determination of Pol in Final Molasses," by C. R. von Stieglitz.
"Cane Trash and Soil Organic Matter," by C. R. von Stieglitz.
"Rapid Field Tests for Soil Fertility," by C. R. von Stieglitz.
"Soil Analytical Methods employed in Queensland," by H. W. Kerr and C. R. von Stieglitz.

The studies in trash decomposition are being continued, and investigations on soil phosphate fixation and potash solubility have been initiated. In collaboration with Mr. L. C. Home, Mr. von Stieglitz is conducting an investigation on cane juice analytical methods, which will be reported on at the forthcoming Conference of the Queensland Society of Sugar Cane Technologists.

Mr. N. G. Cassidy has performed an extensive series of analyses of irrigation waters, collected from the pumping plants of the Burdekin area, by Mr. A. P. Gibson. The continued drought conditions which have persisted in that area for the past eighteen months have had a very serious influence on the water reserves of the district ; in many instances the supplies have failed, while in others the quality of the water has deteriorated to a marked extent. The progressive analyses conducted in this laboratory are of decided assistance to canegrowers in their search for better supplies, or in the application of soil amendments to neutralize harmful salts.

During the present season, Mr. Cassidy was engaged in preliminary analytical work at Gordonvale, following the installation of juice-weighing machines at the Mulgrave Mill.

Work of the Experiment Stations.

Reports prepared by the Chemists in charge of the three Experiment Stations will be found in the following pages, together with a summary of the work on seedling propagation for the past year.

SEEDLING PROPAGATION.

E. J. R. Barke, Cane Breeder.

All cross-pollination work during the past season was carried out at our Freshwater Breeding Station, which is situated seven miles north of Cairns, and close to the banks of the Barron River.

The weather conditions were most unsuitable for arrowing. Drought conditions were experienced from June to early November, after which heavy floods covered the parent canes during a period of three days. Many varieties failed to arrow, and in no instance did a variety reach 50 per cent. of its normal inflorescence. The number of pollen grains per anther was about normal, but their viability was exceedingly low. The relative humidity of the air was low during the major portion of the arrowing season, and this had a deleterious effect on anther dehiscence, it being noticed in many cases that anthers withered and died without opening. The failure of a number of varieties to arrow severely interfered with our intended breeding programme, and the third and fourth nobolization of a number of selected seedlings, containing *S. spontaneum* and *S. robustum* blood, could not be carried out.

Altogether ten major crosses, sixteen minor crosses, and thirty-four new trial marriages were carried out, and these combinations are set out in the following tables.

Crosses Carried Out during the Breeding Season, 1935.

Major Crosses.

The progeny from these crosses have in previous years given a relatively high percentage of good quality seedlings :—

Female. ♀	Male. ♂
Badila	P.O.J. 2878, S.C. 12 (4), S.W. 499, S.J. 872c, S.J. 102c, S.J. 68d
P.O.J. 2878	P.O.J. 2940, S.C. 12 (4), S.J. 82d
P.O.J. 2725	Q. 1098

Oramboo is one of our best female parents, but unfortunately it failed to arrow this season.

Minor Crosses.

Although the progeny from these combinations have not, so far, yielded canes of commercial importance, many of them contain desirable characteristics, and they are receiving a further trial before being finally discarded.

Female. ♀	Male. ♂
Badila	E.K. 28, S.J. 743f, S.J. 91e, S.J. 362e, S.J. 365e, Q. 1098, H.Q. 409.
S.J. 861d	E.K. 28, Q. 1098.
P.O.J. 2725	S.W. 499, S.J. 142d.
P.O.J. 100	S.J. 2c.
S.J. 4	S.C. 12 (4).
S.J. 146d	S.J. 2c.
S.J. 198d	S.J. 2c.
U.D. 110	S.J. 1c.

Seedling Propagation—continued.

New Trial Marriages.

The progeny in this table have been obtained from new combinations, and it is desired to have some knowledge of their possibilities before raising them in large numbers.

Female.	Male.
♀	♂
P.O.J. 2725	20 S. 16, S.J. 8342E, S.J. 83E.
P.O.J. 2878	*S. robustum.*
P.O.J. 2722	Q. 1098, S.J. 83E, S.J. 8342E.
P.O.J. 2747	20S. 16, S.J. 1C, P.O.J. 2940.
P.O.J. 100	Q. 1098, S.J. 3C, S.J. 83E.
Co. 281	Q. 1098, S.J. 8342E.
Co. 290	E.K. 28, S.J. 8342E.
S.J. 4	20S. 16, *S. robustum*, S.J. 70C, Q. 1098, S.J. 8342E.
7R 428	*S. robustum*, S.J. 83E.
Badila	S.J. 3C, P.O.J. 2940, S.J. 83E, S.J. 8342E.
S.J. 7	S.C. 12 (4), S.J. 8342E.
Pt. Senniville	Q. 1098.
S.J. 81E	Q. 1098, S.J. 83E, S.J. 8342E.

Meringa Station.

Selections from 1934 Crossings.

First-year Selections.—Elimination tests were carried out when the seedlings were eleven months old, and final selections at twelve months. The elimination trials were based on vigour, habit, structure of buds, and freedom from disease. In the final selection the refractometer brix was added to the elimination factors.

In the table below, the percentage of progeny selected from each marriage, with the highest and average brix, is given :—

Parents.	Selected.	Highest Brix.	Average Brix.
♀ ♂	Per cent.	Per cent.	Per cent.
S.J. 3172B × P.O.J. 2878	0·2	23·0	21·0
Ba. 11569 × S.C. 12 (4)	0·5	24·4	22·5
M.D. 41 × B.H. 10 (12)	1·5	25·1	23·0
Ba. 11569 × B.H. 10 (12)	0·5	24·2	22·0
Ba. 11569 × S.J. 606B	1·0	23·2	21·4
S.J. 3153B × B.H. 10 (12)	3·0	26·0	23·4
P.O.J. 2364 × E.K. 28	0·25	21·8	19·6
Ba. 11569 × S.J. 694B	Nil	19·8	..
S.J. 3724B × S.C. 12 (4)	1·0	23·0	21·9
P.O.J. 2725 × Q. 1098	2·5	22·3	21·0
P.O.J. 2725 × P.O.J. 2940	4·5	22·9	21·8
P.O.J. 2725 × D. 1135	0·5	23·2	21·0
P.O.J. 2725 × S.J. 52C	6·0	23·1	21·4
P.O.J. 2878 × S.W. 499	5·5	23·7	21·8
P.O.J. 2878 × S.J. 50C	2·0	22·2	20·9
Oramboo × H.Q. 409	8·5	26·1	23·7
Q. 1 selfs	3·0	27·2	24·2
N.G. 24 × S.C. 12 (4)	0·25	23·0	21·9
Badila × S.W. 499	4·5	24·3	22·8
Badila × S.C. 12 (4)	2·0	22·9	22·0
Badila × P.O.J. 2878	1·0	22·0	20·9
Badila × Q. 813	3·5	23·7	22·1
Oramboo × Q. 813	2·0	24·4	22·8
Oramboo × S.C. 12 (4)	1·0	24·6	22·4
Oramboo × E.K. 28	1·5	24·1	22·4

Seedling Propagation—continued.

Second Selection of 1933 Seedlings.

These selections are made on lines somewhat similar to those practiced in the first selections, with the addition of complete juice analysis and weight of stools :—

Seedling.	Parents. ♀ ♂	C.C.S.	Weight per Stool.
		Per cent.	lb.
F. 1 ..	Badila × S.C. 12 (4)	15·8	34
F. 2 ..	Badila × S.C. 12 (4)	16·9	29
F. 3 ..	Badila × S.C. 12 (4)	16·8	31
F. 4 ..	Badila × P.O.J. 2878	15·4	39
F. 5 ..	Badila × P.O.J. 2878	15·1	35
F. 6 ..	Badila × P.O.J. 2940	14·6	32
F. 7 ..	N.G. 24 × Q. 813	15·8	28
F. 8 ..	N.G. 24 × Q. 813	15·9	26
F. 9 ..	P.O.J. 213 × S.J. 1541H	14·9	26
F. 10 ..	P.O.J. 2725 × S.C. 12 (4)	14·1	34
F. 11 ..	P.O.J. 2725 × S.J. 3C	15·6	32
F. 12 ..	P.O.J. 2725 × S.J. 3C	15·8	33
F. 13 ..	P.O.J. 2725 × S.J. 2C	15·4	37
F. 14 ..	P.O.J. 2725 × S.J. 142D	14·6	41
F. 15 ..	P.O.J. 2878 × S.J. 1C	15·6	30
F. 16 ..	P.O.J. 2878 × S.J. 1C	14·7	41
F. 17 ..	S.J. 146D × S.J. 2C	16·7	31
F. 18 ..	S.J. 146D × S.J. 2C	16·2	29
F. 19 ..	S.J. 146D × S.J. 2C	16·2	31
F. 20 ..	S.J. 188D × S.J. 2C	15·8	36
F. 21 ..	S.J. 188D × S.J. 2C	15·9	34
F. 22 ..	S.J. 198D × S.J. 2C	16·4	28
F. 23 ..	Oramboo × Q. 813	15·9	27
F. 24 ..	Oramboo × Q. 813	16·2	30
F. 25 ..	Oramboo × Q. 813	17·0	24
F. 26 ..	Oramboo × Q. 813	16·8	23
F. 27 ..	S.J. 182D × H.Q. 409	15·0	38
F. 28 ..	S.J. 182D × H.Q. 409	15·4	38
F. 29 ..	S.J. 182D × H.Q. 409	15·2	35
F. 30 ..	S.J. 182D × H.Q. 409	14·7	39

Seedling Propagation—continued.

in the first
:—

Weight per Stool.
lb.
34
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39

Final Selection of 1932 Seedlings.

These seedlings have passed the final selection on our Experiment Station, and will now be propagated for yield trials on various farms throughout the Northern districts. All seedlings that pass this selection are taken into our permanent collection, and receive " Q " serial numbers.

Seedlings.	Parents.	C.C.S.	Cane Per Acre.
	♀ ♂	Per cent.	Tons.
Q. 13	Badila × P.O.J. 2878	15·6	38·0
Q. 14 ..	Badila × S.C. 12 (4)	15·8	32·7
Q. 15	Badila × Q. 813	16·9	29·8
Q. 16	Badila × Q. 813	16·7	34·0
Q. 17	P.O.J. 2878 × S.J. 102c	15·3	42·5
Q. 18	P.O.J. 2878 × S.J. 32d	15·7	45·0
Q. 19	Oramboo × H.Q. 409	17·8	30·5

Parents from Self-fertilized Lines.

On account of the adverse arrowing season, all of our selected parents from selfed lines failed to arrow.

Inter-generic Crosses.

As soon as the newly introduced species of *Erianthus* are released from quarantine they will be crossed with various species of *Saccharum*.

Disease Resistance Trials.

Under the direction of the Pathologist, disease resistance trials are carried out with all seedlings, and the results will be found in Mr. Bell's report under the Division of Pathology.

Seedling Work at Mackay and Bundaberg.

Bundaberg.

During the 1934 season 6,000 seedlings were planted in the field, and from this number 410 seedlings, or 6·5 per cent., were selected. The most promising canes were obtained from the cross P.O.J. 2878 × P.O.J. 2940, from which seventy-seven of the progeny were selected as apparently superior to the standard variety Q. 813.

The following table sets out the selected seedlings and their parentage :—

Parents.	Number Selected.	Parents.	Number Selected.
♀ ♂		♀ ♂	
P.O.J. 2878 × S.C. 12 (4)	23	P.O.J. 2878 × P.O.J. 2940	77
P.O.J. 2725 × S.J. 32c	65	Oramboo × H.S. 1541	81
P.O.J. 2725 × Black Innis	3	P.O.J. 2722 × D. 1135	6
Co. 281 × S.J. 50c	9	7R. 428 × P.O.J. 2940	28
Co. 290 × N.G. 16	8	Co. 290 × Q. 1098	9
Co. 290 × S.J. 48c	5	Oramboo × S.C. 12 (4)	4
Co. 290 × N.G. 24	13	P.O.J. 2722 × S.J. 11c	10
P.O.J. 2725 × S.C. 12 (4)	23	N.G. 16 × H.Q. 409	2
Co. 281 × E.K. 28	1	S.J. 4 × P.O.J. 2940	43

Seedling Propagation—continued.

Mr. N. J. King, who carried out the selections, supplied the following comments :—

P.O.J. 2940 × 7R. 428 ..	Practically all seedlings have bad buds, and show low to medium juice quality.
N.G. 16 × H.Q. 409	Quality good.
Co. 290 × N.G. 24	The N.G. 24 does not seem to have had much influence in improving Co. 290. The canes are rather of N.G. 24 type with Co. 290 vigour lost. Juice quality slightly above Q. 813.
Co. 290 × Q. 1098	Co. 290 characteristics predominate, but Q. 1098 has not improved the juice quality.
Co. 290 × S.J. 48c	The juice quality of Co. 290 has been slightly improved and the vigour retained. Stooling is very good.
P.O.J. 2878 × P.O.J. 2940 ..	From this cross we obtained some of the highest quality seedlings.
S.J. 4 × P.O.J. 2940 ..	This cross gave the best seedlings on the basis of vigour and brix. As some of the cut sticks have oozed gum, it is suspected that the progeny will be susceptible to this disease.
Oramboo × H.S. 1541 ..	Average vigour with low to medium juice quality.

Owing to the lack of irrigation facilities and the dry conditions experienced during the past year the selected seedlings from the 1933 season were not sufficiently advanced to allow a further selection to be made during 1935.

The following selected seedlings from previous propagations were planted in preliminary yield trials during August :—

Seedling.	Parents.
B. 1A	N.G. 24 × R.P. 6
B. 2A	N.G. 24 × R.P. 6
B. 3A	P.O.J. 2940 × S.C. 12 (4)
B. 1c	P.O.J. 2875 × H.Q. 409
B. 4c	P.O.J. 2875 × H.Q. 409
B. 6c	P.O.J. 2875 × H.Q. 409
B. 8c	P.O.J. 2875 × H.Q. 409
B. 9c	Co. 290 × S.C. 12 (4)
B. 10c	Co. 290 × S.C. 12 (4)
B. 11c	Co. 290 × S.C. 12 (4)
B. 12c	P.O.J. 2878 × H.Q. 409

Gum Resistance Trials.

A series of gumming resistance trials, comprising selected seedlings and family trials, are carried out each year by the Pathologist ; the results of these trials will be found in Mr. Bell's report for the Division of Pathology.

Mackay—

From all seedlings raised prior to 1934, fourteen canes have been selected for propagation and final trials in checker-board tests. The most outstanding seedlings have been obtained from the combination of P.O.J. 2878 with S.C. 12 (4) ; two of the progeny from this cross, C. 83 and C. 85, suggest, on their present showing, that they will outyield the standard varieties at present grown in the Mackay district.

The first selection of the 1934 seedlings was carried out during October ; 110 canes were selected and planted in observational plots.

Seedling Propagation—continued.

The following table gives the total number of each family grown and the number of seedlings selected :—

Parents.	Number Grown.	Number Selected.
P.O.J. 2878 × P.O.J. 2940	153	6
P.O.J. 2878 × S.J. 42c	55	Nil
P.O.J. 2878 × S.C. 12 (4)	21	Nil
S.J. 4 × P.O.J. 2940	201	7
N.G. 16 × S.J. 52c	967	28
7R. 428 × P.O.J. 2940	1,054	20
P.O.J. 2725 × S.C. 12 (4)	648	2
S.J. 4 × E.K. 28	184	4
N.G. 16 × P.O.J. 2940	428	5
N.G. 24 × S.J. 54c	168	Nil
Co. 290 × Oramboo	392	Nil
P.O.J. 100 × P.O.J. 2940	80	3
N.G. 24 × Q. 813	521	12
Co. 281 × E.K. 28	2	Nil
Co. 281 × S.J. 50c	2	Nil
P.O.J. 2722 × D. 1135	45	1
N.G. 24 × S.C. 12 (4)	980	10
N.G. 16 × S.W. 499	453	12
P.O.J. 2364 × Black Innis	149	Nil

For the season 1935 3,500 seedlings have been planted out on the new Te Kowai Station, and they represent progeny from the following combinations :—S.J. 10192F × S.C. 12 (4), S.J. 10960F × S.C. 12 (4), S.J. 81E × Q. 1098, 7R. 428 × P.O.J. 2940, Co. 290 × Q. 1098, P.O.J. 2878 × S.C. 12 (4), P.O.J. 2725 × S.C. 12 (4), P.O.J. 2725 × 20S. 16, P.O.J. 2725 × Q. 1098, P.O.J. 2725 × H.Q. 409, S.J. 9625F × S.C. 12 (4), and S.J. 12401E × S.C. 12 (4).

NORTHERN SUGAR EXPERIMENT STATION, MERINGA.

MR. E. J. R. BARKE, Chemist in Charge.

METEOROLOGICAL.

The growing season for the 1934-35 sugar-cane crop was not so favourable as that of the preceding year. Adverse conditions were experienced during the early planting months, which resulted in poor germinations, followed by slow growth. An abnormally hot dry spell, amounting to a severe drought for this locality, was experienced from June to October, and, although five inches of rain were recorded during November, it was followed by only seven points in December. The prolonged hot, dry conditions caused a serious check to crop growth, and the cane was very backward when the wet season finally commenced in January. Heavy floods were experienced in March 1935, and caused considerable damage to cane on all low-lying areas. From March until the end of the growing season conditions were favourable for continued growth, the rainfall being adequate and well distributed.

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

Year.	Rainfall in inches.	Year.	Rainfall in inches.
1916	100·73	1926	59·12
1917	66·81	1927	90·16
1918	69·15	1928	62·33
1919	57·53	1929	102·28
1920	94·86	1930	107·61
1921	122·84	1931	98·82
1922	64·90	1932	76·31
1923	53·29	1933	96·06
1924	95·67	1934	91·44
1925	76·98	1935 (9 months) ..	50·46
		Average (19 years) ..	**83·52**

Abstract of Meteorological Observations made at the Northern Sugar Experiment Station, Meringa, from the 1st September, 1934, to 31st August, 1935.

