1932.

QUEENSLAND.

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

REPORT OF THE DIRECTOR

TO

THE HON. THE SECRETARY FOR AGRICULTURE AND STOCK

(*As required by "The Sugar Experiment Stations Act of* 1900").

PRESENTED TO PARLIAMENT BY COMMAND.

BRISBANE:
BY AUTHORITY: FREDERICK PHILLIPS, GOVERNMENT PRINTER.

A. 47—1932.

Contents.

H. T. EASTERBY, DIRECTOR, 1912-1932.

BY the death of Mr. H. T. Easterby on 28th September, 1932, the Sugar Industry has lost one of its most notable leaders, and the Bureau its beloved and esteemed chief. As a pioneer in the field of scientific research, his labours of over thirty arduous years spent in its service have contributed largely to the standard of efficiency which the industry has attained. His term of office coincided with a most eventful epoch in its history, and in the early days of the Bureau's activities he laboured under tremendous difficulties. The strenuous duties of those pioneering days conspired in no small measure to undermine his constitution, but he never lost sight of the goal of his ambition, and recent years brought to him the realization of his dreams. From a solitary experiment station and a handful of workers, the Bureau developed under his diligence until to-day it is one worthy of the great industry which it is called upon to serve.

His health of late had caused his friends much anxiety, but he courageously refused to acknowledge defeat; that he could not be dissuaded from the strenuous Northern tour which he had planned, and which was to end so tragically, is characteristic of his steadfast devotion to duty. His last and valued contribution to our literature was a comprehensive history of the industry, for which duty he was singularly fitted, and into which he infused his whole-hearted energy and enthusiasm.

By his charming and genial manner he endeared himself to all who knew him, and his passing has deprived us of a friend and counsellor whose place in our hearts can never be filled.

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THIRTY-SECOND 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-second Annual Report of the Bureau of Sugar Experiment Stations up to the 15th November, 1932.

H. W. KERR,
Sugar Soils Chemist.

Brisbane, 28th November, 1932.

*1.—Introduction.

The findings of the Sugar Committee, appointed by the Federal Government in 1930, which made its report after searching and exhaustive investigations into the Australian Sugar Industry, were very properly considered to be a complete vindication of all the industry had claimed, i.e., (*a*) it had not been unduly favoured; (*b*) that the profits made by canegrowers were exceedingly low; and (*c*) that it was efficient.

It was then thought that the adoption by the Commonwealth Government of the unanimous committee that the prohibition of the importation of sugar for a period of five years from the 31st August, 1931, and of the majority of the Committee as to the price of sugar and conditions of sale thereof would not be disturbed.

A considerable amount of hostility, however, principally in Victoria, South Australia, and Western Australia, continued to make itself manifest, and in July of the present year Senator McLachlan, the Acting Attorney-General for the Commonwealth Government, visited Queensland for the purpose of securing, if possible, a voluntary concession in the price of sugar from the industry. Accordingly, a conference was called on the 27th July of the present year, at which representatives of the following parties were present:—The Queensland Government (represented by the Premier, Mr. W. Forgan Smith, and the Minister for Agriculture, Mr. F. W. Bulcock), the Queensland Cane Growers' Council, the Australian Sugar Producers' Association, the New South Wales Cane Growers' Association, the Colonial Sugar Refining Company, the Millaquin Refinery, the Australian Workers' Union, the Adelaide Steamship Company, and the Queensland Sugar Board, with Senator McLachlan and Mr. Albert Townsend representing the Commonwealth.

In opening the Conference, Senator McLachlan said his Government was in no way hostile to the Australian Sugar Industry, but the national income had fallen 33 per cent., and consumers had not received any compensation in the price of sugar while savings in costs were being withheld, admittedly with the concurrence of previous Commonwealth Governments, and were being used as a subsidy on surplus raw sugar exported overseas. Each factor interested in the production of sugar should bear a fair share of any fall in price. It was not wished to attempt to force the Australian producer to accept world parity prices, but he hesitated to think of the consequences to the industry of any failure to arrive at a satisfactory conclusion, and in the event of a favourable decision he proposed to ask the Commonwealth Government to take such action as would stabilise the sugar policy for a term of years under conditions which would be satisfactory to producers and consumers alike.

This was replied to by the Premier of Queensland, who stated that his Government as a party to the Sugar Agreement had not been in any way consulted, and he forcibly dealt with the various points at issue, showing that Queensland purchased far more from other States than she sold, and that special grants had been made by the Common-

* Practically all of Sections 1 to 4 of this Report were prepared by the late Director.

wealth to other States, such as Tasmania, South Australia, and Western Australia, to which Queensland had to contribute. These were bounties on dried fruits, wines, wheat, and specially protected tariff advantages to manufacturing interests in the South. Queensland accepted its quota of these obligations without complaint. His Government took the view that a contract was entered into by Queensland and the Commonwealth Government for a period of years, after a full and exhaustive inquiry, and that contract should be honoured by both Governments in its entirety, and the conditions should not be disturbed, and that so far as the Queensland Government was concerned, as one party to the contract, that Agreement will stand.

Finally, when the matter had been fully discussed by the Conference, after hearing the views of both Governments, it was decided that tentative proposals should be put forward by the representatives of the industry which, if accepted by the Commonwealth Government, would be recommended to the respective organisations for approval. It was stated that the point which impressed the representatives of the industry most strongly was the chance of further challenges to the validity of the existing agreement.

The matter was very fully discussed by all parties, and finally a conference of representatives of the industry was held in Canberra on 3rd September, under the chairmanship of the Prime Minister, Mr. J. A. Lyons. The delegates agreed to recommend to their executives that the price of refined sugar be reduced by ½d. per lb. retail as from 1st January, 1933, and that the new price should continue during the currency of the present agreement, which terminates on 31st August, 1936, subject to the new agreement between the Commonwealth and the Queensland Governments being approved by an Act of the Commonwealth Parliament. It was also decided to endorse the automatic reduction in the special contribution by the Sugar Industry to the Fruit Industry. The present contribution of £315,000 a year would therefore be reduced to £200,000.

The decisions of the Canberra Conference were subsequently endorsed by the executives of the Queensland Cane Growers' Council and the Australian Sugar Producers' Association, and a draft of the new agreement has been received by the Premier of Queensland.

The reduced income which the Sugar Industry will suffer as a result of these negotiations will undoubtedly cause considerable hardships on a large section of our industry, and it remains to be seen what the net effect will be.

The industry will benefit from the security and stability which will be assured for the next four years, and the new agreement will not be open to attack as has been the case with previous agreements which did not have the final authority of the Commonwealth Parliament.

2.—Figures of the 1931 Crop.

The yield of raw sugar in Queensland for 1931 was the largest ever produced, and the figures for the last four crops are given for purposes of comparison :—

	Tons 94 net titre sugar.
1928 (previous record)	520,620
1929	518,516
1930	516,783
1931	581,276

In addition, 18,841 tons of 94 net titre sugar were made in New South Wales, according to the Government Statistician's return. This would mean that 600,117 tons of raw cane sugar were manufactured in Australia, which is greatly in excess of the Commonwealth's requirements, and hence it was necessary to export 301,430 tons. This was the largest quantity exported in any one year to date.

The tons of sugar manufactured from beet in Victoria totalled 5,095 tons.

The amount of cane required to make one ton of sugar in 1931 was 6·94 tons, which was slightly higher than in the two previous years.

2. Figures of the 1931 Crop—continued.

The proportion that the sugar manufactured in Queensland and New South Wales during the 1931 season which was deemed to have been delivered for consumption and use in the Commonwealth of Australia bore to the total production, exclusive of the total deliveries of "excess sugar", was 51·004 per cent., and the net value per ton of the 94 net titre exported sugar sold abroad was £9 7s. per ton. The price payable for the sugar for consumption and use in Australia was declared to be £26 19s. per ton, and this latter figure when pooled with the price received for exported sugar provided a price of £18 6s. 6d., which was paid to those mills that did not exceed the peak tonnage. To those mills (ten in number) which made "excess sugar" the price was, of course, less.

The following figures show the prices the industry has received per ton of 94 net titre sugar since 1922 :—

Year.	Price received. £ s. d.
1920–1922	30 6 8
1923	27 0 0
1924	26 0 0
1925	19 10 7
1926	24 10 10
1927	22 0 4
1928	20 17 11
1929	20 5 10
1930	19 13 1
1931	18 6 6

Below is given the export surplus sugar since the year 1924, when the first large surplus occurred. This is actual bagged sugar and is not calculated to 94 net titre :—

	tons.	
1924	74,000	
1925	219,000	
1926	74,777	
1927	152,384	
1928	186,703	
1929	197,000	
1930	203,605	
1931	291,802	
1932	200,000	(estimated)

The price received for sugar overseas, viz., £9 7s. per ton was somewhat better than in 1930, when it was £8 5s. The figures given below show the prices received for exported sugar since 1924, when the export of sugar began :—

	£ s. d.	
1924	21 0 0	(approx.)
1925	11 5 9	
1926	14 18 10	
1927	12 2 6	
1928	10 10 0	
1929	9 17 0	
1930	8 5 0	
1931	9 7 9	

Mr. Albert R. Townsend of the Department of Trade and Customs, who is the Commonwealth adviser on sugar matters, has been good enough to furnish the following table of the amounts of sugar estimated to have been exported in manufactured articles, such as condensed milk, jam, canned fruits, biscuits, confectionery, cordials, beer, &c. :—

	tons.
1924–1925	5,500
1925–1926	6,555
1926–1927	4,807
1927–1928	5,003
1928–1929	5,632
1929–1930	3,981
1930–1931	3,932
1931–1932	5,070

The substantial increase for 1931-1932 was mainly due to the expansion of all exports made possible by the favourable rate of exchange. Increased tariff preferences granted by Canada on Australian canned fruits also affected the position.

2. Figures of the 1931 Crop—continued.

It is expected that exports will remain high for 1932-33 on account of further tariff preferences on fruit products, as a result of the Ottawa Conference, and the large subsidy on exported fruit products which is now contributed by the Sugar Industry and administered by the Fruit Industry Sugar Concession Committee.

The following figures, also compiled by Mr. A. R. Townsend, show the substantial contributions which were made by the Sugar Industry in the form of export rebate on fruit products during the years ended 30th June, 1930, 1931, and 1932 :—

Year.	Fruit Products.	All Products.
	£	£
1930	22,197	84,158
1931	38,914	90,673
1932	43,566	110,984

For the year ended 31st August, 1932, the Fruit Industry Sugar Concession Committee allocated the following amounts in the various States of the Commonwealth :—

	£
New South Wales	40,172
Victoria	86,421
Queensland	24,766
South Australia	18,145
West Australia	1,339
Tasmania	37,884
Commonwealth	£208,727

It is also of interest to record the fact that the rates of export sugar rebate for the twelve months ended 31st August, 1932, averaged £17 16s. 8d. per ton on fruit products, and £24 1s. 8d. per ton on other goods. These rebates are deducted from the ordinary home consumption manufacturing prices of same, viz., £36 11s. 9d. per ton for ordinary goods, and £30 6s. 8d. per ton for fruit products. The effect during the twelve months in question has been to make Australian refined sugar available for the export trade in manufactured goods at £12 10s. per ton net average.

Last year the yields of cane and sugar per acre in the different sugar districts were as under :—

District.	Tons Cane per acre.	Tons 94 N.T. Sugar per acre.
Mossman to Ingham	21·46	3·10
Lower Burdekin District	22·41	3·37
Proserpine	11·81	1·74
Mackay to St. Lawrence	11·65	1·85
Bundaberg, Gin Gin, &c.	13·91	1·85
Maryborough, Childers, &c., to Gympie	13·43	1·85
Nambour and Beenleigh	14·36	1·87
State Average	17·29	2·49

In his 1931 Report, the Registrar-General shows the average acreage grown by cane planters in Queensland to be as follows :—

	Acres.
Cairns to Townsville	55
Ayr to Mackay	46
Bundaberg to Bauple	32
Maroochy (Nambour) to Beenleigh	10
Average	42

This brings the average acreage per farmer to 42 tons, which is one acre higher than the previous year.

2. Figures of the 1931 Crop—continued.

The number of sugar mills in Queensland is now 34, the small Alberton Mill at Beenleigh having ceased operations. There are two refineries—one at Brisbane and one at Bundaberg. Other sugar refineries are situate at Sydney, Melbourne, Adelaide, and Perth.

The value of the Queensland output of sugar in 1931 is given by the Registrar-General at £11,495,964.

Molasses Produced.

	Gallons.
Sold to distilleries	3,235,075
Burnt	7,075,965
Used or sold for feed	2,940,551
Sold for other purposes	47,276
In stock	1,350,769
Manure	1,753,086
Run to waste	910,418*
Total	17,313,140

* This is relatively the smallest amount of molasses ever wasted.

Actual Yields of Cane, 1931.

The table below shows the amount of cane which was crushed by the mills in 1931, as supplied in their final returns made early in 1932 for the purpose of assessment under the Sugar Experiment Stations Act :—

Mills.	Tonnages Crushed 1931 Season.
Mossman	94,561
Hambledon	235,588
Mulgrave	241,910
Babinda	238,536
Goondi	196,646
South Johnstone	233,752
Mourilyan	168,802
Tully	256,569
Victoria	198,401
Macknade	213,373
Invicta	74,591
Pioneer	124,508
Kalamia	144,736
Inkerman	175,231
Proserpine	117,347
Cattle Creek	54,049
Racecourse	89,338
Farleigh	99,802
North Eton	46,474
Marian	106,567
Pleystowe	106,659
Plane Creek	126,442
Qunaba	49,154
Millaquin	108,378
Bingera	121,117
Fairymead	123,984
Gin Gin	38,247
Childers	66,246
Isis	67,599
Maryborough	26,746
Mount Bauple	27,375
Moreton	50,932
Rocky Point	9,391
Alberton	978
Eagleby	1,100
	4,035,129*

* This agrees fairly closely with the figures supplied to the Registrar-General. It discloses an increase of 92,551 tons of cane over the October estimate, and an increase of 369,694 tons of cane over the estimate formed in June, 1931, and shows the influence of the mild growing weather experienced during the 1931 winter.

2. Figures of the 1931 Crop—continued.

COMPARATIVE PROGRESS OF THE INDUSTRY IN THE PAST THIRTY-THREE YEARS.

During the last thirty-three years the acreage from which cane is crushed has trebled, and the yield of sugar has greatly increased. The following table shows the advances the industry has made, especially in recent years:—

Table showing Total Acres Cultivated and Crushed and Total Yields of Cane and Sugar per Acre for a Period of Thirty-three Years.

Year	Acres Cultivated.	Acres Crushed.	Yield.	
			Tons Cane.	Tons Sugar.
1899	110,657	79,435	1,176,466	123,289*
1900	108,535	72,651	848,328	92,554
1901	112,031	78,160	1,180,091	120,858
1902	85,838	59,102	641,927	76,626
1903	111,536	60,375	823,875	91,828
1904	120,317	82,741	1,326,989	147,688
1905	134,107	96,093	1,415,745	152,722†
1906	133,284	98,194	1,728,780	184,377
1907	126,810	94,384	1,665,028	188,307
1908	123,902	92,219	1,433,315	151,098
1909	128,178	80,095	1,163,569	134,584
1910	141,779	94,641	1,840,447	210,756
1911	130,376	95,766	1,534,451	173,296
1912	141,652	78,142	994,212	113,060
1913	147,743	102,803	2,085,588	242,837
1914	161,195	108,013	1,922,633	225,847
1915	153,027	94,459	1,152,516	140,496
1916	167,221	75,914	1,579,514	176,973
1917	175,762	108,707	2,704,211	307,714
1918	160,534	111,572	1,674,829	189,978
1919	148,469	84,877	1,258,760	162,136
1920	162,619	89,142	1,339,455	167,401
1921	184,513	122,956	2,287,416	282,198
1922	202,303	140,850	2,167,990	287,785
1923	219,965	138,742	2,045,808	269,175
1924	253,519	167,649	3,171,341	409,136
1925	269,509	189,466	3,668,252	485,585
1926	266,519	189,312	2,952,662	389,272
1927	274,838	203,748	3,555,827	485,745
1928	283,476	215,674	3,736,311	520,620
1929	291,660	214,880	3,581,265	518,516
1930	296,070	222,044	3,528,660	516,783
1931	309,818	233,304	4,034,300	581,276

* Raw sugar of 88 net titre to 1904. † Raw sugar of 94 net titre to 1931.

2. Figures of the 1931 Crop—continued.

Table showing Yield of Cane and Sugar per Acre and Tons of Cane required to make One Ton of Sugar during Thirty-three Years.

Year.	Tons Cane per Acre.	Tons Sugar per Acre.	Tons Cane to 1 Ton Sugar.
1899	14·81	1·55	9·54
1900	11·68	1·28	9·44
1901	15·10	1·55	9·76
1902	10·86	1·30	8·38
1903	13·65	1·52	8·97
1904	16·04	1·78	8·99
1905	14·73	1·59	9·27
1906	17·61	1·88	9·38
1907	17·64	2·00	8·84
1908	15·54	1·64	9·49
Ten Years' Average	15·04	1·63	9·20
1909	14·53	1·68	8·65
1910	19·45	2·23	8·73
1911	16·02	1·81	8·85
1912	12·72	1·45	8·79
1913	20·29	2·36	8·59
1914	17·80	2·09	8·51
1915	12·20	1·49	8·20
1916	20·81	2·33	8·93
1917 ‡	24·88	2·83	8·79
1918	15·01	1·70	8·82
Ten Years' Average	17·52	2·01	8·69
Nine Years' Average without 1917	16·53	1·90	
1919	14·83	1·91	7·76
1920	15·03	1·88	8·00
1921	18·60	2·30	8·11
1922	15·39	2·04	7·53
1923	14·75	1·94	7·6
1924	18·92	2·44	7·7
1925	19.36	2·56	7·4
1926	15·45	2·06	7·52
1927	17·45	2·38	7·3.
1928	17·32	2·41	7·18
Ten Years' Average	16·74	2·24	7·46
1929	16·67	2·41	6·91
1930	15·89	2·33	6·83
1931	17·29	2·49	6·94

‡ This year (1917) upset averages because there was so great an amount of stand-over cane cut that the average yield of both cane and sugar was much above normal. If we take the average of the nine years from 1909 to 1918 and exclude 1917 we get 16·53 tons of cane and 1·90 tons of sugar, which is a much fairer comparison, and shows that the improvement which has taken place each decade is progressive.

The lowest average yield of cane per acre in a district in 1931 was 11·65 tons at Mackay, and the highest 22·41 tons at Ayr.

Last year the ten mills north of Townsville produced 300,185 tons of sugar, while the twenty-five south of Townsville produced 281,091 tons.

3. Approximate Estimate of the 1932 Crop.

The cane crop this year will be much lower than that of 1931, principally due to the unfavourable season experienced south of Mackay, which has been accentuated by severe frosts in many southern areas. Fortunately, no floods or cyclones have occurred in North Queensland, and while no regular wet season, as generally known, has been experienced this year, the rainfall has been well distributed and has kept the cane moving.

Estimated Crop of Cane, 1932 Season.

