1936.

QUEENSLAND.

THIRTY-SIXTH 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.

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THIRTY-SIXTH 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-sixth Annual Report of the Bureau of Sugar Experiment Stations, covering the period 1st November, 1935, to 30th June, 1936.

A. W. Kerr.

Director.

Brisbane, 26th November, 1936.

General.

Growing conditions for the 1936 crop were, on the whole, satisfactory in most cane districts. In certain areas, notably Cairns-Gordonvale, it is reported that the growing season was the most favourable yet experienced. As a consequence, record cane tonnages are anticipated. In other northern areas the spring months were dry, and the young cane was seriously handicapped. However, beneficial rains were experienced throughout the summer and autumn, and no undue growth check intervened. The promise of a mild winter suggested that early crop estimates would be exceeded in most northern mill areas.

A prolonged dry spell in the Burdekin district made the six-monthly period from July to December one of the driest yet recorded, and growers were forced to maintain continuous irrigation to safeguard their crops. Midsummer rains of a highly beneficial character then carried the crop along, and very satisfactory yields are anticipated. It is interesting to recall that with similar seasons in the past the mills of the area were provided with low tonnages; the true appreciation of the value of irrigation in cane production has been responsible for the marked improvement in recent times.

The Mackay district was favoured by a season which made for the production of crops in excess of the district average, and, combined with the proportion of cane which was allowed to stand over in 1935, the establishment of record crop yields is anticipated for 1936 in practically all mill areas.

The southern districts of the State were badly served for rainfall throughout the spring of 1935. Although December and January rains were satisfactory, the February falls were disappointing, and a dry autumn followed good March precipitations. Sub-normal crop production has therefore been the rule, but, with the assistance of the standover cane from 1935, it is expected that peak tonnages will be harvested by the majority of the mills.

Report of Director—continued.

Crop Estimates, 1936; Actual Yields, 1935.

The following table shows the preliminary mill estimates submitted in May, 1936, together with the actual figures for the 1935 crop:—

Mill.	Estimate, May, 1936.	Actual Yield, 1935.
	Tons.	Tons.
Mossman	134,950	103,868
Hambledon	230,000	182,635
Mulgrave	285,000	224,652
Babinda	243,000	196,204
Goondi	180,000	136,330
South Johnstone	245,000	181,192
Mourilyan	165,000	143,225
Tully	270,000	201,389
Victoria	268,000	222,073
Macknade	234,000	189,236
Invicta	75,900	61,692
Pioneer	163,320	118,421
Kalamia	201,000	174,132
Inkerman	213,460	169,113
Proserpine	150,000	155,890
Cattle Creek	68,000	62,900
Racecourse	170,000	157,048
Farleigh	163,000	149,146
North Eton	84,000	57,700
Marian	155,000	141,618
Pleystowe	160,000	168,829
Plane Creek	150,000	113,751
Qunaba	68,000	76,051
Millaquin	175,000	146,010
Bingera	170,000	169,698
Fairymead	198,627	151,665
Gin Gin	25,000	46,420
Isis	140,000	158,411
Maryborough	24,000	31,155
Mount Bauple	31,000	30,826
Moreton	73,000	80,026
Rocky Point	12,000	16,402
Eagleby	900	2,559
Total	4,926,157	4,220,267

Estimate of Sugar Yield for 1936 Crop.

The preliminary forecast of the crop which will be harvested in Queensland during the 1936 season is 4,926,157 tons. Allowing for a probable low sugar yield per ton of the cane in the northern districts, and assuming that it will require 7·15 tons of cane to make 1 ton of 94 n.t. sugar, the estimated yield is 688,970 tons. Should this be realised, an all-time record will be established—the previous record yield being that of 1933, when 638,734 tons of 94 n.t. sugar were manufactured.

Report of Director—continued.

The estimated yield from the three New South Wales mill areas is 31,000 tons, giving a total Australian production of sugar from cane of approximately 721,000 tons.

Statistics of the 1935 Crop.

The yield of raw sugar in Queensland for the 1935 crop was 610,326 tons of 94 n.t. sugar. This is almost identical with that of 1934 (612,570 tons). The following table is of interest in that it shows the geographical distribution of the crop for the past four seasons as between the "Northern" and "Southern" areas :—

Sugar Production, 1932-35.

	1932.	1933.	1934.	1935.
	Tons.	Tons.	Tons.	Tons.
North of Townsville	299,343	311,825	233,457	258,958
South of Townsville	214,741	326,909	379,113	351,368
Total	514,084	638,734	612,570	610,326

A slight reduction in production south of Townsville, as compared with the 1934 harvest, was offset by an increase of a similar amount in the far northern districts.

The total area harvested in 1935 was 228,515 acres. The yield of cane per acre crushed was 18·47 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–Ingham	19·44	2·83
Lower Burdekin	21·60	3·41
Proserpine	15·12	2·34
Mackay–St. Lawrence	14·91	2·23
Bundaberg–Gin Gin	22·06	2·82
Maryborough–Childers to Gympie	17·58	2·31
Nambour–Beenleigh	18·57	2·48
State Average	18·47	2·67

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, 1926-1935.

Year.	Acres Cultivated.	Acres Harvested.	Total Yields.		Yields per Acre.		Tons Cane to 1 ton Sugar.
			Cane.	Sugar.	Cane.	Sugar.	
			Tons.	Tons.	Tons.	Tons.	Tons.
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
1935	314,700	228,515	4,220,267	610,326	18·47	2·67	6·92
True Average for 10 Years					17·64	2·50	7·06

Report of Director—continued.

In his 1935 report the Government Statistician shows the average acreage grown by cane planters in Queensland to be as follows :—

	Acres.
Cairns to Townsville	53
Ayr to Mackay	47
Bundaberg to Bauple	31
Nambour to Beenleigh	11
State Average	42

The average per planter was 42 acres, which is 1 acre higher than that of the previous year.

Molasses Produced.

The following figures supplied by the Government Statistician show the manner in which the molasses produced in 1935 was disposed of :—

	Gallons.
Sold to distilleries	4,617,431
Burnt as fuel	4,103,475
Used or sold for feed	3,817,755
Sold for other purposes	175,519
Used as manure	2,559,528
Run to waste	1,214,678
Total	16,488,386

In comparison with the data for previous years, it is pleasing to note further increases in the amounts of molasses used by distilleries, as stock feed, or as manure, while the amount burnt as fuel by the mills, and run to waste, shows a progressive diminution.

MAFFRA BEET FACTORY.

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

Crop Yields, 1936 Season.

Area harvested	3,165 acres
Beets purchased	37,634 tons
Beets sliced	35,843 tons
Average sugar-content	17·12 per cent.
Sugar produced	5,115 tons
Price paid for beet	41s.
Average yield beet per acre	11·89 tons
Average yield sugar per acre	1·94 tons

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 55·4761 per cent., and that for export at 44·5239 per cent. These proportions are exclusive of "excess" sugar, produced by mills in excess of their allotments under the "Peak Year" scheme. The excess sugar produced for the season was 45,422 tons, as compared with 69,659 tons for the 1934 crop.

The price payable for the sugar required for consumption and use in Australia was declared at £24 per ton of 94 net titre. The net value per ton of 94 net titre sold abroad was £7 18s. 9d., which is 7s. 6d. in advance of that of the previous year. The average price paid to those mills which did not produce "excess" sugar was £16 17s. per ton of 94 net titre, compared with £16 10s. 11d. for the 1934 crop. The average value of *all* sugar was £16 3s. 8d.

Report of Director—continued.

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

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

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

The total value of the 1935 crop was £9,873,000, as compared with £9,488,275 for the 1934 season.

ECONOMIC REVIEW.

The 1936 crushing season is at hand, with the treatment of a 5,000,000-ton cane crop in prospect. Should this be realised, the sugar yield will far outstrip production in any previous year with a resulting proportional reduction in net sugar values. It is anticipated that this will be considerably below £16 per ton—a cause for much concern by growers. It may be argued that a substantial volume of the increased yield is the direct result of a favourable growing season, and as such has been produced at no increased cost to the farmer. The question goes, however, rather more deeply than this. The Mulgrave Mill area may be taken as an example, in illustration. Here it is anticipated that a yield of approximately 350,000 tons of cane will be harvested. The crushing commenced with heavy crops, requiring ten tons of cane to produce a ton of sugar. This is the usual consequence of excessive tonnage yields. The latter part of the season which will extend into January, despite an accelerated grinding rate in the mill, will probably witness a rapid decline to low C.C.S. values after the peak of maturity is past. It is therefore more reasonable to regard the above-normal production as constituting the cane crushed early and late. At the anticipated sugar content, such cane will return to the grower perhaps 11s. per ton of cane—a figure at which he can scarcely afford to pay the standard harvest charges. It must also be borne in mind that excessive crops exact their toll on soil fertility, and require increased manurial applications to maintain the normal level of productivity in subsequent seasons.

World sugar values continue at the stubbornly lower levels of recent years ; but although there appear no immediate signs of improvement, the future is not without its bright features. The passing of the world depression has been accompanied by an encouraging increase in world consumption, and carry-over stocks are steadily shrinking. Any measure of adverse growing conditions in one of the major producing countries would be accompanied by an immediate shortage of supplies, and a spectacular rise in prices, such as occurred recently with respect to grain, would doubtless follow. The present ruling prices are, of course, virtually meaningless. They bear no relationship whatsoever to actual production costs for the major portion of the world's production, nor do they provide a true reflection of ruling retail prices in the large centres of consumption. They are the result of the rapid contraction in the available unprotected market, which is now confined to a few countries, the chief of which is the United Kingdom. Even there home production of beet sugar, supplemented by Dominion and Colonial supplies, now provides a large proportion of the nation's requirements.

Report of Director—continued.

All recent attempts to convene an International Conference on the sugar question have failed, due largely to the unsettled international position. But it is felt that, unless something can be done to restrict the unecomonic production, such as characterises the sugar industry of many European states, the future of export trade must be fraught with difficulties. The British Empire Conference which was to have been held in London early in 1936, and at which the Queensland industry was to be represented by the Premier (the Hon. W. Forgan Smith), also failed to materialise. The Australian representatives did conduct conversations with members of the British Government, as a result of which no Dominion quotes will be imposed for the present, while an assurance was given that any change in the existing policy would be made only after eighteen months' notice of such intention had been given. In view of the projected 1936 Australian export surplus, which may amount to 400,000 tons, this arrangement is distinctly beneficial. Though it may be uneconomical to dispose of raw sugars at current world prices, the absence of a market for our produce would be disastrous.

A solution for the problem of production expansion is not yet forthcoming. While the Peak Year Scheme and land assignment regulations have been rigidly enforced, they have not been able to deal with the effects of intensive production; for although these methods are effective in reducing production costs per ton of cane, the progressive diminution of sugar values has forced many growers to increase production in an attempt to maintain a pre-determined income level. That such a policy is doomed to failure, while export parity remains at its present low level, does not require emphasis; and one is forced to the conclusion that the only way out lies in a diversification of crops, whereby the valuable agricultural land which is thrown out of cane production, may be employed profitably.

The writer has consistently advocated the need for the full development of all available methods of intensive production, before any successful attempt at crop regulation may be made. These methods both reduce production costs, and assure the desired yields. Unfortunately the restricted degree to which irrigation practice may be developed is a limiting factor; but the marshalling of all available resources of this nature appears to present the best line of attack. It also supplies the means whereby the productivity of the land released from cane cultivation may be made to provide profitable returns. The results obtained from lucerne irrigation at the Bundaberg Experiment Station, for example, are highly suggestive of the possibilities of a coastal stock fattening industry. For such a project, a ready market is in existence both at home and abroad.

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.

During the year a vacancy was created by the resignation of Mr. W. D. Davies, Northern Growers' representative. Arrangements are being made to fill this office for the balance of the term of the present Board.

Two meetings of the Advisory Board of the Bureau of Sugar Experiment Stations were held during the period under review—on the 23rd March, 1936, in Brisbane, and on the 16th June, 1936, in Mackay. At these meetings many matters of importance to the Bureau and its policy were dealt with, and the Board must be regarded as a very valuable adjunct to the organisation.

The Board has given the industry every encouragement to utilize the services of the Bureau to the fullest extent, and has fostered the policy of periodical technical conferences whereby contacts may be made and consolidated. Under directions from the Board, a meeting of Cane Pest Board representatives was called by the Bureau in Townsville, on the 24th October, 1935, with the Assistant Director, Mr. A. F. Bell, as Chairman. This opportunity for a free interchange of information was greatly welcomed by those participating, and it was decided that a further meeting be held at Meringa on the 25th June, 1936. At this Conference 32 delegates representing 16 Pest Boards and the Bureau staff were present. At the conclusion of the meetings the gathering resolved itself into a Standing Committee on Pest Control. It is planned that this Committee shall meet annually, and the next meeting will be held at Meringa in May, 1937.