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 of the Air, 9 a.m.
September, 1934	2·14	11	92·0	78·0	86·0	62·0	49·5	59·0	27·0	71·8	68·0
October, 1934	1·37	7	94·0	84·0	88·7	71·5	58·0	65·8	22·9	81·1	65·7
November, 1934	5·05	15	96·5	84·5	92·2	73·0	61·5	67·2	25·0	83·7	76·3
December, 1934	0·07	3	108·5	94·0	101·0	81·5	63·0	68·1	32·9	87·4	63·0
January, 1935	5·93	13	105·2	84·6	97·9	76·0	70·0	72·2	25·7	86·2	78·0
February, 1935	10·02	12	107·2	80·0	97·6	80·0	67·0	71·9	25·7	85·3	82·6
March, 1935	22·00	14	95·0	79·5	89·2	76·0	63·0	68·8	20·4	79·4	83·5
April, 1935	2·73	13	94·0	85·0	89·4	71·5	56·0	64·4	25·0	76·8	78·0
May, 1935	6·13	11	90·0	83·0	86·8	59·0	49·0	53·9	32·9	70·1	74·7
June, 1935	0·88	4	89·0	82·0	86·9	56·0	48·0	51·1	35·8	65·9	68·0
July, 1935	1·22	3	88·0	81·0	84·0	54·0	48·0	50·9	33·1	66·3	73·0
August, 1935	1·81	11	89·0	75·0	85·4	66·0	43·0	54·2	31·2	70·7	73·5
Year	59·35	117	..	..	..	..	..	..	..	..	73·7*

* Average.

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

TRANSFER OF NORTHERN EXPERIMENT STATION.

Early in 1934, steps were taken to provide the necessary building accommodation at Meringa, to permit of the concentration of the Northern experimental activities at that centre. The South Johnstone Station was vacated in September, 1934. The new Station at Meringa has now been adequately equipped as an up-to-date investigational centre. Increased laboratory space has been provided for the use of the Chemist and Entomologists, while the clearing of new land will permit of an expansion of the seedling propagation work, as well as the initiation of general agricultural investigations with respect to soil fertility and cultural operations.

A glasshouse (60 feet by 18 feet) equipped with a hot-water system will facilitate the seedling work, and a 3-inch centrifugal pump will supply the irrigation water required by the seedlings during the dry spring and early summer months. The glasshouse will also be employed for Mitscherlich pot culture work, in conjunction with farm fertility trials.

All power units on the farm are electrically operated, employing current supplied by the Barron Falls Hydro-Electricity Board.

Official Opening.

The Station was officially opened by the Minister for Agriculture and Stock (the Hon. F. W. Bulcock), at 3 p.m. on Friday, 13th September, 1935. A large number of local farmers and prominent townspeople were present, in addition to the Delegates to the Fifth Congress of the International Society of Sugar Cane Technologists, and the Members of the Experiment Stations Advisory Board.

Experimental Work.

The land at present cleared on the new Station has been devoted to the planting of seedlings and the propagation of disease-free Badila for the planting of experimental blocks during the coming year. The clearing of the land will be continued until the entire area is available for cultivation and general experimental work.

CENTRAL SUGAR EXPERIMENT STATION, MACKAY.

MR. D. L. MCBRYDE, CHEMIST IN CHARGE.

METEOROLOGICAL.

Weather conditions in the Mackay district during the past season were extremely varied. North of the Pioneer River, and particularly in the North Coast sections, growing conditions were, on the whole, very favourable; south of the river they varied from fair to very poor. Drought effects were particularly severe in those areas south of Sarina.

The temperature conditions throughout the year also varied between wide extremes. Following a hot summer season, severe frost damage was experienced in the South Coast and Netherdale areas, with slight injury on the North Coast lands.

The Mackay crops are, therefore, highly variable and range from very good to very poor. On the whole, the district production is above the average, and practically all mills will harvest crops which will yield peak tonnages of sugar. The sugar content of the crop has been consistently high to date.

Rainfall during the winter and spring months of 1935 have been favourable over the greater part of the district, and at the present time prospects for heavy tonnages in 1936 are particularly bright.

The following table shows the monthly rainfall distribution for the past five years :—

MONTHLY RAINFALL DISTRIBUTION FOR THE PAST 5 YEARS.

Month.	1930-31.	1931-32.	1932-33.	1933-34.	1934-35.
September, 1934	·28	·31	·76	3·01	1·06
October, 1934	·62	·94	·28	1·29	2·14
November, 1934	1·21	5·67	2·02	11·82	3·81
December, 1934	2·71	6·17	8·03	5·72	1·82
January, 1935	4·12	25·51	7·27	5·01	3·75
February, 1935	5·32	2·0	20·92	9·28	15·44
March, 1935	5·31	·76	·96	5·30	3·78
April, 1935	1·27	2·75	4·40	2·57	2·80
May, 1935	1·66	4·52	1·72	3·24	8·36
June, 1935	·26	1·15	3·53	2·47	·80
July, 1935	·19	·37	9·64	·60	1·53
August, 1935	·04	·35	1·66	·27	·68
	22·99	50·50	61·19	50·58	45·97

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

ANNUAL RAINFALL SINCE 1920 AT THE SUGAR EXPERIMENT STATION, MACKAY.

Year.	Rainfall in Inches.	Year.	Rainfall in Inches.
1920	57·27	1928	78·28
1921	95·89	1929	64·03
1922	34·47	1930	55·81
1923	25·23	1931	30·01
1924	53·37	1932	48·48
1925	54·80	1933	71·94
1926	34·69	1934	37·57
1927	83·87	1935 (9 months) ..	40·08
		Average (15 years) ..	**55·04**

Abstract of Meteorological Observations made at Sugar Experiment Station, Mackay, from 1st September, 1934, to 31st August, 1935.

Month.	Rainfall in Inches.	Number of Wet Days.	Average Rainfall for 34 years, 1901-1934.	Highest Shade Maximum.	Lowest Shade Maximum.	Mean Shade Maximum.	Highest Shade Minimum.	Lowest Shade Minimum.	Mean Shade Minimum.	Lowest Terrestial Minimum.	Mean Terrestial Minimum.	Mean Diurnal Range.	Mean Temperature, 9 a.m.	Mean Relative Humidity of Air at 9 a.m. Saturation equalling 100.
1934.														
September ..	1·06	4	1·70	89·0	72·0	78·3	69·8	41·8	56·5	40·0	53·9	21·8	72·4	67·0
October ..	2·14	7	1·67	88·0	75·5	81·6	72·0	50·0	63·1	46·0	60·9	18·5	77·1	65·0
November ..	3·81	13	3·22	93·3	81·0	85·7	74·0	61·0	68·4	60·0	66·6	17·3	80·8	67·0
December ..	1·82	7	7·75	96·0	82·8	89·2	78·0	57·5	68·7	55·0	66·1	20·5	83·4	60·0
1935.														
January ..	3·75	7	15·06	100·0	87·0	90·9	77·0	65·0	74·0	62·0	69·3	16·9	85·4	68·0
February ..	15·44	7	9·46	99·0	80·0	91·9	76·0	66·0	72·4	63·0	70·4	19·5	85·1	68·0
March ..	3·78	9	9·53	88·0	74·2	85·0	81·0	63·2	68·6	61·0	67·0	16·4	80·1	78·0
April	2·80	11	5·42	87·0	78·0	81·6	70·2	54·0	60·5	50·0	60·5	21·1	75·6	77·0
May	8·36	9	3·21	84·5	70·0	77·1	65·1	48·0	56·4	44·0	53·4	20·7	68·9	80·0
June	0·80	6	2·51	85·0	63·0	72·5	64·0	43·8	51·7	35·0	48·4	20·8	64·8	78·0
July ..	1·53	3	1·49	80·0	67·0	72·9	63·0	39·0	50·5	36·5	47·0	22·4	63·1	83·0
August ..	0·68	7	1·00	87·0	69·0	74·2	64·0	36·5	52·3	34·0	49·5	21·9	65·9	79·0
Year ..	45·97	90	..	..	..	..	..	..	..	..	..	..	..	*72·5

* Average.

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

TRASH TRIAL (First Ratoon Crop).

Plans and Yields.

Trash	18.5
No Trash	24.0
No Trash	22.0
Trash	31.8
Trash	29.6
No Trash	31.9

Block.—A1.
Variety.—Q. 813.
Harvested.—October, 1935.
Age of Crop.—13 months.
System of Replication.—Three randomised blocks.
Plots.—0·167 acre.

TREATMENTS.

Trash Plots.—The trash from the plant crop was conserved by rolling into alternate interspaces. The bared middles were cultivated.

No Trash Plots.—The trash from the plant crop was burned after harvesting, and the plots were cultivated in the customary manner.

GROWTH NOTES.

All plots ratooned well, but the growth was checked due to dry weather. During this period, it was evident that the cane on the "trash" plots withstood dry conditions much better than the "no trash" plots; apparently the mulching effect of the trash was highly beneficial in its influence on moisture conservation, as evaporation losses were negligible on the trash-covered soil.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square)
Blocks	2	91·33	45·67	..
Treatments	1	0·67	0·67	0·9510
Errors	2	65·12	32·56	2·8929
Totals	5	157·12	..	..

Crop Yields.—Plant and First Ratoon Crops.

Treatment—	Plant Crop.			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.
No Trash	**38.9**	14·7	**5.71**	**26.0**	14·2	**3.69**
Trash	**38.4**	14·7	**5.64**	**26.6**	15·4	**4.10**

DISCUSSION.

As with the plant crop, there was essentially no difference in yield between the treated and untreated plots. It will be observed, however, that the area of land on which the trial was conducted is extremely variable throughout its length, and was actually quite unsuitable for experimental purposes.

A striking feature of the first ratoon results is the marked variation in C.C.S. of the crop from the respective treatments. This was uniformly true for all pairs of plots, as is seen from the individual values:—

Trash { 15·3 per cent. / 15·0 per cent. / 15·8 per cent.

No Trash { 14·2 per cent. / 14·2 per cent. / 14·1 per cent.

The explanation of this difference is not evident; it is possibly related to the influence of the trash on the time of maturity. If the rotting of the mulch provides a steady supply of available nitrogen to the crop, delayed maturity might follow, so that cane from the "trash" plots would attain its peak of sugar content when the "no trash" plots were over-ripe.

A long-distance trash treatment trial similar to that reported here will be established at an early date on the new Station at Te Kowai.

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

TOTAL TONNAGE OF CANE HARVESTED FROM THE CENTRAL EXPERIMENT STATION, MACKAY, SEASON 1934.

It was intended originally to dispose of the cane crop together with the Station. As no sale was effected, the crop is being harvested by the station labour, and the following are the estimated tonnages which will be cut :—

	Acres.	Tons.
Plane cane	9·00	252
Seedling canes	3·75	60
Standover cane	1·25	14
Ratoon cane	1·00	26
Totals	15·00	352

Average cane per acre (estimated) .. .. .. 23.5 tons.

Distribution of New Varieties.

Several farm propagation plots of P.O.J. 2725 and Co. 290 were established in 1934, and the crop therefrom was made available for distribution during the past spring. P.O.J. 2725 was in poor demand, due to its early arrowing and trash-binding tendencies. The demand for Co. 290 was stronger, and about 50 tons were distributed.

In view of the recent favourable results with Co. 290 in the Southern districts, it would appear that the cane is assured of a definite future on the poorer lands of the Mackay area, where Uba and P.O.J. 213 were formerly grown.

Transfer of Central Station to Te Kowai.

During the past year, considerable progress has been made with the new Station site at Te Kowai. At the present time, the new chemist's residence and ploughman's cottage are practically completed; two wells have been sunk, for water supply purposes, and one of these is able to supply a three-inch centrifugal pump. This is a very fortunate circumstance, as it provides for the watering of the seedlings which were this year germinated and potted at the old Station, and transferred to the Te Kowai block which had been prepared for them.

The new building for stables and implements is under construction, and the transfer of the chemical laboratory from the old Station will be effected in the near future.

In all, sixteen acres of cane have been planted at Te Kowai: in addition, twelve acres of ratoons are being cultivated, so that a reasonable crop of cane should be harvested during the 1936 season.

Experimental Plots Planted.

The following trials were initiated this year at Te Kowai :—

Varietal Trial.—A comparison of three Mackay seedlings—M. 57c, 83c, and 85c. These are the first of the seedlings propagated at Mackay to reach the field trial stage.

Fertility Trial.—This is the initial trial designed to determine the plantfood requirements of the new Station land. It consists of the standard 5 x 5 Latin square layout, with treatments—C, NP, NK, PK, and NPK. The variety planted was Q. 813.

Cane Harvested.

The first ratoon crop which occupied one of the blocks at the time the Station was purchased produced a fair tonnage of cane. It yielded 290 tons, with C.C.S. 15·1 per cent., at an average of 20 tons per acre.

The block has been ratooned again.

SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG.

MR. J. PRINGLE, Chemist in Charge.

METEOROLOGICAL.

Growing conditions for the 1935 crop in the Southern areas could not be regarded as favourable. Following a mild winter in 1934, the early spring months were dry, followed by good rains during November. The spring plant cane and ratoon crops came away well, and good progress was maintained until the hot, dry conditions which were experienced during January caused a cessation of growth. Further beneficial rains were received in mid-February, but the advent of cool weather early in April prematurely checked vigorous growth. During the winter, cold periods with heavy frosts caused considerable damage to backward cane ; the 1934 ratoons and spring plant were damaged, while the young 1935 autumn plant crops suffered severely.

Although conditions during August were dry, the well distributed rains of September and October assured good germinations of the spring plantings, the autumn plant cane has made a good recovery from frost damage ; and ratoons have come away vigorously.

RAINFALL AT THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, DURING THE GROWING SEASON 1934–35.

Month.	Rainfall. Inches.	Number of Wet Days.
August, 1934	1·15	4
September, 1934	0·64	3
October, 1934	2·89	8
November, 1934	8·93	7
December, 1934	4·88	5
January, 1935	3·30	6
February, 1935	5·34	10
March, 1935	1·74	10
April, 1935	6·29	5
May, 1935	2·54	5
June, 1935	0·74	3
July, 1935	5·29	7
August, 1935	0·61	4
September, 1935	2·85	7
October, 1935 (26 days)	1·60	7
Total	48·79	91

Experiments Harvested during 1935.

(1) **Irrigation Trial.**—P.O.J. 2878 (first ratoon crop).

(2) **Trash Conservation Trials.**—

(1) Trash rolled into alternate rows (first ratoon crop).

(2) Relieving v. Rolling v. Volunteering on ratoons.

(3) **Varietal Trials.**—

(1) Second ratoons of gumming resistant varieties.

(2) First ratoons of further new varieties.

(4) **Irrigation Trial.**—

(a) Irrigation in row throughout growing period.

(b) Irrigation in row till filled by cultivation, thence in a furrow run down the centre of the interspace.

(5) **Fertilizer Trial.**—Time of nitrogen application.

(6) **Cultivation Trial.**—Cultural operations with varying interspace distance.

(7) **Fertilizer Trial.**—Inorganic v. "Organic" phosphate.

New Experiments Initiated.

(1) **Fertilizer Trial.**—Optimum application of sulphate of ammonia with irrigation.

(2) **Varietal Trial.**—P.O.J. 2878 v. Co. 290, single and double planting.

(3) **Varietal Trial** combined with interspacing distance.

(4) **Varietal Trial** with new seedling canes.

Work of Southern Sugar Experiment Station—continued.

IRRIGATION TRIAL (First Ratoon Crop).

Block.—Nursery. **Harvested.**—October, 1935.
Variety.—P.O.J. 2878. **Age of Crop.**—13 months.
Area.—0·089 acre.

TREATMENTS.

The plant crop was harvested in September, 1934, and ratooning was carried out in the usual manner, employing the subsoiler. Watering and fertilizing followed immediately, and were continued throughout the growing season. The fertilizer and irrigation treatments were similar to those for the plant cane, namely :—

Irrigation.—

Spring months	3 inches per week.
Summer months	4–5 inches per week.
Autumn months	2 inches per week.
Winter months	1 inch per week.

Fertilizer.—

At ratooning, the following mixture was applied :—

Sulphate of ammonia	300 lb. per acre.
Superphosphate	200 lb. per acre.
Muriate of potash	400 lb. per acre.
Total	900 lb. per acre.

Monthly dressings of the following composition were applied throughout the growing period :—

Sulphate of ammonia	100 lb. per acre.
Superphosphate	20 lb. per acre.
Muriate of potash	50 lb. per acre.
Total	170 lb. per acre.

GROWTH NOTES.

The crop made excellent progress during the hot months of the year, which were ideal for irrigated cane. Unfortunately, the irrigation plant was temporarily out of order during January, and a check in growth was suffered by the crop. The early advent of wintry conditions caused a check in growth in late April. A proportion of the crop lodged during the late summer when a heavy south-east gale accompanied by rain was experienced.

Crop Yields—Plant and First Ratoon Crops.

	Plant Crop.	First Ratoon Crop.
Cane, tons per acre	**93.4**	**72.8**
C.C.S. in cane, per cent.	12·1	13·0
C.C.S., tons per acre	**11.3**	**9.5**

DISCUSSION.

This small experimental plot was established in 1933 to determine the rate of crop production under the local environmental conditions, when soil moisture and plant food were eliminated as limiting factors. The prolific crops which become possible under these conditions are demonstrated by the plant and first ratoon yields recorded. For two crops, 166 tons of cane per acre, yielding 20·8 tons of sugar, were harvested, and the results show very definitely what could be achieved on the fertile red volcanic lands of the Woongarra, given an adequate supply of irrigation water.

The plot has been ratooned and the experiment will be continued for a further year.

Work of the Southern Sugar Experiment Station—continued.

TRASH CONSERVATION TRIAL (First Ratoon Crop).

Plan and Yields.

No Trash	12.1
Trash	9.8
Trash	9.6
No Trash	14.1

Block.—E3A.

Variety.—Q. 813.

Harvested.—July, 1935.

Age of Crop.—10 months.

Plots.—0·293 acre.

TREATMENTS.