Mill.	Approximate estimate furnished by Mills at end of October. Tons.
Mossman	106,612
Hambledon	214,000
Mulgrave	220,000
Babinda	208,000
Goondi	168,000
South Johnstone	239,000
Mourilyan	167,000
Tully	262,000
Victoria	237,000
Macknade	247,000
Invicta	78,400
Pioneer	132,400
Kalamia	168,000
Inkerman	167,949
Proserpine	122,000
Cattle Creek	61,000
Racecourse	100,000
Farleigh	99,000
North Eton	41,274
Marian	98,004
Pleystowe	100,000
Plane Creek	122,000
*Qunaba / Millaquin	27,632
Bingera	27,237
Fairymead	53,031
Gin Gin	5,170
Childers	8,965
†Isis	17,689
Maryborough	7,228
*Mount Bauple	(‡4,628)
Moreton	50,000
Rocky Point	8,500
Eagleby	1,035
Total	3,569,754

* Did not crush owing to droughty conditions.
† Including cane from Mount Bauple.
‡ Crushed by Isis.

If the estimate formed by the mills in October is realised, the cane crop should amount to about 3,569,754 tons for Queensland.

The tons of cane required to make one ton of 94 net titre sugar are expected to be somewhere about 6·9, which would give an approximate yield of 517,000 tons of 94 net titre sugar for Queensland. This would amount to 64,000 tons less than manufactured last year.

At the same time the yield of 94 net titre sugar from New South Wales is anticipated to be about 17,500 tons; this added to the Queensland yield above would make a total tonnage of 94 net titre cane sugar for Australia of 534,500.

A factory for manufacturing sugar from beetroots exists at Maffra, in Victoria. This factory turns out a high grade of white granulated sugar, which is usually sold to Government institutions and on the local market. During the past campaign 5,428 tons of sugar were manufactured from 41,985 tons of beets. The area harvested was 3,173 acres. It required 7·73 tons of beet to produce 1 ton of white sugar, which is decidedly higher than last year (7·0). The average sugar in beet was 15·91 per cent.

4.—Work of the Bureau.

The administrative work of the Bureau is carried out in offices situated within the building of the Department of Agriculture and Stock. Such offices, together with the Soils, Pathological, and Technological Laboratories, were opened in 1930, and are now in working order. Visitors are at all times made welcome, and, apart from canegrowers and sugar millers, a large number of students from the University and Technical College frequently come along for information.

Head Office work consists of general correspondence, giving of advice on sugar matters generally, the preparation and circulation of statistical data relating to the industry, and the direction of the Sugar Experiment Station work, on consultation with the officer in charge of the different divisions. These are as follows:—

Division of Soils and Agriculture—Dr. H. W. Kerr, Sugar Soils Chemist.

Division of Pathology—Mr. A. F. Bell, Sugar Pathologist.

Division of Entomology—Mr. E. Jarvis, Entomologist.

Division of Sugar Mill Technology—Mr. E. R. Behne, Assistant Technologist.

The officer in charge of each division is responsible for the work of his branch.

Reports from the officers in charge of the respective divisions will be found in subsequent pages of this Report.

Sugar Experiment Stations are established at South Johnstone, near Innisfail (Northern), Mackay (Central), and Bundaberg (Southern). These Stations have chemical laboratories attached. Laboratories and officers for entomological research work are situated at Meringa, near Cairns (Northern), Mackay (Central), and Bundaberg (Southern).

Overseas Visits of Officers.

During the present year two officers of the Bureau were absent from Australia for a period on official business. Mr. A. F. Bell represented the Queensland Government at the Fourth Congress of the International Society of Sugar Cane Technologists, held in Porto Rico during the month of March, 1932. A report on this visit has already been prepared and circulated. As a result of representations made in Porto Rico, it is pleasing to know that Conference accepted the invitation of the Queensland Government to hold the Fifth Congress of the Society in this State in 1935.

Mr. E. J. R. Barke, who carries out the duties of Cane Breeder in addition to those of Chemist in Charge of our South Johnstone Station, visited Java in March of this year, for the purpose of acquiring a more intimate acquaintanceship with the breeding methods employed at the Java Sugar Experiment Station.

In a report prepared by Mr. Barke on his return, keen appreciation was expressed of the high standard of the work in Java, and also of the facilities which were afforded him in acquiring the information he desired.

5.—Work of the Division of Soils and Agriculture.

REPORT BY Dr. H. W. KERR, SOILS CHEMIST, FOR THE YEAR ENDING 31st OCTOBER, 1931.

Favourable climatic conditions in the Northern areas again assisted us in our field investigations during the past season. The returns from experimental plots, both on farms and on our Northern station, have added materially to our knowledge of the fertilizer requirements of the important soil types in those areas. Our farm fertility trials have already yielded sufficient information to warrant the inauguration of quantitative plant-food trials, as opposed to the earlier qualitative experiments, which our lack of knowledge necessitated. All results clearly confirm the repeatedly expressed opinion that the soils of the humid coastal belt are essentially very poorly supplied with available plant foods, and successive returns stress the need for heavier applications of fertilizer than are at present employed if more profitable crops are to be harvested and the fertility of the land is to be maintained. Response to sulphate of ammonia has been particularly consistent in its influence on crop yield, notably with ratoons. Increases of 12 tons of cane per acre, due to applications of this material, have been recorded. This is indeed to be expected, when the natural deficiency in humus from which these soils suffer is appreciated.

5. Work of the Division of Soils and Agriculture—continued.

In the Burdekin area marked advances are being made in fertilizing practice. Our farm experimental plots in that district have clearly demonstrated the value of nitrogenous manures, and the use of these materials is playing a large part in the solution of the ratooning problem.

Unfortunately, the Central and Southern districts were not well treated by seasonal conditions during the period. Mackay experienced a season similar in many respects to that of 1931, while the Southern areas were even less fortunate. In the Bundaberg district only 5 inches of rain fell during the first nine months of 1932, and drought effects coupled with severe frost damage during the past winter resulted in an almost complete crop failure. Under these conditions it is obvious that reliable field experimental results are impossible.

Trash Conservation.

As our cane lands become older it becomes more clearly evident that the humus deficiency common to our soils is a factor seriously limiting crop production. This is particularly true of the soil types of the Central and Southern districts, where the moisture retentive capacity of the soil is low—an unfortunate circumstance in rainfall-deficient areas. The utilisation of all available trash affords an excellent means of effecting an improvement in this regard, and during the past harvesting season steps were taken for the establishment of "trash" plots on each of our stations. Compost heaps have been built up from cane trash and tops, and, following decomposition, the value of the resulting artificial manure will be investigated. By repeating the applications annually the treated plots will be retained permanently, and evidence of cumulative effects will thus be detected.

Soil Survey Work.

The soil moisture problem in the Bundaberg area is being further studied by Mr. N. J. King, Soil Survey Officer to the Department, whose services have again been made available to the Bureau for a period. An attempt is being made to follow the water economy of the important soil types of the area. Our knowledge in these matters is sadly deficient, and only by an intensive study of the problem can we hope to determine whether the available moisture is being conserved and utilised to the best advantage.

Irrigation.

There is no doubt that the possibilities of irrigation should receive closer attention from growers in those areas where rainfall distribution is generally unfavourable. Where the projected scheme assumes major proportions the matter is one for the community as a whole; but it is also true that facilities for individual enterprise frequently exist, and it is felt that this line of endeavour will receive closer attention in the future. During the past droughty season we received numerous requests for water analyses from farmers who planned to exploit underground supplies existing on their properties. In many instances adequate flows of good quality water had been located, and it is to be sincerely hoped that the projects under consideration will not be abandoned with the advent of favourable rains.

That sugar cane is a water-loving plant is well appreciated; and even in the more humid areas of the State serious reductions in crop yield are effected by protracted dry spells. Included in the report of our South Johnstone Station will be found the results of a minature irrigation trial, and it is noteworthy that the water applied over and above the 150 inches of rainfall for the season was responsible for a tremendous increase in crop.

With respect to irrigation matters in the established Burdekin area, the water survey has been practically completed. Analyses were made of all available samples, and a review of the results presented in a pamphlet issued during the past year. On the whole, the waters were of good quality, and where the presence of excessive injurious salts was detected growers were advised to investigate the possibilities of locating a more favourable drift. A field experiment to determine the value of corrective soil treatments was laid down on Kalamia Estate, and the effects of the applied materials will be followed closely.

Utilisation of Mill By-products.

It is pleasing to record the increased attention which the agricultural value of by-products is receiving. During the past year the value of molasses as a fertilizer was further demonstrated on our Mackay and South Johnstone Stations. The trials carried out at Bundaberg in 1930-31 demonstrated conclusively that the use of this

5. Work of the Division of Soils and Agriculture—continued.

material has a pronounced influence on crop yields from red volcanic loams; and the latest trials, recorded in this Report, indicate the results to be anticipated from soils which do not exhibit marked response to potash fertilization. In these latter cases it is practically certain that the major influence of the molasses is dependent on the nitrogen content of this by-product. Where the demand for molasses as a fertilizer exists, it is wasteful to utilise the material as fuel; for, though a large proportion of the potash and phosphoric acid remains in the furnace ash, the nitrogen is entirely lost.

Attempts are being made to deal with subsider muds so that they may be handled more expeditiously and economically, and an increasing demand for furnace ash is being experienced in many of our districts.

Cane Breeding and Variety Propagation.

During the year the seedling propagation on our three stations was placed under the direct supervision of Mr. E. J. R. Barke, our Cane Breeder. In this way it has been possible to maintain closer contact with the work and eliminate many of the early difficulties which were encountered. A review of the work of the past year is presented elsewhere in this Report.

Of the promising new varieties of cane which are now awaiting farm trial, P.O.J. 2878 is the only one which will be distributed this year. In 1928 we received two setts of this variety from Java, and this year almost 200 acres have been planted. Plots have been established in all mill areas, and it is anticipated that during the 1933 planting season allotment will be made in parcels of the order of 10 cwt. to each grower. This is a departure from the old method of distribution, when a few sticks of promising varieties were given to farmers desiring them. The revised plan has as its objective the assurance of an abundant supply of disease-free planting material at the time when total stocks of the new varieties are relatively low; and the farm propagation plots enable closer observations to be made on the behaviour of new canes under a wide range of environmental conditions.

Maturity Testing of Cane.

In the 1928 Annual Report the writer stressed the value of maturity testing of cane as a guide to crop harvesting. In the absence of specific data, the grower is forced to rely on past experience and intuition in determining when a crop is at its peak of sugar content, and investigation shows that the margin of probable error in judgment is great. During the 1931 season Mr. McBryde, of the Farleigh Mill, instituted a campaign with the object of determining the practicability of maturity testing under our Queensland conditions. The results of his work excited great interest amongst sugar producers. A committee was appointed to investigate the project further, and report to the 1933 Annual Conference of the Queensland Society of Sugar Cane Technologists.

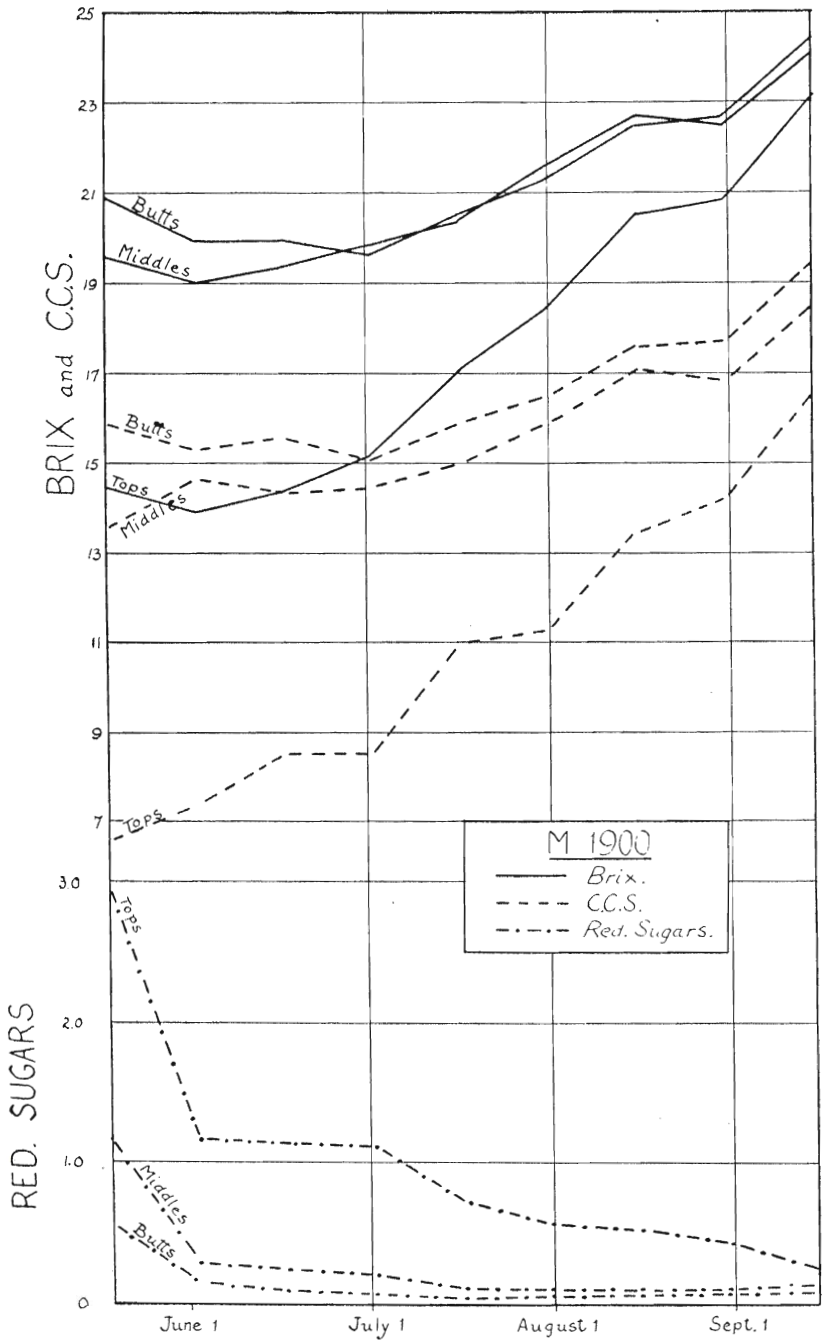
In connection with this investigation a large number of tests was carried out on our Mackay Sugar Experiment Station, and some of the results obtained are presented herewith.

The idea of maturity testing is not new; it has been pursued on the Javan plantations over a number of years. The plan of procedure drawn up for our trials is based on the results of their investigations. The theory underlying the method is briefly as follows:—If a stick of cane be divided into a number of sections, and the juice from each section analysed separately, it would be found, in general, that the composition of the juice varies in a regular manner from one end of stick to the other. If the crop were immature, the results would show that the juice from the internode at the butt of the stick contains the highest percentage of sucrose, has the the highest purity, and the lowest proportion of reducing sugars. The uppermost internode would yield a juice comparatively rich in reducing sugars, poor in sucrose, and of low purity.

Progressive sampling reveals the interesting fact that as the crop matures the composition of the juice from the various sections of the cane approaches uniformity—when the sucrose and purity of the juice attain maximum values and the reducing sugars are at a minimum. The c.c.s. in cane has then attained its maximum value, and the crop if harvested at this time will yield the maximum return to the grower. The juice will maintain this peak for a variable period—depending on variety and environmental conditions—and will then deteriorate. Inversion takes place, and the c.c.s. content of the cane steadily diminishes, commencing with the lower internodes of the sticks and finally affecting the entire cane.

5. Work of the Division of Soils and Agriculture—continued.

In practice, the customary method of procedure is to divide the stick into three sections of equal length—top, middle, and butt. As the method involves sampling the field of cane under review, a multiplicity of sticks is necessary to ensure that the selected sample is truly representative of the entire crop. In the work carried out at Mackay, ten sticks of cane were selected from each of the test blocks. The ten sticks were divided into three equal lengths, and the analysis carried out on the three samples of juice obtained from the composited sub-samples. It was one of the objects of this work to ascertain which determination (or determinations) served as the most reliable and accurate criterion of maturity, and therefore the juices were all analysed for brix, polarisation,

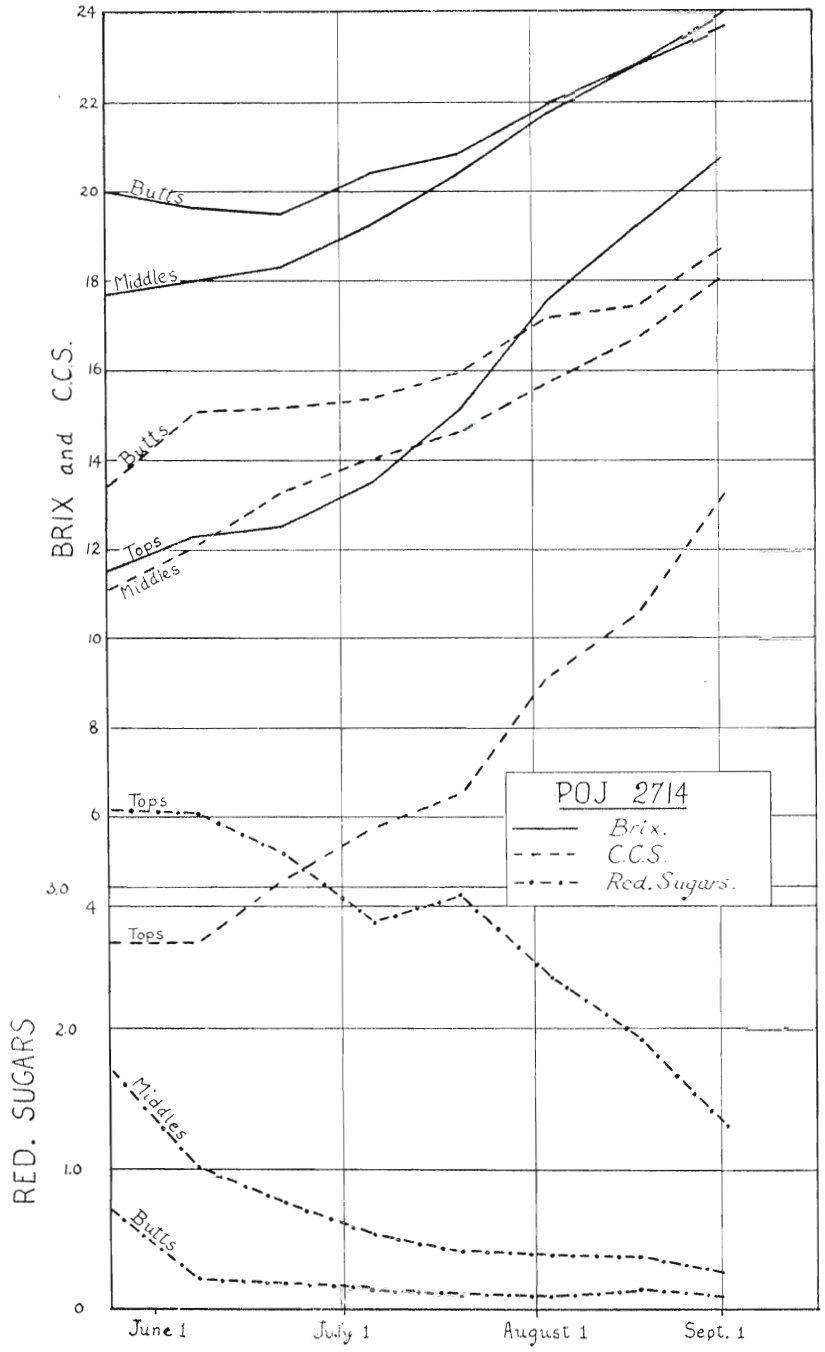


and reducing sugars. The percentage juice extraction on the sample mill was considered an important factor, and an attempt was made to duplicate standard conditions in all tests. Determinations showed extractions over a range of 55-60 per cent. juice on cane by the method employed.