With the appointment of Ir. J. Eigenhuis as head of the Mill Technology Division, the Advisory Board gave careful consideration to this phase of the Bureau's activities, and steps were taken to bring the staff to effective working strength. The Engineer-Technologist has now three assistants, and, for the first time, this Division has been able to plan for a full programme of seasonal investigational work for the 1936 harvest. Doubtless, this policy of concentrated and sustained effort will lead to more tangible benefits than would otherwise be possible, and this result can only be achieved where adequate staff is provided.

In this connection, also, an attempt has been made to gain the confidence and interest of the mills in the work, by forming a Mill Research Programme Committee, which is charged with the duty of discussing the proposed seasonal research programme drawn up by the Engineer-Technologist, and finally deciding on the problems which shall be investigated by the Mill Technology staff each season. This Committee embraces accredited delegates from the Queensland mills, each of which is invited to be represented at the meeting, which is held, for convenience, during the currency of the Annual Conference of the Queensland Society of Sugar Cane Technologists.

A scheme for slack season research work, whereby mill technicians will be granted the facilities of the Brisbane laboratories and library for the study of their problems, has been initiated. The mills have received the suggestion with enthusiasm, and a number have intimated their intention of participating early in 1937.

The presentation of technical papers was also considered, and it was agreed by the Board that these be issued as an annual general series of bulletins.

The matter of educational facilities for sugar technologists was fully discussed, and, following the instructions of the Board, several conferences were held between the executive officers of the Bureau, the University, and the Brisbane Technical College. Though it will not be possible to introduce a special sugar course at the University, suggestions have been made whereby the Chemical Engineering course could be extended to provide specialised training. The Central Technical College is also giving consideration to proposed amendments of the existing Diploma Course in Sugar Chemistry, so as to provide a more comprehensive course in Sugar Technology. It is confidently anticipated that something definite will emerge along these lines for the 1937 College year. We would express our appreciation for the cordial manner in which these educational bodies have met our officers and discussed their proposals.

Staff Changes.

Mr. G. E. Young was appointed Assistant to the Engineer, for one year. At the expiration of that period he will return to the University to complete his Engineering course.

Mr. S. O. Skinner was appointed Cadet on the Agricultural staff, and is now undergoing a period of training in association with senior officers of the staff.

Work of the Bureau—continued.

Transfer of Experiment Stations.

During the year the Central Experiment Station at Te Kowai, Mackay, was provided with the necessary buildings and equipment which will allow it to function as an investigational centre. New residences were provided, while the chemical laboratory and outbuildings from the old Station were placed on the new site. Improvements of a minor nature which will be effected in the near future will provide the desiderata of an up-to-date sub-station.

The outbuildings at Bundaberg are to be demolished later in the year, and a composite shed to accommodate horses, feed, fertilizers, and implements will be substituted. Much of the material from the old buildings will be used in the reconstruction. It is also planned to erect a hothouse, in order to facilitate seedling propagation. During the cold, winter weather the maintenance of suitable temperatures for seed germination and growth presents a difficult problem at the present time.

Queensland Society of Sugar Cane Technologists.

This Society continues to flourish, and is enthusiastically supported by the officers of the Bureau, in their capacity as members. The Society receives annually a substantial selection of technical papers from these officers, for it is realised that the Annual Conferences provide an excellent opportunity for the dissemination of results of the technical researches of the Bureau. It is of interest to recall that the formation of the Society was fostered by our officers, and the benefits which have followed the free interchange of information engendered by the organisation are clearly reflected in the tremendous improvement in mill and farm efficiency since the Society was inaugurated—in 1929.

Balance Sheet.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FROM 1ST JULY, 1935, TO 30TH JUNE, 1936.

Receipts.	£	s.	d.
To Balance, 1st July, 1935	9,563	4	1
,, Assessments	17,597	16	10
,, Endowment	7,000	0	0
,, Bundaberg Station	555	15	11
,, Mackay Station	1,785	8	0
,, Sundries	258	9	3
	£36,760	14	1

Disbursements.	£	s.	d.	£	s.	d.
By Salaries				8,085	16	5
,, Contingencies—						
Salaries and Wages	1,336	19	9			
Travelling Expenses, Hires, Fares, Freights, Allowances	2,898	14	7			
Apparatus, Furniture, Books, Installations	682	6	9			
Printing, Advertising, Stationery	1,218	1	5			
Cars and Maintenance	894	2	2			
General Expenses	892	5	2			
				7,922	9	10
,, Bundaberg Contingencies				1,544	17	10
,, Mackay Contingencies				5,742	5	10
,, Meringa Contingencies				1,738	7	0
,, Balance, 30th June, 1936				11,726	17	2
				£36,760	14	1

C.C.S. Formula.

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

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

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

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

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

Division of Soils and Agriculture.

Staff.

The policy of increasing the strength of the extension service by the appointment and training of diploma-holders from Gatton Agricultural College has been continued, and Mr. S. O. Skinner was appointed early in 1936. The field staff now comprises five officers—two seniors and three juniors. The effective working strength of this section might be placed at six fully-trained assistants, so that it will be some years before it can be claimed that this important branch of our service has attained maximum efficiency. Steps must also be taken to provide for loss by resignations—a phase which may seriously upset the strength of the service while the number of senior men is limited.

Extension Work.

The Instructors in Cane Culture, as they are now classified, are responsible for all phases of extensional work. This embraces farm field trials—both fertility and varietal—and advisory duties in matters of an agricultural, entomological, or pathological character. A substantial amount of farm investigational work of this nature is also carried out on behalf of the research staffs.

Farm Trials.—In all areas, further farm trials were set out during the past year, and a large number will be harvested during the 1936 season. The presentation of results of this work constitutes the January issue of the "Cane Growers' Quarterly Bulletin." It can justly be claimed that the accumulated results of the farm fertility trials have contributed in a large measure to the more intelligent employment of artificial manures, and each year more canegrowers are learning to appreciate the special Sugar Bureau fertilizer mixtures which were designed to meet their full requirements.

Further trials in Southern Queensland with the recently introduced gum-resistant varieties are helping to establish our knowledge regarding the true and relative values of these canes in a much more satisfactory manner than was possible with the former method of varietal distribution. There still remain a few varieties on which further information is required before it will be possible to class them as approved canes or discards. The most notable cane in this class is P.O.J. 2883.

In the far North, the first of the Q. series of seedlings, bred by the Bureau at the South Johnstone Station, have been placed in farm trials, and preliminary returns will be available during the 1936 season. It would appear that Q. 2 possesses definite promise as an early-maturing cane for poorer lands, while its decided rat and borer resistance are also valuable features. With the consolidation of the seedling propagation scheme at all Stations, it is anticipated that a steady flow of promising varieties will be made available to the field staff each year for farm trial purposes.

Spray Irrigation Trial.—Good progress was made by the experimental spray system which was installed in the Ayr district. The comparative yields for the plant crop will be presented and discussed in the "Cane Growers' Quarterly Bulletin"; these results should prove of interest, for the first year of the experiment witnessed one of the driest spring seasons on record.

Seedling Propagation.

The propagation of seedling canes from seed produced at the Freshwater breeding plot, near Cairns, continues to be one of the major functions of the three Stations. In order to effect more intensive co-ordination of this work, the scheme has been placed under the control of the Assistant Director, Mr. A. F. Bell. This effects a desirable fusion of varietal work and disease control—subjects which are closely interrelated under our Queensland conditions. A full report on this work will be found in a separate section.

Experiment Stations.

It is pleasing to record that we are now provided with three Stations, which are highly suitable for the work they are called upon to perform. The Meringa Station is now fully equipped, while a number of items are still awaiting attention at Mackay and Bundaberg. These are being put in hand just as rapidly as finances will permit, and should be virtually all taken care of two years hence.

Division of Soils and Agriculture—continued.

The reports of the individual Stations will be found in their customary positions. It will be observed that no field trial results are reported at this time, in contrast with reports of former years. This is due to an alteration in the period covered by the Report; in future, this will review the financial year, from 1st July to 30th June, and the modified policy has been introduced this year. Full details of the 1936 field trials will therefore be recorded in July, 1937.

Work of the Brisbane Laboratory.

Routine Analyses.—The following is a summary of the routine analyses performed at the Brisbane laboratory for the period 1st November, 1935, to 30th June, 1936 :—

	Number of Samples.
Soils	188
Waters	95
Water Slimes	9
Sugar-canes	13
Limes	5
Miscellaneous	6
Total	316

In addition, a considerable quantity of laboratory glassware and equipment was standardized on behalf of the Mill Technology Division.

The substantial volume of soil investigational work performed in the chemical laboratory has been responsible for the development of valuable and rapid chemical tests, whereby the deficiencies of our soils may be forecast with reasonable precision. This has made it possible to encourage canegrowers to submit soil samples for examination and advice, and this service is freely availed of; all work of this character is performed at no cost to the grower.

The irrigation water survey has been continued as a co-operative effort between our instructor and laboratory chemists. A comprehensive technical discussion of the Lower Burdekin sub-artesian water supply is being prepared, and will be issued shortly in bulletin form.

Publications.

Members of the Agricultural staff contributed several papers and short notes to the several issues of the "Cane Growers' Quarterly Bulletin," while the following technical papers were printed in the 1936 Proceedings of the Queensland Society of Sugar Cane Technologists :—

H. W. Kerr—"Some Important Factors in Cane Irrigation."

This paper discussed the influence of temperature on cane growth, and the necessity for temperature studies in conjunction with the watering programme.

H. W. Kerr—"Spray Irrigation."

This paper described the layout of the spray trial under the control of the Bureau, at Ayr.

C. R. von Stieglitz and L. C. Home—"Report on Analytical Methods used in Factory Control."

This report covered the results of a study of the alternative methods for the determination of pol in juice, and concluded that the dry lead method is the most reliable and suitable.

For reducing sugars in coloured solutions—such as molasses—the electrometric method was recommended.

REPORT OF COMMITTEE ON SEEDLING RAISING.

The problems of disease and pest control in Queensland are very intimately related to varietal reaction, while the extreme range of climatic and edaphic conditions within the canegrowing districts render necessary the raising and selection of seedlings at each of the three field stations of the Bureau. In order to make for better co-ordination and to facilitate administration, it has been decided to control this work by means of a committee consisting of Messrs. E. J. Barke (Meringa), D. L. McBryde (Mackay), and N. J. King (Bundaberg), under the chairmanship of the undersigned. The committee met in Mackay in April last, and it is proposed to meet annually at a date prior to the commencement of the cross-pollination season.

Cross-pollination will be carried out under the supervision of Mr. Barke at the breeding plot at Freshwater, the dried fuzz then being despatched to the stations according to their individual requirements. All work incidental to synthesis of future parents by means of selfing, intervarietal, interspecific and intergeneric crosses, if any, will be carried out by Mr. Barke at Meringa.

Following the initial meeting of the committee, instructions were issued providing for standardised methods of planting, fertilization, and selection of seedlings and the keeping of relevant records. The number of individuals required for a trial marriage has been tentatively set at 200, with a secondary trial of about 500 individuals. Selections of original seedlings will be made by dividing the field into 1/40 acre plots, and selections will be made within each plot in an attempt to overcome the factor of soil variation; seedlings are planted in the field in not more than two batches and in the subdivision of the field into approximately 1/40 acre plots no plot will overlap two planting batches.

The question as to what constitutes a sample of an original stool for planting purposes is being studied by plantings on each of the three stations this year. For the forthcoming planting of first selection seedlings ten setts will be planted, one sett of each selected seedling and the several standards being planted at random in each of ten blocks. Second selections will be planted in four single-row plots of ten stools each.

No pre-selection will be practised and, for the present, brix of original seedlings will be determined on the half-stool basis. Concurrently, however, several methods of sampling for determination of brix by the refractometer will be tested. Disease-resistance trials of family progenies and promising seedlings will be carried out as previously.

The relation of plant stool size to ratoon stool size is being determined by stalk counts and measurements, while evidence is being sought on the relation of ratoon selections to plant selections.