On the removal of the plant crop in September, 1934, the trash on the "no trash" plots was burnt and the cane ratooned with the subsoiler three times per row, while on the "trash" plots the trash was rolled into alternate rows and the bare spaces ratooned in the same manner. Mixed fertilizer was uniformly applied to each plot at the following rate per acre:—250 lb. muriate of potash, and 150 lb. superphosphate at ratooning, with two top dressings of sulphate of ammonia each 150 lb. per acre at monthly intervals.

GROWTH.

Owing to the dry condition of the soil at time of ratooning, the cane did not come away till after a good fall of rain in mid-October, the ratoon being good in the "no trash" plots but rather poor in the "trash" plots. The cane in all plots made good growth while favourable conditions prevailed, but at all periods the "no trash" plots were in the lead; when dry weather set in about mid-January the "trash" plots lost colour quickly, and being shorter in the stick suffered severely from frost during the winter.

Crop Yields—Plant and First Ratoon Crops.

	Plant Crop.			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.
Trash	**36.2**	16·1	**5.83**	**9.4**	13·2	**1.24**
No trash	**36.2**	15·7	**5.68**	**13.1**	12·9	**1.69**

DISCUSSION.

This trial occupies a block which will be devoted to trash conservation experiments over a long period, with a view to determining the benefits to be expected from the treatment. In the plant crop, no difference in yield between the two treatments was recorded. In each case a heavy cane crop was harvested, and a heavy body of trash was left between the rows of the trash plot. The variety was Q. 813, notorious for its weak ratooning qualities in this area, particularly when harvested early. Difficulty was also experienced in preventing the trash from blowing on top of the stools, and as a result the ratoons were a partial failure where the trash had been rolled.

This is reflected in the yields for the ratoon crop, and these results demonstrate very clearly that trash conservation with ratoons can only be effected successfully where a vigorous ratooning cane is grown.

The stools have now been ploughed out, and the crop residues on the "trash" plots turned under. The plots will be planted as before during February-March, with a vigorously ratooning P.O.J. variety.

Attention is drawn to the consistently improved C.C.S. values recorded for the cane from the "trash" plots; this is in conformity with the results from a similar trial at the Mackay Station (see p. 24).

Work of the Southern Sugar Experiment Station—continued.

TRASH TRIAL—RELIEVING v. VOLUNTEERING v. ROLLING (Second Ratoon Crop).

Plan and Yields.

Blocks.		
I.	Volunteered. 14.5	Relieved. 12.8
	Rolled 15.6	Trash Burnt 15.8
II.	Relieved 16.9	Volunteered 15.2
	Trash Burnt 13.4	Rolled 14.4
III.	Volunteered 12.8	Relieved 11.1
	Rolled 11.5	Trash Burnt 10.5

Block.—C1.
Variety.—Q. 813.
Harvested. July, 1935.
Age of Crop.—10 months.
System of Replication.—Three randomised blocks.
Plots.—0·1363 acre.

TREATMENTS.

Volunteered.—Trash from first ratoon crop allowed to remain *in situ*.

Relieved.—Trash drawn away from the stools in each row.

Rolled.—Trash rolled into alternate interspaces, and the bare spaces ratooned with the subsoiler; trash then rolled back to the cultivated space, and the balance of the plot ratooned similarly.

Trash Burnt.—Trash burnt in the usual manner.

GROWTH NOTES.

The ratoon was delayed for about a month after harvesting the first ratoon crop in September, but in response to the mid-October rains the cane in all plots came away well and appeared to grow uniformly until checked by dry weather late in January, but came away well after the rain in mid-February. In November all plots were uniformly treated with a top-dressing of sulphate of ammonia at the rate of 300 lb. per acre. It was noticed during the dry weather that the cane on certain of the plots was light in colour, but on close investigation it was found that this was due more to soil variations than to the effects of treatments. There were no apparent differences due to the respective treatments.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Blocks	2	30·11	15·06	..
Treatments	3	1.39	0·46	0·7631
Errors	6	13·69	2·28	1·5634
Total	11	45·19	..	..

Crop Yields—First and Second Ratoon Crops.

Treatment—	First Ratoon Crop.			Second 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.
Volunteered	21.4	16·2	3.45	14.2	12·8	1.82
Relieved	22.4	16·1	3.60	13.6	13·2	1.80
Rolled	21.5	15·8	3.40	13.8	13·8	1.90
Burnt	22.0	15·7	3.45	13.2	14·3	1.89

DISCUSSION.

The treatments under trial in this experimental block embrace those employed as alternative methods of dealing with trash. The results from both first and second ratoon crops show no significant superiority of one method over another.

Work of the Southern Sugar Experiment Station—continued.

VARIETAL TRIAL (Second Ratoon Crop).

Plan and Crop Yields.

POJ 2725 *47.7	Q 813 16.2	POJ 234 19.8	Q 813 16.8	Co 290 37.2
Q 813 *22.8	Co 290 35.4	Co 281 19.2	Manoa 304 12.3	Q 813 15.6
POJ 234 22.2	POJ 2725 20.7	Q 813 15.0	Co 290 34.2	POJ 2725 23.7
Co 290 37.8	Q 813 12.3	Manoa 304 12.0	Q 813 12.6	POJ 234 24.0
Q 813 17.1	POJ 234 18.6	Co 290 36.3	26 C 188 22.2	Q 813 12.0
26 C 188 22.8	Manoa 304 10.2	Q 813 12.6	POJ 234 20.7	Co 290 Standover. †54.6
Co 290 Standover. †62.7	Q 813 13.2	POJ 2725 27.6	Q 813 10.2	Co 281 22.5

* Affected by Irrigation Water—not included in averages.
† Not included in averages.

Block.—B1.

Harvested.—October, 1935.

Age of Crop.—12 months.

Plots.—1/30 acre.

CULTIVATION.

When the first ratoon crop was harvested in October, 1934, the ratooning was carried out in the usual manner. Mixed fertilizer was applied at the following rate per acre :—

150 lb. superphosphate.

250 lb. muriate of potash, at ratooning, followed by two top-dressings of sulphate of ammonia each 150 lb. per acre at monthly intervals.

GROWTH NOTES.

The ratoons in all plots germinated well, especially the P.O.J. 2725, Co. 290, and P.O.J. 234 ; all plots made steady progress until checked by dry conditions mid-January to mid-February, after which rapid growth was made till retarded by cool weather in April, the canes mentioned above maintaining the lead. Q. 813 and Manoa 304 were badly damaged by frost. There was no arrowing in this crop, but the P.O.J. 2725 showed a tendency towards arrowing when harvested.

CROP YIELDS.

Plant, First and Second Ratoon Crops.

	Plant Crop.	First Ratoon Crop.			Second Ratoon Crop.		
	Cane per Acre.	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.	Tons.	Per cent.	Tons.	Tons.	Per cent.	Tons.
Co. 290	22.8	49.4	15·1	7.46	36.2	14·5	5.25
P.O.J. 2725	16.8	48.1	17·2	8.28	24.0	16·2	3.89
Co. 281	15.1	34.0	14·4	4.90	20.9	14·8	3.09
P.O.J. 234	13.8	31.6	15·9	5.02	21.0	15·6	3.28
26 C. 188	12.2	25.2	14·6	3.68	22.5	14·9	3.35
Q. 813	9.3	20.4	16·2	3.30	14.0	16·0	2.24
Manoa 304	9.2	17.8	14·1	2.51	11.5	13·0	1.50

Work of the Southern Sugar Experiment Station—continued.

DISCUSSION.

Following three crops of these new gum-resistant varieties, grown under a wide range of weather conditions, it is possible to evaluate their relative values for Southern Queensland conditions.

Co. 290 gave consistently the highest tonnages of cane per acre; for the second ratoon crop, grown under rather adverse conditions, it far outyielded all other varieties. The sugar content of the cane was also uniformly satisfactory.

P.O.J. 2725 produced the second highest cane tonnages for all crops, and was consistently richer in sugar than Co. 290. Under the drier conditions of the past year it did not perform so favourably as Co. 290, though it was definitely superior to all other varieties.

Co. 281 and P.O.J. 234 are canes of similar type, and have produced cane yields of similar weight for all three crops. P.O.J. 234 would be preferred, however, due to its higher c.c.s. content.

The standard variety—Q. 813—has performed so poorly that further plantings of the variety on the red volcanic lands should not be made in future. Co. 290 and P.O.J. 2725 are quite definitely far superior to the older cane, and it is anticipated that these, with P.O.J. 2878, will become the staple varieties in these parts in the course of two or three years.

)ctober, 1935.
–12 months.
acre.

VATION.
irst ratoon crop
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ratooning was
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followed by two
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290, and P.O.J.
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April, the canes
maged by frost.
›wards arrowing

l Ratoon Crop.

C.C.S. in Cane.	C.C.S. per Acre.
Per cent.	Tons.
14·5	**5.25**
16·2	**3.89**
14·8	**3.09**
15·6	**3.28**
14·9	**3.35**
16·0	**2.24**
13·0	**1.50**

Work of the Southern Sugar Experiment Station—continued.

VARIETAL TRIAL (First Ratoon Crop).

Plan and Crop Yields.

POJ 2722 17.4	Q 813 14.4	26 C 148 19.2	Q 813 15.6	POJ 2727 24.6
POJ 2727 22.2	POJ 213 19.5	Q 813 10.2	26 C 99 15.3	U.D. 1 23.8
Q 813 17.4	POJ 2940 24.9	U.H. 1 17.7	POJ 2722 18.6	Q 813 11.4
POJ 2722 23.1	POJ 2727 *	Q 813 13.5	POJ 213 24.3	U.D. 1 27.9
POJ 2940 26.7	Q 813 13.2	POJ 2727 21.3	Q 813 10.5	POJ 2940 12.9
Q 813 17.4	POJ 2727 15.9	U.D. 39 27.0	POJ 2722 10.8	Q 813 11.7
POJ 2727 23.7	U.D. 1 28.5	Q 813 12.9	POJ 213 23.8	POJ 2940 9.9
POJ 213 32.7	Q 813 12.6	POJ 2722 18.5	Q 813 12.9	26 C 270 13.8

* Discarded due to Disease.

Block.—B3.

Harrested.—October, 1935.

Age of Crop.—12 months.

Plots.—1/30 acre.

CULTIVATION.

On the removal of the plant crop in October, 1934, the ratooning of the block was carried out in the usual manner. Mixed fertilizer was applied at the following rate per acre :—

150 lb. superphosphate, and

250 lb. muriate of potash at ratooning,

followed by a top-dressing of sulphate of ammonia a month later at the rate of 200 lb. per acre.

GROWTH NOTES.

The ratoons germinated well in all plots and made steady growth till checked by dry conditions from mid-January to mid-February, after which rapid progress was made till retarded by cool weather in April. The Q. 813 and 26C. canes were badly damaged by frost, while the other varieties were unaffected except for the tips of the leaves. There was no arrowing in this crop.

Crop Yields—Plant and First Ratoon Crops.

Variety.	Plant Crop.			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.
U.D. 1	26.1	15·9	4.15	28.4	15.3	4.35
26 C. 148	25.9	15·7	4.07	19.2	10.5	2.02
P.O.J. 2727	25.8	16·2	4.18	21.5	14.8	3.18
P.O.J. 213	25.6	15·4	3.94	26.3	15·5	4.08
P.O.J. 2722	23.3	16·6	3.73	17.2	13·3	2.29
P.O.J. 2940	23.0	17·6	4.05	18.6	15·8	2.94
U.H. 1	22.5	17·6	3.96	17.7	14·0	2.48
U.D. 39	22.5	15·7	3.53	27.9	15·8	4.27
Q. 813	21.1	16·8	3.55	13.3	14·3	1.90
26 C. 99	19.1	12.8	2.44	15.3	7·8	1.19
26 C. 270	19.1	14.2	2.71	13.8	9·9	1.37

DISCUSSION.

Although there appeared a general uniformity in the plant crop yields, and no new variety was outstandingly superior to the standard, Q. 813, the ratoons tells a different story. Q. 813 again exhibited all its ratooning weaknesses under adverse conditions, and the following varieties proved outstandingly superior :—U.D. 1, U.D. 39, and P.O.J. 213.

It is doubtful whether any of these varieties would out-yield Co. 290 or even P.O.J. 2725, under similar conditions (see p. 30) ; this will be the subject of further yield trials.

Work of the Southern Sugar Experiment Station—continued.

IRRIGATION TRIAL—P.O.J. 2878 (PLANT CROP).

Plans and Yields.

2	41.7	Interspace
1	47.2	Row
2	45.4	Interspace
1	46.4	Row
2	40.6	Interspace
1	40.8	Row

Block.—B2.
Variety.—P.O.J. 2878.
Harvested.—August, 1935.
Age of Crop.—17 months.
System of Replication.—3 Randomised Blocks.
Plots.—0·248 acre.

TREATMENTS.

(1) Irrigation in row throughout the growth period
(2) Irrigation in row till filled by cultivation, thence in a furrow run down the centre of the interspace

CULTIVATION.

After harvesting the previous phosphate trial in October, 1933, the block was ratooned and fertilized with the intention of carrying on the trial, but the ratoon was so poor that it was abandoned and the stubble ploughed out early in January, 1934 ; no green crop was sown After receiving a further cross-ploughing and harrowing a month later, and final deep ploughing in mid-March the plots were planted Mixed fertilizer was applied uniformly to all plots at the rate of 150 lb. sulphate of ammonia, 150 lb. superphosphate, and 300 lb. muriate of potash, per acre in the drill at planting, followed by top dressings of sulphate of ammonia, at the rate of 200 lb. per acre, in October and November.

Crop Yields—Plant Cane.

Irrigation Method.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	Per cent.	Tons.
(1) In cane row throughout	44·8	14·2	6·36
(2) In cane row for young cane, in interspace later	42·6	14·4	6·13

DISCUSSION.

The block was laid out for trial of row versus interspace watering. It was found impracticable to apply equal quantities of water to the different plots, due to the obstruction offered by the cane stools in row irrigation. These plots therefore received much more water than the plots watered in the interspaces. The following are the approximate rates of water application :—

	Inches.
12th February	7
5th March	4
18th March	4
23rd March	4
23rd May	4
2nd July	4
	27

It will be observed that the first water was applied in February, after the cane had passed through a trying droughty period. The average yield for all plots—43·7 tons of cane per acre—is, therefore, highly satisfactory ; when compared with the yields from blocks of similar cane, of similar age, which were not watered (see pp. 34, 35, 37), the benefits of even modest irrigations are evident. The net increase due to water may be reckoned at 15–20 tons of cane per acre.

The slight difference in yield between the plots of the two treatments (2·2 tons per acre in favour of the " row " irrigation), would probably not compensate for the greater volume of water applied.

Work of the Southern Sugar Experiment Station—continued.

NITROGEN TRIAL—TIME OF APPLICATION (PLANT CROP).

Plan and Yields.

Blocks.				
I.	2	4	3	1
	23.0	21.5	19.3	23.4
II.	3	2	1	4
	22.9	21.3	19.1	19.8
III.	1	3	4	2
	23.4	21.6	17.8	19.4
IV.	4	2	3	1
	21.7	22.5	21.5	22.0
V.	1	3	2	4
	21.2	18.6	20.4	17.6
VI.	3	1	4	2
	17.7	18.0	17.1	19.1

Block.—E4.
Variety.—P.O.J. 2878.
Harvested.—August, 1935.
Age of Crop.—17 months.
System of Replication.—Six Randomised Blocks.
Plots.—0·111 acre.

TREATMENTS.

All plots received :—

270 lb. muriate of potash,

180 lb. superphosphate per acre in drill with plants.

(1) 360 lb. sulphate of ammonia per acre in drill.

(2) 180 lb. sulphate of ammonia in drill and 180 per acre as top dressing, October.

(3) 120 lb. sulphate of ammonia per acre in drill, 120 lb. as top dressing, October, and 120 lb. as top dressing, December.

(4) No nitrogen in drill.
120 lb. sulphate of ammonia per acre—top dressing—November.
120 lb. sulphate of ammonia per acre—top dressing—January.
120 lb. sulphate of ammonia per acre—top dressing—March.

CULTIVATION.

In preparing the land for this trial the stubble from the previous crop was ploughed out in January, 1934 ; as it was desired to plant again in March, no green manure was sown. After receiving a further cross-ploughing early in March the plots were laid out and planted about the middle of that month. The germination was slow but ultimately fairly good ; the misses were planted up in April, but were practically a failure.

GROWTH NOTES.

All plots made slow progress during the winter and early spring months, but after a good fall of rain in mid-October commenced to grow vigorously which continued till retarded by dry weather from the second week in January to the beginning of the third week in February, following this good progress was made till checked by cool conditions late in April. During the growing period there was no apparent difference due to any of the treatments, the whole block presenting a uniform appearance.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Blocks	5	44·92	8·98	..
Treatments	3	13·53	4·51	0·7532
Errors	15	34·25	2·28	0·4121
Total	23	92·70	..	..

Crop Yields.

	Treatment. 1.	Treatment. 2.	Treatment. 3.	Treatment. 4.
Cane, tons per acre	**21.2**	**21.0**	**20.3**	**19.3**
C.C.S. in cane, per cent.	13·8	13·8	14·3	13·7
C.C.S., tons per acre	**2.93**	**2.90**	**2.90**	**2.64**

DISCUSSION.

The time of application of sulphate of ammonia has had but slight influence on the plant crop results, although the very late applications (treatment 4) appear to have caused a reduction in cane and sugar yield.

It should be pointed out that sulphate of ammonia shows consistently no appreciable plant crop increases on the red volcanic loam, though greater benefits may be expected with ratoons.

Work of the Southern Sugar Experiment Station—continued.

CULTURAL AND INTERSPACING TRIAL (PLANT CROP).

Plan and Yields.