In a general way there is a definite correlation between cane variety and period of maturity. Clark's Seedling and H.Q. 285 are recognised as early maturing canes, Q. 813

5. Work of the Division of Soils and Agriculture—continued.

as a mid-season maturer, and so on. In order to introduce this factor, three blocks were selected of each of four major varieties in the Mackay area—Clark's Seedling, Q. 813, M. 1900 Seedling, and P.O.J. 2714. The selected blocks were fairly well distributed over both rich and poor soils; seven blocks carried plant cane and five first ratoons. In addition, a block of plant S.J. 2 was tested—this being a high c.c.s. seedling raised at South Johnstone, which is planted in certain localities in preference to Clark's Seedling.



The tests were commenced in May, and continued at fortnightly intervals until all blocks were harvested. Naturally, growers were guided by the results of our tests, and, therefore, we were not able to secure data on the influence of over-maturity.

In order to show the nature of the results obtained, the attached tables and graphs are presented. From the graphs the general trend of the several factors is clearly demonstrated, and it is quite evident that the condition of the P.O.J. 2714—which was the only truly late-maturing variety of those selected— was considerably removed from the peak of maturity when the crop was cut. An interesting feature of the tests is the

rapid rise in c.c.s. values as maturity is approached, emphasising the necessity for determining the exact point of maximum c.c.s., and—what is equally important—harvesting the entire crop without delay, if the highest monetary returns are to be obtained.

A complete review of the subject will be made elsewhere when the full returns from all sugar districts are to hand.

CLARK'S SEEDLING (Plant Crop).

Brix.

Date.	5th May.	8th June.	21st June.	5th July.	19th July.	2nd August.
Tops	14·0	13·7	15·5	17·0	18·4	20·0
Middles	19·6	19·4	19·6	19·8	20·1	21·0
Butts..	21·0	19·8	19·9	19·7	20·0	20·5
Pol.						
Tops	10·3	10·3	12·5	13·7	15·4	16·9
Middles	17·6	18·3	18·5	18·5	18·7	19·6
Butts..	19·7	19·0	19·1	18·5	18·8	19·3
Reducing Sugars.						
Tops	2·73	1·90	1·86	1·67	1·28	1·32
Middles	1·04	·38	·37	·22	·21	·22
Butts..	·53	·18	·16	·10	·13	·14
C.C.S.						
Tops	7·0	7·2	9·2	10·1	11·7	12·8
Middles	13·9	14·9	15·1	14·9	14·9	15·8
Butts..	16·0	15·6	15·7	15·0	15·3	15·7

CLARK'S SEEDLING (Plant Crop).

Brix.

Date.	24th May.	10th June.	23rd June.	5th July.	22nd July.	5th August.	18th August.
Tops ..	14·1	16·2	17·4	17·3	18·8	19·2	20·6
Middles ..	19·6	20·0	19·9	19·8	20·0	20·3	21·6
Butts ..	20·3	20·3	19·9	19·0	19·3	19·5	20·4
Pol.							
Tops ..	10·9	12·9	15·8	15·0	16·4	17·6	18·6
Middles ..	18·4	19·1	19·4	18·8	18·8	19·0	20·4
Butts ..	19·4	19·7	19·6	18·3	18·5	18·8	19·2
Reducing Sugars.							
Tops ..	1·54	1·94	1·08	·83	·68	·45	·17
Middles ..	·40	·23	·10	·12	·14	·11	·11
Butts ..	·18	·07	·04	·05	·07	·10	·08
C.C.S.							
Tops ..	7·7	9·4	12·6	11·6	12·8	14·1	14·8
Middles ..	15·0	15·6	16·1	15·4	15·3	15·4	16·6
Butts ..	16·0	16·3	16·4	15·1	15·1	15·5	15·6

S.J. 2 (Plant Crop).

Brix.

Date.	18th May.	21st June.	5th July.	19th July.	2nd Aug.	16th Aug.	31st Aug.	13th Sept.	27th Sept.
Tops	15·8	17·0	18·2	20·0	20·8	22·0	23·1	23·6	24·1
Middles	20·2	20·9	20·8	21·7	22·7	23·7	23·9	24·1	24·8
Butts	21·3	21·0	20·6	21·4	22·3	23·2	23·7	24·2	25·0
Pol.									
Tops	12·0	13·7	15·3	17·2	17·9	19·5	20·9	22·0	22·0
Middles	18·2	19·2	19·5	20·4	21·4	22·6	22·6	23·1	23·4
Butts	19·9	19·3	19·7	20·4	21·3	22·3	22·5	23·2	23·7
Reducing Sugars.									
Tops	..	..	1·54	1·43	1·47	1·11	·80	·61	·43
Middles	..	..	·38	·29	·29	·24	·31	·31	·26
Butts	..	..	·20	·16	·20	·22	·24	·28	·23
C.C.S.									
Tops	8·4	10·1	11·5	13·2	13·7	15·3	16·5	17·6	17·5
Middles	14·3	15·3	15·7	16·5	17·3	18·4	18·3	18·8	19·0
Butts	16·0	15·4	16·0	16·6	17·4	18·2	18·3	18·9	19·3

5. Work of the Division of Soils and Agriculture—continued.

Q. 813 (Ratoon Crop).

Brix.

Date.	24th May.	10th June.	23rd June.	5th July.	22nd July.	5th Aug.	18th Aug.	2nd Sept.
Tops	14·4	17·1	17·5	16·9	18·3	20·0	20·4	21·1
Middles	19·9	20·6	20·6	20·8	21·5	21·8	22·2	22·7
Butts	20·1	20·6	20·7	20·7	21·6	21·7	22·2	22·6
Pol.								
Tops	11·3	14·0	15·7	14·9	16·0	18·1	18·6	19·4
Middles	18·7	19·7	20·2	19·7	20·4	20·7	21·1	21·6
Butts	19·2	19·8	20·3	19·7	20·8	20·6	21·2	21·8
Reducing Sugars.								
Tops	2·00	1·79	1·07	1·05	·60	·45	·37	·22
Middles	·34	·20	·13	·12	·11	·14	·10	·05
Butts	·23	·08	·07	·05	·06	·09	·08	·07
C.C.S.								
Tops	7·9	10·2	12·1	11·4	12·2	14·1	14·6	15·3
Middles	14·8	15·6	16·5	15·8	16·4	16·6	17·0	17·7
Butts	15·3	16·0	16·5	15·8	16·8	16·5	17·1	17·6

Implements.

During the year a mole drainer was imported from England, and demonstrated to farmers throughout the cane areas. Under suitable conditions, the implement did excellent work, and it can be definitely recommended as an implement capable of effecting satisfactory and inexpensive drainage. It will be used to drain a trial field in the Proserpine area in advance of the coming wet season, as a wireworm control measure, and later it will be put to work at our South Johnstone Station.

Field Days.

During the past winter and spring the writer conducted approximately forty farmers' field days and meetings, distributed throughout all cane districts, except Bundaberg. Attendances were very satisfactory, in general, particularly in out-lying areas. In certain of the larger centres the response was rather disappointing. It is felt that with a little co-operation on the part of all growers these meetings could be made very successful. They would combine all the advantages of an Experiment Station function, in addition to that of affording an opportunity for our officers to discuss with growers the specific difficulties in the particular circumscribed area under review.

Wireless Lectures.

A series of wireless lectures was delivered in June last, dealing with the fundamental principles of soil fertility and cultivation, together with a discussion of present farm methods. The lecturettes were also issued in pamphlet form for distribution amongst growers.

Farm Fertility Trials.

The results of the 1931 farm fertility trials were published as Farm Bulletin No. 3. Farmers find in these results an admirable guide to their fertilizer requirements, while they are extremely valuable to our officers in advising growers in this respect. As an outcome of our recommendations, based on the results of field trials, the fertilizing programme in several areas has undergone a radical revision, and the employment of more suitable plant-food mixtures is reflected in the enhanced crop yields which are being harvested.

During the 1932 planting season further trials were set out on the farms of the following growers :—

Northern Division.

H. Crawford, Mossman
S. J. Page and Son, Edmonton
G. Fox, Highleigh
J. Juhas, South Johnstone
Larsen Bros., Mourilyan
A. Newman, South Johnstone
H. H. Smith, Mundoo

5. Work of the Division of Soils and Agriculture—continued.

Central Division.

G. E. Watt, Pioneer
E. Lewty, Pioneer
P. King, Home Hill
E. Nielsen, Septimus
A. S. Hamilton, Rosella
A. Petersen, Homebush
G. Windsor, West Plane Creek
T. A. Lilliendahl, Koumala
Hill and Sons, Peri
E. O'Brien, Sunnyside
A. McNicol, Palmyra
Dunne Bros., Kolijo

Southern Division.

E. H. Newitt, South Kalkie
A. Gordon, senior, Clayton
E. H. Gladwell, North Bundaberg
F. Knudsen, Elliott Heads
E. A. Nielsen, Millbank
J. A. Carlson, Nikenbah
P. H. Geysing, Yerra
W. Ramm, Maroochy River
G. E. Nuttall, Rosemount

In addition, a large proportion of the trials of the present season have been refertilized in the ratoons. Subsoiling trials were also set out in the Central district, on the following farms :—

F. Stevens, Homebush
J. McKay, Palmyra
A. McNicol, Palmyra.

We would convey our sincere appreciation to all growers who have afforded us the necessary assistance and co-operation in this project ; and also to the following firms who have provided us with the fertilizer required for all farm trials :—

Messrs. A.C.F. and Shirley's Fertilizers, Limited ;
Imperial Chemical Industries (Aust. and N.Z.), Limited ;
Pacific Potash Limited.

Work of the Laboratories.

With the provision of additional equipment and facilities at our Mackay and South Johnstone laboratories, these stations are now competent to undertake a large proportion of the routine soil studies in their respective districts. At the Brisbane laboratory, soil investigational work, covering a wide range, has been performed during the year. Soil micro-biological processes have received close attention, including studies of nitrification, and trash and green manure decomposition. The influence of the residues from the latter process on the physical properties of the soil is of particular interest to us at this time. A large number of maturity tests has been carried out both at Mackay and in Brisbane. The analysis of soils from farm fertility trial blocks has been continued, and we should soon be in a position to estimate the true value of our laboratory tests in the light of field response to added fertilizers. Irrigation waters again constitute a large proportion of the analyses performed, while the number of by-product samples submitted by the mills has shown a marked increase.

The following is a summary of the analyses performed at the Brisbane laboratory for the year ended 31st October, 1932 :—

Soils	198
Waters	95
By-products	24
Sugar-canes	94
Sugar	1
Limes and fertilizers	17
Miscellaneous	11
Total	440

5. Work of the Division of Soils and Agriculture—continued.

WORK OF THE EXPERIMENT STATIONS.

The following are the detailed reports of the Cane Breeder and the Experiment Station Chemists, giving the full results of the experiments harvested during the year, together with an account of other work performed on the stations:—

SEEDLING PROPAGATION.

E. J. R. Barke, Cane Breeder.

The crossing work during the 1932 season was carried out at the Northern Sugar Experiment Station, South Johnstone, and at our Freshwater Sub-station, Cairns.

The cane arrowed a little later than usual, and the percentage was below that of last year. Altogether fifty-five different marriages were employed, and these are set out in the table hereunder:—

Crosses carried out during the Breeding Season, 1932—South Johnstone and Freshwater.

Female.	Male.
Badila	D. 1135, S.C. 12/4, Q. 813, H.Q. 409, Kassoer, P.O.J. 2878, P.O.J. 2940, S. robustum, W. 4.
N.G. 16	D. 1135, S.C. 12/4, W. 4, Ewa 371, H.Q. 409, Q. 813, P.O.J. 2878, P.O.J. 2940.
N.G. 24	S.C. 12/4, W. 4, Ewa 371, R.P. 8., S.J. 3.
P.O.J. 213	H.Q. 409, D. 1135.
P.O.J. 2364	D. 1135, H.Q. 409, Badila, S.J. 4, S.J. 6D, 14D, 92D.
P.O.J. 2722	S.C. 12/4.
P.O.J. 2875	D. 1135.
P.O.J. 2878	P.O.J. 2940, S.C. 12/4, S.J. 102C, S.J. 1D.
Co. 227	D. 1135, S.C. 12/4.
B. Cheribon	S.C. 12/4, Ewa 371, S. robustum, S.J. 2994D.
Uba	S.C. 12/4.
R.P. 6	S.C. 12/4, S.J. 1D.
M.Q. 1	S.C. 12/4, P.O.J. 2878.
7 R. 428	S.C. 12/4, Badila.
P.O.J. 2725	H.Q. 409.
Oramboo	S.C. 12/4, Q. 813, Kassoer, H.Q. 409.

Crossing Technique.

The technique employed in crossing work was similar to that of the 1931 season, with the introduction of a few modifications.

The adoption of the Hawaiian preserving solution, containing 0·01 per cent. sulphur-dioxide and 0·01 per cent. phosphoric acid, in place of 0·03 per cent. sulphur-dioxide, gave better results. The male canes placed in this solution continued shedding viable pollen for double the period of those placed in the 0·03 per cent. solution. In the case of female canes, only slightly better results were obtained, the number of germinations from these arrows being 21 per cent. of that obtained when the female was allowed to grow under natural conditions.

Controlled crosses represent 98 per cent. of our seed, and 2 per cent. comes from selfs of F1 and F2 generations.

Disease Resistance.

In co-operation with the Division of Pathology, leaf-scald resistance trials are carried out with each different marriage.

In 1931, 1,000 seedlings, representing 32 different matings, were inoculated with a suspension of the leaf-scald organism and planted out at Meringa. The results obtained from the December inspection are as follows:—

Cross.	Infection.
P.O.J. 2878 × S.C. 12 (4)	Nil.
P.O.J. 2940 × S.C. 12 (4)	Nil.
P.O.J. 2364 × S.J. 103B	Nil.
P.O.J. 2364 × S.C. 12 (4)	Nil.
P.O.J. 2878 × S.J. 1602C	Nil.
P.O.J. 2722 × S.C. 12 (4)	Nil.
P.O.J. 2722 × S.J. 42A	Nil.
P.O.J. 2875 × H.Q. 409	Nil.
N.G. 24 × P.O.J. 2940	80 per cent.
N.G. 24 × P.O.J. 2878	70 per cent.
N.G. 24A × P.O.J. 2940	68 per cent.
Oramboo × P.O.J. 2878	Nil.

Work of the Division of Soils and Agriculture—continued.

Cross.	Infection.
Oramboo × P.O.J 2940	2 per cent.
Oramboo × S.C. 12 (4)	Nil.
N.G. 24 × S.C. 12 (4)	35 per cent.
N.G. 24 × E.K. 28	98 per cent.
N.G. 16 × M. 33/95	25 per cent.
N.G. 16 × S.J. 2408c	10 per cent.
N.G. 16 × S.J. 5021c	Nil.
N.G. 16 × S.J. 1308c	Nil.
N.G. 16 × S.W. 499	40 per cent.
Badila × R.P. 6	Nil.
N.G. 16 × S.J. 5488c	35 per cent.
N.G. 16 × S.J. 2082c	Nil.
N.G. 16 × S.C. 12 (4)	Nil.
S.J. 3145c × S.C. 12 (4)	Nil.
M. 55/453 × S.C. 12 (4)	Nil.
S.J. 4 × S.C. 12 (4)	Nil.
Badila × S.C. 12 (4)	Nil.
M. 291/08 × E.K. 28	80 per cent.
S.J. 4012c × E.K. 28	45 per cent.

This trial will be continued in the ratoons, and all plants will be reinoculated.

Inter-specific Crosses.

Inter-specific crosses have been carried out between *S. officinarum*, *S. spontaneum*, and *S. robustum*. In crosses of *S. officinarum* and *S. spontaneum* all progeny are of the *Kassar* type, and exhibit a high degree of resistance to leaf-scald. In the case of *S. robustum* crossed with the noble variety, the resulting canes are of fairly stout habit, fair sucrose, but are not so resistant to disease.

The second nobilization of *S. spontaneum* and *S. robustum* has been carried out this year, the noble blood being chiefly that of our standard variety—Badila.

Inter-generic Crosses.

An attempt has been made to cross *S. officinarum* and *S. spontaneum* hybrids with a specie of *Erianthus*. In all cases *Erianthus* was used as the male, and from these results twenty-four seedlings have been obtained.

1931 Seedlings.

These seedlings made fast growth, and are the most vigorous yet produced. All these canes have undergone a first selection, 152 being chosen for further trials.

The method of selection is based on vegetative characteristics, together with the total solids as determined by a field refractometer. Three samples of juice from different sticks in each stool are used for examination, and the minimum brix allowed being 21 per cent. The most outstanding seedlings were derived from combinations of P.O.J. 2878, this variety being used as a female at South Johnstone and as a male at Freshwater.

Seedling Work at Mackay and Bundaberg.

Of the 900 seedlings grown at Mackay during the 1931-32 season, 25 have been selected for further planting. Owing to the fact that a large number of seedlings was not planted until late in the year, the plot has been ratooned, and a further selection will be made in 1933. The most outstanding crosses were—

N.G. 16 × H.Q. 409
N.G. 16 × S.C. 12/4
P.O.J. 2878 × S.C. 12/4
Badila × H.Q. 409.

The present season has been the most successful so far experienced, in the matter of the number of seedlings raised and planted in the field. Already about 3,000 have been set out, and it is expected that over 4,000 will be planted before the middle of November. The difficulties experienced in previous years, when large numbers of the young seedlings perished in the flats, have been successfully eliminated.

Owing to the prolonged drought experienced in Bundaberg during the past year, conditions were decidedly unfavourable for seedling work. With the assistance of light irrigation it was possible to maintain growth, but the backward nature of the crop precluded any selection this year. In all, about 1,750 seedlings were planted out, including 150 raised from seed received from Hawaii. Of the seed supplied from South Johnstone, that representing crosses of Oramboo, S.J. 4, and Badila with S.C. 12/4 yielded good germinations, while fair results were obtained from Pompey × D. 1135, N.G. 16 × S.J. 103B, S.J. 43B × S.J. 45B, and Badila × E.K. 28.

NORTHERN SUGAR EXPERIMENT STATION, SOUTH JOHNSTONE.

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

METEOROLOGICAL.

During the early planting months of April, May, and June, 1931, conditions were ideal for excellent germinations and rapid early growth. A dry spell was experienced during the months of September and October, and this was responsible for a slight check in growth. Favourable weather conditions prevailed until the end of January, when an unusually dry February followed; cane growth was severely checked, and where grubs had attacked the cane the crop showed signs of distress. From March until the end of the growing period conditions were favourable for continued growth, until checked by abnormally cold weather in June. During the past winter frosts were recorded on low-lying areas on one or two occasions.