The weather conditions during the current season have been very suitable for the early arrowing canes and arrowing has been prolific. Continued wet weather has, however, interfered with cross-pollination and the satisfactory drying of seed. It is anticipated that the nominated requirements of each station with regard to particular crosses will be filled to a reasonably satisfactory degree. In previous years all F3 seedlings have failed to arrow, but this year two F3 seedlings from the cross Oramboo x S.C. 12/4 have arrowed freely and an F4 generation has been obtained, as well as an F3 from the cross Badila x (Oramboo x S.C. 12/4). These self-fertilized lines have been selected on the basis of large stooling and high sugar content and in the F1 progeny of Oramboo x S.C. 12/4 it was found that the three largest stooling canes had also the highest sugar content. The progeny of the second selfing produced 1/3 runts, 3/5 average canes and 1/20 large-stooling canes of high sugar content. The latter class were again selfed and six selected from the progeny. These six F3 canes are all large-stooling, high sugar content canes, but failed to arrow until the present season, when two which had been planted in swampy ground arrowed freely and produced normal flowers, containing approximately 30 per cent. viable pollen.

Plants of the sugar cane-sorghum hybrids (Co. 352, 355, 356, and 515) have been released from quarantine and planted in the breeding plot. These canes are making good growth and it is hoped that crosses with *Saccharum* species will be possible in 1937.

Report of Committee on Seedling Raising—continued.

Five seedlings raised at South Johnstone—viz., Q. 1, 2, 4, 10 and 12—will be planted out in farm observation trials in the several mill districts of North Queensland this year. Of these, Q. 2 would appear to be the most promising and, provided it will give a satisfactory germination under general farm conditions, should find a place in the plantings of the northern areas. It is maturing early during the current season, trashes very freely in spite of being a thin cane, is resistant to beetle borer and leaf-scald disease, but is fairly susceptible to gumming disease. In addition to the farm-observation trials mentioned above, it is proposed to plant three 2-acre blocks of Q. 2 in each of the northern mill districts this spring. The parentage of the variety is as follows :—

D. 1135 x D. 109
|
Badila x S.J. 3102 P.O.J. 2940 x S.C. 12/4

A. 684 x C. 642
|
Q. 2

It is proposed to set out this spring three yield-observation trials of promising seedlings. Some twenty seedlings will be distributed over these three trials and from them will be selected the most promising for inclusion in district farm observation trials in 1937.

Several seedlings of promise have been produced at the Bundaberg Station and are to be set out in a yield-observation trial this year. While there is little doubt that they would have outyielded the old standard varieties of four or five years ago, the standard of competition is now much more severe and it is doubtful whether they will outyield P.O.J. 213, P.O.J. 2878, Co. 290, and P.O.J. 234.

From information being obtained from farmers regarding their planting programmes, it is anticipated that these four new varieties will constitute 90 per cent. of the plantings in the Bundaberg-Isis district this year.

The variety S.J. 4, raised by the Bureau at the South Johnstone Station, has attained prominence in the far northern areas and is now computed to occupy upwards of 8,000 acres. If the increase in yield over the varieties it has replaced be computed at the conservative figure of 3 tons per acre per annum, it will be seen that this one variety has already made a substantial contribution to the farm economy of North Queensland. Unfortunately, the variety is extremely susceptible to gumming disease, and it is to be regretted that the indifference of some farmers in the Mulgrave quarantine area constitutes a serious menace to the continued success of its culture in the far North.

ARTHUR F. BELL,
Chairman.

NORTHERN SUGAR EXPERIMENT STATION, MERINGA.

MR. E. J. R. BARKE, MANAGER.

METEOROLOGICAL.

The growing season for the 1935–36 sugar cane crop was one of the most favourable on record. Excellent weather conditions, comprised of high temperatures and adequate rainfall, were experienced during the early planting months of March, April, and May, 1935, and resulted in good germinations and rapid early growth. The winter months of June and July were unusually warm, and although the rainfall was slightly below normal, it was well distributed and sufficient to maintain maximum growth. The late planting months, with the exception of September, were also suitable for germinations and the continuance of fast growth. Good rainfalls were experienced throughout the remainder of the growing season, and as this year has been devoid of the usual flood and grub damage, the 1936 harvest should approach an all-time record. The absence of the usual growth-check ripening influence will probably result in the sugar content and purity of the juice being below normal.

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	1927	90·16
1917	66·81	1928	62·33
1918	69·15	1929	102·28
1919	57·53	1930	107·61
1920	94·86	1931	98·82
1921	122·84	1932	76·31
1922	64·90	1933	96·06
1923	53·29	1934	91·44
1924	95·67	1935	59·91
1925	76·98	1936 (6 months)	75·54
1926	59·12	**Average (20 years)**	**82·34**

Abstract of Meteorological Observations made at the Northern Sugar Experiment Station, Meringa, from the 1st September, 1935, to 30th June, 1936.

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, 1935	0·02	3	97·0	84·0	89·9	64·0	56·0	60·1	29·8	79·2	72·8
October, 1935	3·89	11	93·0	87·0	90·3	73·0	51·0	63·5	26·8	83·6	77·6
November, 1935	5·16	14	98·5	89·0	92·4	67·0	59·0	62·2	30·2	81·6	74·6
December, 1935	0·12	1	109·0	92·5	99·3	72·0	65·0	68·6	30·7	85·9	65·1
January, 1936	11·83	16	102·0	87·0	93·3	75·0	67·0	72·1	21·2	83·1	78·6
February, 1936	29·06	20	105·0	80·0	91·7	75·0	67·0	70·0	21·7	79·2	85·6
March, 1936	13·91	16	95·0	86·5	90·6	73·0	62·0	69·6	21·0	78·5	83·9
April, 1936	7·74	16	89·0	79·5	83·8	73·5	58·0	65·4	18·4	74·7	77·1
May, 1936	6·09	28	89·0	83·0	86·4	63·5	48·5	57·1	29·3	68·2	79·4
June, 1936	6·91	17	89·0	71·0	82·7	62·0	40·0	56·7	26·0	66·3	78·8

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

Experimental Work.

An area of 17 acres has been cleared, and this land is now planted with disease-free Badila, and first, second, and third year seedlings. The clearing of further land is being carried out by the Station labour, and it is hoped that in the near future all arable land will be under cultivation.

To date it has not been possible to institute fertility or cultural trials. The availability of glasshouse accommodation has made it practicable to carry out preliminary Mitscherlich pot trials, and when the results of these are available, the possibilities of the method will be reviewed. A paper on this subject will be presented at the Cairns Conference of the Queensland Society of Sugar Cane Technologists.

Distribution of Disease-free Badila Plants.

Due to the widespread nature of chlorotic streak disease, and the desirability of providing stocks of disease-free canes, advantage was taken of the plant crop on the Meringa Station which had been produced from Badila stocks obtained on the Tableland.

The project was given wide publicity, and many growers in the areas from Mossman to Tully notified their intention of obtaining supplies of the clean seed. It is anticipated that over 70 tons will be distributed in this way.

Details of Analytical Work performed at the Laboratory of the Sugar Experiment Station at Meringa, from 1st November, 1935, to 30th June, 1936.

Materials.	Number of Analyses.
Sugar-cane for Growers	231
Sugar-cane for Experiment Station	714
Sugar-cane Fibres	14
Agricultural Lime	4
Burnt Lime	2
Fertilizers	8
Waters	31
Soils	49
Total	1,053

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..	231
..	714
..	14
..	4
..	2
..	8
..	31
.	49
.	1,053

CENTRAL SUGAR EXPERIMENT STATION, MACKAY.

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

METEOROLOGICAL.

The growing season for the 1936 crop was one of extremes. Mild droughty conditions during the latter months of 1935 were followed by a wet season of abnormal rains. A short but severe drought followed in April ; this was rather the result of abnormal crop root development than of soil moisture deficiency. A sequence of favourable showers in May, followed by good rains in June, enabled the crop to become thoroughly established.

The January–February rains were such as to ensure maximum absorption with little run-off loss ; but by the end of February the soil had become saturated, so that all but the higher lands were waterlogged.

The reaction of soil moisture to rainfall is demonstrated in a very interesting manner by the water-levels taken at the laboratory well during the season. These are shown in the accompanying graph.

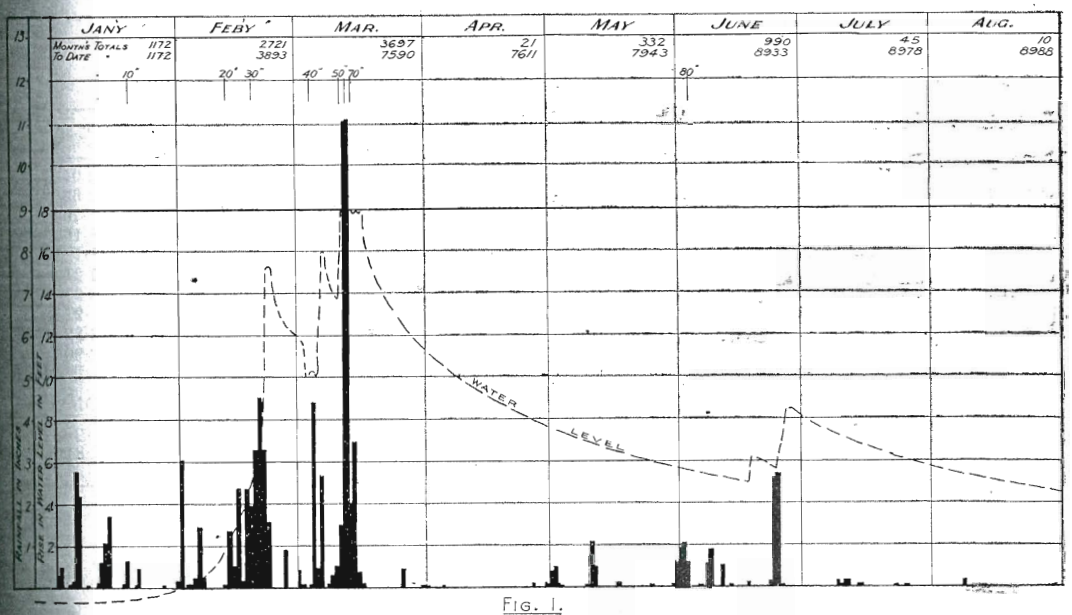

FIG. 1.

INFLUENCE OF RAINFALL ON WATER LEVEL

It will be observed that the first foot of rainfall in January was without perceptible influence, and it was not until about 20 inches had been recorded that a rapid rise occurred. It then rose to a height of 15 feet 6 inches above normal level. Following the heavy March rains, the soil became thoroughly saturated, and the level stood at the ground surface.

Another interesting feature is the rapid rate at which the level fell, following the cessation of rains. It may safely be claimed that the situation of the well is particularly suitable for a rapid get-away of water, due to the absence of any impervious substrata, and the existence of a stratum of coarse gravelly drift at depths of from 8 to 30 feet.

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

Abstract of Meteorological Observations made at Sugar Experiment Station, Mackay, from 1st September, 1935, to 30th June, 1936.

Month.	Rainfall in Inches.	Number of Wet Days.	Average Rainfall for 35 years, 1901-1935.	Highest Shade Maximum.	Lowest Shade Maximum.	Mean Shade Maximum.	Highest Shade Minimum.	Lowest Shade Minimum.	Mean Shade Minimum.
1935.									
September	2·94	4	1·79	87·0	73·0	79·4	64·0	47·0	55·3
October	2·62	4	1·69	91·0	77·0	82·3	71·0	56·0	63·5
November	·79	3	3·12	95·0	80·0	83·9	72·0	58·0	64·4
December	1·16	4	7·59	101·0	85·0	90·6	78·0	63·0	70·4
1936.									
January	11·72	18	14·60	91·0	79·0	85·7	80·0	69·0	73·0
February	27·21	18	10·70	87·0	79·0	83·2	77·0	63·0	72·2
March	36·97	18	10·19	89·0	74·0	81·1	77·0	63·0	70·7
April	·21	5	5·20	88·0	77·0	80·1	72·0	53·0	63·9
May	3·32	14	3·33	86·0	70·0	75·6	67·0	48·0	61·0
June	9·90	15	2·67	79·0	58 0	70·8	69·0	42·0	58·0
10 Months	96·84	103	..	..	..	..	..	..	..

MONTHLY RAINFALL DISTRIBUTION FOR THE PAST FIVE GROWING SEASONS.

Month.	1931-32.	1932-33.	1933-34.	1934-35.	1935-36.
September	·31	·76	3·01	1·06	2·94
October	·94	·28	1·29	2·14	2·62
November	5·67	2·02	11·82	3·81	·79
December	6·17	8·03	5·72	1·82	1·16
January	25·51	7·27	5·01	3·75	11·72
February	2·00	20·92	9·28	15·44	27·21
March	·76	·96	5·30	3·78	36·97
April	2·75	4·40	2·57	2·80	·21
May	4·52	1·72	3·24	8·36	3·32
June	1·15	3·53	2·47	·80	9·90
July	·37	9·64	·60	1·53	..
August	·35	1·66	·27	·68	..
	50·50	61·19	50·58	45·97	96·84*

* 10 Months.