	Interspace Distance.	Non-Subsoiled	Subsoiled.		Non-Subsoiled.	
Autumn Plant.	4′ 6″ ..	28.2	30.5	31.7	28.2	C
		27.3	25.6	25.6	25.7	NC
	4′ 0″ ..	27.6	26.3	25.0	23.9	C
		27.6	27.7	25.8	25.7	NC
	4′ 0″ ..	28.7	26.7	27.3	28.2	NC
		32.0	31.2	30.5	28.1	C
	4′ 6″ ..	30.5	29.4	30.5	25.8	C
		29.3	29.9	26.9	26.2	NC
Spring Plant.	4′ 0″ ..	19.6	18.3	19.0	16.1	C
		19.6	20.5	18.5	16.0	NC
	4′ 6″ ..	19.3	21.2	19.8	14.4	NC
		21.2	22.3	21.2	16.2	C

Blocks.—B4 and 5.

Variety.—P.O.J. 2878.

Harvested.—September, 1935.

Age of Crop.—17 months.

System of Replication.—Three Randomised Blocks.

Plots.—0·084 acre.

TREATMENTS.

(a) **Cultivation**—

C. Cultivated in usual matter.

NC. Subsequent cultivation with hand hoe only.

(b) **Interspace distance**—

(1) 4′ 6″.

(2) 4′ 0″.

(c) **Subsoiling v. non-subsoiling.**

GROWTH NOTES.

The stubble from the previous crop was ploughed out in October, 1933, and the block sown to poona-pea. A good crop of green manure was turned under in mid-January ; this was followed by a cross-ploughing early in February. In the middle of March the block was measured and one-half subsoiled according to plan to a depth of 18 to 20 inches with tractor power. The plots were laid out and planted at the end of March ; owing to the wet condition of the soil and cool atmosphere the strike was very poor, so much so that in August the germinated setts from the worst portion were used as supplies in the better portion. The cane in this portion of the trial made little progress during the late autumn and winter months but grew vigorously after the rain in October. Mixed fertilizer was applied to each plot at the rate of 300 lb. muriate of potash, 150 lb. superphosphate per acre in drills, with a top-dressing of 200 lb sulphate of ammonia per acre in late spring. In August the fallow portion from which the germinated setts had been removed for miss-planting was harrowed and planted ; the strike in this portion was excellent.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square.)
Blocks	2	885·13	442·57	..
Subsoiling	1	14·06	14·06	1·3220
Interspace distance	1	6·02	6·02	0·8976
Cultivation	1	18·50	18·50	1·4589
Errors	42	160·94	3·83	0·6714
Total	47	1084·67	..	..

Work of the Southern Sugar Experiment Station—continued.

Crop Yields.

—	Subsoiled.	Non Subsoiled.	Interspace.		Cultivated.	Non-cultivated.
			4 ft. 6 ins.	4 ft. 0 ins.		
Cane, tons per acre	**25.5**	**24.4**	**25.3**	**24.6**	**25.6**	**24.3**
Cane, percentage of mean yield	102·2	97·8	101·4	98·6	102·6	97·4

C.C.S. in cane, per cent. (average) .. .. **14·9** per cent.
Standard error (mean of 24 plots) .. .. **1·60** per cent.

DISCUSSION.

This experiment was set out in an attempt to determine the influence of various cultural factors on the yield of P.O.J. 2878—one of the new varieties which has come into favour in the Southern area. In habit and general growth characteristics it differs entirely from the older standard, Q. 813, with which similar trials to the above have been carried out.

It will be seen that a small crop increase (1·1 tons) was recorded due to subsoiling. The slight difference (0·7 tons) in favour of the wider interspace was not significant, while the benefit from surface cultivation amounted to 1·3 tons of cane per acre.

An interesting side issue is the evidence for autumn v. spring planting which is afforded by the results. The following are the relative data for the respective portions of the block —

—	Cane per Acre.	C.C.S in Cane.	C.C.S. per Acre.
	Tons.	Per cent.	Tons.
Autumn plant	**27.9**	**15.2**	**4.24**
Spring plant	**19.0**	**14.1**	**2.68**

The yield figures are over-whelmingly in favour of autumn planting.

Work of the Southern Sugar Experiment Station—continued.

FERTILIZER TRIAL—FORMS OF PHOSPHATE (Plant Crop).

Block.—E3b.
Variety.—P.O.J. 2878.
Harvested.—August, 1935.
Age of Crop.—17 months.
System of Replication.—5 x 5 Latin Square
Plots.—0·062 acre.

Plan and Yields.

P_MK 25.2	K 20.3	N_AP_SK 12.3	P_SK 17.6	N_BP_MK 28.6
N_AP_SK 21.3	P_SK 16.5	K 18.7	N_BP_MK 17.7	P_MK 23.7
N_BP_MK 22.7	P_MK 21.0	P_SK 15.6	N_AP_SK 17.7	K 26.6
P_SK 31.5	N_BP_MK 20.0	P_MK 16.1	K 20.2	N_AP_SK 31.6
K 20.5	N_AP_SK 16.3	N_BP_MK 14.0	P_MK 22.3	P_SK 18.4

TREATMENTS.

(a) **Drill Applications**—

K 200 lb. muriate of potash per acre.

P_MK 200 lb. meatworks per acre.
200 lb. muriate of potash per acre.

P_SK 50 lb. sulphate of ammonia per acre.
127 lb. superphosphate per acre.
200 lb. muriate of potash per acre.

N_BP_MK 200 lb. meatworks per acre.
225 lb. dried blood per acre.
200 lb. muriate of potash per acre.

N_AP_SK 50 lb. sulphate of ammonia per acre.
127 lb. superphosphate per acre.
200 lb. muriate of potash per acre.

(b) **Top Dressing**—

N_AP_SK plots received 150 lb. sulphate of ammonia as top dressing in spring.

CULTIVATION.

After harvesting the standover crop in September, 1933, the trash was ploughed under and allowed to decay; a further cross-ploughing was given in November and the block sown to poona pea. In January a good crop of green manure was turned under and allowed to decompose; the block was then ploughed and harrowed and the plots laid out and planted on the 20th March. The setts germinated fairly well, the gaps being filled in early in April with poor results. During the growth period the block appeared to be quite uniform with the exception of the middle column where the soil varies considerably; these plots were frost damaged, while the balance were not injured.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (Mean Square.)
Rows	4	85·64	21·41	..
Columns	4	365·76	91·44	..
Treatments	4	12·92	3·23	0·5862
Errors	12	142·02	11·84	1·2358
Total	24	606·34	..	..

Cane Yields.

Treatment—	K	P_MK	P_SK	N_BP_MK	N_AP_SK
Cane, tons per acre	21.3	21.7	19.9	20.6	19.8
C.C.S. in cane, per cent.	14·1	14·2	14·1	14·4	14·0
C.C.S., tons per acre	3.00	3.00	2.81	2.97	2.77

Work of the Southern Sugar Experiment Station—continued.

DISCUSSION.

It is generally recognised that the red volcanic loam is well supplied with available phosphates, though it is often claimed that increased yields from soluble phosphates are not recorded due to " fixation " by the iron of the soil. The above experiment therefore embraced a comparison between equivalent amounts of soluble phosphate and phosphate as bone; in addition, a comparison of organic nitrogen *versus* nitrogen as ammonia was also included.

The erratic nature of the individual plot yields was responsible for a measureable degree of variation in crop returns from the several treatments, though none of these differences is significant. It is therefore not proven that either plant food in the organic form is superior to that in the inorganic state.

DETAILS OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, FROM 1st NOVEMBER, 1934, TO 31st OCTOBER, 1935.

Materials.	Number of Analyses.
Sugar-canes and juices for growers	686
Sugar-canes and juices for Agricultural Show, Bundaberg	234
Sugar-canes and juices for Agricultural Show, Maryborough	26
Sugar-canes and juices for Agricultural Show, Gin Gin	289
Sugar canes and juices for Experiment Station	204
Total	1,439

In addition to the above, field refractometer tests were made of over 5,000 seedlings in August and September.

DETAILS OF CROP HARVESTED FROM THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, DURING 1935.

	Tons.
Cane sent to mill	484·8
Cane used for plants	9·0
Total	493·8
Nature of Crop—	
Autumn plant cane	280·0
Spring plant cane	60·4
First ratoon cane	100·2
Second ratoon cane	42·1
Standover cane	11·1
Tonnages—	Per cent.
P.O.J. 2878	60·7
Q. 813	18·8
Seedlings	7·4
Other varieties	13·1
Area harvested	21·8 acres
Average tons per acre	**22·65**

Report of the Division of Entomology and Pathology.

By Arthur F. Bell, Officer in Charge.

Staff.

Since the publication of the last annual report the staff has been augmented by the acquisition of the services of Mr. D. R. L. Steindl, a graduate of Sydney University, as Assistant to Pathologist. The Entomological and Pathological sections have thus three technical assistants in each, but owing to the recent appointments of all three in the latter section, it will be some time before it attains to full working strength. During the year, Mr. R. W. Mungomery, the senior assistant Entomologist, paid a visit to the Territory of Hawaii for the dual purpose of studying the Giant American Toad (*B. marinus*), in a suitable environment before importing a consignment into Australia, and also of making a first-hand study of the entomological methods of that country. At the kind invitation of the Director, Mr. Mungomery made his headquarters at the Experiment Station of the Hawaiian Sugar Planters' Association. With the courteous assistance of the entomologists of that institution he was enabled to investigate thoroughly the question of borer (*R. obscura*) control by parasitisation by the Tachinid fly, and the reasons for its greater efficiency in Hawaii than in Queensland.

Pathology.

The abnormally dry, hot season experienced during 1934-35 has had a very considerable effect upon the incidence of disease in most parts of the State and, as in the case of insect pests, the general tendency being towards a reduced incidence.

Quarantine and Introduction of Varieties.

An insect-proof quarantine glasshouse unit was completed during the year, and is now being utilised for the reception of sugar cane varieties from overseas. The question might well be asked by the layman as to why quarantine is necessary in Queensland where we already have most of the known major diseases of sugar cane; but it must be emphasised that there are frequently different strains of organisms which cause a particular disease. Thus, for example, some of the strains of mosaic disease in the United States differ from that in Australia, and hence it is probable that without the exercise of due care we could import a strain of mosaic which might attack some of our varieties now considered to be highly resistant to mosaic.

Importations for the year consist of four varieties of the cane-sorghum hybrids from India, viz., Co. 352, Co. 355, Co. 356, and Co. 515. These hybrids were raised by Rao Bahadur T. S. Venkatraman, who visited Queensland for the recent Conference of the International Society of Sugar Cane Technologists, and who aimed at producing early maturing varieties. The four reached maturity in about six months, and are reputed to have a satisfactory sugar content, but in India, their vigour does not measure up to standard. It is unlikely, therefore, that these importations will be of direct commercial use to us, but we are hopeful that they may be found to set fertile flowers, in which case they will be crossed back to cane at our northern Station.

Other varieties recently imported are :—Co. 419 (a cross between Co. 290 and P.O.J. 2878) from India; C.P. 28/19 and Co. 29/116, two seedlings which come recommended to us from the United States Department of Agriculture; 28 S.N.G. 47, an early maturing seedling raised by the Colonial Sugar Refining Company; 30 S.N.G. 361, a disease resistant and vigorous C.S.R. Company seedling which will be used for breeding purposes; and *Erianthus arundinaceum*, a plant somewhat closely related to cane, with which experimental crosses will be made.

Leaf-Scald.

No report of the presence of this disease was received from the Mackay area, and it is believed that the small outbreak in the Bundaberg district has now been stamped out. In North Queensland the position in the worst area, El Arish, has improved greatly during the past few years. During the very hot, dry spell prior to the commencement of rains early this year, a fair amount of scald was noticeable in many fields of S.J. 4. As is characteristic of the reaction of this variety and leaf-scald, the vast majority of the diseased stools died out, leaving the fields mainly or completely disease free.

Division of Entomology and Pathology—continued.

Family and Varietal Resistance Trials to this disease were carried out on the farm of Mr. W. S. Chapman, with the following results :—

Family Resistance Trial.

Two setts of each of one hundred seedlings inoculated with a mixture of cultures and diseased juice. Setts which failed to germinate due to pest injury are designated "Killed," and those which failed for no obvious reason are tabulated as "Failed."

Gross.	Setts Germinated.	Setts Failed.	Setts Killed.	Setts Diseased.	Per cent. Stools Diseased.
P.O.J. 2878 × P.O.J. 2940	184	16	0	51	28
Badila × S.C. 12/4	196	4	0	48	24
C. 1162 × D. 7861	192	8	0	39	20
C. 104 × S.C. 12/4	178	6	16	16	9
P.O.J. 2725 × S.C. 12/4	186	14	0	15	8
P.O.J. 2878 × S.C. 12/4	179	21	0	6	3
C. 626 × S.C. 12/4	182	12	6	3	15

Varietal Resistance Trial.

Setts inoculated as in Family Resistance Trial. Twenty-five setts of each planted except in the case of Q. 1, of which only eight were planted. As a check, twenty-five setts of uninoculated setts of established varieties were also included to test the effect of inoculation upon germination. Figures in brackets indicate results from uninoculated setts, in which no case of leaf-scald occurred :—

Variety.	Setts Germinated.	Setts Failed.	Setts Killed.	Stools Diseased.
Q. 1	8	0	0	1
Q. 2	25	0	0	2
Q. 3	19	6	0	11
Q. 4	25	0	0	2
Q. 5	25	0	0	14
Q. 6	15	10	0	6
Q. 7	24	1	0	8
Q. 8	22	3	0	1
Co. 290	25 (25)	0	0	0
P.O.J. 2725	20 (21)	5 (4)	0	0
D. 1135	25 (25)	0	0	0
Oramboo	2 (4)	22 (4)	0	1
P.O.J. 2940	12 (15)	13 (10)	0	1
Clark's Seedling	19 (22)	6 (3)	0	9
Co. 281	25 (25)	0	0	0
P.O.J. 2878	17 (22)	8	0	0
S.J. 4	17 (21)	8 (4)	0	1
P.O.J. 234	18 (22)	7 (3)	0	0
Badila	23 (24)	2 (1)	1 (0)	8
E.K. 28	20 (23)	5 (2)	0	7
S.C. 12/4	19 (22)	6 (3)	0	7
P.O.J. 2747	17 (21)	8 (4)	0	2

Division of Entomology and Pathology—continued.

As has been stated previously, a satisfactory method for the reliable determination of varietal resistance to leaf-scald remains to be evolved. It will be seen that inoculation depresses germination, but whether this can be attributed to the leaf-scald organism *per se* or to the inoculation of a contaminated solution into the sett, is a matter which is being investigated at present. It would also seem necessary that some distinction be made between varieties which exhibit early symptoms which later disappear and varieties in which the symptoms tend to be more constant. The system of recording devised for current trials will permit of this being done.

Gumming Disease.

It is evident that this disease will soon cease to be a factor of importance in the southern districts; considerable difficulty was experienced in finding conveniently-situated diseased fields for the instruction of the visiting Technologists. No reports of the disease have been received from the Farleigh area this year.

The outbreak in the variety S.J. 4 in the Mulgrave area was further investigated during July-August. All farms in the quarantine area were surveyed, and 25 per cent. of the farms outside the quarantine area. Of the thirty-five farms within the quarantine area the disease was found on eight farms and on one new location just beyond the borders of the area. In all cases the varieties found to be diseased were S.J. 4 or Clark's Seedling, demonstrating the wisdom of the condemnation of these varieties last year.

A resistance trial was carried out in the Woongarra area, but owing to the dry summer, the amount of spread was not as intense as could have been desired.

(a) **Family Resistance Trial**—Final Inspection, 7th October, 1935.

Location: Windermere Plantation.

Planted: 17th August, 1934.

Plan: One sett of each of one hundred seedlings. Every third row mixed Black Innes, D. 1135 and M. 1900 S.

Crosses.	No. of Stools.	Few or no leaf streaks.	Numerous leaf streaks.	Stools with dead stalks.
		Per cent.	Per cent.	Per cent.
P.O.J. 2878 × D. 1135	88	97	2	1
P.O.J. 2725 × S.C. 12/4	100	99	0	1
P.O.J. 2722 × P.O.J. 2940	87	95	0	5
P.O.J. 2722 × Ewa 371	82	69	12	19
P.O.J. 213 × S.J. 3c	64	98.5	0	1·5
P.O.J. 213 × Ewa 371	83	90	6	4
N.G. 16 × *S. robustum*	80	84	7·5	8·5

(b) **Varietal Resistance Trial**—Final Inspection, 7th October, 1935.

Location: Windermere Plantation.

Planted: 17th August, 1934.

Plan: Ten stools of each of one hundred seedlings. Every third row mixed Black Innes, D. 1135 and M. 1900 S.

Variety.	Streaking at final inspection.	Total Stalks.	Dead Stalks.	Living Stalks Oozing.
Q. 813	Few	41	1	2
"D" 1	Nil	47	Nil	0
"D" 2	Numerous	38	1	8
"C" 2	Nil	18	Nil	0
"C" 3	Nil	34	Nil	0
"C" 5	Few	51	Nil	1
"C" 7	Nil	49	Nil	0
"C" 13	Few	43	Nil	1
"C" 14	Nil	36	1	1
"C" 15	Few	23	Nil	1
"A" 1	Nil	*	Nil	..
"A" 2	Nil	*	Nil	..
"A" 3	Nil	*	Nil	..
"C" 1	Nil	*	Nil	..
"C" 4	Nil	*	Nil	..
"C" 6	Nil	*	Nil	..
"C" 8	Nil	*	Nil	..
"C" 9	Nil	*	Nil	..
"C" 10	Nil	*	Nil	..
"C" 11	Nil	*	Nil	..
"C" 12	Nil	*	Nil	..
Q. 813	Nil	23	Nil	0
Oramboo	Nil	51	Nil	0
P.O.J. 2878	Nil	63	Nil	0
Kavengire	Nil	122	Nil	0
Merthi	Nil	114	Nil	0
Oshima	Nil	87	Nil	0
C.P. 807	Nil	69	Nil	0
C.P.H. 139	Nil	34	Nil	0

*Cut for trials and total stalks not counted, but ranging from 40-50.

Division of Entomology and Pathology—continued.