Despite a heavier loss, due to grub damage, the tonnage per acre for the district should be higher than that for the 1930-31 season.

The following are the rainfall records taken at this station since the year 1919:—

Year.	Rainfall in inches.	Year.	Rainfall in inches.
1919	97·61	1926	77·50
1920	123·92	1927	138·11
1921	202·52	1928	118·63
1922	107·14	1929	129·53
1923	84·78	1930	145·54
1924	146·71	1931	137·26
1925	118·94	1932 (9 months)	114·34

Abstract of Meteorological Observations made at the Northern Sugar Experiment Station, South Johnstone, from the 1st September, 1931, to 31st August, 1932—Covering Period of Growth of Experiment Canes.

Month.	Rainfall in Inches.	Number of Wet Days.	Average Rainfall, 12 Years, 1920–1931.	Highest Shade Maximum.	Lowest Shade Maximum.	Mean Shade Maximum.	Highest Shade Minimum.	Lowest Shade Minimum.	Mean Shade Minimum.	Lowest Terrestrial Minimum.	Mean Terrestrial Minimum.	Mean Diurnal Range.	Mean Temperature, 9 a.m.	Mean Relative Humidity of the Air, 9 a.m.
September, 1931	0·85	8	3·33	88·0	79·5	83·0	72·0	55·0	64·0	53·0	62·0	19·0	75·3	74·5
October, 1931..	4·33	10	3·71	89·5	79·8	83·5	68·0	55·0	64·5	53·2	62·5	19·0	76·8	76·5
November, 1931	11·75	12	4·49	92·5	82·5	88·2	72·0	60·5	66·5	58·0	64·5	21·7	79·9	82·3
December, 1931	24·16	21	10·51	98·0	79·0	89·5	75·0	67·5	71·0	66·0	68·5	18·5	81·9	84·7
January, 1932	43·36	19	21·40	92·3	85·0	89·1	76·0	66·0	71·0	64·0	69·0	18·1	81·5	88·0
February, 1932	6·01	10	19·78	96·5	86·0	90·4	73·5	68·0	71·5	66·5	69·5	19·1	82·9	78·5
March, 1932 ..	27·19	24	27·80	89·5	79·0	85·7	74·5	67·0	72·0	64·0	69·5	13·7	79·9	85·5
April, 1932 ..	6·31	12	13·58	91·0	82·0	87·5	74·0	59·0	69·0	56·5	66·5	18·0	80·7	79·0
May, 1932 ..	16·95	28	10·55	89·0	77·0	84·2	68·8	46·5	60·2	44·0	58·0	24·0	74·9	83·0
June, 1932 ..	5·30	9	6·91	84·0	70·0	77·8	54·5	34·0	45·5	32·0	42·5	32·3	70·5	79·5
July, 1932 ..	3·66	13	3·81	80·5	71·5	76·0	65·0	37·5	47·5	34·5	45·0	28·5	62·9	76·0
August, 1932 ..	4·47	14	2·97	85·0	69·2	76·2	67·8	43·5	50·2	41·0	48·0	26·0	66·2	76·5
Year ..	154·34	180	128·84	..	..	..	..	..	..	..	..	..	..	*80·3

* Average.

Experiments Harvested during 1932.

1. *Fertilizer experiment.*—Amounts of nitrogen and phosphate—fallowed and non-fallowed land—second ratoon crop.
2. *Fertilizer and liming experiment.*—Amounts of nitrogen and potash—second ratoon crop.
3. *Fertilizer experiment.*—Amounts of nitrogen, phosphate, and potash—first ratoon crop.
4. *Fertilizer experiment.*—Value of phosphate in different fertilizers—nitrogen and time of application—first ratoon crop.
5. *Fertilizer experiment.*—Time of application of nitrogen—third ratoon crop.
6. *Molasses and fertilizer experiment.*—Plant crop.
7. *Varietal and fertility trial.*—Plant crop.
8. *Optimum growth rate experiment.*—Early and late plant cane.

Work of the Northern Sugar Experiment Station—continued.

FERTILIZER TRIAL ON FALLOWED AND NON-FALLOWED LAND (Second Ratoon Crop).

Plan and Yields :—

	Fallowed.	Non-Fallowed.
I.	2N 2P 37·6	1N 2P 34·8
	1N 1P 31·5	1N 1P 30·8
	1N 2P 33·6	2N 2P 36·8
	2N 1P 35·2	2N 1P 34·1
	C 19·8	C 17·4
II.	C 17·1	2N 2P 36·2
	2N 2P 35·4	2N 1P 33·1
	2N 1P 33·8	C 15·3
	1N 2P 32·8	1N 1P 30·6
	1N 1P 32·1	1N 2P 33·5

Block.—B3.

Variety.—Badila.

Harvested.—August, 1932.

Age of Crop.—11 months.

System of Replication.—Four randomised blocks—2 fallowed and 2 non-fallowed.

Plots.—0·134 acre.

Treatments.—All plots received a basal dressing of 100lb. muriate of potash per acre.

In addition—

C—No further manure.

1N—200 lb. sulphate of ammonia per acre.

2N—400 lb. sulphate of ammonia per acre.

1P—200 lb. superphosphate per acre.

2P—400 lb. superphosphate per acre.

Preparation of Land—Plant Crop.—

Fallowed Land.—Cowpeas planted November, 1928. Ploughed under June, 1929. After rotting of organic matter, land ploughed and harrowed four times. Planted August, 1929.

Non-fallowed.—Plant Crop. Previous cane stools ploughed out July, 1929. Land ploughed and harrowed four times. Planted August, 1929.

Ratoon Crops.—

Fallowed and Non-fallowed plots were ratooned according to the usual practice.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Blocks	1	6·84	6·84	..
Fallowed *v.* non-fallowed	1	1·99	1·99	1·4954
Fertilizers	4	923·31	230·83	3·8720
Errors	13	9·80	0·754	1·0101
Total	19	941·94	..	..

Standard error (4 plots) = $\sqrt{3·016}$ = 1·74, or 1·42 per cent.

Work of the Northern Sugar Experiment Station—continued.

Ratoon Crop).

Crop Yields.

Treatment.	Fallowed.			Non-Fallowed.		
	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	Per cent.	Tons.	Tons.	Per cent.	Tons.
C	**18.45**	16·8	**3.10**	**16.35**	16·5	**2.70**
1N 1P	**31.8**	16·1	**5.12**	**30.7**	16·2	**4.97**
1N 2P	**33.2**	16·1	**5.34**	**34.15**	16·0	**5.46**
2N 1P	**34.5**	16·0	**5.52**	**33.6**	16·0	**5.38**
2N 2P	**36.5**	15·9	**5.80**	**36.5**	15·95	**5.82**

Summary of Crop Yields—Plant, First and Second Ratoons.

Treatment.	Plant Crop.				First Ratoon Crop.				Second Ratoon Crop.			
	Fallowed.		Non-Fallowed.		Fallowed.		Non-Fallowed.		Fallowed.		Non-Fallowed.	
	Cane per Acre.	C.C.S. per Acre.	Cane per Acre.	C.C.S. per Acre.	Cane per Acre.	C.C.S. per Acre.	Cane per Acre.	C.C.S. per Acre.	Cane per Acre.	C.C.S. per Acre.	Cane per Acre.	C.C.S. per Acre.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
C	30·3	4·88	25·9	4·25	24·8	4·07	21·2	3·52	18·45	3·10	16·35	2·70
1N 1P	32·6	5·22	28·7	4·65	31·7	5·17	28·5	4·67	31·8	5·12	30·7	4·97
1N 2P	36·35	5·78	30·3	4·82	35·2	5·74	31·6	5·15	33·2	5·34	34·15	5·46
2N 1P	33·4	5·34	30·9	4·91	33·8	5·47	31·2	5·12	34·5	5·52	33·6	5·38
2N 2P	37·1	5·82	32·4	5·15	36·95	5·93	33·2	5·41	36·5	5·80	36·5	5·82

DISCUSSION.

The yields for the second ratoon crop reveal further interesting features regarding the response to fertilizer treatment on fallowed and non-fallowed land. The influence of the fallow, with green manure, had almost entirely disappeared by the time the first ratoon crop was harvested, and the increases in cane yield, due to both phosphate and nitrogen, were much greater on the second ratoon crop. The response to the heavier application of these plant foods over the lighter dressing is brought out in the following table :—

Pre-treatment.	Increase due to extra 200 lb. dressing of—					
	Superphosphate.			Sulphate of Ammonia.		
	Plant.	First Ratoon.	Second Ratoon.	Plant.	First Ratoon.	Second Ratoon.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Fallowed (with green manure)	3·7	3·3	1·7	0·8	1·9	3·0
" Plough-out and replant "	1·6	2·6	3·2	2·2	2·2	2·6

The average increased yields due to the heavier dressings of superphosphate and sulphate of ammonia were 2·5 and 2·8 tons respectively, which indicate that ratoon applications of even 400 lb. per acre of each of these fertilizers, on this particular soil type, are not sufficient for the production of maximum crop yields. Experimental results recorded elsewhere further support this contention.

It is interesting to note that the average yield from plots receiving full treatments (36·5 tons cane) was more than double the yield from the plots receiving no fertilizer (17·4 tons).

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Work of the Northern Sugar Experiment Station—continued.

FERTILIZER AND LIMING EXPERIMENT—AMOUNTS OF NITROGEN AND POTASH (Second Ratoon Crop).

Plan and Yields.

No Lime	2 N 31·45	C 21·15
	N 25·68	N K 25·68
Lime	C 23·21	2 N 32·55
	N 27·47	N K 28·79
No Lime	N 25·13	C 21·70
	N K 26·51	2 N 28·57
Lime	2 N 34·61	N K 28·57
	N 30·08	C 25·54

Block.—B6.

Variety.—Badila.

Harvested.—September, 1932.

Age of Cane.—Eleven months.

System of Replication.—Two randomised blocks.

Plots.—0·0913 acre.

I. *Treatment.*—One-half of each block received burnt lime at the rate of 1 ton per acre before planting.

All plots received superphosphate at the rate of 400 lb. per acre.

The following additional dressings were given :—

C.—No further manure.

N.—150 lb. sulphate of ammonia per acre.

2N.—300 lb. sulphate of ammonia per acre.

K.—150 lb. muriate of potash per acre.

II. *Preparation of Land.*—Plant Crop : A crop of cowpeas was ploughed into the land in June, and, after decomposition of the organic matter, the block was prepared in the usual manner. Ratoon Crops : The plots were ratooned by ploughing away from cane and centres broken with skeleton plough to a depth of 12 inches.

Fertilizer.—The fertilizer treatments for the ratoons were identical with those for the plant crop. No further lime was applied.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Blocks	1	1·40	1·40	..
Lime	1	38·88	38·88	1·8292
Fertilizers	3	158·47	52.82	1·9834
Errors	10	12·23	1·223	1·0062
Total	15	210·98	..	..

Crop Yields.

Treatment.	No Manure.	150 lb. Sulphate of Ammonia per acre.	300 lb. Sulphate of Ammonia per acre.	150 lb. Sulphate of Ammonia + 150 lb. Muriate of Potash Per Acre.	Lime.	No Lime.
Cane—Tons per acre	22·90	27·09	31·80	27·39	28·85	25·73
Cane—Percentage of mean yield	83·9	99·3	116·5	100·3	94·3	105·7
C.C.S. in Cane—Per cent.	16·8	16·6	16·4	16·7	16·6	16·6
C.C.S.—Tons per acre	3·84	4·49	5·22	4·58	4·78	4·28
Standard Error	2·02 per cent.				2·85 per cent.	

Work of the Northern Sugar Experiment Station—continued.

Summary of Crop Yields—Plant, First and Second Ratoon Crops.

Treatment.	Plant Crop.		First Ratoon Crop.		Second Ratoon Crop.	
	Cane per acre.	C.C.S. per acre.	Cane per acre.	C.C.S. per acre.	Cane per acre.	C.C.S. per acre.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
No manure	37·3	5·99	30·8	5·10	22·9	3·84
N	38·5	6·22	35·1	5·80	27·1	4·49
2 N	40·0	6·37	37·6	6·18	31·8	5·22
N K	39·5	6·32	35·2	5·82	27·4	4·58
Lime	41·1	6·58	36·1	5·94	28·9	4·78
No lime	36·5	5·86	33·2	5·51	25·7	4·28

DISCUSSION.

The decided influence of lime on the cropping capacity of the acid alluvial soils was strongly marked even on the second ratoon yields, where it showed an increase of 3·2 tons of cane per acre. For the three crops the total increase due to one ton of burnt lime applied prior to planting is 10·7 tons of cane. The beneficial effects of sulphate of ammonia on ratoons are most evident in this experiment, 300 lb. per acre of this fertilizer being responsible for an increased crop yield of 8·9 tons of cane. The response to potash has again been very slight—0·3 tons of cane per acre.

FERTILIZER EXPERIMENT—AMOUNTS OF NITROGEN, PHOSPHORIC ACID, AND POTASH (First Ratoon Crop).

Plan and Yields.

I.	N 2P 3K 39·6	2N P 3K 42·1	N P 3K 35·9	N 2P K 36·5	2N 2P 3K 46·9	2N P K 41·4
	N 2P 2K 37·5	N P K 35·6	2N 2P K 46·6	2N P 2K 40·7	2N 2P 2K 46·4	N P 2K 35·8
II.	2N 2P 2K 38·3	N 2P K 36·5	N P K 33·8	N P 3K 35·8	2N 2P K 37·6	2N 2P 3K 38·5
	2N P 2K 37·6	2N P 3K 37·3	2N P K 36·7	N 2P 2K 36·5	N 2P 3K 36·7	N P 2K 34·4
III.	2N 2P K 40·0	N P K 32·3	2N 2P 2K 40·0	2N 2P 3K 40·9	2N P 3K 37·3	2N P 2K 38·5
	N P 3K 34·6	N 2P 3K 37·5	N P 2K 32·3	N 2P K 37·5	2N P K 36·2	N 2P 2K 37·6
IV.	N P 3K 36·8	2N P 2K 38·7	2N P K 36·9	2N 2P K 40·9	2N 2P 3K 41·4	2N P 3K 37·3
	N P K 35·9	2N 2P 2K 44·8	N 2P 2K 38·7	N 2P K 39·3	N P 2K 36·2	N 2P 3K 40·2

Block.—B4.

Variety.—Badila.

Harvested.—September, 1932.

Age of Crop.—11 months.

System of Replication.—Four randomised blocks.

Plots.—0·049 acre.

Fertilizer.—

N—100 lb. sulphate of ammonia per acre.

2N—200 lb. sulphate of ammonia per acre.

P—300 lb. superphosphate per acre.

2P—600 lb. superphosphate per acre.

K—100 lb. muriate of potash per acre.

2K—200 lb. muriate of potash per acre.

3K—300 lb. muriate of potash per acre.

Preparation of Land.—Plant Crop: A good crop of Mauritius Bear was ploughed under in May, and, after decomposition of organic matter, the land was ploughed and harrowed twice. Cane was planted in August, 1930.

First Ratoon Crop: The plots were ratooned by ploughing away from cane and centres broken with a skeleton plough to a depth of 12 inches.

Work of the Northern Sugar Experiment Station—continued.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (Mean Square).
Blocks	3	109·88	36·63	..
Nitrogen (N)	1	166·88	166·88	2·5588
Phosphate (P)	1	121·28	121·28	2·3991
Potash (K)	2	7·44	3·72	0·6568
Interactions—				
Nitrogen and Phosphate	1	0·99	0·99	..
Nitrogen and Potash	2	4·14	2·07	0·3638
Phosphate and Potash	2	0·08	0·04	..
Nitrogen, Phosphate, and Potash	2	0·04	0·02	..
Errors	33	92·08	2·79	0·5130
Total	47	502·81	..	..

Crop Yields.

Treatment.	Sulphate of Ammonia.		Superphosphate.		Muriate of Potash.		
	100 lb.	200 lb.	300 lb.	600 lb.	100 lb.	200 lb.	300 lb.
Cane, tons per acre	**36.40**	**40.13**	**36.67**	**39.85**	**37.73**	**38.38**	**38.68**
Cane, percentage of mean yield	95·1	104·9	95·8	104·2	98·6	100·3	101·1
C.C.S. in cane, per cent.	**17.0**	**16.8**	**16.9**	**16.9**	**16.9**	**16.9**	**17.0**
C.C.S. tons per acre	**6.19**	**6.74**	**6.20**	**6.73**	**6.38**	**6.49**	**6.58**
Standard Error	**0.89** per cent.		**0.89** per cent.		**1.09** per cent.		

Summary of Crop Yields—Plant and First Ratoon Crops.

Plots receiving—	Plant Crop.			First Ratoon Crop.		
	Cane per acre.	C.C.S.	C.C.S. per acre.	Cane per acre.	C.C.S.	C.C.S. per acre.
	Tons.	Per cent.	Tons.	Tons.	Per cent.	Tons.
100 lb. sulphate of ammonia	**48.29**	16·3	**7.88**	**36.40**	17·0	**6.19**
200 lb. sulphate of ammonia	**49.15**	16·3	**8.01**	**40.13**	16·8	**6.74**
300 lb. superphosphate	**47.48**	16·4	**7.77**	**36.67**	16·9	**6.20**
600 lb. superphosphate	**49.96**	16·3	**8.12**	**39.85**	16·9	**6.73**
100 lb. potash	**48.42**	16·3	**7.87**	**37.73**	16·9	**6.38**
200 lb. potash	**48.83**	16·3	**7.94**	**38.38**	16·9	**6.49**
300 lb. potash	**48.92**	16·4	**8.01**	**38.68**	17·0	**6.58**

DISCUSSION.

The results from this experiment show some very interesting features, particularly when the first ratoon yields are compared with those from the plant crop. The following table presents the yield increases more clearly :—

——	Increased Yield due to—			
	Extra 100 lb. Sulphate of Ammonia.	Extra 300 lb. Superphosphate.	Extra 100 lb. Potash.	Extra 200 lb. Potash.
	Tons.	Tons.	Tons.	Tons.
Plant crop	0·9	2·5	0·4	0·5
First ratoon crop	3·7	3·2	0·7	1·0

Whereas the plant crop showed an increase of 3·9 tons of cane for the heaviest dressing, over that for the light application, the ratoon yield was practically 8 tons in favour of the former. As regards the individual plant foods, it appears very definite that 200 lb. of sulphate of ammonia was quite inadequate for the ratoon crop ; and 600 lb. of superphosphate gave a superior yield of 3·2 tons of cane over that from 300 lb., indicating that even heavier dressings might be employed to advantage. Although the effect of potash was more marked on the ratoons than on the plant crop, it is doubtful whether applications of more than 100 lb. per acre are economical on this type of soil. Again it was found that the heaviest potash dressing exerted a slight though definite influence on the c.c.s. content of the cane.

Work of the Northern Sugar Experiment Station—continued.

FERTILIZER TRIAL—VALUE OF PHOSPHATES IN DIFFERENT FERTILIZERS AND TIME OF APPLICATION (First Ratoon Crop).

Plan and Yields.