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

Year.	Rainfall in Inches.	Year.	Rainfall in Inches.
1920	57·27	1929..	64·03
1921	95·89	1930..	55·81
1922	34·47	1931..	30·01
1923	25·23	1932..	48·48
1924	53·37	1933..	71·94
1925	54·80	1934..	37·57
1926	34·69	1935..	45·15
1927	83·87	1936 (6 months) ..	89·33
1928	78·28	**Average (16 years)**	**54·42**

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

a 1st September,

Highest Shade Minimum.	Lowest Shade Minimum.	Mean Shade Minimum.
64·0	47·0	55·3
71·0	56·0	63·5
72·0	58·0	64·4
78·0	63·0	70·4
80·0	69·0	73·0
77·0	63·0	72·2
77·0	63·0	70·7
72·0	53·0	63·9
67·0	48·0	61·0
69·0	42·0	58·0
..	..	..

ASONS.

35.	1935-36.
6	2·94
4	2·62
1	·79
2	1·16
5	11·72
4	27·21
8	36·97
0	·21
6	3·32
0	9·90
3	..
8	..
7	96·84*

IACKAY.

nfall nches.
4·03
5·81
0·01
3·48
1·94
7·57
5·15
0·33
4·42

Notes on Meteorological Tables.

The rainfall for the period January to March, 1936, has been exceeded on only one occasion—in 1918, when 9,708 points fell, as compared with 7,592 this year. The fall of 3,697 points for March is the highest recorded at the Experiment Station for that month. The early winter conditions were notably mild, and no reports of frost damage to crops were received.

Experimental Work.

Due to the disorganisation caused by the transfer of activities to the present Station site, and the necessity for much preparatory work, little in the nature of experimental trials could be considered. Two trials were initiated, and the plant crops therefrom will be harvested during the 1936 season. These were :—

(1) Qualitative Fertility Trial.
(2) Varietal Trial—Mackay Seedlings.

New Varieties.

Two varieties were introduced to the Mackay area for trial purposes during recent years—P.O.J. 2725 and Co. 290. P.O.J. 2725 met with a mixed reception ; its early arrowing and tendency to trash-binding are the major objections, but doubtless it will be a useful cane in a suitable environment.

Co. 290 was intended as a substitute for the thin P.O.J. 213 and Co. 210. Plantings of the cane should be confined to poorer lands, on which other and superior varieties are not profitable. The trashness of the variety, and its comparatively low C.C.S. where very heavy crops are harvested, have been causes of disappointment.

Transfer of the Station.

When the last Annual Report was presented, the new Station was in a transition stage. The necessary new residences have now been completed, and the laboratory and outbuildings which were transferred from the old Station are now in place and available for use.

A 4-inch centrifugal pump driven by a 7 h.p. Diesel engine was installed at the well, and the permanence of the supply seems assured. The water is of excellent quality for irrigation purposes. It is employed mainly for seedling watering, but it will later be put to a number of uses, for irrigating both cane and alternative crops.

An extensive system of piping has also been laid at various points on the Station.

During the absence of laboratory facilities, it was necessary to carry on cane analytical work at Racecourse Mill, and our thanks are due to the Manager and Staff for their courtesy and the facilities placed at our disposal.

The Station site is notoriously low-lying, and in many parts very poorly drained. This was one influencing factor which governed the original selection of the area. Much attention will be given to bedding, grading, and surface-draining in general ; this is an ambitious project which must be carried through several years. Attention to sub-drainage at the neighbouring main road will be necessary if the lowest areas of the farm are to be drained ; this matter is now receiving the consideration of the Main Roads Commission.

Rotational Grazing Trial.

An interesting experiment has been commenced on a block which includes the poorest area of the farm. An attempt is being made to demonstrate the influence on productivity of a long rotation (8 years) during which two cane crops will be produced (plant and 1st ratoon), and the land will be under pasture or green manure crop for the balance of the period.

At the direction of the Minister, sheep and lamb grazing will be studied, in order to determine the possible value of such a plan as an adjunct to canegrowing. The area is therefore being fenced and subdivided into 8 blocks, each of 2 acres ; such an experiment must of necessity be continued over a long period of years.

SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG.

MR. J. PRINGLE, CHEMIST IN CHARGE.

METEOROLOGICAL.

The 1935–36 growing season in the Southern cane areas was far from favourable. Following a severe winter in 1935, conditions during August were dry, but well-distributed showers during September and October assured a good germination for spring plantings, and the ratoons came away vigorously. A severe growth check until mid-December was followed by favourable growing conditions, but the month of February was dry, and growth was again suspended. The crop made good progress during March, when 9·4 inches of rain were received, in well-distributed falls. Though cool weather in April caused a retardation in crop growth, the early winter was free from frosts, and the cane continued to make slow progress.

RAINFALL AT THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, FOR THE YEAR ENDED 30TH JUNE, 1936.

Month.	Rainfall.	Number of Wet Days.
July, 1935	5·29	7
August, 1935	0·61	4
September, 1935	2·85	7
October, 1935	1·65	8
November, 1935	0·01	1
December. 1935	9·26	10
January, 1936	5·65	10
February, 1936	1·58	5
March, 1936	9·40	14
April, 1936	1·11	4
May, 1936	2·61	9
June, 1936	4·22	6
Total	44·24	85

Experiments to be Harvested during 1936.

The following experiments are to be harvested during the 1936 season :—

1. Irrigation trial.—P.O.J. 2878 (Second Ratoon crop).
2. Varietal trial.—Gumming-resistant varieties (Third Ratoon crop).
3. Cultivation trial.—(First Ratoon crop).
4. Fertilizer trial.—Forms of Phosphate (First Ratoon crop).
5. Irrigation trial.—Quantity of Sulphate of Ammonia (Plant crop).
6. Varietal trial.—P.O.J. 2878 v. Co. 290 (Plant crop).
7. Varietal trial.—(Plant crop).

Records of Trial Results.

Owing to the policy, commenced this year, of presenting the Annual Report for the period ending 30th June, the harvest data for the current season will be presented in the 1936–37 Report.

DETAILS OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, FOR THE YEAR ENDED 30TH JUNE, 1936.

	Samples.
Sugar-canes and Juices for Growers	272
Sugar-canes for Agricultural Shows	552
Sugar-canes and Juices for Experiment Station	328
Sugar-canes and Juices for Farm Trials	70
Total	1,222

In addition, miscellaneous work of an investigational character was performed by the Soil Survey Officer, Mr. N. J. King, who is stationed at this centre. Mr. King has been provided with a specially equipped laboratory for this purpose.

Crop Estimate.

Due in part to the installation of a small irrigation plant for seedling propagation and small-scale watering trials, and in part to the introduction of disease-resistant varieties of superior yielding quality, the crop yield of the Bundaberg Station has shown progressive increases during recent years. The preliminary estimate for the 1936 season is 550 tons ; if this be realised, it will constitute a record tonnage, since the farm was acquired for experimental purposes.

Report of the Division of Entomology and Pathology.

By Arthur F. Bell, Assistant Director.

I present herewith a report of the activities of the Division of Entomology and Pathology, covering the period 1st November, 1935–30th June, 1936. Since the period under review covers but two-thirds of the cropping cycle the report necessarily does not present a complete picture of seasonal trends in the disease and pest situation, particularly insofar as concerns those diseases and pests which have their greatest incidence in the early and mid-harvesting season.

Cane Pest Boards Conference.

As recorded in the Annual Report for 1934-35, a Conference of Cane Pest Boards was held in Townsville on 24th October, 1935, and was attended by 19 delegates, representing 11 Pest Boards, and the Bureau of Sugar Experiment Stations. The purpose of the Conference, viz., the better co-ordination of investigational and control work carried out by Pest Boards and the Bureau was amply justified and, in consequence, I was instructed to convene a further conference which was held at the Meringa Station on 25th June, 1936. This second Conference was attended by 32 delegates, representing 15 Pest Boards, and the Bureau.

Reports on several topics, presented to Conference by members of the Bureau staff and Mr. K. Gard of the Macknade Board, were fully discussed and subsequently several resolutions adopted. The delegates declared themselves in favour of holding annual conferences during the month of May, and at the conclusion of proceedings appointed a sub-committee to draw up draft rules with a view to constituting a Standing Committee on pest control.

The Greyback Cane Beetle (*L. albohirtum*).

Northern District.—The hot droughty weather conditions which prevailed during the summer months of 1934-35 were to a somewhat less extent repeated last season during the months November-December, a period which is known to be vitally important in the econony of this insect. Temperatures up to 109°F. accompanied by low humidities were again recorded, resulting in the death of many beetles on the feeding trees. In the Hambledon and Mulgrave areas (excepting Greenhill) an already depleted beetle population was decimated, with the result that no fumigation was necessary and little grub damage occurred. In parts of the Innisfail district, however, the grub attack was quite severe. This is due to the fact that in the areas where beetle emergence is usually very early, the spring rains allowed the beetles to emerge and deposit their eggs before the onset of the hot weather mentioned above. These eggs hatched out normally and grub damage occurred in all areas where these early beetle flights occurred.

Fumigation : A further result of the hot dry weather was that owing to the dryness of the soil the grubs concentrated under the stools, so that, in some cases, a single injection of fumigant per stool sufficed to kill them. Moreover, due to the stunted condition of the cane the progress of the fumigators was less impeded than usual, and it became possible to fumigate up to half an acre per man per day. Accordingly, fumigation costs were considerably below those of previous years and amounted approximately to £5—£5 13s. 0d. for fumigant and £1 13s. 0d. for labour per acre. The total acreage fumigated in the area from Tully to Hambledon amounted to 793 acres.

During February comparative fumigation tests were carried out in the South Johnstone area with a horse-drawn injector. Despite the fact that the machine was operated in small cane, and under conditions superior to those under which it would frequently be required to operate, the mortality obtained was very disappointing when compared with one injection per stool with a hand fumigator. It appeared that to be effective a completely new machine was necessary and the matter was referred to the Engineer-Technologist for report. After examining all details it was found that the necessary experimentation would be very expensive and that in any case the necessarily increased cost of fumigant used by the horse-drawn injector would more than off-set the reduced cost of application as compared with the manually operated injector. Moreover, the use of a horse-drawn injector would definitely be limited to unlodged cane and would encounter difficulties in unevenly grown ratoons. After discussion of the subject at the June Pest Board Conference it was decided to direct any future investigation towards the possible improvement of the hand injector.

Trash Conservation and Cane Grubs : Further observations have been made on the peculiar effect of trash conservation in grub infested areas. Where trash is conserved the grubs remain in the moister soil immediately below the trash rows for a much greater period than they do in fields where trash is not conserved. Consequently, on occasions, when digging stools to determine the grub population (on which evidence the fumigation campaign is based), no grubs have been

observed beneath such stools and fumigation has not been undertaken. At a later date, however, such areas have shown grub damage. Under such conditions it is necessary to make the population counts, not merely by digging the actual stools out but by adhering rigidly to the recommended method of also digging half-way across the interspace on each side. In addition it is necessary to wait for a longer period, to ensure concentration around the stool, before fumigation is carried out.

Spraying of Feeding Trees: Experiments were carried out to determine the most efficient toxic compound with which to spray the foliage of feeding trees should an attempt be made in the future to control beetles by the spraying of their favoured feeding trees. Lead arsenate, Paris green, calcium arsenate and a proprietary mixture containing derris were tried in combination with the following "stickers":—Linseed oil, fish oil, flour, "Vallo," Agral 1, and glue and potassium bichromate.

Lead arsenate proved superior to the other poisons both in the rapidity of kill and the percentage of kill obtained: Paris green was almost equal in final mortality, but rate of kill was not so rapid, and furthermore it is not so readily seen on the foliage of the sprayed trees. Beetles were placed in a large cage in which sprayed and unsprayed trees were growing in tubs and allowed to make free choice of food. The spraying of the foliage appeared to exercise no repellant action; the leaf area of sprayed foliage eaten was less than that of the unsprayed, but this appeared to be due to the fact that beetles feeding on sprayed foliage soon became sick and died. These experiments will be continued in the coming season.