Discussion of Results—The oozing of gum was determined in the usual way by cutting the canes, covering with trash, and allowing them to lie thus overnight. Although, as stated above, the rate of spread was by no means all that could be desired, nevertheless the amount of death in the guard rows was quite appreciable, the proportion of stools showing death being as follows :—

M. 1900 S.—30 per cent., D. 1135—5·5 per cent., Black Innes,—2 per cent.

The total number of stools of these infected varieties was approximately two hundred and forty each.

It would appear then, that the majority of the canes grown were highly resistant. Of the families, P.O.J. 2722 x Ewa 371 is somewhat doubtful, but is also of doubtful value insofar as vigour is concerned. The seedling " D " 2 is also of doubtful resistance, but its vigour does not make re-trial necessary. A number of the more promising seedlings have been included in a confirmatory trial at Nambour.

Red Stripe.

This disease was very difficult to find in North Queensland last year, a few light patches showing up here and there. The red stripe stage was somewhat in evidence in scattered fields in the Southern district this year, following late summer rains. Since the disease appeared in new varieties, some temporary anxiety was felt by farmers, but the evidences of the disease soon disappeared without having caused any damage.

Fiji Disease.

The Fiji disease situation in Southern Queensland has received a considerable amount of attention, and surveys have been carried out in the Kalkie, Maryborough, and Maroochy areas.

A survey carried out by the Isis Mill authorities assisted by Bureau officers, revealed no sign of the disease there. In the Kalkie quarantine area the number of infected farms has apparently been reduced to seven.

In a general survey of the Maryborough district carried out in February last, the following results were obtained in a survey of 20 per cent. of the Island Plantation farms, and approximately 10 per cent. in the remainder of the area.

District.	Farms Inspected.	Farms Diseased.
1. Island Plantation and Saltwater Creek..	12	12
2. Walker's Point, Dundowran, Granville, and The Pocket	9	8
3. Bidwell, Magnolia, and Tinana	9	8
4. Antigua, Yerra, Mungar, Yengarie, Oakhurst	9	3
5. Pialba, Nikenbah, Takura	16	2

The inspection again showed the highly undesirable state of affairs, especially in No. 1 district, where infection was particularly heavy. It is pleasing to record, however, that there has been a marked change in the attitude of farmers during the last few months, and serious efforts are being made to improve the situation. Experiments with Fiji-disease-resistant varieties have also been laid down in the Island Plantation.

A further survey of District No. 5, involving ninety-two farms, showed that the disease was present on three farms only, and if farmers in that district will only exercise due care regarding the sources of their plants, the disease can readily be held in check. Arrangements have been made for the complete survey of District No. 4 during the coming summer.

In the Nambour-Maroochy district, eighty-eight farms were inspected and Fiji disease was found on eleven ; it must be admitted that the survey covered all farms on which there was thought to be any likelihood of the disease being present, and with the exception of one farm, all infection was light. Nevertheless, the situation should be viewed with all seriousness by the farmers since P.O.J. 2878, which promises so well as a standover cane in the district, is extremely susceptible to Fiji disease.

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Resistance Trial—

A Fiji disease resistance trial was concluded at Eagleby, with the following results:—

Variety.	No. of Setts Planted.	No. of Stools which ratooned.	No. of Diseased Stools, 31-7-35.	Diseased Stools as Percentage.
H.Q. 285	30	29	0	0
P.O.J. 213	30	30	0	0
P.O.J. 234	30	30	0	0
Co. 210	30	28	0	0
Co. 290	30	28	0	0
Badila*	8	7	0	0
Oramboo	25	24	0	0
S.J. 7	25	23	0	0
Korpi	30	28	1	4
P.O.J. 100*	30	24	1	4
P.O.J. 2379	30	27	1	4
P.O.J. 2722*	30	24	1	4
Q. 813	50	49	6	12
Co. 281	30	29	7	24
N. G. 26 (?)	19	19	5	26
Hawaiian Uba	30	28	10	36
Kassoer	30	27	12	44
Fischer's Innes	13	13	6	46
Black Innes	40	36	18	50
H. 109*	13	12	6	50
P.O.J. 2940	14	10	5	50
D. 1135	30	29	16	55
P.O.J. 2727	30	18	10	56
P.O.J. 2878	30	27	15	56
U.D. 39	30	29	17	59
P.O.J. 2875	30	25	16	64
P.O.J. 2725	30	29	19	66
P.O.J. 2364	30	30	23	77
P.O.J. 2747*	14	10	8	80
P.O.J. 2714	30	28	26	93
Natal Uba	25	25	25	100
U.D. 1	30	30	30	100

*Varieties marked with an asterisk were generally poorly grown and hence would not receive the attention from leaf-hoppers which might be expected were a greater leaf surface developed. It is considered that this should be borne in mind when attempting to assess relative resistance.

Discussion of Results—

The results of this trial are interesting, and re-emphasise the generally-high susceptibility of the high-numbered P.O.J. canes and Uba derivatives. A possible exception is P.O.J. 2722 but, as this variety was rather poorly grown, it is felt that it might have been passed over by the leaf-hoppers, and it has been included in a further trial. The resistance of P.O.J. 213 and P.O.J. 234 is confirmed, and the apparent resistance of Co. 290 is satisfactory, since this variety is being planted on a considerable scale in Southern Queensland. Owing to the importance of this variety it has been included in a further trial, and all the apparently disease free cane from the last trial has been planted out for observation.

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Several improvements have been incorporated in the current trial as compared with the one recorded. In order to overcome the effects of the discontinuous mode of spread, the varieties have been planted in six lots of five setts. Planting material for the infection rows consists of several varieties, uniformly set out, and the setts themselves are cut from apparently-healthy stalks in diseased stools, since it has been found that these will give a high proportion of diseased but succulent plants.

Downy Mildew.

This disease is mainly confined to the Lower Burdekin district as an economic factor, but is also scattered throughout the Mackay district. It is the only disease of importance in the Burdekin district and, now that the P.O.J. canes have been banned in that area, it is virtually confined to the variety B. 208. At present, this variety constitutes a distinct menace to other new canes which are being introduced, and our representative there, Mr. A. P. Gibson, states that there is a growing weight of public opinion among the farmers that it should be at least temporarily disapproved in order that the disease situation of the district may be cleared up.

In a resistance trial concluded early this year the infection eventuated at 30-1-1935 was as follows :—

Variety.	Total Stools.	Diseased Stools.
Badila	38	0
Korpi	25	0
S.J. 7	32	0
S.J. 4	32	1
Oramboo	38	1
P.O.J. 2747	36	4
P.O.J. 2727	30	4
B. 208	30	6
P.O.J. 2878	33	10
P.O.J. 2722	28	18

At a later date (June, 1935), infection had increased considerably, and there were five single stalks of S.J. 7 affected, and two of Badila. The completely tangled nature of the cane however, prevented any attempt at accurate determinations. Field plantings have also indicated that S.J. 7 will contract the disease, and hence the desirability of protecting this new promising cane from a heavy bombardment of infection from diseased B. 208.

In another trial conducted at Palms Estate, Mackay, by Mr. F. E. M. Clarkson, the following results were obtained :—

Variety.	Total Stools.	Diseased Stools.
Q. 813	24	0
1900 S.	23	0
S.J. 2	23	0
Korpi	23	0
Oramboo	23	0
Badila	23	0
E.K. 28	24	0
P.O.J. 2725	24	0
P.O.J. 2875	24	0
P.O.J. 2747	23	1
P.O.J. 2727	25	3
P.O.J. 2714	20	2
P.O.J. 2878	35	7
P.O.J. 2722	10	5

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The degree of infection is normally much lighter in Mackay than the Burdekin, but the order of susceptibility is very similar to that found in the Burdekin.

Chlorotic Streak Disease.

This disease was again very evident in the fields of the districts north of Townsville, and all observations tend to confirm the impression that it is causing very considerable losses in the low-lying areas of heavy rainfall. It has been observed in most varieties grown, including D. 1135. Last year a number of small plantings were made under different conditions from Mossman to Tully, in order to determine the relative intensity of spread under these varying conditions. In some cases secondary spread was noticed within three months of planting, but in others the plant crop remained apparently disease-free. It will not be possible, however, to make the desired observations until the ratoons are inspected in November-December; moreover, the abnormally dry year may have been responsible for a retardation of the rate of spread. Such infection as was observed, occurred chiefly in the young cane in the spring and early summer, and where it did occur it was found to coincide with small depressions in the fields. In such a case, assuming the disease to be insect borne, transmission may have occurred per medium of insects which are extremely localised in their sphere of activities, which is most unlikely. On the other hand, transmission may have occurred by reason of some selective tendency on the part of the insect vector, since during dry periods these shallow depressions would tend to hold moisture for longer periods than the surrounding country, and consequently, young stools of cane growing therein would most likely be more vigorous, succulent, and acceptable to sap-sucking insects than those growing elsewhere in the field.

In order to gain more details on this point, another trial was planted in May this year, containing most of the varieties grown commercially in North Queensland, as well as those that are thought to be desirable from a breeding standpoint. These comprise the following varieties:—Black Innes, Clark's Seedling, P.O.J. 234, P.O.J. 2364, Co. 290, Uba, Q. 1, Q. 2, Q. 4, Q. 8, Q. 12, Q. 813, *S. robustum*, B. 147, D. 1135, and S.J. 4, and in all cases diseased Badila was planted in every third row of the plot. No disease has appeared in any of these varieties up to date; but this could hardly be expected as some of the diseased Badila did not commence to display symptoms until October, the time of the last inspection.

In addition, it is hoped to find a cane variety from amongst those under trial which will display symptoms for a longer period, and to a greater age than Badila, the variety with which we have carried out most of our experiments up to the present, for it is well known that at the Kailua sub-station in Hawaii, chlorotic streaks are strongly displayed by some seedling canes of twelve months age and over. The sap-sucking insects noticed present on the cane leaves in the plots include the following:—*Phaenacantha australica*, *Perkinsiella saccharicida*, *Nesosteles dryas*, *Nephotettix* sp., *Cicadella partheon*, *Lophops saccharicida*, and several unidentified Hemiptera, Homoptera, and Thysanoptera.

We realise the incompleteness of conducting surveys for possible insect vectors solely by examining the insects actually in association with the cane plant, as this process would possibly not disclose such vectors as are transitory, which do not normally colonise on the cane plant, such as the case of *Aphis maidis*, and its ability to transmit sugar cane mosaic.

To intercept these migratory insects, fly-paper sheets tacked to a board and operated by a wind vane will be placed out in those fields where rapid spread occurs, and a twenty-four hour collection will be made with these sheets periodically, and examined. This will also ensure a representative sample being obtained of night flying as well as day flying species, as it is well known that many Homopterous insects fly at about dusk, and some of these can be taken at lights.

Of the ratoons of the two yield trials harvested last year, one was destroyed by flood and the other has yet to be harvested. It was noticeable, however, that in both cases the young

ratoons in the plots from healthy plants were almost 100 per cent. diseased, although the stools appeared much stronger than those from the originally diseased setts. In order to determine the rate of spread into large plantings of healthy cane, in zones of known rapid spread, a planting of some four tons of Badila was made in the Babinda area this year.

Dwarf Disease.

At different times during the year several of the farms, from which dwarf had been reported, and several farms growing P.O.J. 2714 adjacent to the dwarf area were inspected. In August all relevant farms were inspected. These inspections showed the disease to be very scarce this year. There are two reasons to be given for this :—(1) as advocated by the Bureau, farmers have not planted any of the most susceptible variety, P.O.J. 2714, during the past two years ; (2) the year has been a dry one.

One well-grown field of P.O.J. 2714 second ratoons furnished the only case of secondary spread of dwarf found this year. The spread was very light and occurred in March following the fourteen to fifteen inches of rain during the latter end of February. This is of interest, when it is considered that secondary spread of dwarf is found only in low water-logged parts of fields ; this rain was the only excessive precipitation during the year.

Attempts made during the year to transmit the disease by insects, have been as unsuccessful as in previous years. The experiments using the better-known sap-sucking insects found on cane and as reported last year. were repeated, using a technique suitable to an insectary. In addition, the list of grass insects used in this work was lengthened. Of these, two were found to be of some special interest.—(a) In past years numerous inspections of grasses in " dwarf " fields had been made and the diseased appearance of *Sorghum verticelliflorum* was often noticed. During February-March of this year an unidentified but striking member of the Jassoidea was found to be present on this grass. By virtue of its sluggishness, gregarious feeding habits, and position of feeding it seems apparent that the diseased appearance of this grass is caused mechanically by this insect. Attempted transmissions both from grass and from dwarf cane using this insect as a possible vector gave negative results. (b) As up to the present, dwarf has not been transmitted in experiments with the various sucking insects which are to be found on cane or swept from grasses a search was made in suitable localities for ground insects. This resulted in the finding of a ground aphid on the roots of certain grasses in some of the dwarf fields. At present very little is definitely known about the habits and distribution of this aphid. A plentiful supply of the winged forms was easily obtained from amongst the roots of grasses last March, and they apparently will feed on cane leaves. Thorough investigation of this insect as a possible vector of dwarf has had to be postponed until weather conditions are more suitable, for repeated attempts during the past dry spring to find the winged forms have failed.

All sticks of cane from shoots used in attempted transmission work during the 1934-35 season were cut during July and planted out. There was no appearance of dwarf in the resulting shoots. From field observations, it is not expected that dwarf in P.O.J. 2714 will follow Fiji disease in a protracted delay in the showing of symptoms. On the contrary, it is anticipated that when the proper vector has been used, it will behave somewhat as mosaic has done during experiments in the Mackay district.

Type of Planting Material Trial.

In last year's report were given the germination and crop results when various types of planting material were used, in order to ascertain to what extent the size of the plant stool influenced the size of the subsequent ratoon stool. For this purpose six stools in each of the sixteen rows of the plot were pegged, and at the expiration of twelve months the number of

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stalks per stool and feet of cane per stool were recorded. The results of this examination are given below; the upper, black-faced member of each pair represents the results for the plant crop, while the lower, italicised figure represents the results of the ratoon crop:—

BLOCK—	ROW—	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
4		7-29 *6-24*	3-11 *3-12*	3-14 *2-11*	6-21 *5-19*	8-39 *7-36*	8-37 *7-32*	7-35 *6-36*	6-28 *5-25*	8-36 *7-34*	7-32 *6-30*	7-32 *6-30*	4-15 *3-16*	6-28 *7-26*	7-33 *5-27*	3-14 *4-13*	7-29 *6-28*
			5-25 *4-24*		9-40 *10-36*		3-11 *4-12*		5-18 *5-17*		4-21 *3-17*		8-35 *6-25*		4-14 *5-13*		3-8 *4-9*
3		4-17 *4-15*		9-37 *7-34*		3-14 *3-12*		8-36 *10-33*		3-12 *4-11*		4-16 *3-17*		3-10 *3-11*		4-13 *3-11*	10-45 *9-36*
			2-7 *2-6*		3-6 *2-7*		4-18 *4-17*		9-39 *7-30*		3-14 *4-13*		4-10 *4-9*		3-7 *4-9*		
		7-29 *6-23*		4-16 *4-13*		8-33 *7-30*		7-34 *6-31*		6-29 *5-30*		7-27 *6-24*		6-21 *5-19*		7-30 *5-28*	
2		4-14 *4-12*	3-8 *3-6*	7-24 *7-20*	4-19 *4-14*	4-18 *4-17*	4-12 *4-10*	11-47 *9-44*	4-19 *3-15*	3-11 *4-12*	6-23 *5-19*	7-34 *5-29*	5-16 *5-14*	2-7 *2-6*	2-7 *2-5*	2-8 *3-7*	4-15 *4-12*
			5-20 *4-18*		2-7 *2-8*		2-9 *3-8*						7-33 *6-30*		7-31 *6-29*		
1		7-22 *5-18*	8-28 *7-21*	4-17 *4-16*	5-23 *4-20*	4-15 *3-13*	7-28 *7-24*	7-30 *7-31*	5-19 *5-14*	6-28 *5-24*	5-24 *6-27*	3-10 *4-9*	1-5 *2-7*	4-18 *3-13*	6-25 *6-24*	4-15 *3-12*	6-26 *5-24*
		10-27 *8-24*		11-54 *9-43*		7-35 *7-30*		6-22 *5-21*		1-6 *2-5*		5-24 *6-18*		4-13 *5-14*		6-25 *3-14*	

It will be seen that there is a close relationship between the amount of cane produced by the plant stool and that of the subsequent ratoon stool, and it is suggested that the results indicate the necessity for a further investigation into the desirability of supplying odd "misses" in a field.

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Minor Diseases.

Knife cut was relatively severe in the Bundaberg area, the variety affected being chiefly D. 1135. As high winds were experienced during July, the damage in some crops was quite appreciable. No complaints have as yet been received regarding red rot. Stem gall and the possibly-related clustered stool were somewhat more commonly noticed in the P.O.J. canes than usual. Virtually no obvious symptoms of root disease were reported; a considerable amount of laboratory work has been carried out on soil parasites, but work has not proceeded far enough to warrant its being reported upon.

Entomology.

The phenomenally dry summer, accompanied by almost unprecedentedly high temperatures, which characterised most of the Queensland cane belt during the past season, exercised a profound effect upon the insect pests of the canefields. Thus Mr. MacDougall, who is stationed in the southern half of the State, says "The year 1935 stands out as one during which cane in the Mackay district has been particularly free from insect damage," while Mr. Mungomery, the Northern Entomologist, comments on "the almost complete absence of any noticeable grub damage in the Northern cane areas," and of the beetle borer (*R. obscura*)—"this pest has been much less in evidence this year than in the past."

While it is gratifying from the agricultural point of view to be able to record this practical absence of insect damage, it is somewhat disconcerting to the technologist that this state of affairs necessarily entails that most field trials have been without result.

With the object of effecting better co-ordination between the far-northern Pest Boards, a conference was called by the Advisory Board of the Bureau, and took place in Townsville under the chairmanship of the writer, on 24th October. The conference was well attended by representatives of all mill areas north of Townsville; an interesting discussion eventuated, and several recommendations were forwarded to the Advisory Board. It is intended to call such conferences annually and to utilise the entomological section as a co-ordinating agency.

Greyback Beetle (*Lepidoderma albohirtum* Waterh.).