Blocks	I.	II.	III.	IV.	V.
	N Ps K Early 41·9	N Pm K Early 41·4	N Pb K Early 31·3	N Ps K Late 29·8	N Ps K Early 28·6
	N Pm K Early 40·8	N Pb K Early 32·9	N Ps K Late 31·0	N Pb K Late 28·8	N Pb K Late 28·1
	N Pb K Late 36·3	N Ps K Late 32·7	N Pm K Early 31·5	N Ps K Early 27·5	N Pm K Early 28·3
	N Pm K Late 33·3	N Ps K Early 34·2	N Ps K Late 31·0	N Pb K Early 27·3	N Pb K Early 25·6
	N Pb K Early 41·4	N Pb K Late 32·7	N Ps K Early 30·6	N Pm K Early 27·3	N Ps K Late 25·4
	N Ps K Late 36·0	N Pm K Late 35·8	N Pm K Late 30·4	N Pm K Late 27·1	N Pm K Late 28·7

Block.—A1.
Variety.—Badila.
Harvested.—August, 1932
Age of Crop.—11 months.
System of Replication.—Five randomised blocks.
Plots.—0·065 acre.
Treatment.—
(1.) Fertilizer—
Ps—400 lb. superphosphate per acre.
Pb—467 lb. basic-superphosphate, containing P_2O_5, equivalent of 400 lb. superphosphate per acre.
Pm—177 lb. monammonium phosphate, containing P_2O_5, equivalent of 400 lb. superphosphate per acre.
All plots received an application of 100 lb. of muriate of potash per acre, and sulphate of ammonia to bring nitrogen equivalent to 150 lb. sulphate of ammonia per acre.
(2.) Time of Application—
E—In furrow at time of ratooning.
L—Two months after ratooning.
Preparation of Land.—Plant Crop: A heavy crop of Mauritius Bean was ploughed under in March, and, after decomposition of organic matter, the land was ploughed and harrowed twice. Cane was planted in May, 1930.
Ratoon Crop: The plots were ratooned by ploughing away from cane and centres broken with skeleton plough to a depth of 12 inches.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Blocks	4	517·15	129·29	..
Quality of phosphate	2	4·59	2·30	0·4164
Time of application	1	18·41	18·41	1·4565
Errors	22	115·77	5·26	0·8301
Total	29	655·92	..	..

Crop Yield.

	Form of Phosphate.			Time of Application.	
	Superphosphate.	Basic Superphosphate.	Monammonium Phosphate.	Early.	Late.
Cane, tons per acre	**31.78**	**31.53**	**32.46**	**32.70**	**31.14**
Cane, percentage of mean yield	99·6	98·8	101·6	102·5	97·5
C.C.S. in cane, per cent.	**16.2**	**16.3**	**16.3**	**16.3**	**16.2**
C.C.S., tons per acre	**5.15**	**5.14**	**5.29**	**5.33**	**5.04**
Standard Error	**2.27** per cent.			**1.85** per cent.	

Work of the Northern Sugar Experiment Station—continued.

Summary of Crop Yields—Plant and First Ratoon Crops.

Treatment.	Plant Crop.			First Ratoon Crop.		
	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	Per cent.	Tons.	Tons.	Per cent.	Tons.
Phosphate as—						
Superphosphate	**46.16**	16·12	**7.44**	**31.78**	16·2	**5.15**
Basic superphosphate	**46.41**	16·13	**7.49**	**31.53**	16·3	**5.14**
Monammonium phosphate	**46.23**	16·12	**7.45**	**32.46**	16·3	**5.29**
Fertilizer applied—						
Early	**46.67**	16·19	**7.56**	**32.70**	16·3	**5.33**
Late	**45.86**	16·05	**7.36**	**31.14**	16·2	**5.04**

DISCUSSION.

The first ratoon results follow those of the plant crop very closely. Again there was no significant difference between the yields from the different forms of readily available phosphates under review. Fertilizer applied early gave 0·56 tons of cane per acre more than that applied two months later. A slight though definite improvement in the c.c.s. content of the cane was also shown where the fertilizer was applied early.

TIME OF APPLICATION OF NITROGEN EXPERIMENT (Third Ratoons).

Plan and Yields.

A	B	A	B
41·6	37·0	44·1	42·7
D	C	A	D
40·2	41·2	38·8	44·6
C	D	B	C
42·9	38·9	40·6	45·5

Block.—A2.
Variety.—Badila.
Harvested.—September, 1932.
Age of Crop.—11 months.
Plots.—0·119 acre.
Fertilizer.—All plots received the following amounts of fertilizer:—4 cwt. sulphate of ammonia per acre, 5 cwt. superphosphate per acre, and 1 cwt. muriate of potash per acre.
Treatment.—Superphosphate and muriate of potash were applied to all plots at time of ratooning. Sulphate of ammonia was applied as follows:—

A.—1 cwt. at time of ratooning, 1½ cwt. ten weeks later, and 1½ cwt. after a further interval of four weeks.
B.—1⅓ cwt. at time of ratooning, 1⅓ cwt. four weeks later, and 1⅓ cwt. after a further interval of four weeks.
C.—2 cwt. at time of ratooning, 1 cwt. four weeks later, and 1 cwt. after a further interval of four weeks.
D.—2 cwt. at time of ratooning and 2 cwt. four weeks later.

Crop Yields.

Treatment.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	Per cent.	Tons.
A	**41.5**	16·2	**6.72**
B	**40.1**	16·2	**6.50**
C	**43.2**	16·1	**6.95**
D	**41.2**	16·2	**6.67**

DISCUSSION.

Slight differences in crop yield were experienced, due to the modifications in manner and time of application of fertilizer on ratoons. But the degree of precision of the experiment was not sufficiently fine to allow of definite conclusions being drawn.

Work of the Northern Sugar Experiment Station—continued.

MOLASSES AND FERTILIZER EXPERIMENT (Plant Crop).

Plan and Yields.

Fertilizer 36·9	Check 29·5	Molasses 40·5
Check 29·5	Molasses 39·9	Fertilizer 38·5
Molasses 43·4	Fertilizer 39·5	Check 26·3

Block.—A3.

Variety.—Badila.

Harvested.—August, 1932.

Age of Crop.—12 months.

System of Replication.—3 x 3 Latin square.

Plots.—One-tenth acre.

Treatments.—

Molasses—Ten tons per acre applied broadcast and allowed to decompose before planting.

Fertilizer—The following fertilizer equivalent in plant-food content to 10 tons of molasses :—

1,010 lb. sulphate of ammonia per acre ;
165 lb. superphosphate per acre ;
860 lb. sulphate of potash per acre.

The superphosphate, sulphate of potash, and one-third of the sulphate of ammonia were applied broadcast before planting. The remainder of the sulphate of ammonia was applied in two equal dressings after the crop had been planted, at intervals of six weeks.

Check—No treatment.

Analysis of Variance.

Due to.	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (Mean Square).
Rows	2	0·89	0·45	..
Columns	2	3·78	1·89	..
Treatments	2	270·81	135·41	2·4541
Errors	2	12·64	6·32	0·9219
Total	8	288·12	..	..

Crop Yields.

——	Check.	10 tons molasses per acre.	Fertilizer equivalent to 10 tons molasses per acre.
Cane, tons per acre	28.43	41.27	38.30
Cane, percentage of mean yield	79·0	114·6	106·4
C.C.S. in cane, per cent.	16.0	15.3	15.6
C.C.S., tons per acre	4 54	6.32	5.97
Standard Error	4.03 per cent.		

DISCUSSION.

The results of this experiment should be of interest to growers in the Northern areas, where the extensive use of molasses as a fertilizer is becoming increasingly more popular. A 10-ton application of molasses, before planting, was responsible for an increase in cane yield of almost 13 tons per acre over the plots receiving no treatment. Further, the molasses gave a superior yield of almost 3 tons over those plots which received fertilizer equivalent to the plant food contained in the molasses.

Work of the Northern Sugar Experiment Station—continued.

Now, it has been shown elsewhere that the soils of this station show a marked response to superphosphate and sulphate of ammonia, and but little return from potash. It may, therefore, be concluded that the greater proportion of the crop increase is due to the large amount of nitrogen and smaller amount of phosphate contained in the molasses. The superiority of the plant food applied in the molasses is probably due to the fact that in this form it becomes slowly available throughout the growing period of the crop, whereas the influence of the sulphate of ammonia is more intensive but not protracted. In addition, the heavy applications of sulphate of ammonia (almost one-half ton per acre) would be responsible for a substantial intensification of the acidity of the soil—an effect which is not produced in like degree by the molasses.

The continued supply of available nitrogen from the molasses is reflected in the delayed maturity of the crop on those plots receiving this treatment. The c.c.s. value of the cane was 0·3 per cent. lower than that shown by the fertilized cane, and 0·7 per cent. inferior to that of the untreated cane.

When it is remembered that the main plant-food constituent of molasses is potash, the results to be expected from the use of this by-product as a fertilizer on the red volcanic soils should be even more outstanding than the above.

VARIETAL AND FERTILITY TRIAL (Plant Crop).

Plan and Yields.

Badila 3P Ks 35·1	POJ 2878 N 2P Ks 38·6	POJ 2878 N 3P Km 42·9	POJ 2878 3P Km 40·4	Badila 2P Km 30·3	Badila N 2P Km 31·3
Badila 2P Ks 31·7	POJ 2878 2P Km 37·1	Badila N 2P Km 32·7	POJ 2878 N 3P Ks 41·7	Badila N 3P Km 39·1	POJ 2878 3P Km 44·2
POJ 2878 N 2P Km 44·5	Badila N 3P Ks 34·4	POJ 2878 2P Ks 36·1	Badila N 2P Ks 33·5	POJ 2878 N 2P Ks 41·5	Badila 2P Ks 31·2
Badila N 3P Km 39·3	Badila 3P Km 36·3	POJ 2878 3P Ks 40·9	POJ 2878 2P Km 33·3	Badila 3P Ks 35·3	POJ 2878 N 3P Ks 37·3

Blocks I. II.

Block.—B2.

Varieties.—Badila and P.O.J. 2878.

Harvested.—August, 1932.

Age of Crop.—12 months.

System of Replication.—Two randomised blocks.

Plots.—0·0975 acre.

Fertilizer.—

N—200 lb. sulphate of ammonia per acre;

2P—600 lb. superphosphate per acre;

3P—900 lb. superphosphate per acre.

Km—150 lb. muriate of potash per acre;

Ks—156 lb. sulphate of potash per acre.

Preparation of Land.—A good crop of Mauritius Bean was ploughed under in May, and, after decomposition of organic matter, the land was ploughed and harrowed twice. Cane was planted in July, 1931.

Work of the Northern Sugar Experiment Station—continued.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Blocks	1	4·59	4·59	..
Quantity of nitrogen (N)	1	25·83	25·83	1·6257
Quantity of phosphate (P)	1	84·75	84·75	2·2199
Varieties	1	194·37	194·37	2·6350
Muriate *v.* sulphate of potash	1	8·28	8·28	1·0569
Interactions—				
Quantity of N and P	1	16·51	16·51	1·4021
Quantity of N and varieties	1	0·70	0·70	..
Quantity of P and varieties	1	6·51	6·51	0·9367
Quantity of N and P and varieties	1	23·01	23·01	1·5680
Errors	14	57·90	4·14	0·7104
Total	23	422·45	..	..

Crop Yields.

—	Badila.	P.O.J. 2878.	Superphosphate.		Sulphate of Ammonia.		Potash.	
			600 lb.	900 lb.	None.	200 lb.	Muriate.	Sulphate.
Cane, tons per acre	**34.18**	**39.88**	**35.15**	**38.90**	**35.99**	**38.07**	**37.62**	**36.44**
Cane, percentage of mean yield	92·3	107·7	94·9	105·1	97·2	102·8	101·6	98·4
C.C.S. in cane, per cent.	**15.85**	**13.99**	**14.95**	**14.88**	**15.00**	**14.83**	**14.90**	**14.93**
C.C.S., tons per acre	**5.44**	**5.60**	**5.26**	**5.79**	**5.40**	**5.65**	**5.61**	**5.44**

Standard Error **1.59** per cent.

DISCUSSION.

An attempt was made in this experiment to determine the comparative yield values of Badila and P.O.J. 2878, and at the same time to determine the differential response to fertilizer treatment, if any, between the two varieties. Incidentally, two forms of potash salts—sulphate and muriate—were employed in order to obtain further evidence of the relative values of these materials on cane.

Unfortunately, the experimental block was planted rather late in the season, and Top Rot disease was responsible for severe damage in the following February. It should be observed in passing that P.O.J. 2878 exhibited a much greater susceptibility to the disease than Badila, thus emphasising the need for early planting of this variety.

The results show that the Javan variety possesses greater vigour of growth than Badila, and outyielded the latter by 5·7 tons of cane per acre. A comparison of the c.c.s. values, however, shows that Badila was markedly superior—at least when harvested in the month of August. This is in agreement with our earlier observations that P.O.J. 2878 is a true late-maturing variety, and attains its peak of sugar content not before October. The above crop was, therefore, quite immature at harvesting time, but it is doubtful whether it would attain the high c.c.s. values recorded by Badila under comparative conditions.

As regards results from fertilizer, both varieties responded well to the liberal dressings of superphosphate, and the returns indicate that the 900-lb. application is a profitable one on this soil type. The light sulphate of ammonia dressing was also responsible for a definite increase in yield. The slight difference in yield between plots treated with sulphate and muriate of potash was not significant. This is in keeping with our previous findings—that the two forms are of equal value.

With respect to the differential response between varieties and fertilizers, it appears that Badila exhibits a greater response to heavier dressings of fertilizer than does P.O.J. 2878, particularly as regards superphosphate.

Work of the Northern Sugar Experiment Station—continued.

OPTIMUM GROWTH RATE EXPERIMENT WITH EARLY AND LATE PLANT CANE.

Block.—E.

Variety.—Badila.

Early Plant.—Planted 12th April, 1931.

Late Plant.—Planted 12th August, 1931.

Harvested.—Both plots harvested 13th August, 1932.

Fertiliser.—The following monthly dressings were applied to both plots:—

20 lb. muriate of potash per acre;
50 lb. superphosphate per acre;
100 lb. sulphate of ammonia per acre.

Irrigation.—

Winter—Two inches per acre per week in two applications.
Spring—Four inches per acre per week in two applications.
Summer—Six inches per acre per week in three applications.

Preparation of Land.—Trenches were dug, running east and west, to a depth of 3 feet and 3 feet wide. Stable manure and lime were mixed with the soil to give ideal tilth.

Yields.

Treatment.	Cane per acre.	C.C.S. in Cane.	C.C.S. per acre.
	Tons.	Per cent.	Tons.
Early Plant	**143·9**	15·9	**22·88**
Late Plant	**58·3**	15·8	**9·21**

Remarks.—The late plant cane was badly affected with top-rot disease, and suffered a considerable loss in tonnage. It is remarkable that not one stick of the early plant cane suffered top-rot infection.

DISCUSSION.

An attempt was made to determine a figure approximating to a maximum crop yield which might be expected in this area, when all adjustable factors limiting crop production were removed. The return of 144 tons per acre is certainly sensational, and indicates very clearly that the crop yields ordinarily harvested in this vicinity fall far below the maximum yield which is possible. Truly, the methods employed could not be adopted in farm practice, but the results demand consideration from many angles.

One point worthy of serious consideration is the possibility of irrigation in the humid northern areas. During the spring months our crops invariably suffer from moisture deficiency, even in these parts, and backward crops are never able to take full advantage of the heavy rain of the wet season. The subject has been discussed with growers in the North during the past season, and it would be interesting to have the results of a test block on which irrigation had been practised under farm conditions.

Another matter worthy of note is the question of top-rot incidence as related to time of planting. Reference has been made to this point in the Report of the Plant Pathologist.

MATURITY TESTING OF CANES.

In connection with the work of the Committee appointed by the Queensland Society of Sugar-cane Technologists to investigate the practicability of maturity testing, a series of results was obtained by the selection of P.O.J. canes employed for breeding purposes at this station. Owing to the limited supply of available canes for the purpose, the number of tests performed was necessarily restricted. However, they are of interest in showing the trend of maturity of the several varieties, and the c.c.s. values determined are tabulated below:—

Progressive C.C.S. Values for Javan Varieties.

P.O.J. 2364.

—	6th June.	20th June.	4th July.	18th July.
Tops	5·61	8·38	8·47	9·03
Middles	7·44	9·53	10·08	10·62
Butts	8·46	11·18	11·61	12·60

Fibre in cane = 11·1 per cent.

Work of the Northern Sugar Experiment Station—continued.

P.O.J. 2714.

—	6th June.	20th June.	4th July.	18th July.
Tops	10·17	11·52	12·25	12·68
Middles	12·00	13·34	13·69	14·01
Butts	14·12	14·56	14·82	15·03

Fibre in cane = 10·9 per cent.

P.O.J. 2722.

—	6th June.	20th June.	4th July.	18th July.
Tops	7·08	8·83	9·37	9·85
Middles	8·06	10·66	11·39	11·71
Butts	10·89	11·83	12·44	12·54

Fibre in cane = 11·6 per cent.

P.O.J. 2725.

—	6th June.	20th June.	4th July.	18th July.
Tops	9·82	10·68	11·94	13·77
Middles	11·75	12·38	13·18	14·29
Butts	12·54	13·04	13·85	15·05

Fibre in cane = 11·5 per cent.

P.O.J. 2875.

—	6th June.	20th June.	4th July.	18th July.
Tops	9·06	10·57	10·79	11·49
Middles	10·90	11·94	12·51	13·29
Butts	11·15	13·18	13·45	13·83

Fibre in cane = 11·2 per cent.

P.O.J. 2878.

—	6th June.	20th June.	4th July.	18th July.
Tops	6·74	9·97	9·98	12·39
Middles	7·87	11·80	12·31	13·63
Butts	11·28	12·85	13·73	14·63

Fibre in cane = 11·6 per cent.

P.O.J. 2940.

—	6th June.	20th June.	4th July.	18th July.
Tops	9·68	10·98	12·02	12·49
Middles	12·53	13·36	14·05	14·50
Butts	13·88	14·19	14·89	15·05

Fibre in cane = 11·4 per cent.

Work of the Northern Sugar Experiment Station—continued.

DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE, FROM 1st NOVEMBER, 1931, TO 31st OCTOBER, 1932.

Materials.	Number of Analyses.
Sugar-cane for growers	102
Sugar-canes for Experiment Station	5,128
Sugar-cane fibres	72
Coral lime	8
Agricultural lime	16
Fertilizers	6
Waters	2
Soils	215
Juices (P_2O_5)	74
Total	5,623

YIELD OF CANE HARVESTED FROM THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE—SEASON 1932.

	Tons.
Cane sent to mill	695·0
Distributed to farmers	96·5
Used for plants, seedling propagation, analysis, and show exhibits	14·2
Total	805·7

Nature of Crop—	Per cent.
Plant cane	39·5
First ratoon	26·5
Second ratoon	23·6
Third ratoon	10·4

Tonnages—	Tons.
Badila plant	258·5
Badila first ratoon	172·2
Badila second ratoon	149·3
Badila third ratoon	72·5
Varieties	153·2
Acreage under cane	20·7
Tons per acre	38·92

CENTRAL SUGAR EXPERIMENT STATION, MACKAY.