Grub Populations Beyond Cane Fields: Excavations carried out in the Cordonvale area in past years have indicated that the forest tracts surrounding the cane lands carried almost insignificant grub and beetle populations. However, diggings in the South Johnstone area revealed that grub populations of up to 24,000 per acre occurred in blady grass lands away from the canefields. Of 180 acres sampled the average population amounted to 3,000 grubs per acre. In some districts it would appear that most of the land suitable for carrying large grub populations is occupied by cane cultivation, whilst in other districts, such as South Johnstone, a considerable area of suitable land is not under cane. Such are important breeding areas of the pest and cannot be ignored in the consideration of measures aiming at affecting general control.

Parasites of *L. albohirtum*: Parasites were fairly common amongst the beetles which were kept caged on small feeding trees, and the following were bred and identified:—

Palpostoma testacea R. & D.—Identified by C. H. T. Townsend.
Sarcophaga calcifera Boettch—Identified at British Museum.

Central District.—Grubs were reported from several localities, but much more severe and more widely spread infestations have been experienced in the past. In this district the system of paying for the collection of grubs and beetles is still followed; details of the collections in the Mackay district (exclusive of Plane Creek) during the past two seasons are as under:—

	1934–5. Lb.	1935–6. Lb.
Beetles	24,072	20,462¼
Grubs	1,395½	2,281½

The monthly record, in pounds, of beetle collections during 1935-36 was—December 704½, January 18,409, February 911½, March 388¼, and April 49. Grubs were collected throughout the year, the monthly collection in pounds from July, 1935, to June, 1936, inclusive, being 25, 26, 32, 9, 40, 41½, 978¼, 24, 157¾, 550¾, 162, 235¼.

Damage by grubs was reported chiefly from the North Coast areas of Mackay in isolated and scattered localities, often in close proximity to scrub. Some apparent grub damage is found on some of these farms nearly every year, but as a rule it is patchy in the majority of fields and grub counts show much of the infestation to be of the order of 1½ grubs per stool, although, occasionally, as many as 7 grubs per stool have been found. Under conditions of low infestation fumigation is not an economic practice and it would appear that the growth of stronger rooting canes in the fields usually grub infested would be the most profitable measure of control for the farmers concerned.

The Giant American Toad (*Bufo marinus*).

Since these toads were introduced from Hawaii last year they have reproduced exceedingly well under confined conditions, and over 60,000 toadlets have been liberated in various centres in the Cairns, Innisfail and Tully districts. Egg strings have also been placed in streams and water

Division of Entomology and Pathology—continued.

holes. It is estimated that over $1\frac{3}{4}$ million eggs have been laid in captivity since the colony was introduced into Queensland. Toads have been recovered a mile away from the nearest point at which they were liberated as toadlets and individuals up to $5\frac{1}{4}$ inches in length have been found. It is expected that the first Australian born toads will commence to reproduce during the coming summer months and populations should then increase rapidly.

The Beetle Borer (*Rhabdocnemis obscura* Bois).

Following the reoganisation of the Division some $2\frac{1}{2}$ years ago the situation in respect to the Beetle Borer and its parasite, the Tachinid Fly, was critically re-examined. Infestation and parasitisation has been examined on a statistical basis and experimental large scale liberations of parasites have been made. As a result we are forced to the conclusion that only under favourable climatic conditions does the parasite exert any appreciable control over the pest; further, such control as takes place is usually effected in the crushing season when the damage has already been done.

Preliminary observations have indicated that lack of field sanitation and the utilisation of certain cultural practices are important contributing factors in the heavy incidence of this pest early in the season. This factor will be examined closely during the coming season, particularly in its relation to trash conservation, pre-harvest burning and cane topping.

It is an observed fact that hardness of rind is an important factor in conferring resistance to borer attack upon a cane variety. The possibility of increasing rind hardness is now receiving attention in the cane breeding programme, and a rind hardness testing machine has been constructed for the purpose of facilitating the testing of seedlings in their earlier stages. In addition, trial plantings of five seedlings will be made in borer infested localities during the coming spring.

In the Mackay area the beetle borer was more prevalent this year than during the past two years. This pest is found in approximately the same areas each year, attacking chiefly the varieties Badila and 1900 Seedling.

Army Worms.

Outbreaks of *Spodoptera exempta* occurred sporadically throughout the cane belt of Queensland during the early months of the year. Most of the infestations occurred in grassland or in grassy leguminous crops which were being grown for green manure and, although the visitations caused considerable alarm there was as usual comparatively little invasion of cane fields and very little, if any, actual damage to cane resulted. Crude oil sprays, rollers, bran baits, &c., were all used with success in decimating the pest, but the degree of parasitism rapidly became so high as to render any other method of attack superfluous. One species of Tachinid alone was responsible for 53 per cent. parasitism amongst specimens of caterpillars collected in the field in the Cairns district, whilst Carabid larvæ (*Chlaenius* sp.) busily attacked caterpillars in the denser grassy leguminous crops.

Cirphis loreyi and *Cirphis unipuncta* have both been in evidence during the year, but their numbers have been restricted and were effectively controlled by parasites. The following parasites, bred from caterpillars of *Cirphis* spp., have been identified during the past year by the British Museum authorities :—

Goniophana heterocera Macq. Locality Gordonvale.
Cuphocera varia F. Locality Gordonvale.
Cuphocera pilosa Mall. Locality Bundaberg.
Sturmia inconspicuoides Baran. Locality Gordonvale.
Actia nigritula Mall. Locality Gordonvale.
Compsilura concinnata sumatrensis Towns. Locality Gordonvale.

Rats.

The problem of rat damage to cane assumed very considerable importance in North Queensland during the seasons 1934 and 1935, and accordingly it was decided to undertake a fundamental and long term investigation of the problem and its possible control. Mr. W. A. McDougall, Assistant Entomologist, was detailed for this work, and during November-December, 1935, spent some six weeks studying the problem in the Herbert River district in company with officers of the Colonial Sugar Refining Company. Subsequently he spent some two months in Brisbane, Sydney, and Canberra, and later returned to a field study of this pest. As a preliminary to the investigation a rat species survey of the cane districts from Ayr to Mossman was initiated.

It has been found that the two species described by Gard (*Proc.* L.S.S.C.T., 1935) as damaging cane in the Herbert River district (viz. *Rattus culmorum culmorum* Thomas and Dollman and *Melomys littoralis littoralis* Lonberg) occur in all mill areas north of Townsville. *R. culmorum*,

with *M. littoralis* present, also severely damages cane in certain types of country in the Central district. *M. littoralis* was trapped in Ayr canefields, while specimens have been received from Gympie, and it is known to exist at least as far south as West Moreton. A *Melomys* species (probably *littoralis*) is also found on the Atherton Tableland. It is believed that *R. culmorum* extends much further south than Mackay. *Rattus rattus* Tinné was found on numerous occasions in canefields, forest, lantana country and even in rain forest on the Tableland. *Rattus assimilis coracius* Thomas was almost invariably found in virgin rain forest on Coast and Tableland, while *Uromys caudimaculatus* Krefft was found here and occasionally in canefields. *Hydromys chrysogaster reginae* Thomas and Dollman was commonly found in coastal swamps and creeks; *Hydromys longmani* Thomas was collected at Ravenshoe. *Rattus norvegicus* and *Rattus rattus* were also trapped in one of the small coastal towns.

Rat damage in canefields for the current season promises to decline greatly from the peak years of 1934 and 1935, particularly in the Herbert River district. The Lower Burdekin, where damage was reputed to be severe in 1934, will during this season have practically no damage, even though the amount of poisoning which has been carried out in the interim is negligible. Elsewhere in the Central districts damage greater than in several of the Northern mill areas has occurred, although, in general, intensity of infestation during the past few years has run parallel to that of areas further north.

Pest authorities in all northern mill areas have conducted campaigns against rats in canefields by means of poison distribution and the destruction of cover when and where practicable. Thallium sulphate treated wheat has now ousted nearly all other well known rat poisons, although in some areas it is supplemented to some extent during the dry spring months by the use of phosphorus paste on bread. The strength of the thallium baits used in the different mill areas varies from 1 lb. thallous sulphate to 250 lb. wheat to 1 in 1,000, while size of bait varies from ·18 to ·33 oz. Pre-harvest baiting (sometimes commencing immediately after the cessation of the previous harvest), continued at intervals, is usually advocated. Depending largely upon the degree and distribution of damage in different areas the pre-seasonal baiting may be carried out systematically on a large scale by Pest Board officers, or may be left in the hands of the farmers themselves. Similarly, the actual distribution may consist in broadcasting the baits or placing them in cover or around headlands.

Concerning such poisoning campaigns, Mr. McDougall reports as follows:—"Some of the poison bait campaigns are carried out as efficiently as circumstances permit from an administrative point of view, and probably the bait used is amongst the best so far prepared for field conditions. Undoubtedly, these baits kill rats in laboratory and field cages and there is direct evidence that some rats are killed by the baits in the field. However, it is considered that, taking into account the lengthy experience of other countries with poison baits as a control for rats—and past experiences with this form of control in Queensland, it is advisable to treat the present campaigns with thallium sulphate treated wheat baits, not as an accepted control; but only as the best available palliative. Before going further some difficult technical problems, such as the finding of a satisfactory and sound method of checking the actual value of a control method, have to be solved."

"In discussing further the use of poison baits as a control for rats it could be pointed out that the subject of "search" is one to be considered. That is to say—are baits of lethal dose eaten, or collected and eaten by the rats (when searching for food) in quantities sufficient to reduce the rat population to an extent where their damage is economically negligible? Obviously the results of this "search" could be improved by increasing the attractiveness and palatability of the bait, but up to the present the efforts of many workers along these lines have not been successful. In some areas in Queensland linseed oil has been added to baits to make them more attractive. In the Central district, during a dry spring, field tests with linseed oil and corn oil do not show one to be better than the other, and show both to be not sufficiently efficient for the required purpose."

Wireworms (*Lacon variabilis*).

It has been pointed out repeatedly that the only known satisfactory safeguard from these pests in the Central district is thorough preparation for drainage before the commencement of the wet season which precedes planting. As was stated in the Annual Report for 1934-35 the degree and extent of infestation on unimproved wireworm country has been found to be governed in general by the rainfall of the previous season. To a certain extent this applies to drained land, depending upon the efficiency of the drainage. Thus, following an exceptionally heavy wet season such as 1928, the get-away provided in the improved lands may not be adequate and wireworm damage may result; in such infrequent circumstances it would doubtless be better to make a very late planting, even in some of the improved lands of the Mackay wireworm country.

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The conditions of the past wet season have been comparable to those of 1928, and it is anticipated that where pre wet-season drainage has not been satisfactorily carried out wireworm damage will be a serious factor, militating against satisfactory strikes, unless planting is delayed until late September. A warning to this effect has been prepared for incorporation in the July number of the Cane Growers' Quarterly Bulletin.

General Disease Situation.

Southern.—In considering the general disease situation it is competent at this juncture to review the progress of the anti-gumming disease campaign which has been conducted in Southern Queensland, and particularly in the Bundaberg-Isis district, over the past eight years. Gumming disease first appeared in this area in the eighteen-nineties, and caused widespread havoc, but, with a change of varieties and following severe droughts, it would appear to have become virtually extinct in the period 1915-20. This hypothesis is strongly supported by the fact that in 1920 at least 98 per cent. of the cane harvested consisted of varieties susceptible to gumming disease. Thus the industry was ill prepared to meet the next onslaught of this disease, which now commenced to reappear. During the next few years reports by field officers of the Bureau contained several references to the presence of gumming in different localities, and at the end of 1924 Mr. W. Cottrell-Dormer wrote of the Bundaberg district: "Gumming disease, though not at present doing acute injury to cane, was found well distributed in many parts of the district." From that time the development of the disease was rapid, reaching a climax in 1929, at which time an intensive farm to farm survey of the district revealed less than 50 gumming disease-free farms—mainly situated on the fringe of the district. During the period 1924-29 the yield of cane gradually declined from 16·5 tons to 12·5 tons per acre (see Fig. 2).