In marked contrast to the 1934 season, when this pest infested widespread areas in the far North, and caused very considerable losses of cane, the past season has been characterised by a virtual freedom from noticeable grub damage. In the Mackay area, damage was light in the 1934 season, and negligible during the past season.

The great reduction in grub damage in the far northern section of the cane belt can be attributed mainly to the abnormally hot and dry weather conditions which prevailed during the latter part of 1934, and in the early months of 1935, at which time the beetles would normally have been congregated on their feeding trees, or in the process of emerging from or returning to the soil to deposit their eggs. Shade temperatures as high as 108°F., in combination with very low humidities, were recorded in December, 1934, and shade temperatures of over 100°F. continued with few interruptions during the ensuing period until February, 1935, when heavy monsoonal rains were recorded. This hot weather had the effect of killing most of the beetles that had emerged during November, whilst those that were still in their pupal cells underground were unable to emerge. Diggings carried out in early January revealed that these latter beetles were suffering from the effects of their prolonged and enforced imprisonment, and from 28th December, when the natural mortality amounted to 12 per cent., the death ratio rose steadily until by 25th January it amounted to 70 per cent. in those areas where the main beetle flight had been delayed. Accordingly, when a fall of rain eventually did occur in late January, the beetles were too weak to oviposit, and a further period of dry weather likewise accounted for them.

It would appear from the above that an almost complete destruction of the beetle population was achieved through the agency of these droughty conditions, but the presence of grubs in a few areas was revealed by systematic diggings. In these isolated observations it was an easy matter to correlate the presence of these normally-developing grubs with local thunderstorms which had occurred during late September and October, particularly in some of

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the mountain gorges. Subsequent favourable conditions, prevailing until mid-November, allowed the beetles to mature and deposit their eggs in the canefields prior to the incidence of the hot weather, and the hatching of eggs was fairly normal and grubs survived. However, in those areas, soil fumigation successfully dealt with such infestations as would otherwise have resulted in some uprooting of cane stools.

In the majority of sections where September and October rains permitted of normal emergence of beetles and egg-laying, an important factor was the actual killing of the eggs and young grubs through desiccation, brought about by the excessively high soil temperatures and low moisture content; a soil-recording thermometer showed readings of 100°F. and 99½°F. at depths of 4 inches and 8 inches, respectively. A very striking example of the resultant mortality which occurred throughout parts of North Queensland was experienced in the Highleigh area, near Gordonvale. In January, sufficient first-stage grubs were found under the cane stools to warrant the establishment of a fumigation trial in the then near future. About three weeks later, when it was estimated that the grubs would have moulted and changed to their second stage (i.e., a suitable stage for fumigating), further check diggings were carried out, and these showed that very few grubs remained alive—certainly not in sufficient numbers to justify fumigation from a crop-saving standpoint.

As a consequence of the heavy mortality that has taken place both in the beetle and grub stages through the hot and dry weather, and by their satisfactory destruction with soil fumigants where survival did occur, it can be confidently anticipated that the beetle flight this season will be relatively small in the majority of the usual grub-infested centres, and that growers may look forward next year to only a fairly mild infestation, or none at all, as far as the greyback grub is concerned. This should not by any means be interpreted as a hint to growers to abandon temporarily their policy of searching for grubs by systematic diggings, for only by this practice can they be assured that grubs are present in, or absent from, their canefields.

Trash Layering in Relation to Grub Incidence.

It seemed possible that the layering of trash in certain rows when ratooning may have caused a differential laying of eggs by the beetles, or migration by the young grubs, with the result that it would not be necessary to fumigate on both sides of every cane row. An experiment along these lines was carried out with the co-operation of the Manager of Greenhill Plantation, but the results were without promise.

Soil Fumigation Experiment.

Owing to the heavy grub mortality previously referred to, it was virtually impossible to find suitable localities for the establishment of soil fumigation plot trials. However, one 5 x 5 Latin square trial was established in the Mulgrave area, utilising various mixtures of paradichlorbenzene-carbon bisulphide and orthodichlorbenzene-carbon bisulphide. Unfortunately, this field was harvested by the farmer without our being advised, and individual plot weights were not obtained. Diggings carried out in the experimental block some few days after fumigation showed that the mixture CS_2 and P.D.B. in the proportion of 2 : 1 gave the best mortality, whilst CS_2 alone gave a very high degree of control.

Fumigation under Exceptionally Dry Conditions.

When undertaking soil fumigation it has been customary to try to select a period some few days after a fall of rain, when the soil has sufficiently drained out to allow the toxic vapours to penetrate throughout the soil interstices, and when the grubs are reasonably near the surface—i.e., within a killing radius from the point where the fumigant is injected. During dry weather, grubs usually retreat deeper into the soil (outside the radius of influence of the fumes), and consequently it is not recommended that soil fumigation be carried out during dry periods. During this last year, however, it was necessary to reconstruct previous ideas on this subject to some extent. The soil was so abnormally dry that grubs were forced to go to the cane roots rather than to deeper soil layers to obtain sufficient moisture for their development; hence they became concentrated around the roots at the base of the stools, and by fumigating under these hot, dry conditions, which incidentally ensured a more rapid volatilisation of the fumigants, a high degree of mortality was obtained.

Optimum Dosage of Carbon Bisulphide.

Fumigation trials under field conditions were carried out using carbon-bisulphide. Subsequent diggings determined the relative proportions of dead and living grubs, and the results indicated that under the conditions of the trials the optimum dosage lies between 4·5 and

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5·0 ml. Dosages in excess of these amounts appear to be wasteful, as the lateral spread of the toxic vapours is not proportional to the increased dosage. Using a dosage of 4½ ml., the optimum distance between doses was determined to be 15 inches, for where the spacing was lengthened to 18 inches the fumes did not converge, and in a small area from 1–2 inches away from the centre the grubs survived.

Trials with Other Fumigants.

Insofar as conditions permitted, trials were carried out to determine the relative efficiency of fumigants other than carbon bisulphide. These included ethylene dichloride, propylene dichloride, propylene oxide, propylene chlorhydrin, ethylene chlorhydrin, epichlorhydrin, trichlorethylene, dichlorethyl ether, and methyl-iso-butylketone. In all cases, however, their killing power was inferior to carbon bisulphide.

Light Trapping of Beetles.

Throughout the last beetle-flighting season the trapping of beetles from feeding trees, using artificial light as the source of attraction, was made the subject of a special investigation. It was early demonstrated that it is futile to erect traps in canefields at some distance away from feeding trees, in the hope that the emerging beetles will be interrupted on their way. Similarly, beetles returning to the fields in the early mornings, to oviposit, are not attracted to these traps in the slightest degree. It also became apparent that it was absolutely necessary to shake the feeding trees in order to disturb a proportion of the beetles before any great percentage flew towards the trap; otherwise the majority remained in the trees and were relatively little influenced by the light. Moonlight also had a strong counter-influence on the response of the beetles to light, even when they had been dislodged from the feeding trees, and if light trapping be later demonstrated as an effective economic control measure, this work will have to be carried out at such times as when the moon has set, in order to obtain satisfactory results. Likewise, beetles respond best to the attraction of light after they have been feeding for a period of a few hours rather than after they have just settled on the tree.

Despite disabilities which have been mentioned above, we were able to trap one hundred thousand beetles over a period of twenty nights (including moonlit nights) from three *Ficus* trees growing within fifty yards of each other on one farm. The numbers of male and female beetles represented in this catch were approximately equal. From the small number of gravid females obtained in the collection, it appeared that the trapping operations were effectively draining the beetle population in the immediate vicinity, and it was our intention subsequently to test out this probability by systematic radial diggings carried out in the surrounding canefields, in order to disclose the presence of any grubs resulting from beetles that had escaped this nightly trapping. Droughty conditions which killed off the remaining beetles and grubs in this area precluded carrying through this project, but results are sufficiently encouraging to warrant a continuance of this method of attack as soon as opportunity again permits. Details of this work appeared in a paper presented at the Conference of the International Society of Sugar Cane Technologists held in Brisbane during August, 1935. The Meringa area has been selected for a large-scale experiment and has been surrounded by trees of *Ficus benjamina* planted two hundred yards apart, but whenever opportunity permits, other species of native *Ficus*, &c., which are known to be beetle-feeding trees will be interplanted. By this means it is hoped to ascertain the relative attractiveness of the various species, and determine the most desirable species for extensive plantings if such a scheme be later launched on a district-wide basis.

Spraying Experiments.

Preliminary experiments in the spraying of feeding trees have been carried out utilising lead arsenate, calcium arsenate, and Paris green, in combination with various stickers and spreaders such as fish oil, linseed oil, flour, "Vallo," and Agral No. 1, the latter two being proprietary preparations. Various kinds of feeding trees, such as the native fig, weeping fig, Moreton Bay ash, and broad-leaf wattle, have been sprayed near Greenhill plantation in anticipation of an early flight there, and at a later date trees where the beetles are actually feeding will be sprayed. From these sprayings it is hoped that data will be obtained on the relative adhesiveness of the various sprays after the usual rains which occur prior to the flighting period of the beetles. Collateral experiments utilising beetles on caged sprayed-trees will attempt to determine the relative repellency or attractiveness of the sprayed foliage, and also the toxicity of the sprays under test.

Progressive Decrease in Grub Infestation Following Continuous Fumigation.

In certain districts in which Pest Boards have conducted systematic supervised fumigation of all grub-infested farms annually for some years, it would seem that the pest has been reduced

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to a minimum, and that years of extensive infestation are a thing of the past. During the past year we have carried out extensive diggings in the Gordonvale area, and these diggings have demonstrated that most of the beetle population emerges from the farmed area, whilst the surrounding forest country harbours relatively few grubs or beetles. There may be a few exceptions to this generalisation in the case of some grazing paddocks which frequently carry heavy infestations, but on the whole this can be accepted with few reservations. Where such conditions prevail it is obvious that an adequent fumigation of the canefields themselves would destroy most of the grubs, and so tend to keep the numbers of the pest at a continuously low level, and this would seem to be a highly probable explanation of the results referred to above.

During this past season, when nature has so ably assisted in limiting grub incidence to the lowest limits, we suggest that in the case of certain canegrowing areas carrying light infestations which in the ordinary course of events would not suffer any serious damage, and which consequently would probably not have been fumigated, these lightly-infested areas should be fumigated with a view to reducing still further the already-depleted grub population, and so prevent any considerable emergence of beetles during the 1936 summer months. It is further suggested that Pest Boards might profitably co-operate in determining the ratio of grubs in canefields to those existing outside canefields, and where the ratio is great, that they give consideration to the fumigation of highly-infested areas (assuming the area is not excessive) for the future benefit of the district as a whole—in short, to attack the enemy when it is in a weakened state. Where the areas of light infestation are extensive, it would, of course, be prohibitive to fumigate them, but we have stressed that in those districts where growers have co-operated in past years, reducing their grub populations, and this year find themselves in the fortunate position of having a relatively small percentage of lightly grub-infested cane land, they might profitably turn their attention to fumigating this latter as a benefit to the district as a whole. In such cases it is obvious that the growers concerned, on whose farms these minor infestations occur, will not individually benefit to any much greater extent than the other growers whose areas are clean. Therefore, they should not be expected to defray the major cost of such work, but in such cases it is suggested that any fumigation carried out on such areas might be more heavily subsidised by the Pest Boards concerned.

Beetle Borer (*Rhabdocnemis obscura* Boisd.).

In the Mackay district there has been a tendency to exaggerate greatly the importance of this pest. A system of weekly inspections of cane in mill yards last year indicated that the Farleigh Mill district was the only one in which the pest was of any importance. The system of weekly inspections was continued this year, and again it was found that the pest was confined to the North Coast and the hills around Farleigh. The only cases of any considerable infestation were found in standover Badila, and, except in the case of damaged stalks, all injury was confined to the butts.

In North Queensland this pest has been much less in evidence this year than in the past, and the percentage of bored sticks delivered to the mills was considerably less. The chief reason for this is attributed to the unseasonable weather which operated during the summer of 1934–35, which placed a natural check on the survival of the immature stages of the borer, rather than through the activities of the Tachinid fly parasite, *Ceromasia sphenophori* Vill. This fact was particularly evident in a block of standover cane in the Babinda district, which last year was very heavily infested with borers, and which was left to standover again, without any attempt being made to control the pest by trapping or by burning. In the ordinary course of events this cane would again have been heavily infested with borers, but at the commencement of the crushing operations this year the cane was, considering its previous history, only slightly infested. Tachinid flies definitely were not responsible for this unusual depression in the borer population.

In a few instances requests have come to hand for releases of Tachinid flies, but in most cases investigated at the commencement of the crushing season (July) fly parasites were recovered with comparative ease where moderate borer damage occurred, even though the percentage of parasitism was very low, varying from 1–2 per cent. In such circumstances it is futile to make further liberations of a few hundred flies on these farms when the fly population at the time is already of the order of some thousands.

During June and July the Tachinid was contributing very little towards control, but during September and October the percentage of parasitism had risen to a much higher figure, and the parasite has exercised some checking influence on the pest. However, any badly damaged cane, such as that suffering from the effects of grubs, rats, and borers, &c., is usually harvested

at the commencement of the crushing season before it deteriorates further ; consequently, unless the Tachinid maintains a fairly high degree of parasitism for some months prior to the commencement of the crushing season, and actually prevents further damage by killing off the developing borers, its net effect is practically negligible.

During other years the percentage of parasitised borers at the commencement of the crushing season has been high, but of the many factors governing borer parasitism one of the chief seems to be the dependence of the parasite on favourable weather conditions, and this obviously is beyond our immediate control. It appears, therefore, that under the Queensland system of harvesting, too much reliance should not be placed on the Tachinid fly cleaning up borer infestations. It is thought that trapping might be of some service towards the end of the season when the adult borer beetles migrate from rejected cane in harvested fields, and fly into the more advanced blocks of young cane, which are just making cane, and which serve to perpetuate the pest in large numbers. The Tropical toad has been known to eat beetle borers in Hawaii, and in Puerto Rico a census of the toad's food comprised many weevils closely related to our sugar-cane borer, so that we have some reason for hoping that on those farms where trappings are carried out, the toad may eventually contribute in a large measure towards cleaning up those beetles migrating towards the split or rotting cane traps.

Wireworms.

These insects continue to be both actually and potentially the most serious pest of cane in the Mackay area. Climatic conditions during the 1934–35 summer were not favourable for the establishment of large larval populations of the chief pest species (*Lacon variabilis* Cand.) over extensive areas, although strikes in several badly-drained hollows and/or ends of fields were considerably damaged by this species. In some of the heavy blacksoil fields the species *Crepidomenus queenslandicus* Blr. was responsible for frequent misses.

Early in the year a paper (Bulletin No. 22) dealing with the practical aspects of wireworm control was compiled by Mr. McDougall. It was emphasised in this paper that the drainage requirements of the field must be attended to prior to the wet season which precedes planting, and not merely prior to planting. The degree and extent of infestation on unimproved wireworm country has been found to be governed in general by the rainfall of the previous wet season. To a certain extent this applies also to drained land, depending upon the efficiency of the drainage. Thus following an exceptionally wet season, such as 1928, the get-away provided in the improved lands may not prove adequate and wireworm damage may result ; in such infrequent circumstances it would doubtless be better to make a very late planting even in the improved lands of the Mackay wireworm country.

Soldier Fly (*Metaponia rubriceps* Macq.).

Some two years ago attention was focussed on this pest by virtue of its comparatively severe attack on ratoon cane at Fairymead Plantation, Bundaberg. A return to the more normal dry conditions appears, however, to have reduced the pest to insignificant proportions. Attempts at a laboratory study of the life cycle have not been successful, and in future recourse will be had to bulk sampling for this purpose. Some studies of the physiological aspects of the pest-cane association have been made, but conclusions are as yet only tentative. It is of interest to note, however, that during the hotter portions of the day the flight of gravid females is not so cumbersome as literature on this subject might perhaps lead one to believe.

Large Moth Borer (*Phragmatiphila truncata*).

Although of little economic importance, the damage caused by this pest is rather obvious, and it is the cause of a considerable number of enquiries in the Mackay district. Owing to the scarcity of local knowledge of the life cycle and habits of this insect, it was made the subject of a subsidiary investigation by Mr. McDougall, who reports as follows :—

During late winter and spring the collecting of all possible stages in the field was carried on. At the present time, however, data from parallel laboratory experiments are not sufficiently complete to allow of a full interpretation of the seasonal life history, which is complicated by considerable overlapping of generations.

In the laboratory it was possible during July–September to get females to lay up to 1,200 fertile eggs each ; dissections indicate this number to be their probable maximum fecundity. The first batch of eggs was laid normally on the third night after emergence, and oviposition continued, on occasions, during the succeeding four nights. The egg stage, both under laboratory and caged conditions in the field, occupied 10–12 days at a mean temperature of 62·3°F. ; the

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pupal stage varied from 20 to 26 days. From controlled experiments it is evident that the eggs are not oviposited on leaves but beneath the edges of the outside fresh and tightly rolled leaf sheaths of cane shoots, where they cannot be seen externally, or in similar situations in grasses. These facts make it extremely difficult to find the eggs in the field, especially during a dry year such as 1935, when the pest is very scarce. It is not known if and what grasses are preferred for oviposition. Until eggs can be found in the field, the fundamental reason underlying the correlation between presence of grasses and damage to cane cannot be worked out with precision.

It is seldom that larvæ smaller than the fourth instar are to be found in borer-damaged standing cane, and these, together with the third instar, are responsible for the usual dead-hearts found in the field. When this insect is reared on cane from eggs it is noticed that the smaller instars do not burrow through fresh tissue to the centres of shoots, as do the older larvæ, but rather confine their activities to burrowing in the tissue of individual leaf sheaths.

In addition to the usually reported larval parasite (*Apanteles flaviceps* Cam.), an Ichneumon was bred from a full-grown larva. In the same field another Ichneumon was found to have parasitised 7 out of 322 pupæ.

Army Worms.