MR. F. KEOGH, Chemist in Charge.

METEOROLOGICAL.

The rainfall during the 1931 planting season was scanty, the last soaking rain being 5·3 inches received in March. However, good germinations resulted, although no further beneficial rains were recorded until November. The cane was backward in growth at this time, but favourable rains in late November and early December promoted good growth, which was maintained throughout January. From February until May conditions were distinctly unfavourable, but 4½ inches of rain in the latter month promoted good late growth. These rains also served to maintain the crop in good condition until October.

The season was similar in many respects to that of 1930-31. The rainfall was much higher, but the distribution was equally poor, and one-half of the total of 50 inches was recorded in the month of January. The average crop yield for the district will be slightly heavier than for 1931.

The past winter was one of the coldest experienced in the district, and numerous severe frosts caused damage to a large tonnage of cane. The c.c.s. content of the crop also suffered as a consequence, and where the cane was seriously damaged the crop failed to mature.

The following table shows the rainfall distribution for the past three seasons, and indicates the run of unfavourable seasons which the district has experienced since 1929.

Month.	1929-30.	1930-31.	1931-32.
September	·02	·28	·31
October	·56	·62	·94
November	·90	1·21	5·67
December	2·73	2·71	6·17
January	28·94	4·12	25·51
February	4·38	5·32	2·00
March	4·39	5·31	·76
April	1·14	1·27	2·75
May	7·88	1·66	4·52
June	3·38	·26	1·15
July	·28	·19	·37
August	·60	·04	·35
Total	55·20	22·99	50·50

RAINFALL SINCE 1920 AT THE SUGAR EXPERIMENT STATION, MACKAY.

Year.	Rainfall in Inches.	Year.	Rainfall in Inches.
1920	57·27	1927	83·87
1921	95·89	1928	78·28
1922	34·47	1929	64·03
1923	25·23	1930	55·81
1924	53·37	1931	30·01
1925	54·80	1932 (10 months)	38·43
1926	34·69		

Abstract of Meteorological Observations made at Sugar Experiment Station, Mackay, from 1st September, 1931, to 31st August, 1932.

Month.		Rainfall in Inches.	Number of Wet Days.	Average Rainfall, 31 Years, 1901–1931.	Highest Shade Maximum.	Lowest Shade Maximum.	Mean Shade Maximum.	Highest Shade Minimum.	Lowest Shade Minimum.	Mean Shade Minimum.	Lowest Terrestrial Min.	Mean Terrestrial Min.	Mean Diurnal Range.	Mean Temperature, 9 a.m.	Mean Relative Humidity of the Air, at 9 a.m. Saturation equalling 100.
September	1931	·31	2	1·79	90·6	72·4	85·7	67·6	47·9	58·6	45·4	57·1	27·1	77·0	66·0
October	1931	·94	5	1·71	90·1	80·1	88·0	67·1	50·0	61·4	47·7	60·3	24·6	79·1	62·8
November	1931	5·67	6	2·96	95·1	78·0	88·4	77·0	59·2	68·7	58·4	67·4	19·7	82·0	70·2
December	1931	6·17	17	7·94	95·1	78·9	88·5	76·7	66·4	71·4	65·1	70·4	17·1	80·8	79·0
January	1932	25·51	10	15·99	97·8	74·0	87·3	74·9	65·0	69·6	63·7	68·5	17·7	79·4	80·4
February	1932	2·00	10	9·32	92·0	85·9	88·9	74·6	64·2	69·8	63·3	68·7	19·1	79·9	81·0
March	1932	·76	9	10·12	96·8	84·1	88·5	76·0	64·1	68·3	63·0	67·4	20·2	80·6	75·0
April	1932	2·75	6	5·68	91·6	80·6	85·2	77·0	52·8	66·4	50·9	64·9	18·8	79·8	65·2
May	1932	4·52	18	3·31	84·0	63·0	77·3	67·9	52·6	62·6	51·4	60·9	15·3	69·9	80·6
June	1932	1·15	5	2·55	82·8	63·3	74·2	63·5	35·0	50·9	32·8	47·7	26·5	63·5	78·0
July	1932	·37	5	1·30	80·5	65·0	71·7	60·8	37·0	45·5	34·0	42·9	26·2	60·8	77·0
August	1932	·35	3	·99	84·0	67·8	74·9	65·5	35·5	49·9	33·6	47·3	25·0	66·2	68·0
Year		50·50	96												*73·5

*Average.

Work of the Central Sugar Experiment Station—continued.

Work of the Station.

After a long fallow of the entire station, the experimental blocks were re-distributed along more suitable lines and planted during 1931. Unfortunately, the strike on several blocks was seriously affected, due to the incidence of the Pentodon beetle. In many instances the supplies were also damaged, and the stand was patchy. Attempts have been made to plant up the misses for the ratoon crops, so that a higher degree of precision may be expected from the succeeding harvests.

Experiments Harvested during 1932.

1. *Fertilizer Trial.*—Forms of nitrogen, phosphate, and potash.
2. *Molasses Trial.*
3. *Fertilizer Trial.*—Amount and forms of nitrogen, phosphate, and lime; fertilizer applied early and late.
4. *Fertilizer Trial.*—Amounts of nitrogen.

FERTILIZER TRIAL—FORMS OF NITROGEN, PHOSPHATE, AND POTASH (Plant Crop).

Plan and Yields.

I.	Nn Ps Km	14·6	Nn Pb Km	16·5
	Na Pb Ks	14·0	Nn Ps Ks	18·3
	Nn Pr Ks	14·2	Na Pr Km	18·5
	Na Pbs Km	16·0	Na Pbs Ks	19·5
	Nn Pb Km	18·5	Na Pb Ks	19·3
	Nn Ps Ks	18·9	Nn Ps Km	15·8
	Na Pbs Ks	20·8	Nn Pr Ks	16·0
	Na Pr Km	17·9	Na Pbs Km	18·3
II.	Na Ps Km	21·6	Nn Pr Km	17·5
	Na Pr Ks	17·3	Na Ps Ks	24·3
	Nn Pb Ks	21·8	Na Pb Km	17·7
	Nn Pbs Km	22·0	Nn Pbs Ks	20·8
	Na Ps Ks	21·0	Na Pr Ks	17·5
	Nn Pr Km	22·4	Na Ps Km	19·5
	Nn Pbs Ks	24·6	Nn Pbs Km	26·9
	Na Pb Km	24·6	Nn Pb Ks	22·4

III.

Block. B1.

Variety.—Q. 813.

Harvested.—September, 1932.

Age of Crop.—14 months.

System of Replication.—Four randomised blocks.

Plots.—0·0607 acre.

Treatments.—

- Na—200 lb. sulphate of ammonia per acre.
- Nn—260 lb. nitrate of soda per acre.
- Pb—260 lb. bonemeal per acre.
- Ps—300 lb. superphosphate + 75 lb. dried blood per acre.
- Pbs—388 lb. basic superphosphate + 75 lb. dried blood per acre.
- Pr—290 lb. rock phosphate + 75 lb. dried blood per acre.
- Km—150 lb. muriate of potash per acre.
- Ks—156 lb. sulphate of potash per acre.

IV. *Growth.*—This block was slightly affected by Pentodon beetles, which caused a patchy strike. As a consequence, the crop was uneven in growth at harvesting.

Work of the Central Sugar Experiment Station—continued.

Crop Yields.

—	Form of Nitrogen.		Form of Phosphate.				Form of Potash.	
	Sulphate of Ammonia.	Nitrogen of Soda.	Bone.	Super.	Basic Super.	Rock Phosphate.	Muriate of Potash.	Sulphate of Potash.
Cane, tons per acre	19.24	19.45	19.35	19.25	21.11	17.66	19.27	19.42
Cane, percentage of mean yield	99·4	100·6	100·0	99·5	109·1	91·3	99·6	100·4
C.C.S. in cane, per cent.	16.8	16.8	16.8	16.5	16.9	16.9	16.8	16.8
C.C.S., tons per acre	3.23	3.27	3.25	3.18	3.57	2.98	3.24	3.26

DISCUSSION.

The experiment was designed to bring out any differences which might be shown on this soil type by the use of different common forms of nitrogenous, phosphatic, and potassic fertilizers. The damage caused by pest attack has interfered with the precision of the final result; further, the adverse season did not favour high response to applications of artificial manures, and, coupled with the fact that the land had undergone a long fallow, distinctive differences are not to be expected from the plant crop. Both nitrate of soda and sulphate of ammonia were equally valuable forms of nitrogen, and a similar statement describes the relative influences of muriate and sulphate of potash. With regard to phosphates, it does appear that rock phosphate is definitely inferior to the more readily available forms, and basic superphosphate seems to be the most favourable form. However, it will be well to defer judgment until the ratoon crops have been harvested.

MOLASSES TRIAL (Plant Crop).

Plan and Yields.

Fertilizer 21·3	Molasses 25·0	Check 14·6
Check 18·2	Fertilizer 24·0	Molasses 20·5
Molasses 25·6	Check 20·3	Fertilizer 31·5

Block.—C2.
Variety.—Q. 813.
Harvested.—September, 1932.
Age of Crop.—14 months.
System of Replication.—3 x 3 Latin square.
Plots.—0·101 acre.
Treatments.—
Check—No treatment.
Molasses—Ten tons molasses applied broadcast before planting.
Fertilizer—Plant-food equivalent to that contained in 10 tons molasses was applied in the following fertilizer :—
900 lb. sulphate of ammonia per acre;
280 lb. superphosphate per acre;
1,180 lb. sulphate of potash per acre.

The superphosphate and potash were applied broadcast at the same time as the molasses was spread; one-third of the sulphate of ammonia was applied broadcast six weeks later, and the remainder in two equal top dressings after the crop was planted, at four-week intervals.

Growth.—A good strike was obtained on this block, with but slight damage from Pentodon beetle.

Crop Yields.

—	Check.	Molasses.	Fertilizer.
Cane, tons per acre	17.30	23.70	25.61
Cane, percentage of mean yield	74·2	106·2	114·6
C.C.S. in cane, per cent.	18.16	17.76	17.60
C.C.S., tons per acre	3.21	4.20	4.50

Work of the Central Sugar Experiment Station—continued.

DISCUSSION.

The benefits of molasses as a fertilizer, even in an unfavourable year, are clearly borne out by the results of this trial. In contrast to the returns from a similar trial at South Johnstone Station, the fertilized plots gave slightly superior yields to those receiving molasses, but the difference is not significant.

Past experience has shown that this soil responds favourably to nitrogenous manures, and also in a smaller degree to phosphates. The increased yield due to potash is generally slight. It may, therefore, be concluded that the nitrogen supply of the molasses has been chiefly responsible for the increased yield observed.

The heavy plant-food applications have been responsible for an appreciable depression in the c.c.s. content of the cane, but this is very definitely outweighed by the favourable influence of the added plant food on the cane yield.

FERTILIZER TRIAL—LIME, NITROGEN, AND PHOSPHATE—TIME OF APPLICATION (Plant Crop).

Plan and Yields.

	LIME.		NO LIME.		LIME.		NO LIME.	
I.	C	10·9	2NN 2P Early	12·2	2NN 2P Early	13·3	1NA 1P Early	18·3
	1NA 1P Early	14·1	1NN 2P Early	12·5	C	14·4	2NN 1P Late	18·8
	2NN 1P Late	17·8	2NA 1P Early	19·3	1NN 2P Early	13·9	1NA 2P Late	22·0
	2NA 2P Late	19·1	C	12·7	1NN 1P Late	19·2	2NA 2P Late	23·4
	1NA 2P Late	12·9	1NN 1P Late	19·9	2NA 1P Early	22·0	C	17·2
II.	1NA 1P Early	16·5	C	10·0	1NN 1P Late	19·2	1NA 1P Early	20·1
	1NA 2P Late	19·9	2NN 2P Early	11·4	2NN 2P Early	14·4	1NN 2P Early	15·6
III.	1NN 2P Early	12·7	1NN 1P Late	12·0	2NN 1P Late	15·0	2NA 2P Late	14·1
	2NA 2P Late	14·9	2NA 1P Early	12·1	C	11·8	1NA 2P Late	12·9
IV.	C	15·5	2NN 1P Late	15·7	2NA 1P Early	13·2	C	15·9
	NO LIME.		LIME.		NO LIME.		LIME.	

Block.—C1.

Variety.—Q. 813.

Harvested.—September, 1932.

Age of Crop.—15 months.

System of Replication.—Four randomised blocks.

Plots.—0·06 acre.

Treatments.—

Lime *v.* No Lime—Four blocks of five plots received 1 ton burnt lime per acre, before planting. Remaining twenty plots received no lime.

All plots received 150 lb. muriate of potash per acre.

In addition—

C—no further manure.

1NA—200 lb. sulphate of ammonia per acre.

1NN—260 lb. nitrate of soda per acre.

2NA—400 lb. sulphate of ammonia per acre.

2NN—520 lb. nitrate of soda per acre.

1P—200 lb. superphosphate per acre.

2P—400 lb. superphosphate per acre.

Early v. Late.—On plots receiving fertilizer early, all P and K and one-quarter of the N was applied in the drill. The late-treated plots received similar fertilizer at "ploughing-away" time.

All additional—N was applied at the same time, in October and November.

Growth.—The germination on this block was seriously affected by Pentodon beetles. They attacked the young shoots from the time of germination until November. Misses were supplied and these also were damaged. The damaged stools at harvest time showed 3–4 ft. of cane, while the unaffected stools had 5–6 ft. of cane. The crop was, as a consequence, most uneven at harvesting.

Work of the Central Sugar Experiment Station—continued.

Crop Yields.

——	Lime.	No Lime.	No Fertilizer.	Amount of Nitrogen.		Kind of Nitrogen.		Amount of Superphosphate.		Time of Application.	
				1 N	2 N	Sulphate Ammonia.	Nitrate of Soda.	1 P	2 P	Early.	Late.
Cane, tons per acre	14.87	16.47	13.55	16.36	16.04	17.18	15.23	17.19	15.32	15.12	17.30
C.C.S. in cane, per cent. ..	17.38	17.31	17.46	17.47	17.17	17.34	17.30	17 46	17.18	17.28	17.36
C.C.S., tons per acre	2.58	2.85	2.37	2.86	2.75	2.98	2.63	2.99	2.63	2.61	3.00

DISCUSSION.

The plot yields in this experiment are so erratic, due to pest damage, that no reliable conclusions may be drawn from the results. The block has been ratooned, and it is hoped that succeeding crops will be free from the complicating features influencing the plant yields.

FERTILIZER TRIAL—AMOUNTS OF NITROGEN (Plant Crop).

Plan and Yields.

4N 10·8	C 11·9	3N 15·8	1N 15·9	2N 15·6
1N 9·1	2N 14·2	4N 17·4	3N 15·8	C 18·4
2N 9·3	3N 17·0	1N 14·5	C 15·1	4N 18·1
C 12·0	1N 14·9	2N 17·9	4N 18·8	3N 18·2
3N 14·1	4N 20·4	C 19·9	2N 17·6	1N 21·8

Block.—B2.

Variety.—Q. 813.

Harvested.—October, 1932.

Age of Crop.—14 months.

System of Replication.—5 x 5 Latin square.

Plots.—0·05 acre.

Fertilizer.—

All plots received—
400 lb. superphosphate per acre ;
150 lb. sulphate of potash per acre.

In addition—

C—No further fertilizer.

1N—125 lb. sulphate of ammonia per acre.

2N—250 lb. sulphate of ammonia per acre.

3N—375 lb. sulphate of ammonia per acre.

4N—500 lb. sulphate of ammonia per acre.

Growth.—The block suffered severely from damage by Pentodon beetle. Counts made of damaged shoots showed about 25 per cent. affected. Allowing for those shoots damaged prior to and subsequent to the counts, it is possible that 40 per cent. of the original shoots were attacked.

Analysis of Variance.

Due to	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Rows	4	69·93	17·48	..
Columns	4	158·70	39·68	..
Treatments	4	15·18	3·80	0·6675
Errors	12	18·89	1·57	0·2255
Total	24	262·70	..	..

Work of the Central Sugar Experiment Station—continued.

Crop Yields.

	No Nitrogen.	1 N	2 N	3 N	4 N
Cane, tons per acre	15.46	15.24	14.92	16.18	17.10
Cane, percentage of mean yield	98·0	96·6	94·6	102·5	108·3
C.C.S. in cane, per cent.	17.81	17.73	17.86	17.48	17.79
C.C.S., tons per acre	2.76	2.71	2.66	2.83	3.04
Standard Error	3.55 per cent.				

DISCUSSION.

Due to the adverse conditions brought about by pest attack, the results of this crop allow no conclusions to be drawn. The ratoons might be expected to provide some useful information with respect to the optimum dressing of nitrogen—the plant food which has been found to be most instrumental in effecting increased yields on this soil type.

DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE SUGAR EXPERIMENT STATION, MACKAY, FROM 1st NOVEMBER, 1931, TO 30th OCTOBER, 1932.

Materials.	Number of Analyses.
Sugar canes for growers	117
Sugar canes for station	149
Sugar canes for Mackay Show	72
Limestones	5
Soils—Acidity and phosphate	30
Juice—Phosphate determinations	137
Maturity test on cane (including ash, phosphate, and reducing sugars)	327
Fibre determinations in cane	9
Total	858

TOTAL TONNAGE OF CANE HARVESTED FROM THE CENTRAL SUGAR EXPERIMENT STATION, MACKAY, SEASON 1932.

	Tons.
Cane sent to mill	151·1
Used for plants	6·0
Sold for plants	16·3
Total	173·4

Nature of Crop—

	Per cent.
Plant cane	100·0
Acreage under cane	10·0
Tons of cane per acre	17·34

SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG.

MR. J. PRINGLE, Chemist in Charge.

METEOROLOGICAL.

The past growing season was marked by a combination of adverse conditions, since, following on a fairly mild winter in 1931, the months of August and September were warm and dry, and the crops made but little progress till after a fall of 1·90 inches early in October; this was sufficient to produce a satisfactory germination in the spring plantings and start the young ratoons away, but as it was followed by a few weeks of dry weather the growth was retarded. During the next two months good growing conditions prevailed and the cane, making a rapid recovery, grew vigorously, this period being responsible for four-fifths of the crop harvested. Abnormally hot, dry conditions prevailed from mid-January to the end of March, and in many parts the cane commenced to die out. A fall of 175 points early in April eased things a little, but cold, dry conditions followed, and the cane made no further growth before harvesting.

The already serious position was greatly accentuated by successive sharp frosts in July doing much damage to the stunted cane which, had it not been for the frost, could have been allowed to standover; but, as it was, it had to be cut and removed, and constituted a heavy loss.

The past winter was very severe, and the early spring months have been for the most part dry. Showery conditions during September have been followed by good general rains in October, and the strike of Spring planted cane is now assured. The ratoons have also shown good progress since the rain.

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

Month.	Rainfall. Inches.	Number of Wet Days.
August, 1931	0·87	7
September, 1931	0·74	5
October, 1931	1·90	4
November, 1931	2·82	8
December, 1931	10·04	10
January, 1932	1·62	8
February, 1932	0·27	3
March, 1932	0·10	2
April, 1932	1·75	7
May, 1932	2·12	10
June, 1932	0·13	4
July, 1932	0·34	2
August, 1932	0·27	3
September, 1932 (to 27th)	1·45	8
Total	24·42	81

Experiment Harvested during 1932.