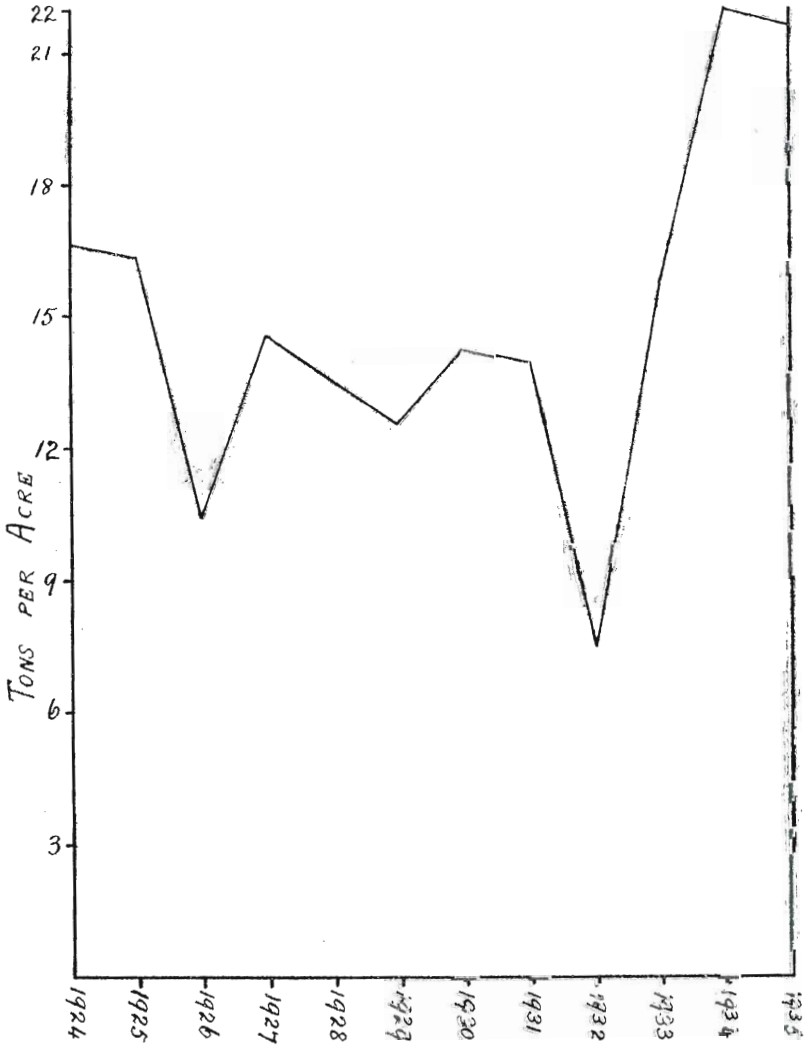

Figure 2.—Graphical record of average yield of cane per acre in the Bundaberg district for the 12-year period 1924-35. Gumming disease had become widespread in 1925, and reached its peak in 1929. The years 1926 and 1932 were drought years, 1932 being exceptionally unfavourable for cane growth, while 1934 was exceptionally favourable.

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With the organisation of a Division of Pathology in 1928 it was evident that the control of gumming presented the State's most serious disease problem. It was quickly realised that the substitution of satisfactory disease resistant varieties of cane offered the only practical permanent solution of the problem, but an advisory service of plant selection was instituted to assist in tiding over the interim period until such varieties could be developed and propagated.

Varietal resistance trials were inaugurated immediately and a search was made for suitable varieties both in Australia and abroad. Over 200 individual varieties were gathered together and tested in one to several trials each, while some 2,500 seedlings, representing a number of crosses, have also been tested for collective disease resistance. In addition access was had to the results of varietal trials carried out by the Colonial Sugar Refining Company in New South Wales.

Varieties found to be resistant were propagated and released for field trial as rapidly as possible. In the meantime, the resistant Q.813, Uba, Co.210, and Co.213 were used to bridge the gap and in 1931 and 1932 they constituted 32 and 51 per cent. of the crop, respectively. Apart from their gumming resistance, however, these varieties have several drawbacks, and their utilisation could only be regarded as a temporary expedient. The 1933 crop witnessed the first crushing of varieties which had been tested under the new campaign, and the proportion of these has rapidly expanded with successive plantings. In an attempt to forcast the probable plantings for the 1936 season officers of the Bureau have collected information which indicates the following probable proportions :—

	Per cent.
P.O.J. 213	30
Co. 290	25
P.O.J. 2878	25
P.O.J. 234	10
1900 Seedling	3
Q. 813	2
D. 1135	2
P.O.J. 2725	2
Others	1

Should these intentions be carried out it will be seen that the 1936 planting will consist of 94-95 per cent. highly resistant varieties and 92-93 per cent. varieties which have been commercially cropped only during the past four seasons. Another interesting fact is the decrease in "Other Varieties" which a decade ago constituted 26 per cent. of the total crop.

The trend of the influence on yields of the substitution of varieties which has taken place is indicated by the graph illustrated in Fig. 2. It must, of course, be remembered that the 1934 season was very favourable, and the stabilised improvement in the position will not be ascertainable until there has been full cropping of the new varieties over a period of a few years.

Mosaic remains of little importance ; the varieties P.O.J. 213 and P.O.J. 234 are quite susceptible to infection under suitable conditions, but appear to be little affected by the disease. Downy mildew was found in one field of P.O.J. 2940 (which will be ploughed out) ; insignificant amounts of red stripe were observed, but no pokkah boeng or knife cut were observed. Root rots have largely disappeared with the advent of more strongly rooting canes.

Fiji disease remains of direct importance in the Maryborough district and of indirect importance in all other districts in Southern Queensland since, although it may be present only in scattered localities, the new high numbered P.O.J. canes are extremely susceptible. A fresh outbreak, on two farms, was discovered in the Isis district and must be viewed seriously by virtue of the extensive plantings of P.O.J. 2878 ; it is considered that in this district it would be advisable to reduce the acreage of P.O.J. 2878 and replace it with the resistant Co.290 and P.O.J. 213. A distinctly improved community attitude has developed towards the question of control in the Maryborough district where concerted efforts to reduce the amount of disease are now being made by the farmers.

Central.—The Central districts continue to enjoy comparative freedom from loss caused by major cane diseases. Downy mildew is decreasing in the Lower Burdekin district with suspended plantings of the variety B.208 ; this disease occurs sporadically in Mackay, but no heavy infestation was noted during the year. Dwarf disease is being reduced to negligible proportions with the gradual elimination of P.O.J. 2714 from the Rosella district. Mosaic disease is widely spread and is particularly noticeable around Habana, where P.O.J. 213 is frequently heavily infested ; fortunately this variety appears to suffer less diminution in tonnage than most of the susceptible canes.

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Northern.—Climatic conditions in North Queensland did not favour the development of Red Stripe (Top Rot) disease which was virtually non existant, except in odd patches of very late plant or ratoon Badila (some heavy localised infestations were recorded at Mackay, in 1900 Seedling and particularly in P.O.J. 2714). Leaf-scald was very little in evidence, excepting in H.Q. 426 in the Tully area ; the dry hot spells of the past two years have greatly assisted in self-cleaning of S.J. 4, through bringing about the death of diseased stools, and the situation is at present satisfactory. Chlorotic streak has again been much in evidence, particularly in low-lying areas. The economic importance of this newly recognised disease is difficult to gauge at this juncture, but it is unquestionably considerable, as is further emphasised below. The Bureau has available at the Meringa Station a supply of disease-free Badila, which is being offered for sale for plants at a reasonable figure. Farmers are availing themselves widely of this offer, and the widespread planting of such disease-free cane will enable the making of valuable observations on the incidence and effects of the disease.

It is with regret that we have to report that the provisions of the quarantine imposed to control the gumming disease outbreak at Aloomba have not been strictly observed and the disease has spread further outward, necessitating the enlargement of the quarantine area. We have had many years experience of gumming disease in the Herbert River and Bundaberg districts and consequently can assess the situation at its true worth. The condemned varieties—Clark's Seedling and S.J. 4—are both highly susceptible, S.J. 4 being the most susceptible cane ever tested by the Bureau. It is consequently no exaggeration to say that unless the facts of the situation are squarely faced the otherwise excellent variety S.J. 4 is doomed.

Resistance Trials.

Resistance trials to determine varietal and/or progeny resistance have been set out in respect to the following diseases :—Gumming, leaf-scald, red stripe, downy mildew, Fiji, and chlorotic streak diseases. During the period under review only the red stripe trial has been completed. This consisted of original seedlings which were inter-planted with Badila in a field apparently well suited for the development of this disease. A final inspection of the planting was made 15th to 17th April, 1936, and the following results noted :—

Family.	Total Stalks.	Stalks Killed Top Rot.	Percentage Death.
E. 724 × S.C. 12/4	13,066	4,532	34·7
P.O.J. 2875 × S.C. 12/4	1,980	641	32·4
Badila × E.K. 28	2,213	579	26·2
P.O.J. 2747 × C. 1	205	53	25·9
S.J. 7 × S.C. 12/4	3,871	941	24·3
Badila × H.Q. 409	1,197	275	23·0
Badila × S.W. 499	2,212	497	22·5
E. 8342 × S.W. 499	622	138	22·2
Badila × S.C. 12/4	7,933	1,647	20·8
S.J. 4 × Q. 1098	2,192	439	20·0
Badila × C. 3	535	93	17·4
Petite Senneville × Q. 1098	409	64	15·6
C. 70 × Q. 1098	4,696	677	14·4
P.O.J. 2725 × Q. 1098	4,118	577	14·0
C. 70 × E.K. 28	991	114	11·5
Totals	46,240	11,267	24·4
Badila	427	160	34·4

In the case of Badila some of the dead stalks may not have persisted but those of the seedlings definitely would have done.

Division of Entomology and Pathology—continued.

Chlorotic Streak.

Chlorotic streak is one of the newest recognised diseases of sugar cane and has been reported from Queensland, Java, and Hawaii; it has some features in common with leaf-scald and when first found in Queensland was known as false leaf-scald. The addition of Mr. D. R. L. Steindl to the staff has made it possible to initiate a thorough investigation of this disease which is of a rather obscure nature. Repeated laboratory investigation along cultural and histological lines has failed to reveal any relationship to the true leaf-scald, but the latter study is being further and extensively pursued owing to obvious differences between diseased and healthy tissue, which may assist investigations as to causation. Extensive surveys of insect populations have been carried out by the Entomologist, and arrangements have been made to cage healthy plants in four localities where spread of the disease is known to be rapid.

In 1934 we reported the results of two trials designed to ascertain the losses, if any, caused by this disease in the variety Badila planted under field conditions. In the Meerawa trial diseased (about 70 per cent. of the setts were diseased) cane was tested against healthy cane from the Tableland Nursery, and the loss of yield in the diseased plots of 17·9 per cent., or 25·6 per cent. if calculated on the basis of 100 per cent. diseased plants. In the second trial, at Tully, the plants used were 100 per cent. diseased, but one half the material was "cured" by warm water treatment. Both trials were ratooned, but that at Meerawa was subsequently badly damaged by floods and had to be abandoned; the Tully trial, however, was carried through and harvested on 5th December, 1935. The complete results of the latter trial expressed in tons per acre are as follows:—

——	Untreated Plots.	Treated Plots.	Loss Due to Disease.	Loss as Per Cent. Treated Yield.
Plant Trial	20·71	30·43	9·72	31·9
Ratoon Trial	21·19	28·13	6·94	24·8
Total, 2 Crops	41·90	58·56	16·66	28·4

It will be seen therefore that the nett gain from planting healthy setts in this trial has been 16·66 tons per acre for the two crops. Actually the ratoon crop in the treated plots soon became 100 per cent. diseased (although no symptoms were seen in the plant crop), but nevertheless the more vigorous stand resulting from the originally healthy stools gave an increase of 6·94 tons per acre. It should be borne in mind, of course, that in these trials the plots of originally healthy cane were small and were set out among heavily infected cane; consequently if this is an infectious disease the cane therein had every opportunity to become infected.

Gumming Disease.

Although the dry summer and autumn weather was not suitable for the spread of gumming disease in the Bundaberg–Isis district, the winter showers and windy weather were conducive to rapid spread and practically all fields of susceptible varieties became generally diseased. So greatly have the areas of susceptible varieties shrunk, however, that it is not possible that much economic loss can occur during the coming season. A family resistance trial planted on Windermere Plantation promises to be completely successful.

During March–April a further survey was made on the farms within the quarantine area at Mulgrave. The disease was found on two further farms, and its presence is suspected on at least two more. Although these farms were situated within the existing quarantine area, they lay towards the outer fringe, and hence it was necessary to extend the boundaries of the area by Proclamation. Some plantings of the prohibited varieties S.J.4 and Clark's Seedling were observed during the survey; the implications of this disregard of the Proclamation are discussed on page 25.

The imminent eradication of gumming disease from the commercial cane fields of Southern Queensland has naturally focussed attention on the possible existence of alternate hosts. Following up some work with cultures of the gumming disease organism, which were forwarded by us to Wisconsin University, we have found that the disease is readily transmissible to some varieties of maize by hypodermic injection, particularly in the case of the well-known Fitzroy variety. *Bacterium vascularum* was reisolated from the infected plants and its retention of pathogenicity was demonstrated by inoculation into the cane variety S.J.4. In another trial seeds of several varieties were interplanted with inoculated stools of S.J.4 cane, the disease was transmitted under natural conditions to the variety Fitzroy, from which the organism was reisolated. All the streaks on the corn arose from small single punctures. This work will be repeated and extended during the coming season when several grasses common to canefields will also be included.