From September onwards, young ratoon cane in North Queensland has suffered damage through the activities of army worms, but in most cases under observation this damage has not been of a particularly severe nature, and no complete defoliation has been recorded. The October rains materially helped the young cane to outgrow this temporary setback, but even before the advent of the rains damage was beginning to decrease on account of extensive parasitism. Several specimens of one small and two large species of Tachinids and an Ichneumonid have been bred from the caged caterpillars; the number of caterpillars that have succeeded in transforming has been very small. Bred specimens have disclosed the pest this season to be mainly *Cirphis loreyi* Dup.

Introduction of the Giant American Toad (*Bufo marinus* L.).

During the Puerto Rican Conference of the International Society of Sugar Cane Technologists the attention of delegates was directed to the Giant American Toad, of which excellent reports were received regarding its efficacy as an insect pest destroyer. It appeared desirable that the toad should be introduced into Australia, and after it had been introduced into and firmly established in Hawaii, arrangements were made to import a colony into Australia. As stated previously, this work was undertaken by Mr. R. W. Mungomery during a visit to Hawaii this year.

One hundred and two specimens of the toad were introduced, there being no casualties en route, and were liberated in a specially constructed pond at Meringa. Shortly after arrival one female laid a string of eggs and from these some 4,500 young toads were hatched and distributed in various grub-infested areas around Mulgrave and Hambledon. Further laying of eggs has taken place in the pond, this being the first time that the toads have been bred in captivity. In addition to the distribution of toadlets a few of the originally imported toads have been liberated in nearby lagoons, and the recent finding of hundreds of blackish tadpoles in these localities indicate that the toads are finding the environmental conditions suitable. Liberations have now been made in the Innisfail district and will shortly be extended into other grub-infested areas.

The importation of this toad has been made primarily in the hope that it will aid in controlling the greyback beetle, and the entomologists of Puerto Rico are very optimistic that it will do so. Nevertheless, should it fall short of our hopes in this respect, there is little doubt that the importation will be more than justified by the attack upon other pests.

Rats.

As a result of the abnormally dry season the incidence of the rat pest has been very greatly reduced during the current season, and damage is considerably less compared with that of last year. In order to supplement the efforts of Cane Pest Board supervisors, it has been arranged that the habits and control of the rat will be made the subject of a special investigation by Mr. W. A. McDougall, Assistant Entomologist. As a preliminary to undertaking the investigation, Mr. McDougall will take a special course of zoological study in the South.

Division of Mill Technology.

Mr. E. R. Behne, Assistant Technologist.

Introduction.

Since the last Annual Report, the personnel of this Division has remained unchanged, but Mr. D. L. McBryde, Assistant Technologist, has been transferred to the Mackay Experiment Station. Applications have been called for the positions of Mill Engineer and Assistant Mill Technologists, and early appointments are anticipated.

Laboratory Work.

In addition to the standardisation of apparatus, an investigation was commenced during the last slack season to determine the factors governing the exhaustion of final molasses.

Standardisation of Apparatus.

Brix Spindles.—Two hundred and seventy-one spindles were tested and all but thirty-four received official certificates. Thirty-one of the thirty-four were of irregular ranges and the remaining three had errors in excess of the tolerances allowed.

Polariscope Tubes.—Twenty-one tubes were tested and all but one were satisfactory.

Flasks.—Fifty-three flasks were checked, and of these forty-one were satisfactory.

Pipettes and Burettes.—Eighteen were tested and fourteen were satisfactory.

Weights.—One set was checked.

Polariscopes.—Two instruments were cleaned and checked.

Mutual Control.

One further mill joined the control making a total of twenty-four supplying information. The Third Annual Synopsis was compiled and issued to those mills in the Control.

The Exhaustion of Final Molasses.

The need for some reliable criterion of the efficiency of exhaustion of final molasses has long been felt. Up to the present purity and experience have been the only guides, and obviously these are of but little practical value particularly when abnormal conditions prevail.

In consequence of this lack, the following investigation was initiated along the lines mapped out by Sijlmans* in Java. Naturally, due to local and climatic differences, Sijlmans' findings could not be applied directly to Queensland molasses. Samples of molasses were therefore obtained from most of the mills and were analysed in the Bureau Laboratory. In all 119 samples were received—representing fortnightly composites over the latter portion of the 1934 season, from 19 mills. Three samples fermented, leaving 116 samples for the investigation.

A preliminary microscopic examination of these samples revealed that in a great number of instances considerable quantities of crystallised sugar were present. In the worst case it amounted to 6 per cent. by weight. This represented a considerable loss of sugar which could not be attributed to faulty exhaustion. Consequently those samples which contained much sugar were filtered through a 70-mesh screen (size of opening 0·192 mm.) and the analyses made on the resulting " grain-free " molasses.

Each sample was analysed individually, but space does not permit of the detailed results being given here. They have, therefore, been grouped according to their mill of origin (Table I.); These values were then reduced to a saturation coefficient of 1·0000 resulting in Table II.

In accordance with Sijlmans' method the (ash per cent. water — t°C) v. (ash per cent. non sucrose) graph was plotted (Figure I.).

The line AB in this graph represents the limit postulated by Sijlmans. The compositions of the molasses of which the points lay on, or closely adjacent to this line were then investigated, and the following equation developed for calculating the practical exhaustibility.

$$A = 45{\cdot}93 + 0{\cdot}01311\ X - 0{\cdot}02679\ B.$$

Where A = practical exhaustibility expressed as true purity.

X = ash per cent. o.o.m.

B = reducing sugars per cent. o.o.m.

This equation was applied to each of the samples and the ratio of the actual to the calculated true purity (or the exhaustion ratio) was determined. This value varied from ·70 to 1·09.

*Archief voor de Suik. in Ned. Ind., Mede. v.h. Proefstation. Vol. II., No. 6, 1934.

Division of Mill Technology—continued.

As pointed out by Sijlmans, there appears to be a certain optimum ash concentration for satisfactory work at the low grade station, and the following formula was derived from the Queensland molasses :—

$$C = 2{\cdot}4754D + 1{\cdot}0407t - 37{\cdot}84.$$

Where C = optimum ash per cent. water.

D = ash per cent. non sucrose.

t = fugalling temp. in °C.

The ratio of the actual concentration (coefficient of saturation adjusted to 1·0000) to the optimum value was then obtained and plotted against the exhaustion ratio (Figure 2).

Table I.—Average Molasses Analyses for each Mill as Received.

Mill.	Brix.	Pol.	Apparent Purity.	Dry Substance.	Sucrose.	True Purity.	Reducing Sugar.	Sulphate Ash.	O.O.M.	Fugalling Temp. °C.	Saturation Coeff.
A	86·02	26·23	30·49	79·48	35·39	44·59	18·98	10·40	14·73	54	0·7247
B	90·50	30·55	33·76	82·91	38·62	46·50	11·86	15·52	16·91	38	1·0750
C	84·58	32·35	38·25	78·06	37·35	47·83	10·96	13·38	16·37	39	0·7809
D	88·28	26·39	29·89	81·21	36·57	45·04	19·97	12·06	12·61	37	1·0032
E	89·30	31·17	34·90	81·20	37·42	46·08	11·03	15·03	17·72	48	0·8470
F	84·59	32·88	38·87	77·13	37·28	48·32	8·37	15·39	16·09	30	0·8105
G	86·99	29·60	34·03	77·93	36·23	46·49	8·13	15·19	18·38	44	0·7045
H	85·77	27·63	32·21	78·05	35·97	46·07	13·67	11·27	17·14	38	0·7766
I	87·21	31·20	35·78	77·76	35·91	46·19	8·89	15·54	17·42	32	0·7915
J	89·69	32·31	36·02	79·93	36·71	45·92	11·10	13·35	18·77	43	0·8129
K	85·71	33·51	39·10	77·79	37·82	48·62	10·47	12·66	16·84	43	0·7468
L	85·18	34·89	40·96	77·15	39·38	51·00	10·09	13·59	14·09	63	0·6290
M	83·11	26·05	31·34	77·67	36·26	46·69	21·15	9·64	10·63	29	0·8971
N	87·91	35·25	40·10	81·38	42·55	52·29	15·13	12·60	11·10	48	0·9975
O	84·57	34·32	40·58	76·38	36·75	48·12	9·98	14·68	14·97	36	0·7344
P	85·48	31·61	36·98	80·36	39·63	49·33	14·29	12·94	13·50	47	0·8850
Q	82·24	30·37	36·93	78·00	39·62	50·79	14·61	8·87	14·90	39	0·8455
R	84·31	34·95	41·45	76·46	35·81	46·83	9·28	15·28	16·09	37	0·7043
S	85·86	29·44	34·29	78·04	37·09	47·55	13·11	15·33	12·51	37	0·8043

Table II.—Average Molasses Analyses for each Mill Reduced to a Saturation Coefficient = 1·0000.

Mill.	Water.	Dry Substance.	Sucrose.	Reducing Sugars.	Sulphate Ash.	O.O.M.	Fugalling Temp. °C.	True Purity.
A	16·28	83·72	37·26	19·95	10·94	15·57	54	44·50
B	18·10	81·90	38·09	11·83	15·31	16·67	38	46·50
C	18·29	81·71	39·08	11·47	13·56	17·60	39	47·83
D	18·63	81·39	36·65	20·02	12·09	12·63	37	45·04
E	16·58	83·42	38·43	11·36	15·44	18·19	48	46·08
F	19·54	80·46	38·88	8·74	16·05	16·79	30	48·32
G	16·89	83·11	38·64	8·67	16·21	19·59	44	46·49
H	18·19	81·81	37·70	14·16	11·82	18·13	38	46·07
I	18·69	81·31	37·56	9·30	16·27	18·43	32	46·19
J	17·23	82·77	38·03	11·49	13·84	19·41	43	45·92
K	18·09	81·91	39·83	11·02	13·32	17·74	43	48·62
L	16·06	83·94	42·82	10·97	14·79	15·36	63	51·00
M	20·70	79·30	37·03	21·57	9·87	10·83	29	46·69
N	18·66	81·34	42·53	15·10	12·61	11·10	48	52·29
O	18·70	81·30	39·13	10·64	15·64	15·89	36	48·12
P	17·92	82·08	40·48	14·58	13·22	13·80	47	49·33
Q	19·46	80·54	40·92	15·09	9·17	15·36	39	50·79
R	18·06	81·94	38·26	9·90	16·35	17·39	37	46·83
S	18·71	81·29	38·66	13·65	15·89	12·69	37	47·55

This graph indicates a very high degree of correlation between the two independently determined values which, according to Sijlmans, is proof of the validity of the method of attack. The degree of correlation is not as high as that obtained by Sijlmans in Java, due possibly to the fact that in Java little dilution is practised at the back fugals and repurging is common—whereas in Queensland single purging with relatively high dilution is used. Moreover, the quantity of dilution varies from mill to mill. Another variable in Queensland, not so apparent in Java, is the effect of climatic and geographical condition on the resultant molasses. The Queensland industry extends for about 1,000 miles north and south along the coast, whilst in Java it is concentrated within comparatively narrow limits of latitude.

However, in spite of these limitations, there does appear to be considerable value in the method, and steps have been taken to continue the work during the coming slack season.

Division of Mill Technology—continued.

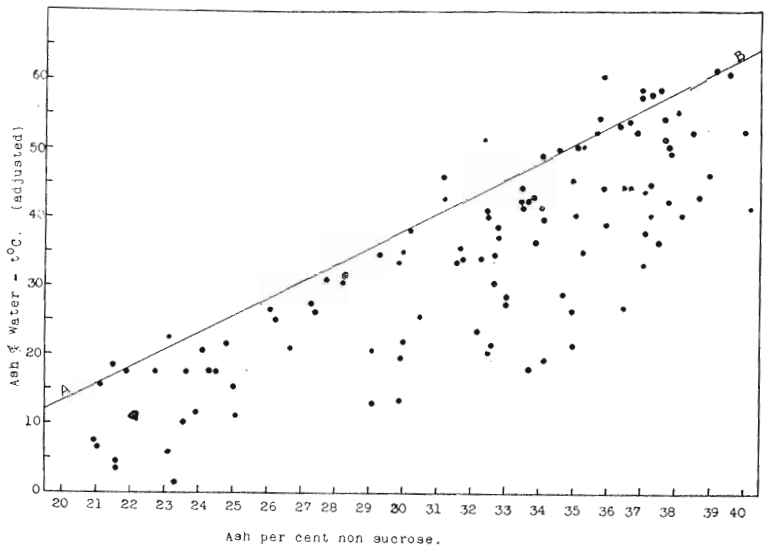

Fig. 1.

Mill Investigations.

Automatic pH Control.

The attempt to control automatically the pH of the juice at Tully has been successful this year. Previous attempts were frustrated by our inability to devise a suitable filter to treat the juice. The type of electrode assembly supplied by the makers demanded perfectly clear juice, so that, since it was proved impracticable to filter the juice, a new type of assembly was used and the raw dirty juice treated. The type now adopted is a modification of that used by Khainovsky

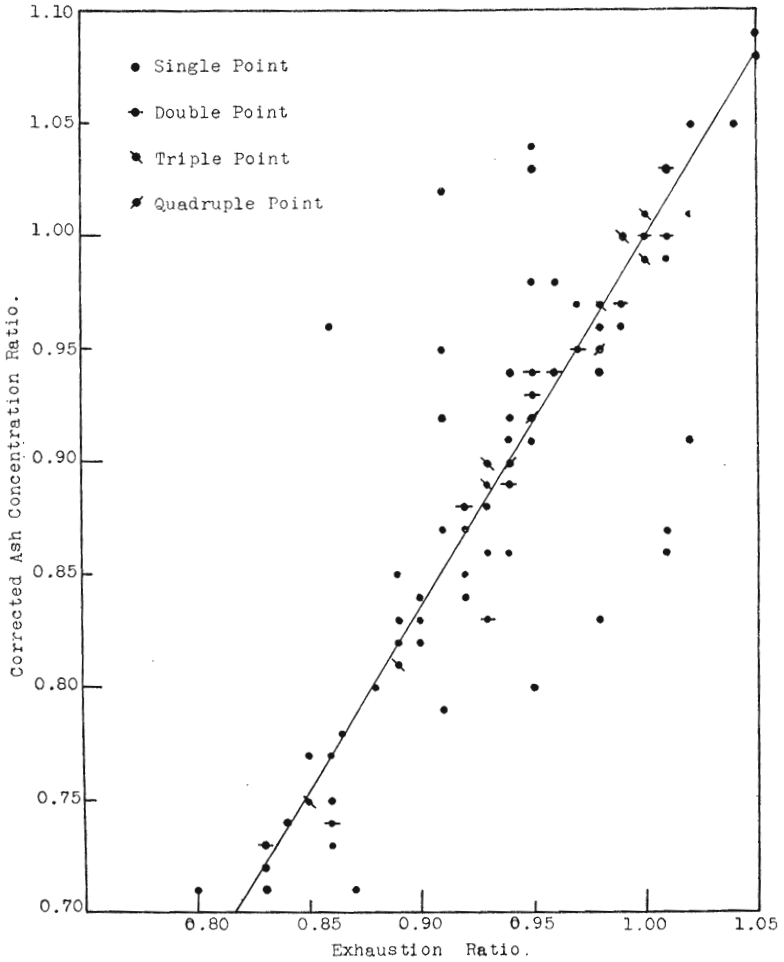

Fig. 2.

Division of Mill Technology—continued.

in Java. The raw juice is treated as it leaves the juice tank, and the lag has been reduced to thirteen seconds. The electrode is self-cleansing and the only attention required is to change a small paper plug every twelve hours.

A portion of a chart obtained with the present layout is reproduced herewith (Figure 3). The recorder was set to maintain the raw juice pH within a range of 7·9 to 8·0 as shown by the two heavy parallel lines. The pH of the clarified juice is also shown. This record was obtained from regular colorimetric determinations made on snap samples of the clarified juice each hour. During this particular run a considerable number of mill stops caused some interference ; the stops are indicated on the chart. In spite of these, the pH of the raw juice was maintained substantially constant, whilst that of the clarified juice showed a variation of $\pm$ 0·1 unit.

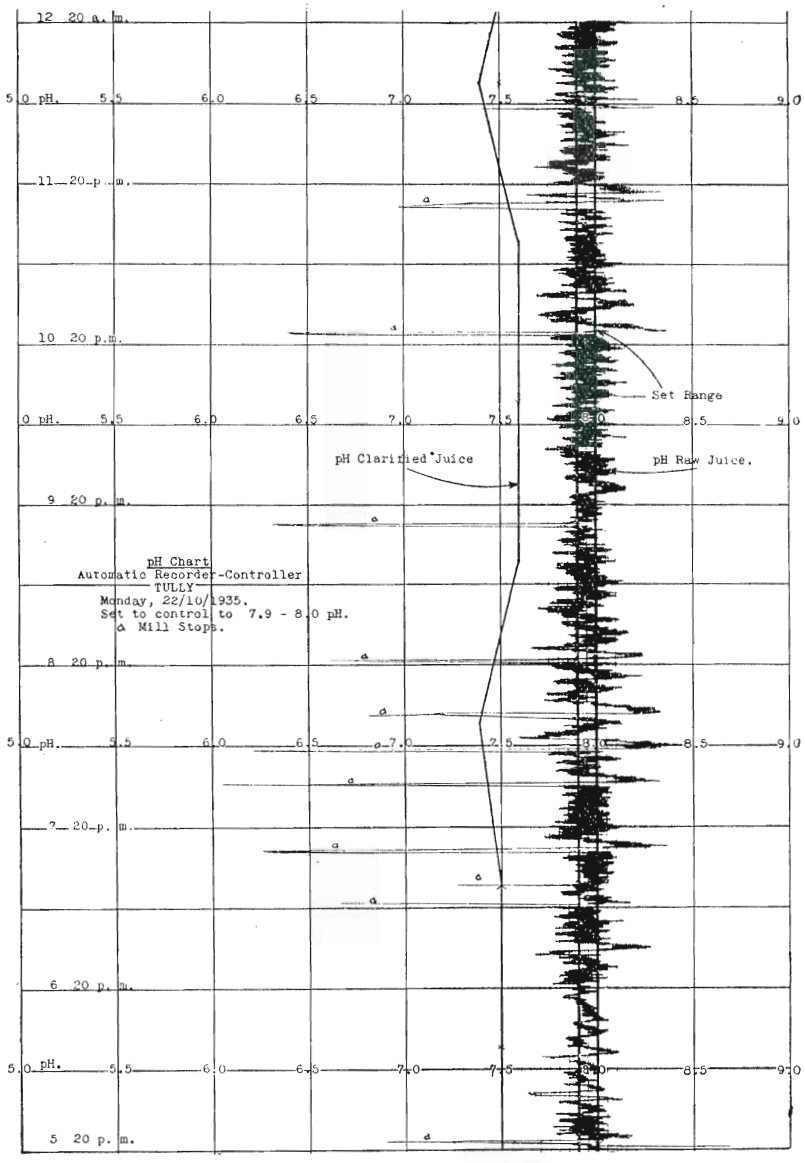

FIG. 3.—Illustrating the nature of the pH control effected with the automatic lining controller.