Varietal Trial with Oramboo, Korpi, Nanemo, S.C. 12/4, and Q. 813.

New Experiments Initiated.

(1) Two Trials with Molasses—

(i.) Three plots using four, six, and eight tons of molasses per acre;

(ii.) Three plots using three, five, and seven tons of molasses per acre.

(2) Subsoiling combined with fertilizing.

(3) Varietal Trial with Co. 281, Co. 290, Manoa 304, P.O.J. 2725, P.O.J. 2727, P.O.J. 2747, P.O.J. 234, P.O.J. 2379, 26 C. 148, 26 C. 188, and U.D. 1.

Work of the Southern Sugar Experiment Station—continued.

VARIETAL TRIAL—PLANT CROP (Standover).

Plan and Crop Yields.

KORPI	NANEMO	Q. 813	S.C. 12/4	ORAMBOO
(1) 21·33	17·69	15·33	13·33	14·29
(2) 3·34	2·76	2·33	1·84	2·21
Q. 813	KORPI	ORAMBOO	NANEMO	S.C. 12/4
(1) 16·33	21·59	16·16	14·16	10·52
(2) 3·46	2·49	2·36	1·93	1·56
NANEMO	S.C. 12/4	KORPI	ORAMBOO	Q. 813
(1) 14·16	9·92	14·73	14·24	13·80
(2) 2·13	1·42	2·41	2·02	2·08
ORAMBOO	Q. 813	S.C. 12/4	KORPI	NANEMO
(1) 14·16	14·52	10·00	11·22	10·52
(2) 2·07	1·89	1·57	1·59	1·34
S.C. 12/4	ORAMBOO	NANEMO	Q. 813	KORPI
(1) 13·99	16·54	12·66	13·69	15·46
(2) 2·27	2·62	1·99	2·03	2·23

(1) Cane, tons per acre. (2) C.C.S., tons per acre.

Block.—E. 3A.
Harvested. — August, 1932.
Age of Crop.—2 years.
System of Replication.—5 x 5 Latin square.
Plots.—0·0375 acre.
Manurial Treatment.—All plots received fertilizer at the following rate per acre :—
250 lb. muriate of potash ;
75 lb. superphosphate ;
100 lb. ammonium sulphate.

Cultivation.—In December, 1929, the stools of the previous crop were ploughed out and the block harrowed. Further cross-ploughings were given in February and May, 1930. The cane was planted at the beginning of August, 1930, and the soil being fairly moist each variety germinated well, except S.C. 12/4, where a few misses had to be filled in ; these were supplied in October.

Growth.—All varieties made good progress during September and October, but suffered a set-back in November, and growth was slow till after the good rain in February, 1931, when further progress was made. This was again retarded by cold conditions in April. As the cane had not made sufficient growth to warrant cutting in 1931 it was allowed to standover. Further growth was made from October to December, but owing to the extremely dry conditions no progress was made during the late summer months, and before harvesting there was a fair quantity of dead sticks in each of the varieties—Korpi apparently having the least. During the whole period the plots were practically uniform.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Rows	4	61·16	15·29	..
Columns	4	45·02	11·26	..
Varieties	4	75·39	18·85	1·4686
Errors	12	27·57	2·30	0·4164
Total	24	209·14	..	..

Work of the Southern Sugar Experiment Station—continued.

Crop Yields.

—	Q. 813.	S.C. 12/4.	Korpi.	Nanemo.	Oramboo.
Cane, tons per acre	**14.73**	**11.55**	**16.87**	**13.84**	**15.08**
Cane, percentage of mean yield	102·2	80·2	117·0	96·0	104·6
C.C.S. in cane, per cent.	**14.6**	**15.1**	**15.1**	**14.5**	**15.1**
C.C.S., tons per acre	**2.15**	**1.75**	**2.55**	**2.09**	**2.28**
Standard Error	**4.70** per cent.				

DISCUSSION.

The yields show that Korpi was significantly superior to the standard Q. 813, while all other varieties out-yielded S.C. 12/4. Having regard for the fact that this was a two-year-old crop, which had experienced excessively adverse conditions, the results cannot be taken as a true reflection of the relative yielding capacities of the several varieties.

DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, FROM 1st NOVEMBER, 1931, TO 31st OCTOBER, 1932.

Materials.	Number of Analyses.
Sugar canes and juices for growers	225
Sugar canes and juices for Agricultural Show, Bundaberg ..	158
Sugar canes and juices for Agricultural Show, Maryborough ..	18
Sugar canes and juices for Agricultural Show, Pialba	46
Sugar canes and juices for Experiment Station	25
Total	472

TOTAL TONNAGE OF CANE HARVESTED FROM THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, DURING 1932.

	Tons.
Cane sent to mill	64·75
Cane used for plants	1·00
Total	65·75
Nature of Crop—	Tons.
Plant cane	32·85
Plant cane (standover)	23·10
First ratoon cane	9·80
Tonnages—	Per cent.
Q. 813	56·04
D. 1135..	13·39
Other varieties	30·57
Area harvested (acres)	9·5
Average tons per acre	6·92

6.—Work of the Division of Pathology.

REPORT OF Mr. A. F. BELL, SUGAR PATHOLOGIST, FOR THE YEAR ENDING 31st OCTOBER, 1931.

With increasing knowledge and its application the goal of the permanent and automatic control of the major sugar-cane diseases draws appreciably nearer. The application of pathological technique, improved facilities for plant breeding, and the availability of new important "blood" lines make it possible to work towards the production of resistant varieties of sugar-cane upon a sound and hopeful basis. The major portion of the laboratory work is being directed towards obtaining information which will assist in the operation of the all-important disease resistance trials and, during the period under review, some important advances have been made in this direction, particularly in the case of leaf-scald disease. In the field unsuitable climatic conditions have greatly militated against the success of experimental work, and several trials have had to be abandoned.

Variety Introductions.

The varieties Tekcha, Oshima, Kavangire, Merthi, and C.H. 64/21 were received from the United States Government collection in November, 1931. These varieties are of the Uba type, Kavangire being the "Uba" of Argentina and Porto Rico. They appear inferior to Natal Uba in vigour of growth, but should prove of some value as parents in cane-breeding work.

The variety isolation and propagation garden on Stradbroke Island has proved of particular benefit under the droughty conditions prevailing this year. The collection at present contains over seventy varieties.

Pseudo-Scald.

In the Annual Report of 1929 I recorded the presence of a disease which appeared to be distinct from leaf-scald in certain important characteristics. Pending investigation this disease was provisionally termed pseudo-scald. In 1930 the same disease was reported and fully described in Hawaii under the name of "Chlorotic Streak"; it is also known to exist in Java, where it was found in 1928, and in Porto Rico. No associated organism has been demonstrated by exhaustive histological examination in Hawaii, Java, and in this laboratory, and we have been unable to isolate any such organism in culture, although culture media of different types, with varying pH and Eh, have been used. Included in these have been media, developed in this laboratory, which are extremely favourable for the culture of the leaf-scald organism. This evidence, as well as field observations, indicates that the two diseases are definitely distinct.

Pseudo scald may be found all through the Northern districts wherever Badila is grown, and it was recently found in this variety on the Maroochy River, but so far it has not been found in other varieties to any great extent. The symptoms, which have been described previously, are best observed when the young cane is about 2 ft. 6 in. high; in older cane there is usually a complete masking of the symptoms. No estimation of losses, if any, due to this disease has been possible heretofore, on account of the difficulty of finding infected cane which could at the same time be guaranteed free from leaf-scald. Fortunately this difficulty now appears to have been overcome, and every effort will be made to propagate supplies in order to make adequate tests. At the same time, good evidence of natural secondary spread of the disease has been obtained.

The disease appears to be readily controllable by means of hot water treatment of cuttings, so that it should prove an easy matter to obtain supplies of disease-free plants when desired.

Leaf-Scald.

As indicated in last Report, leaf-scald has been constituted the chief problem for laboratory investigation. This disease, the most important in the main sugar areas of Queensland, presents many complex problems, and a good deal of fundamental research work requires to be done before our knowledge of many essential points can be regarded as satisfactory. The considerable amount of technical work which has been done in accordance with these requirements is briefly summarised below.

Improved Culture Medium.

In order to ensure the successful isolation and culturing of the causal organism (*B. albilineans*) in the presence of small amounts of inoculum, an amended medium was devised. This consisted of ordinary Wilbrink's agar medium plus ·005 per cent. of anhydrous sodium sulphite added after sterilisation. With this medium, growth is assured at dilutions of the order of 1/1000 of the minimum required in the case of the non-amended medium. The optimum concentration of sodium sulphite may be expected to vary with variations of other constituents of the medium, and the precise definition of the amended medium in terms of oxidation-reduction potentials is deferred pending the arrival of material from abroad.

6. Work of the Division of Pathology—continued.

Resistance Trial.

In co-operation with the Plant Breeder, a large experimental resistance trial was laid out in order to determine the practicability of testing the relative group resistance of the progeny from various crosses. Thirty-two crosses were represented; cuttings were inoculated at planting with a suspension containing *B. albilineans* from three sources. Inspections have been made periodically, the apparent infection reaching a maximum in December and rapidly declining, owing to the masking of symptoms and/or the death of infected shoots. It is not proposed to record the results in detail, but the following selections from the December inspection are typical and interesting:—

Cross.	Resistance of Parents.	Infection.
N.G. 24 × E.K. 28	Both susceptible	98 per cent. stools infected
M. 291 × E.K. 28	Female unknown, male susceptible ..	80 per cent. stools infected
N.G. 24 × S.C. 12/4	Female susceptible, male resistant ..	35 per cent. stools infected
N.G. 15 × S.C. 12/4	Female tolerant, male resistant ..	0 per cent. stools infected
P.O.J. 2364 × S.C. 12/4	Both resistant	0 per cent. stools infected

N.G. 24, a susceptible cane, appeared in five crosses, the minimum infection (N.G. 24 × S.C. 12/4) being 35 per cent.; S.C. 12/4 appeared in ten crosses and, with the exception of the N.G. 24 × S.C. 12/4 cross, none of the progeny became infected. While, naturally, any great importance cannot be attached to the results of a single experiment, the above results are certainly suggestive of value of the method. A trial along similar lines has been planted this year, and contains seedlings of eight crosses, of which the progeny have excellent vigour. Four of these crosses were represented in last year's trial, and exhibited four different grades of resistance; they will, therefore, serve as checks on the consistency of the results obtained.

Methods of Inoculation.

In the above trial, cuttings were inoculated immediately prior to planting by smearing a suspension of bacteria over the freshly-cut surface. While this method has obviously produced positive results in this instance, it may have certain defects. Accordingly, two methods of mechanical inoculation are being investigated.

Treatment of Infected Planting Material.

Owing to the Breeding Station at South Johnstone being situated in the midst of a leaf-scald infected area, the removal of plants is restricted, thereby causing a good deal of inconvenience. For this reason a considerable amount of thought has been given to possibility of some therapeutic treatment for leaf-scald diseased cane intended for planting purposes. To this end, preliminary work has been done in the way of determining the penetrability of various substances and their subsequent effect upon the germination of the cuttings, together with determinations of their toxicity towards *B. albilineans*. Two or three promising lines of attack have been determined, and are now being tested. In connection with this work, an interesting point has developed, viz., that the desideratum is the bacteriostatic concentration of the toxic substance and not the bactericidal concentration.

The Existence of Strains of B. albilineans.

The possible existence of strains of a parasite of varying pathogenicity, but otherwise indistinguishable, is the bug-bear of the Plant Breeder and the Pathologist. We have observed in leaf-scald disease some anomalies which could be explained by the presence of strains of the causal organism, and this has led to a search for possible physiologic strains. Under certain conditions cultural variants may be observed in giant colonies in the form of sectors, and a number of these has been isolated. The strains isolated include an extremely rough type and an extremely smooth type, and, owing to the frequent relation of "roughness" and "smoothness" to pathogenicity, the relative pathogenicity of these two types is being investigated.

In this connection, Mr. Cottrell-Dormer, Assistant Pathologist, has devised a simple, effective, and inexpensive single cell apparatus for the ultimate purification of these cultures. This apparatus will be described in due course.

Gumming Disease.

Although "infected" planting material of susceptible varieties is widely used in Southern Queensland, nevertheless in the very young plants, as a rule, the disease can be found in only a small proportion. Under normal conditions, however, with the advent of the rainy season, the disease spreads rapidly from plant to plant, and the whole field soon becomes infected. Owing to the complete failure of the rainy season last summer this secondary spread did not eventuate and, consequently, gumming disease has been little in evidence this year.

6. Work of the Division of Pathology—continued.

A variety resistance trial, including thirty new varieties, was laid out in Bundaberg, but owing to the adverse season has had to be abandoned. A further trial has recently been planted; in addition to possible commercial varieties this trial includes seedlings representing the progeny of several "Trial Marriages." From the mass behaviour in this trial will be judged the likelihood of resistant seedlings resulting from the particular crosses used.

The propagation of stocks of varieties found to be resistant in previous trials has been retarded by the drought, but, fortunately, fair stocks of a number were obtainable from the Isolation Garden. A preliminary yield trial of six new varieties has been set out, together with an observational yield trial of a further fifteen varieties.

Red Stripe Disease.

The field investigations on the incidence and control of Red Stripe or Top Rot Disease in the far Northern areas have been advanced a further stage. It has been well demonstrated that with the standard variety, Badila, practically 100 per cent. control may be effected by early (i.e., autumn) planting. This fact was well illustrated in an "Optimum Condition" experiment, carried out at South Johnstone Experiment Station, the conditions and results of which are recorded on page 34 of this Report. The cane planted on 12th April, 1931, was entirely free from Red Stripe disease, while in the immediately adjoining cane, planted on 12th August, 1931, death of the order of 25 per cent. occurred. The amount of autumn planting is naturally dependent upon the duration of the rainy season, and in particular localities and in certain seasons it is impracticable. Consequently, experimental work is being directed towards methods of reducing the losses likely to be incurred when the cane must be planted late in the season.

Compensation Factor.

Field observations had indicated definitely that the death of certain stalks in the stool was to some extent compensated by an increased growth on the part of the remaining stalks. Last year we reported the results of an experiment conducted in the Burdekin irrigation area, which showed that the degree of compensation may be considerable. During the current year a further trial along the same lines was carried out under natural rainfall conditions at J. Evered's farm at Mundoo. The experimental lay-out was six randomised blocks of three treatments, viz., check, 10 per cent. death, and 20 per cent. death. Following population counts, the distribution of the treated stalks within the stools was determined from data from previous population counts in diseased fields. The stalks so designated were killed by the injection of a suspension of *B. rubrilineans*: later inspection checked the fact that the inoculations had been 100 per cent. successful and no secondary spread had occurred.

Results.

C 35·68	B 37·69	A 39·06
A 42·84	C 36·11	B 39·24
B 39·24	A 40·54	C 38·23
A 38·23	B 42·12	C 34·09
C 35·28	A 42·01	B 39·56
B 39·13	C 34·52	A 46·15

A = Check; B = 10 per cent. Death; C = 20 per cent. Death.
Yield of plots expressed as tons per acre.
Trial planted July, 1931; harvested September, 1932.

6. Work of the Division of Pathology—continued.

Analysis of Variance.

Due to	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log_e (mean square).
Blocks	5	12·19	2·44	..
Treatments	2	105·12	52·56	1·9812
Error	10	50·16	5·02	·8067

S.E. (6 plots) $\sqrt{6 \times 5{\cdot}02} = 5{\cdot}49$ or 2·35 per cent. of mean.

Summary of Yields.

—	A	B	C	Mean.	S.E.
Cane, tons per acre	41·47	39·49	35·66	38·87	·91
Percentage of mean	106·7	101·6	91·7	100	2·35

Discussion.

The difference of 1·98 tons between the mean yields of the check plots and 10 per cent. killed is possibly significant, while the difference between check and 20 per cent. killed (5·81 tons) is certainly significant. In the case of the 10 per cent. killed, the loss has amounted to 4·8 per cent., against the theoretically expected loss of 10 per cent., and, in the case of the 20 per cent. killed, 14 per cent. against 20 per cent. expected. It is evident, therefore, that there has been a definite compensation through increased growth of the remaining stalks. It should be borne in mind that these losses are greater than would normally occur, since, under the conditions of the experiment, the total death occurred in March, whereas, under natural conditions, the greater proportion of death would occur in January and early February. There would thus be allowed a much greater period of the season of rapid growth for the compensation factor to operate.

Varietal Resistance.

Owing to unfavourable weather conditions in that particular locality, the Red Stripe resistance trial had to be abandoned; two fresh trials have been planted out this year. It should perhaps be mentioned at this time that the variety P.O.J. 2878 has proved extremely susceptible to this disease.

Density of Stalk Population.

Based on field observations, the theory was advanced some time ago that the incidence of top rot was correlated with the density of the stalk population per acre. This theory was tested by means of population counts covering the plots in two fertilizer trials. In each case a marked correlation was found between the number of stalks per plot and the percentage of death from top rot. This theory will be further tested during the coming season, and, in addition, the effect upon yield and percentage of top rot caused by a differential spacing of setts in the drill is being tested experimentally.

Influence of Fertilizers.

The influence of fertilization upon the incidence of top rot may be conveniently studied in the farm fertility trials laid out by the Division of Soils and Agriculture. However, owing to weather conditions in the autumn of 1931 permitting widespread early planting, only one late plant fertility trial with adequate amounts of top rot was available. Population counts in this trial demonstrated that where nitrogenous fertilizers had been applied there was an increase in both the number of stalks per acre and the amount of death. It is expected that much more information will be available this year, since the prolongation of the rainy season has necessitated a very large proportion of late planting.

Dwarf Disease.

Dwarf disease was recorded on one farm in a new locality (Oakenden), but the number of farms on which the disease was found during the twelve-month period was reduced to eight. These farms have been placed under quarantine for a period of two years.

Further efforts were directed towards culturing a possible causal organism, employing culture media of varying constitution—hydrogen ion concentration and oxidation-reduction potential—but without success. Repeated histological examinations have also failed to demonstrate the presence of any visible causal agent. The Assistant Entomologist at Mackay plans to investigate the possibility of insect transmission, and has made preliminary observations.

6. Work of the Division of Pathology—continued.

Fiji Disease.

A strong effort has been made towards improving the Fiji disease situation in the Bundaberg district, and several visits have been paid to the infected farms, and the destruction of diseased stools supervised by an officer of the Bureau. Mr. Kelly has also spent a considerable amount of time in the Maryborough district in an effort to arouse interest in the more effective control of the disease in that area. The presence of Fiji disease in Southern Queensland must now be given much more serious consideration on the part of canegrowers, owing to the fact that a number of the new gumming resistant varieties are definitely quite susceptible to the disease. An illustrated pamphlet, describing the symptoms of the disease and the methods for control, was recently distributed to farmers in Southern Queensland.

Minor Diseases.

The following minor diseases and abnormalities have been observed from time to time, and are included here for the purposes of record:—Brown stripe, leaf freckle, leaf stipple, Pestalozzia leaf spot, yellow leaf blotch, and wind buckle.