Division of Entomology and Pathology—continued.

Red Stripe.

Owing to the insignificant amount of this disease present little progress could be made with investigations. In an examination of the soils from two adjacent patches with 10·9 and 43·2 per cent. death from top rot it was found that the number (plate counts) of bacteria, actinomyces and fungi in the former patch was 15,600,000 per gram of soil as compared with 10,400,000 for the latter. It remains to be seen, however, whether such a difference is significant or constant. At the same time it was observed in another centre that the top rot was virtually confined to semi-sterile patches of shallow soil.

Dwarf Disease.

Secondary spread of dwarf disease was noticed in two blocks of old ratoons of P.O.J. 2714 on a farm at Rosella. These blocks have since been ploughed out and with the exception of one small field there is now no P.O.J. 2714 in the dwarf area. Clark's Seedling and Malagache have also disappeared from the plantings of the majority of farms on which this disease was previously found.

Minor Diseases.

Witches broom was reported from a number of centres during the late summer and autumn months, and caused a considerable degree of alarm by virtue of its occurrence in new P.O.J. varieties. The condition appeared to be brought about by either or both of two causes, viz., abortive arrowing or the fact that owing to dry weather certain stalks of standover crops had reached maturity and the growing point had died, forcing side shooting.

Sun scald was also commonly observed in the southern districts, while in the north the harmless, but quite striking, banded sclerotial disease was a concomitant of the prolonged wet season.

Pineapple disease appears more common than usual in current late autumn and winter plantings, and in one case a 60-acre planting on the Lower Burdekin failed almost entirely. In all cases this disease appeared to be largely dependent upon unfavourable planting conditions.

Division of Mill Technology.

Ir. J. Eigenhuis, Engineer-Technologist.

Staff.

Since the last Annual Report was presented, the personnel of this Division has been strengthened substantially. The writer was appointed as Engineer on the 9th January, 1936, and later placed in charge of the Division. Mr. G. E. Young was appointed for one year as Assistant to the Engineer; his term of office will expire in March, 1937, when he will return to the University to complete his engineering course.

With a working strength of four officers, it becomes possible to institute a more definite plan of campaign, whereby major sugar mill problems may be attacked, and a full measure of seasonal investigation work undertaken at selected mills. Provision of the necessary equipment for this work, planning the work as endorsed by the Mill Research Programme Committee, and many other duties of a preliminary nature have kept the staff busily occupied in advance of the harvesting season.

Mutual Control.

A modified Mutual Control Data sheet will be introduced during the 1936 crushing. Certain of the items previously required have been eliminated or replaced by more informative and useful figures, while the sheet in its present form gives a clearer understanding of the calculation methods employed. The value of some of the newer concepts was discussed in the Fourth Annual Synopsis of Mill Data issued earlier in 1936. It is hoped that a true appreciation of these modifications will gradually lead to substantial improvements in mill performance.

Twenty-four mills will again participate in the scheme this year.

Standardization of Apparatus.

The work of standardizing apparatus for the mills was continued, and the following is a record of the work undertaken:—

Brix Spindles.—One hundred and forty-nine spindles were tested, and all but seventeen conformed with the official requirements. Thirteen of these were in error beyond the set limits of tolerance, while four were of unofficial ranges.

Polariscope Tubes.—Twenty-two were tested, and all were satisfactory.

Flasks.—Forty were tested, and eleven condemned.

Pipettes and Burettes.—Forty-five were tested, and eleven found to be in error.

Polariscopes.—One instrument was checked and adjusted.

Thermometers.—Nine were tested.

Sundries.—One measuring cylinder and one quartz plate were also submitted for calibration.

Laboratory Work.

Colorimetric Standard pH Sets.

Following a survey of the methods employed for pH determination, the mills were supplied this year with a set of colour standards, prepared in the Brisbane Laboratory. The indicator employed was phenol red, with a range pH 7 to 8·6. A supply of indicator solution was also supplied, to enable the mills to check their stock indicator in daily use.

Exhaustion of Final Molasses.

This investigational work was commenced in 1935, but no definite conclusions were possible at that time. As the results appeared promising, it was decided to continue these researches for a further season. Samples of final molasses were obtained for the majority of the mills, and these were submitted to "complete" analysis during the slack season. When opportunity permits, these data will be submitted to statistical examination.

Division of Mill Technology—continued.

Electrometric pH Meter.

Towards the close of the 1935 harvest, a pH meter was constructed according to the design of Khainovsky. Some trouble was experienced in obtaining the required valves, which had to be procured from Java. By the time these were received, the season was practically at a close; however, the meter was tested at Bingera Mill for one week. It proved successful from the point of view of liming control, but it possessed several serious shortcomings; the chief of these was the inconvenience and trouble in battery maintenance. It was also necessary to have specially-selected valves, to ensure satisfactory balance at the zero point.

After the season, an attempt was made to re-design the entire instrument. A new circuit was therefore prepared, which would permit of operation from the power mains. This enabled higher voltages to be employed, and also widened the range of alternative valve types which could be used. A twin triode valve was eventually selected, since it provided automatic balancing, and possessed other characteristics which would ensure a high standard of performance. By a suitable auxiliary circuit, it was possible to superimpose an opposing e.m.f. to that set up in the measuring electrodes. This enabled large currents to be read in incremental steps, so that greater sensitivity could be secured with a single low-range milliammeter. An experimental set was constructed for use in the 1936 investigations.

Mill Visits.

The writer attempted to visit all Queensland mills in advance of the crushing season, in order to become acquainted with mill staffs and equipment.

The policy was introduced of preparing a detailed report following mill visits by officers of this Division. These serve as valuable records for future reference, as well as keeping all officers in touch with one another and with their work. A copy of such report is also sent to the mill concerned, as a confirmation of the visit.

Technical Publications.

The following papers were presented at the Seventh Annual Conference of the Queensland Society of Sugar Cane Technologists, by members of the staff:—

Ir. J. Eigenhuis—"The Utilization of Surplus Bagasse in Java."

This paper defined "surplus bagasse," and gave a survey of the uses to which this by-product could be put; the baling and briquetting of bagasse, and the machinery employed for the purpose were dealt with in detail.

E. R. Behne—"Automatic pH Control."

A description was presented of the automatic pH control instrument, and the early difficulties encountered were discussed. A reproduced recorder chart demonstrated that the instrument has been established, without undue trouble, as a successful factory control device. The importance of time lag and its elimination were fully dealt with.

N. Smith—"Notes on Clarification."

This paper is a record of the clarification investigations carried out by Mr. Smith while employed by the Mackay Sugar Manufacturers' Association.

N. Smith—"Notes on the Design of Vacuum Pans."

This paper deals with the examination of the answers to a questionnaire sent to all mills by the Bureau at the end of the 1935 season. New theoretical deductions were drawn from the relationship between pan design and performance.

Design and Drawing Work.

Considerable time was occupied in preparing designs for miscellaneous equipment, requiring in all twelve tracings.

Special Equipment Acquired.

For the 1936 seasonal investigations, the following items of special equipment were obtained:—Bagasse extraction and drying apparatus (Khainovsky type), 4 in. Kennedy water meter, with bypass, weighing scales, "Mono" apparatus for flue gas analysis, Prandtl tube for air measurements, and a specially designed drawing table.

Division of Mill Technology—continued.

Seasonal Investigations, 1936 Harvest.

Following an informal meeting of milling representatives, during the progress of the Technologists' Conference held in Mackay in April, a Mill Research Programme Committee was constituted, and in future the Committee will meet officially to consider the programme of mill research work drawn up by the Mill Technology Division of the Bureau for the ensuing season,

The programme as adopted at Mackay, and which will be followed during the 1936 season, is as follows :—

1. *Milling Investigations.*—These will be based on the methods of bagasse analysis standardized by Khainovsky ; a comparison will also be made with the routine Queensland method.

2. *Boiler Efficiency Investigations.*—This work will be directed towards a solution of the problem of furnace design and construction.

3. *Investigation of Alternative Defecation Methods.*—In an attempt to deal successfully with clarification problems, notably when treating refractory P.O.J. juices, certain Queensland mills are prepared to modify their installations in such a way that modifications of the normal defecation practice may be tried. It is hoped that a cheap and successful solution of this problem may be discovered.

4. *Investigations in Pan Work.*—This investigation will be directed towards acquiring more complete data on pan construction, as was put forward in the above-mentioned paper by Mr. N. Smith.

5. *Other investigations of an urgent and unforeseen nature.*

The above items provide a full programme for the limited number of investigators available. Certain points may require investigation over more than one season. In order to secure the highest efficiency for the effort expended, the following policy will be adhered to :—

A. The research subjects will be investigated as thoroughly as possible ; all possible data will be assembled, even those which would appear to have no direct bearing on the problem. In this way, the Bureau will feel justified in deferring further consideration of the subject for a period while devoting attention to other problems.

B. A thorough preparatory study of the problem in all its aspects is made by the officers concerned, well in advance of the seasonal investigations themselves. A detailed treatise is prepared outlining the research, the methods which would appear to offer best promise of success, the equipment necessary, time requirements, &c. The paper is fully criticised, discussed and improved upon, and finally all necessary preparations are taken in hand before the season commences. It permits also of a full discussion with mill executives co-operating in the investigations, so that the officer on arrival at the mill may proceed directly with his work, and no time is lost with preliminaries. Naturally, difficulties will arise which were not anticipated, and suitable modifications of the working plan will become necessary ; but here again the fully-prepared programme is helpful.

Presentation of Results.

While it is not possible to forecast the probable outcome of the season's work, it is confidently anticipated that results of value will be forthcoming. A full description of the researches, the results obtained, and the conclusions which may be drawn, will be presented in a series of Technical Bulletins. No time will be lost in their preparation, and it is hoped that they will be in the hands of mill executives and staffs by the end of March, 1937.

Mill Work for the 1935 Season.

The 1935 season might be regarded as a reasonably " normal " one in all areas except the Burdekin, where the rainfall deficiency was acute, and the crop was produced almost entirely by irrigation. Mill work shows further improvements, as compared with previous seasons, and the definite advance in crushing rates is noteworthy. In 1933 the average was 44·73 tons, in 1934 47·82 tons, and in 1935 it rose to 53·10 tons.

Division of Mill Technology—continued.

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
	1935	14·56	14·47	88·6
Central District	1930	16·80	13·06	91·70
	1931	16·73	12·42	89·93
	1932	16·22	11·99	90·02
	1933	15·40	12·25	90·84
	1934	16·45	12·20	90·82
	1935	16·54	12·36	90·78
Northern District	1930	15·98	11·38	90·77
	1931	15·56	10·61	89·94
	1932	16·01	10·51	90·11
	1933	14·92	10·27	88·84
	1934	15·16	10·30	89·08
	1935	15·91	11·35	89·63
All Districts	1930	15·97	12·59	90·90
	1931	15·94	12·28	89·59
	1932	15·90	11·51	89·64
	1933	14·85	12·00	89·40
	1934	15·57	12·23	89·95
	1935	15·84	12·39	89·83

This table shows that all areas recorded substantially normal cane qualities, and the tons of cane required to make a ton of 94 n.t. sugar was 6·92. This is a definite improvement on the figures for 1933 and 1934, as is shown in the following comparison :—

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

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

The tables below set out the average and total figures for all mills during the 1935 season, and the main features are compared with those of the previous five years.

SOUTHERN DISTRICT.

	1930.	1931.	1932.	1933.	1934.	1935.
Tons of Cane	647,794	691,247	208,591	659,393	817,551	909,223
Tons of 94 n.t. sugar	84,114	91,546	23,747	77,229	107,676	117,447
Tons of cane per ton 94 n.t. sugar ..	7·72	7·551	8·784	8·538	7·593	7·74
Pol in cane	14·58	15·01	13·32	13·55	14·67	14·56
Fibre in cane	15·00	15·40	15·16	15·21	14·59	14·47
Purity—						
First expressed juice	89·91	88·25	84·95	87·85	89·74	88·6
Clarified juice	89·00	87·77	83·87	86·88	88·44	87·78
Syrup	88·51	87·37	83·59	87·38	88·73	88·1
Gallons molasses per ton cane	4·66	4·73	5·07	4·45	4·02	4·11
Apparent purity final molasses	..	40·90	39·06	40·96	41·24	39·72
Overall recovery	85·32	85·13	81·62	83·63	85·70	86·08
Recovery on mixed juice	90·42	90·45	87·42	89·74	89·59	91·095
Boiling house efficiency	94·67	95·54	94·09	95·11	96·12	96·94

Division of Mill Technology—continued.