With this method of control it may be expected that the pH of the clarified juice might fluctuate slightly although that of the raw juice remains constant, because the relation between pH of raw and clarified juice is not strictly constant and would probably be a function of the condition of the cane being crushed. At the recent International Conference two important statements were made by overseas investigators :—

(i.) That operating with a pH of clarified juice between 7·2 and 7·6 gave no variation in the quality of the sugar ;

(ii.) That the efficiency of clarification is largely governed by the uniformity of pH in the raw juice.

In consequence of these two findings it is thought that the control as operated at present is satisfactory. An attempt will be made during the remainder of the season to check this.

Division of Mill Technology—continued.

Juice Weighing Machines.

At Mulgrave Mill the installation of two Maxwell-Boulogne weighing machines was made, to weigh the mixed juice entering manufacture; due to their late arrival and subsequent minor mechanical difficulties, no information as to their effect on mill control is as yet available.

Phosphate Experiment.

At Isis Central Mill, P_2O_5 was added to the raw juice at the rate of 60–80 p.p.m. in an attempt to improve the clarification. The final P_2O_5 content was 280–300 p.p.m. During the trial the juice for the most part was very clear; occasionally it became very dirty, but this was traced to faulty distribution of juice to the subsiders. The general impression obtained during this run was that there was a slight improvement, but it was impossible to evaluate this. The filterability of the sugar produced showed practically no improvement.

Sugar Boiling.

At Babinda Mill a conductivity set was installed, and applied particularly to seeding operations. The results obtained by this installation were very satisfactory, although the data did not agree, absolutely, with those obtained further south. Southern mills find the natural graining point to be about 150 m.a., whereas at Babinda the value was about 10 m.a. This is a very great difference and cannot be accounted for by difference in the details of installation. It is possible that the nature of the ash in the north varies from that in the south. At Mulgrave Mill, charts similar to those obtained at Babinda were produced. The Javan method of seeding was tried, but found unsuccessful due to the low level of the mass in the pan; when introduced, the icing sugar passed right through and was not retained. Consequently the shocking method was adopted, and at present is giving very satisfactory results.

Mill pH Determination.

A preliminary survey was made of the methods used in the various mills in the determination of pH, and the apparatus used. Duplicate runs were made, comparing the results obtained with the mill set and a standard set of the Bureau.

Mill.	pH Value.		Error.	Indicator.	Comparator.	Method.
	Mill.	Bureau.				
A	7·8	7·1	+ ·7	Phenol Red	Hellige	Direct
B	6·5	6·5	·0			
	7·5	7·6	— ·1	B. Thymol Blue	Standard Tubes	Dilution
C	7·2	7·3	— ·1	Phenol Red	Standard Tubes	Dilution
D	7·5	7·6	— ·1	Phenol Red	Standard Tubes	Direct
E	7·5	7·6	— ·1	Phenol Red	Standard Tubes	Direct
	6·8	6·9	— ·1	Phenol Red	Standard Tubes	Direct
F	7·4	7·4	·0	Phenol Red	Standard Tubes	Direct
G	7·2	7·2	·0	Phenol Red	Standard Tubes	Direct
H	7·0	7·0	·0	B. Thymol Blue	Hellige	Direct
I	7·4	7·4	·0	Phenol Red	Drop Ratio	Direct
J	7·0	7·0	·0	B. Thymol Blue	Hellige	Direct
K	*	*	*			
L	7·4	7·4	·0	B. Thymol Blue	Standard Tubes	Direct
M	7·2	7·2	·0	B. Thymol Blue	Standard Tubes	Direct

* No pH set employed.

The sets at the remaining mills have not yet been checked. Except in the case of mill A, the agreement is sufficiently close for mill work, but it must be pointed out that only in a few cases have the mills any satisfactory means of checking their working standards. Consequently it is desirable that the mills be furnished each year with a standard set, prepared in the Bureau Laboratory; this set should be preserved by the mill and used to standardise its own sets. It was with this project in view that the survey was made, and the fact that even one mill was considerably in error is considered sufficient reason for proceeding with the plan.

General.

The present season's work was interrupted to a certain extent by—

(*a*) The International Conference; and

(*b*) The industrial strike which dislocated mill operations for a considerable period in the north.

Division of Mill Technology—continued.

Mill Work for Season 1934.

The 1934 season was characterised by exceptionally low tonnages in the Northern district, due to excessive rain, and an excellent season in the Central and Southern districts. In the Burdekin district the crushing was prolonged into the new year; the quality of the cane fell off rapidly at the end, so that the average figures for this particular area do not reflect the high quality which was general in the Central and Southern Districts. The crushing rates again increased appreciably; in 1933 the average was 44·73 tons, and in 1934, 47·82 tons, an increase of 6·91 per cent.

The following table indicates how the quality of the cane compared with that of previous seasons :—

	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
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
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
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

This table shows that the Central and Southern districts returned to practically normal values in 1934 and the North, although yielding better figures than in 1933, still fell short of previous average values.

Due to the reduced influence of the Northern areas, the tons of cane per ton of 94 n.t. sugar was not as low as it might normally have been. Even so, it was a substantial improvement on the 1933 figure :—

Tons of Cane per Ton of 94 n.t. Sugar.

1928.	1929.	1930.	1931.	1932.	1933.	1934.
7·18	6·91	6·83	6·94	6·90	7·31	6·97

The following tables set out the average and total figures for all mills during the 1934 season, and the main features are compared with those of the previous four years.

SOUTHERN DISTRICT.

	1930.	1931.	1932.	1933.	1934.
Tons of cane	647,794	691,247	208,591	659,393	817,551
Tons of 94 n.t. sugar	84,114	91,546	23,747	77,229	107,676
Tons of cane per ton 94 n.t. sugar	7·72	7·551	8·784	8·538	7·593
Pol in cane	14·58	15·01	13·32	13·55	14·67
Fibre in cane	15·00	15·40	15·16	15·21	14·59
Purity—					
First expressed juice	89·91	88·25	84·95	87·65	89·74
Clarified juice	89·00	87·77	83·87	86·88	88·44
Syrup	88·51	87·37	83·59	87·38	88·73
Gallons molasses per ton cane	4·66	4·73	5·97	4·95	4·02
Apparent purity final molasses	..	40·99	39·46	40·95	41·24
Overall recovery	85·32	85·13	81·62	83·63	85·70
Recovery on mixed juice	90·42	90·45	87·42	89·74	89·59
Boiling house efficiency	94·67	95·54	94·09	93·11	96·12

Division of Mill Technology—continued.

CENTRAL DISTRICT.

——	1930.	1931.	1932.	1933.	1934.
Tons of cane	1,155,912	1,265,744	1,283,821	1,737,205	1,766,564
Tons of 94 n.t. sugar	176,619	189,440	190,995	249,680	271,437
Tons of cane per ton 94 n.t. sugar	6·53	6·682	6·722	6·958	6·508
Pol in cane	16·80	16·73	16·22	15·40	16·45
Fibre in cane	13·06	12·42	11·99	12·25	12·20
Purity—					
First expressed juice	91·70	89·93	90·62	90·84	90·82
Clarified juice	91·30	88·88	89·38	90·47	90·42
Syrup	91·60	89·20	89·52	90·52	90·41
Gallons molasses per ton cane	3·61	4·65	4·60	4 08	3 60
Apparent purity final molasses	40·52	40·45	39·50	40·28	38·91
Overall recovery	86·69	85·35	86·56	87·44	88·69
Recovery on mixed juice	92·23	91·35	91·77	92·38	93·53
Boiling house efficiency	95·69	95·63	96·02	96·26	97·47

NORTHERN DISTRICT.

——	1930	1931.	1932.	1933.	1934.
Tons of cane	1,717,999	2,078,138	2,054,031	2,270,430	1,685,876
Tons of 94 n.t. sugar	254,537	300,289	299,343	311,825	233,457
Tons of cane per ton 94 n.t. sugar	6·75	6·920	6·862	7·281	7·221
Pol in cane	15·98	15·56	16·07	14·92	15·16
Fibre in cane	11·38	10·61	10·51	10·27	10·30
Purity—					
First expressed juice	90·77	89·94	90·11	88·84	89·08
Clarified juice	90·59	89·74	89·63	89·19	89·68
Syrup	90·77	90·02	90·30	89·23	89·64
Gallons molasses per ton cane	3·39	3·61	3·63	3·65	3·79
Apparent purity final molasses	39·55	35·33	37·33	35·21	37·78
Overall recovery	87·63	87·67	87·85	87·94	86·80
Recovery on mixed juice	92·22	92·40	92·43	92·71	91·62
Boiling house efficiency	96·13	96·72	96·67	97·60	96·34

ALL QUEENSLAND DISTRICTS.

——	1930.	1931.	1932.	1933.	1934.
Tons of cane	3,521,705	4,035,129	3,546,443	4,667,028	4,269,991
Tons of 94 n.t. sugar	515,270	581,276	514.085	638,734	612,570
Tons of cane per ton 94 n.t. sugar	6·84	6·942	6·885	7·307	6·970
Pol in cane	15·97	15·94	15·90	14·85	15·57
Fibre in cane	12·59	12·28	11·51	12·00	12·23
Purity—					
First expressed juice	90·90	89·59	89·64	89·40	89·95
Clarified juice	90·50	89·06	89·15	89·25	89·42
Syrup	90·60	89·28	89·42	89·41	89·48
Gallons molasses per ton cane	3·70	4·18	4·18	4·07	3·76
Apparent purity final molasses	40·65	39·19	38·31	38·55	39·20
Overall recovery	86·83	86·37	86·88	86·76	87·37
Recovery on mixed juice	91·89	91·79	91·86	91·88	92·49
Boiling house efficiency	95·72	96·27	96·31	96·39	96·82
Pol extraction	94·49	94·10	94·58	94·43	94·46
C.C.S. in cane	14·957	14·798	14·767	13·76	14·485
Coefficient of work	97·82	97·35	98·15	98·31	98·41

Division of Mill Technology—continued.

FIGURES FOR 1934 SEASON.

——	Northern.	Central.	Southern.	Totals and Averages.
Tons cane crushed	1,685,876*	1,766,564*	817,551*	4,269,991*
Tons sugar made (94 n.t.)	233,457*	271,437*	107,676*	612,570*
Net titre	97·308	97·180	97·291	97·247
Tons of cane per ton 94 n.t. sugar ..	7·221*	6·508*	7·593*	6·970*
C.C.S. in cane	14·037	15·376	13·675	14·485
Coefficient of work	98·34	99·33	96·47	98·41
Crushing rate	68·25	50·66	34·11	47·82
Lost time, per cent.	2·86	6·15	6·09	5·27
Fibre, per cent. cane	10·30	12·20	14·59	12·23
Pol, per cent. cane	15·16	16·45	14·67	15·57
First expressed juice—				
Brix	20·10	21·84	20·40	20·91
Purity	89·08	90·82	89·74	89·95
Clarified juice—				
Brix	16·13	16·65	15·26	16·08
Purity	89·68	90·42	88·44	89·42
Syrup—				
Brix	69·07	68·03	67·07	67·54
Purity	89·64	90·41	88·73	89·48
Last expressed juice—				
Purity	78·46	81·20	79·21	78·94
Clarified juice per 100 cane	98·55	103·19	101·02	101·78
Dilution per cent. first expressed juice	24·61	31·19	33·68	30·04
Final bagasse—				
Pol	3·36	3·21	3·02	3·19
Dry substance	47·72	50·05	49·57	49·25
Pol extraction	94·74	94·83	93·43	94·46
Extraction ratio	·511	·424	·450	·453
Milling loss	7·731	6·966	6·661	7·061
Final molasses—				
Gallons per ton cane	3·79	3·60	4·02	3·76
Brix	85·20	85·23	83·79	84·80
Apparent purity	37·78	38·91	41·24	39·20
True purity	48·56	48·45	47·14	48·07
Reducing sugars	17·74	12·91	10·59	14·02
Final mud—				
Tons per 100 tons cane	3·12	2·14	3·31	2·81
Pol	3·40	2·80	2·05	2·79

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

Division of Mill Technology—continued.

FIGURES FOR 1934 SEASON—*continued.*

——	Northern.	Central.	Southern.	Totals and Averages.
Sugar—				
Pol	98·700	98·737	98·783	98·737
Reducing sugars	·295	·237	·224	·252
Ash	·219	·264	·251	·247
Moisture	·300	·272	·228	·270
Dilution indicator	30·00	27·45	23·05	27·19
Pol balance—				
Sugar (recovery)	86·80	88·69	85·70	87·37
Bagasse	5·26	5·17	6·57	6·54
Molasses	5·20	4·69	6·07	5·17
Mud	·70	·36	·46	·50
Undetermined	2·04	1·09	1·20	1·42
Boiling house efficiency	96·34	97·47	96·12	96·82
Fuel—				
B.T.U.'s, 1,000s. per ton cane—				
Wood	40·55	161·85	255·71	148·41
Coal	5·40	75·26	14·27	37·13
Molasses	204·75	38·35	1·22	81·00
Bagasse	2,081·4	2,433·6	2,873·6	2,438·84
Total	2,332·1	2,709·06	3,144·80	2,705·38
Crop days	1,354*	1,863*	1,165*	4,382*

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

The excellent overall work in 1934 resulted in a higher recovery than in any previous year, and a higher coefficient of work, although the extraction was approximately the same. Due to the very high purities in the Central and Southern districts, the gallons of molasses per ton of cane in these two were lower than previously, resulting in a lower average figure. The boiling-house efficiency is the highest recorded to date. Due to the wet conditions in the North the quantity of mud greatly increased—3·12 tons per 100 cane as compared with 2·74 the previous year, or about 14 per cent. increase. Parallel with this, the pol in mud increased from 2·82 to 3·40, resulting in an increase in mud loss for the Northern district from 0·52 to 0·70 per cent. pol in cane. At the same time there was a considerable reduction in the quantity of mud in the other districts, so that the overall mud loss was only slightly greater than that of 1933.

The efficiency at the milling station remained about the same, the increase in fibre being practically offset by the rise in pol in cane. The dry substance and pol in bagasse were both higher than in the previous year. In this connection it is pleasing to note that each year shows a considerable increase in the crushing rate, but the extraction in no way suffers.

The polarisation of the sugar was slightly higher than that of the previous year, but due to a considerable increase in the ash content, the net titre was a little lower. The sugar was much drier than in 1933, the dilution indicator being 27·19, compared with 33·26 in 1933.

Slightly more total fuel was used in 1934, although the added fuel was less. The increase was due to the greater quantity of bagasse resulting from the slightly higher fibre.

Crushing for the 1934 season was commenced on 6th June and continued till January 31st, 1935. The first mill to start was Pioneer, and the last to finish was Inkerman. The maximum harvesting period was 233 days at Pioneer and the minimum 28 days at Eagleby. The total crop days for all mills was 4,382, compared with 5,130 in 1933, 3,276 in 1932, and 4,377 in 1931.

Division of Mill Technology—continued.

Cane Milled and Sugar Yields, Season 1934.

Mill.	Tons Cane Crushed.	Tons 94 n.t. Sugar made.	Tons Cane per Ton 94 n.t. Sugar.	
			1934.	1933.
Mossman	84,418	10,600	7·964	7·794
Hambledon	172,476	23,334	7·392	7·359
Mulgrave	178,986	24,150	7·411	7·450
Babinda	132,723	17,971	7·386	7·340
Goondi	138,129	18,165	7·604	7·325
South Johnstone	200,531	26,893	7·457	7·315
Mourilyan	157,221	22,154	7·097	6·914
Tully	221,821	32,918	6·738	7·001
Victoria	225,385	32,005	7·042	7·386
Macknade	174,186	25,267	6·894	7·182
Total for Northern District ..	1,685,876	233,457	7·221	7·281
Invicta	121,143	18,639	6·500	6·633
Pioneer	210,477	32,453	6·485	6·601
Kalamia	240,886	38,098	6·435	6·525
Inkerman	254,283	39,496	6·438	6·540
Proserpine	139,566	20,704	6·741	7·168
Cattle Creek	68,275	9,863	6·922	7·644
Racecourse	135,668	20,852	6·506	7·145
Farleigh	132,547	19,117	6·933	7·415
North Eton	69,520	10,679	6·510	7·529
Marian	120,533	18,363	6·564	7·229
Pleystowe	137,178	20,968	6·542	7·197
Plane Creek	136,488	22,205	6·147	7·007
Total for Central District ..	1,766,564	271,437	6·508	6·958
Qunaba	70,378	9,069	7·760	8·429
Millaquin	137,925	18,075	7·631	8·552
Bingera	149,899	20,234	7·408	8·649
Fairymead	121,700	15,901	7·654	8·723
Gin Gin	45,026	6,054	7·437	9·912
Isis	181,231	23,474	7·720	8·825
Maryborough	24,547	3,340	7·349	7·828
Mount Bauple	33,396	4,443	7·517	9·224
Moreton	44,849	6,064	7·396	7·534
Rocky Point	7,262	878	8·269	8·318
Eagleby	1,338	144	9·292	9·478
Total for Southern District ..	817,551	107,676	7·593	8·538

Brisbane, 4th December, 1935.

H. W. KERR,
Director.

Price, 1s. 6d.]

By Authority: DAVID WHYTE, Government Printer, Brisbane.