CENTRAL DISTRICT.

——	1930.	1931.	1932.	1933.	1934.	1935
Tons of cane	1,155,912	1,265,744	1,283,821	1,737,205	1,766,564	1,530,240
Tons of 94 n.t. sugar	176,619	189,440	190,995	249,680	271,437	233,901
Tons of cane per ton 94 n.t. sugar	6·53	6·682	6·722	6·958	6·508	6·542
Pol in cane	16·80	16·73	16·22	15·40	16·45	16·54
Fibre in cane	13·06	12·42	11·99	12·25	12·20	12·36
Purity—						
First expressed juice	91·70	89·93	90·02	90·84	90·82	90·78
Clarified juice	91·30	88·88	89·38	90·47	90·42	90·01
Syrup	91·60	89·20	89·52	90·52	90·41	90·06
Gallons molasses per ton cane	3·61	4·65	4·60	4·08	3·60	3·91
Apparent purity final molasses	40·52	40·45	39·50	40·28	38·91	39·52
Overall recovery	86·69	85·35	86·56	87·44	88·69	88·79
Recovery on mixed juice	92·23	91·35	91·77	92·38	93·53	93·79
Boiling house efficiency	95·69	95·63	96·02	96·26	97·47	97·8

NORTHERN DISTRICT.

——	1930.	1931.	1932.	1933.	1934.	1935.
Tons of cane	1,717,999	2,078,138	2,054,031	2,270,430	1,685,876	1,780,804
Tons of 94 n.t. sugar	254,537	300,289	299,343	311,825	233,457	258,958
Tons of cane per ton 94 n.t. sugar	6·75	6·920	6·862	7·281	7·221	6·877
Pol in cane	15·98	15·56	16·07	14·92	15·16	15·91
Fibre in cane	11·38	10·61	10·51	10·27	10·30	11·35
Purity—						
First expressed juice	90·77	89·94	90·11	88·84	89·08	89·63
Clarified juice	90·59	89·74	89·63	89·19	89·68	89·96
Syrup	90·77	90·02	90·30	89·23	89·64	89·89
Gallons molasses per ton cane	3·39	3·61	3·63	3·65	3·79	3·86
Apparent purity final molasses	39·55	35·33	37·33	35·21	37·78	36·53
Overall recovery	87·63	87·67	87·85	87·94	86·80	87·93
Recovery on mixed juice	92·22	92·40	92·43	92·71	91·62	92·86
Boiling house efficiency	96·13	96·72	96·67	97·60	96·34	97·34

ALL QUEENSLAND DISTRICTS.

——	1930.	1931.	1932.	1933.	1934.	1935.
Tons of cane	3,521,705	4,035,129	3,546,443	4,667,028	4,269,991	4,220,267
Tons of 94 n.t. sugar	515,270	581,276	514,085	638,734	612,570	610,326
Tons of cane per ton 94 n.t. sugar	6·84	6·942	6·885	7·307	6·970	6·915
Pol in cane	15·97	15·94	15·90	14·85	15·57	15·84
Fibre in cane	12·59	12·28	11·51	12·00	12·23	12·39
Purity—						
First expressed juice	90·90	89·59	89·64	89·40	89·95	89·83
Clarified juice	90·50	89·06	89·15	89·25	89·42	89·51
Syrup	90·60	89·28	89·42	89·41	89·48	89·57
Gallons molasses per ton cane	3·70	4·18	4·18	4·07	3·76	3·93
Apparent purity final molasses	40·65	39·19	38·31	38·55	39·20	38·39
Overall recovery	86·83	86·37	86·88	86·76	87·37	87·8
Recovery on mixed juice	91·89	91·79	91·86	91·88	92·49	92·98
Boiling house efficiency	95·72	96·27	96·31	96·39	96·82	97·36
Pol extraction	94·49	94·10	94·58	94·43	94·46	94·93
C.C.S. in cane	14·957	14·798	14·767	13·76	14·485	14·79
Coefficient of work	97·82	97·35	98·15	98·31	98·41	97·78

Division of Mill Technology—continued.

FIGURES FOR 1935 SEASON.

	Northern.	Central.	Southern.	Totals and Averages.
Tons cane crushed	1,780,804*	1,530,240*	909,223*	4,220,267*
Tons sugar made (94 n.t.)	258,958*	233,901*	117,467*	610,326*
Net titre	97·4	97·23	96·73	97·21
Tons of cane per ton 94 n.t. sugar ..	6·877*	6·542*	7·74*	6·915*
C.C.S. in cane	14·78	15·48	13·42	14·79
Coefficient of work	98·39	98·74	96·27	97·78
Crushing rate	71·68	51·42	36·19	53·097
Lost time, per cent.	2·76	3·92	4·85	3·843
Fibre, per cent. cane	11·35	12·36	14·47	12·39
Pol, per cent. cane	15·91	16·54	14·56	15·84
First Expressed juice—				
Brix	21·22	22·05	20·41	21·35
Purity	89·63	90·78	88·6	89·83
Clarified juice—				
Brix	16·45	16·61	15·36	16·27
Purity	89·96	90·01	87·78	89·51
Syrup—				
Brix	68·32	68·6	65·44	67·8
Purity	89·89	90·06	88·1	89·57
Last expressed juice—				
Purity	79·51	81·0	78·36	79·8
Clarified juice per 100 cane	100·93	109·65	100·63	102·07
Dilution, per cent. first expressed juice	28·997	32·75	32·88	31·22
Final bagasse—				
Pol	3·35	3·2	2·96	3·21
Dry substance	49·11	48·82	49·44	49·08
Pol extraction	94·69	94·67	93·57	94·43
Lost cane juice per cent. fibre	44·2	39·91	40·57	41·78
Final molasses—				
Gallons per ton cane	3·86	3·91	4·11	3·93
Brix	85·89	85·98	87·33	86·25
Apparent purity	36·53	39·52	39·72	38·33
True purity	48·66	49·18	47·33	48·55
Reducing sugars	15·24	10·05	10·95	12·4
Final mud—				
Tons per 100 tons cane	3·01	2·58	3·51	2·96
Pol	4·17	2·68	2·31	3·23

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

Division of Mill Technology—continued.

FIGURES FOR 1935 SEASON—*continued.*

——	Northern.	Central.	Southern.	Totals and Averages.
Sugar—				
Pol	98·72	98·75	98·65	98·72
Reducing sugars	·312	·22	·22	·26
Ash	·202	·26	·34	·25
Moisture	·304	·29	·3	·298
Dilution indicator	31·15	30·21	28·57	30·35
Pol balance—				
Sugar (recovery)	87·93	88·79	86·08	87·8
Bagasse	5·31	5·33	6·43	5·57
Molasses	4·94	5·21	6·38	5·33
Mud	·79	·34	·52	·6
Undetermined	1·03	·33	·59	·7
Boiling house efficiency	97·34	97·8	96·94	97·36
Fuel—				
B.T.U.'s 1,000s. per ton cane—				
Wood	21·67	190·32	288·19	162·78
Coal	·54	50·75	·92	20·13
Molasses	135·49	45·61	1·23	62·49
Bagasse	2,280·39	2,470·48	2,877·8	2,479·13
Total	2,438·09	2,757·16	3,168·14	2,724·53
Crop days	1,436*	1,536*	1,324*	4,296*

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

The figures for the season 1935 show that there has again been a general all round improvement in the work. Particularly is this so in the boiling house where the highest boiling house efficiency so far recorded was obtained. Due to this increase there was a record high overall recovery in spite of the fact that the pol extraction remained approximately at the same figure.

Again there was an increase in both the pol and fibre in cane. This was most pronounced in the Northern district where a return to normal values was noted. Is is probable that even better values for pol in cane would have been obtained in this district had the season not been seriously disorganised by industrial trouble in the middle of the crushing.

The bagasse figures were slightly inferior to those of last year, but due to the richer cane the extraction remained very much the same and the lost juice per 100 fibre improved from 42·74 to 41·78. A measure of this improvement may be due to the increased dilution (30·04 in 1934 and 31·22 in 1935), but it is probable that better milling combined with better quality cane was responsible.

A considerable increase in the quantity of final molasses was noted—an increase not commensurate with the slight drop in purity of the first expressed juice. The slightly lower apparent purity of the molasses may represent better exhaustion or it may be due to the adoption of a modification in the analytical method of acidifying the filtrate prior to polarizing in the pol determination, in accordance with the recommendation of C. R. von Stieglitz*. The increase in brix however is a definite improvement.

There was a considerable increase in the quantity of final mud and also in the pol, resulting in a relatively considerably higher mud loss. This was more pronounced in the Northern district. Slightly better work was obtained at the clarification station, the clarified juice being higher in purity than in 1934, whilst that of the first expressed juice was lower. In a small measure this may be related to the higher mud quantities as it is probable that high pH values were maintained this season.

The sugar polarization was slightly lower, which, combined with slightly higher ash and reducing sugar contents, resulted in a lower net titre. The dilution indicator was not quite as satisfactory as in the previous year.

Less excess fuel was used, but, resulting from the higher fibre in cane, more bagasse was produced, the resulting total fuel being slightly in excess of last year's figure.

Crushing for the 1935 season was commenced on the 26th June, 1935, and continued till the 12th January, 1936. The first mills to start were Victoria and Macknade and the last to finish was Tully. The maximum harvesting period was 168 days at Goondi and the minimum 64 days at Eagleby.

With the exception of 1932 the total number of crop days was the lowest since 1931 as is shown in the following table :—

Year	1931	1932	1933	1934	1935
Crop Days	4,377	3,276	5,130	4,382	4,296

* Notes on the Determination of Pol. in Final Molasses by C. R. Von Steiglitz, Proc. Q'land Soc. Sugar Cane Tech., 1935, page 119.

Division of

Mossman
Hambledon
Mulgrave
Babinda
Goondi ..
South John
Mourilyan
Tully ..
Victoria ..
Macknade
Total f

Invicta ..
Pioneer ..
Kalamia
Inkerman
Proserpine
Cattle Cree
Racecourse
Farleigh
North Eton
Marian ..
Pleystowe
Plane Creek
Total f

Qunaba ..
Millaquin
Bingera ..
Fairymead
Gin Gin ..
Isis ..
Maryborou
Mount Baup
Moreton
Rocky Point
Eagleby
Total £

Price : 1

Division of Mill Technology—continued.

Cane Milled and Sugar Yields, Season 1935.

Mill.	Tons Cane Crushed.	Tons 94 n.t. Sugar made.	Tons Cane per Ton 94 n.t. Sugar.	
			1935.	1934.
Mossman	103,868	15,301	6·788	7·964
Hambledon	182,635	26,098	6·998	7·392
Mulgrave	224,652	31,958	7·03	7·411
Babinda	196,204	28,513	6·881	7·386
Goondi	136,330	20,336	6·704	7·604
South Johnstone	181,192	26,246	6·904	7·457
Mourilyan	143,225	21,042	6·807	7·097
Tully	201,389	29,157	6·907	6·738
Victoria	222,073	32,403	6·853	7·042
Macknade	189,236	27,904	6·782	6·894
Total for Northern District ..	1,780,804	258,958	6·877	7·221
Invicta	61,692	9,570	6·446	6·500
Pioneer	118,421	18,624	6·359	6·485
Kalamia	174,132	27,531	6·325	6·435
Inkerman	169,113	26,672	6·34	6·438
Proserpine	155,890	24,120	6·463	6·741
Cattle Creek	62,900	9,518	6·609	6·922
Racecourse	157,048	23,133	6·789	6·506
Farleigh	149,146	22,432	6·649	6·933
North Eton	57,700	8,071	7·149	6·510
Marian	141,618	21,961	6·449	6·564
Pleystowe	168,829	25,624	6·589	6·542
Plane Creek	113,751	16,645	6·834	6·147
Total for Central District ..	1,530,240	233,901	6·542	6·508
Qunaba	76,051	9,473	8·028	7·760
Millaquin	146,010	18,402	7·934	7·631
Bingera	169,698	22,245	7·629	7·408
Fairymead	151,665	19,868	7·634	7·654
Gin Gin	46,420	5,248	8·845	7·437
Isis	158,411	20,908	7·577	7·720
Maryborough	31,155	4,122	7·558	7·349
Mount Bauple	30,826	3,932	7·840	7·517
Moreton	80,026	11,112	7·202	7·396
Rocky Point	16,402	1,867	8·785	8·269
Eagleby	2,559	290	8·824	9·292
Total for Southern District ..	909,223	117,467	7·740	7·593

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