International Conference.

In the capacity of Queensland Government Delegate, I attended the Fourth Triennial Conference of the International Society of Sugar Cane Technologists, held in San Juan, Porto Rico, in March of this year. The section on diseases of sugar-cane was attended by Pathologists from Continental United States, Porto Rico, Peru, Hawaii, Java, Philippines, and Australia, and a large number of papers was read and discussed. *En route* to the Conference I spent some time in Hawaii and Continental United States, visiting a number of laboratories, and collecting a good deal of useful information. A full report of my trip was made in May of this year.

Publications.

During the year, papers on the following subjects have been compiled by either the Pathologist or the Assistant Pathologist, and published in various journals:—

Dwarf Disease of Sugar Cane;
The Cane Killing Weed;
Red Stripe Disease of Sugar Cane in Queensland;
The Fiji Disease Menace in Southern Queensland;
Bacterial Diseases of Sugar Cane;
Disease Resistance Trials;
An Improved Method for the Isolation of the Leaf-Scald Organism;
The Estimation of Losses due to Red Stripe Disease in Queensland.

In addition, Wireless Lectures were delivered on the following subjects:—

Selection of Sugar Cane for Planting Purposes;
Disease Resistant Varieties—How they are Produced;
Red Rot and Related Diseases;
Notes on the Sugar Conference in Porto Rico.

7.—Work of the Division of Entomology.

The work of this Division is carried out in the Northern, Central, and Southern sugar areas. The main entomological station is situated at Meringa, near Cairns, where the Chief Entomologist, Mr. E. Jarvis, is located. Assistant Entomologists, Messrs. Mungomery and McDougall, are in control of the investigational work in the Bundaberg and Mackay districts, respectively; facilities for this work are provided at the local experiment stations.

Mr. J. H. Buzacott, Assistant at Meringa, was granted leave for part of the year to enable him to complete his Final year at the Queensland University.

REPORT OF Mr. E. JARVIS, ENTOMOLOGIST IN CHARGE AT MERINGA.

Before detailing the nature of such activities and results obtained in connection with the control of cane insects, I wish to state that the past twelve months apparently mark, as it were, the turning point with regard to the attitude hitherto shown by the majority of our canegrowers towards entomological research work.

It is particularly interesting to find that Italian farmers are becoming keen on the question of soil fumigation, and are beginning to realise that cane grub attack does not necessarily mean certain destruction of their crops.

Similarly, with reference to scientific control of the "Cane Weevil" (*Rhabdocnemis obscurus* Boisd.) and of the "Army Worm" (*Cirphis unipuncta* Haw.) intelligent growers are quite satisfied that these pests can, if desired, be effectually combated by means of the remedies advocated by the Sugar Bureau for dealing with such cane insects.

As a result of the "Monthly Hints" emanating from this experiment station, farmers have commenced to purchase spray-pumps and arsenical compounds, &c., for use against the various leaf-eating beetles, caterpillars, &c., known to attack the leaves of sugar-cane.

Establishment of Soil Fumigation.

The successes achieved against our cane-grubs by the practice of soil fumigation have now established this control measure on a firm basis; proving beyond doubt the economic value of both paradichlorobenzene and carbon bisulphide.

As often pointed out in former Reports during past years, these fumigants are effective against root-eating scarabæid grubs, whether employed separately or mixed together.

It should be noted, however, that entomologists in other countries prefer the former and simpler mode of application, and in latest research bulletins are recommending dry nodules of paradichlorobenzene for controlling the ravages of such grubs, with which they claim to be obtaining high percentages of mortality. Again, on the other hand, marked successes have resulted in the Cairns and Innisfail districts from the administration of injections of carbon bisulphide, both with and without the admixture of paradichlorobenzene.

In illustration of the advantages being secured by our method of grub fumigation, I may mention that growers, in the Mulgrave Mill area alone, have placed orders for the abovementioned fumigants with the Manager for the coming season, which amount to a total of £4,500 for the purchase of thirty-one tons of carbon bisulphide, and twenty tons of paradichlorobenzene.

Outstanding success was again secured by grub fumigation last season at the Greenhills Estate, where about 150 acres were treated.

Biological Control Work.

Breeding Digger-Wasp Parasites.

Since publication of my Annual Report for 1930-31, the breeding of *Campsomeris aureicollis* Lep. has been steadily carried on; seven successive broods of this Philippine parasite having been reared at Meringa between the dates January, 1931, to June, 1932.

Sufficient experimentation in this connection has now been carried out here to prove definitely that *C. aureicollis* will readily parasitise and breed through from egg to the adult form on the grubs of three species of our northern scarabæid cane-beetles (including those of *Lepidoderma albohirtum* Waterh. and *Lepidiota frenchi* Blkb.), and on larvæ of the so-called "Southern Cockchafer" (*Pseudogolophylla furfuracea* Burm.)—specimens of the larvæ of which were procured by me from Bundaberg for such experimental work—and will complete its life-cycle stages from egg to wasp parasite on the grubs of either of these four hosts.

Campsomeris sp. (near *C. tasmaniensis* Sauss.)—Two specimens of this species, both of which were females, were received from the district of Miles, near Dalby, during August, 1931. These were placed in separate cages containing moist soil and a single third-stage grub of *Anomala australasiæ* Blkb. on 28th August, and two days later an egg was procured from one of these parasites.

7. Work of the Division of Entomology—continued.

The other female commenced to oviposit on 23rd October; while eggs Nos. 2, 3, 4, and 5 were obtained from this wasp on 24th, 25th, 27th, and 31st of the same month; the parasite dying on 9th November.

Phorid Fly (probably classed in Section Syrphoidea).—Dipterous larvæ were found lying amongst mealy bugs occurring under leaf-sheaths of cane at Meringa, under conditions suggesting predatory habits. These were successfully reared to the pupal and adult stages, thus establishing interesting relationship between this predatory fly and *Pseudococcus calceolariæ*. This matter will be further investigated in the near future. This fly was first noticed by me associated with mealy bugs at Gordonvale in 1916.

Control of Rhabdocnemis obscurus Boisd.—The present position with regard to this serious cane pest, the insidious working of which if unchecked would lead to considerable financial losses, is, on the whole, very satisfactory. The Tachinid fly parasite (*Ceromasia sphenophori*) appears to be doing excellent work, particularly in the South Johnstone and Babinda areas, as well as those localities where suitable sanctuaries have been provided where this insect parasite can breed naturally.

Ten requests from growers for liberation of these useful flies were received during the period July, 1931-32, and 170 specimens have been sent out to farms at Daradgee, Mulgrave, Innisfail, Pawngilly, and Tully.

It is very encouraging to note that at South Johnstone the Field Supervisor, Mr. G. Wilson, reports:—"A survey has been made of the degree of infestation of the cane with beetle borers, and to what extent these have been controlled by the Tachinid fly since the beginning of the 1932 crushing. Flies have been found on twenty-seven farms, distributed over almost the entire area from Nerada to Warrubullen and Goolboo. These are not all the farms on which flies exist.

"As the harvesting goes on the survey will be completed, and flies will be found on many more farms."

At the beginning of the year a new breeding-cage for *Ceromasia sphenophori* was built by us from a new design supplied by Mr. Buzacott, which has resisted invasion by ants, cockroaches, and spiders better than cages of earlier construction.

Reported Damage by "White-Ants."

A few complaints have come to hand regarding injuries to cane from the attacks of various termites, and advice sought as to simple methods for combating such ravages.

In our canefields, injury by white ants may consist in destruction by the worker and soldier forms of a community of (1) newly planted setts and young shoots arising from same; (2) invasion of the setts and growing cane sticks from below ground level; or (3) ultimate removal of the entire internal cellular tissue of the sticks, thus reducing such canes to hollow tubes, nothing being left but the rind. Such injury as that described under (3) is shown externally by a wilted or brown appearance of the central heart-leaves. Commonsense control methods should be practised when possible, the first step in this direction being a careful survey of the extent of an infested area, with a view to discovering sources from which invasions may have originated. Such line of procedure often proves successful on farms where this pest has appeared recently, and not had time to obtain a secure footing. Additional controlling factors are described in the "*Queensland Agricultural Journal*," vol. xxxvii., page 297, under the following headings:—

(*a*) Tracing direction of tunnels through the soil.
(*b*) Destruction of termitariums near headlands.
(*c*) Rejection of infested seed cane.
(*d*) Ploughing deeply during autumn months before planting on new ground.
(*e*) Avoidance of burying heavy trash or debris under or against cane stools.
(*f*) Dipping setts in a poisonous solution before planting same; or the cut ends in some deterrent mixture.

Experiment Plots.

An acre of first ratoons of Badila was made use of this year for experimental purposes, with a view to testing the toxic value of paradichlorobenzene and carbon bisulphide when used separately against grubs of *Lepidoderma albohirtum* Waterhouse. Fumigation was started on 16th March at the southern end of this plot, by injecting nine rows of 3 chains 44 feet long (= 9,801 square feet) with carbon bisulphide, giving a dosage of 18 cc. per stool in four separate injections (= about ¾ oz.). This dose was obtained with a Vermorel Pal Excelsior Injector carrying one ring.

The plants at this time were six to eight feet high, injections being made at an average depth of about four inches, and at a time when the grubs of *albohirtum* occurred in second and third instars of development.

The next five rows (= 5,445 square feet) were left untreated to act as check plot; while the following nine rows (Nos. 16 to 24 = 9,801 square feet) were injected with carbon bisulphide in the same manner as rows 1 to 9.

7. Work of the Division of Entomology—continued.

The four succeeding rows form another check plot (Nos. 25 to 28); the following four (Nos. 29 to 32) being injected with dry crystals of paradichlorobenzene, put in with a Jarvis Injector; the dosage used being about 7 drachms per stool, administered in four separate injections.

At the present time (19th September), all the treated cane looks well, the sticks averaging about five feet in height, but that in the check plots is very noticeably damaged by grubs, particularly in the five rows between the two plots that were fumigated with carbon bisulphide, where the cane is little more than half the height of that on either side, and most of the top leaves are brown or quite dead.

Field Work with Carbon Bisulphide.

In this connection it was interesting to note that at South Johnstone this year a kill of 85·7 per cent. was secured against cane grubs by using carbon bisulphide alone as a soil fumigant. One realises more and more, as time goes on, that past failures by farmers when using this insecticide were due merely to faulty application, and not to any want of toxicity in the fumigant. Success in such cases is dependent upon the conjunction of certain factors, such as (1) soil moisture, (2) aeration of the soil, (3) amount of dose and point of application, (4) depth of the injection, (5) age of grubs, (6) time of month when treated, (7) closing hole made by injector, and last, but of most importance, the performance of conscientious, systematic, and thorough work on the part of the operator.

The Kelly Fumigating Machine.

For the past three years we have been in communication with a resident of Cairns, who has invented a new horse-machine for injecting carbon bisulphide into grub-infested soil. During last April this appliance was tried out on cane land on this station, and gave results of an encouraging nature. A few additional improvements, however, have yet to be made, chief of which is some device for placing injections closer to the stools, while still leaving any disturbed soil level and the surface over the line of injections slightly compacted. We hope to perfect this machine in time to demonstrate its efficiency in field practice during the coming season.

A New Fumigant for Cane Grubs.

Some experiments were carried out at this station during May with a fumigating powder mixture devised by a Mr. Oldoini, by the request of Dr. A. Digiacomo.

Cages containing living grubs were used, while a dose of the powder in varying amounts was mixed with the moist soil in cages; all doses used being far in excess of any possible practical dose. Results showed that this fumigant possesses no value as a grub destroyer, seeing that no mortality was obtained from any of the doses used.

Occurrence of Notable Cane Insects.

"*Greyback*" *Cockchafer.*—Although damage caused by the grubs of *Lepidoderma albohirtum* Waterh. was more or less in decided evidence during autumn months on quite a number of cane farms, no other serious outbreak of any other cane pest chanced to occur in the Cairns, Babinda, or adjoining sugar-growing districts.

"*Weevil Borer.*"—Despite a few inquiries for Tachinid fly parasites of this cane-borer, it was by no means plentiful in a general way. Conditions, indeed, similar to those at present obtaining at Mossman appear likely to occur here in the near future, seeing that evidence of such gradual establishment of *Ceromasia sphenophori* is not wanting in several localities.

"*French's Cane-Beetle.*"—Grubs of this insect were represented as usual locally on plantations of young plant and ratoon cane during the months of September and October. Damage caused, however, was not sufficient to necessitate prolonged remedial measures.

"*Christmas Beetle.*"—Larvæ of *Anoplognathus boisduvali* Boisd. occurred rather plentifully, inflicting noticeable injury on cane land situated in the immediate neighbourhood of numerous feeding-trees of this beetle, *Eucalyptus platyphylla*. The last few years have shown that in such localities the grubs of this rutelid beetle are decidedly injurious to cane roots. On the Greenhills Estate, for example, Mr. Carne, the Manager, has reported its occurrence as being a factor of economic interest.

"*Lepidiota consobrina* Gir."—Grubs of this cane-beetle have been unusually numerous of late among roots of cane growing at the Experiment Station, causing injuries similar to those inflicted by the larvæ of *L. frenchi*. Up to the present, however, *consobrina* has not proved very destructive to cane; possibly on account of its life-cycle stages occupying a period of two years.

7. Work of the Division of Entomology—continued.

"*Army Worm.*"—Little or no trouble has been experienced from *Cirphis unipuncta* Haw., the season apparently having proved unfavourable to its increase; although very minor outbreaks have been reported and speedily checked by using arsenical sprays, &c.

"*Plant-Eating Bronze Beetle.*"—The little chrysomelid beetle *Rhyparida morosa* Jac. has not called for investigation or remedial action during the last twelve months; the minor injuries inflicted on cane leaves having proved negligible.

"*Yellow-Winged Locust.*"—Eggs of this locust, which had been laid early in March, 1931, were sent to me from Victoria Mill, Herbert River district, by Mr. C. K. Simpson, Technical Field Officer, with a request that I would report on their fertility.

These eggs were found to be free from disease, and I concluded that they would probably overwinter before hatching, which subsequently proved to be correct.

Whilst in a breeding-cage at Meringa Experiment Station they were examined at intervals of about three weeks during May to August, throughout which period no change was observed in the yolk.

Early in September, however, signs of the development of the embryo became apparent, and was very noticeable about the end of the month. Emergence of the young hoppers occurred at the beginning of October, specimens of this first larval instar measuring 6·50 mm. in length of body, and 10 mm. to the end of fully extended hind legs. This stage of development may be briefly described as follows:—Head very large in proportion to rest of the body, striped diagonally on sides with dark brown. Pronotum specked with brown, and having two eye-like dark shining hemispherical projections on frontal portion, separated by the keel. Eye rather small, dark patch between same and the above projections. Antennæ light fulvous. Two dark bands crossing central area of hind femora. Abdomen reaching to about distal end of hind femora.

The first moult into second instar took place about a fortnight after emergence from the egg, the body length being then 8 mm., and 16 mm. to end of hind legs. Towards the end of this month (22nd October) another moult into the early nymphal condition was recorded, such specimens being then 12 mm. long and 20 mm. to end of hind legs; while the second nymphal instar was noticed on 5th November, when a length of 17 mm. was reached, and 29 mm. to end of hind legs.

Improvements to Museum of Sugar Entomology.

Many additional show-cases, charts, &c., have lately been added to our official museum, devoted to the exhibition of cane-insects and their life-cycle stages of development, spirit specimens of grubs, wireworms, and pupæ, together with numerous species of parasitic and predaceous insects which exercise an important biological control of the "greyback" and other destructive cane-beetles.

The small eastern wing to the museum, which was added about two years ago, is now stocked with entomological preparations, including diagrammatic charts demonstrating interesting phases in the transformation of economic insects, and examples of injury to cane sticks due to the attacks of various pests.

Our present collection of pinned and named insects, which totals about 2,200 species, and 7,350 specimens, is contained in store-boxes measuring 10 in. by 14 in., corked and papered internally on both sides.

I would suggest, however, that in view of better preservation of this valuable and unique collection, which has taken about eighteen years to accumulate, it should be transferred to a couple of proper insect cabinets containing glass-top drawers, which, while facilitating reference to the specimens, would at the same time afford better preservation from mould, &c., and be more attractive from an exhibition standpoint.

The following additional exhibition glass-top cases have been prepared recently:—

A large show-case illustrating the life-history of *Campsomeris aureicollis* Lep., giving stages in its metamorphosis, pinned male and female adult wasps, favourite honey-bearing feeding-plants of the parasite, &c.

A table-case showing commercial value of dried grubs and beetles of *L. albohirtum*, and meal prepared from same for use as poultry and bird food.

Table-case showing specimens of common "Mason Wasps" (*Eumenidæ* and *Sphegidæ*), examples of their mud nests, together with dipterous and hymenopterous parasites bred from same.

Exhibit of Cane Insects by Sugar Bureau at Cairns Show.

At the Cairns Show, on 18th to 21st of July, opportunity was afforded for having a chat with growers over matters relating to the control of cane-insects. Some of the questions discussed were (1) grub fumigation, (2) collecting grey-back cockchafers, (3) protection of friendly insects occurring in canefields, &c. Considerable interest was manifested by those present in this annual exhibition of the Bureau.

7. Work of the Division of Entomology—continued.

Breeding and Study of Economic Insects.

Campsomeris aureicollis Lep.—Propagation of this insect was carried on from last year without intermission, the sixth brood of these wasps having been successfully reared from eggs to adult parasites. The period occupied by such breeding work was ten months, dating from the first egg laid by a wasp of Brood 1, on 1st August, 1931, to emergence of an adult female parasite of the sixth brood on 1st June, 1932.

This gives an average life-cycle period of 50·5 days for the development of each succeeding brood from egg to adult wasp during the warmer months of the year.

Anthela acuta Walker.—The life-history of this bombylid moth is being studied, the larval condition having been described in a recent confidential report (July to August).

Lepidiota sp. ?—This melolonthid beetle occurs commonly around Cairns during December. Larvæ bred from eggs laid in breeding-cages hatched about the end of January, pupation being commenced in November. The life-cycle occupies twelve months.

Eumenes latreillei Sau.; *Eumenes arcuatus* Fab.; *Sceliphron lætum* Sm.; *Sceliphron formosa* Sm.—These four species of hymenopterous insects were bred from the egg, and their respective nests obtained. The larvæ of *S. lætum* were found to be attacked by a Tachinid fly parasite and a chrysidid wasp; the former parasite being the more numerous and the first to emerge from the nest, and the host the last, appearing a week or so after the ruby-tail parasite.

Pison ruficornis Sm. and *P. ignavum* Turn.—Both these species of Trypoxylidæ were bred from nests made in various holes in buildings, such as keyholes, &c.; a braconid wasp parasite was reared from a nest of *P. ignavum*.

Megachile quinquelineata Ckll.—Several complete nests of this leaf-cutting bee were obtained and adult bees bred from same. This insect constructs three cells in each nest out of circular pieces of leaf, the outer cell being closed at the mouth with several little discs, which form a sort of wad. No parasites were reared from any of the nests obtained. This little bee is more or less of a nuisance in houses, owing to its habit of building its tubular nests in keyholes, the central holes in cotton-reels, &c.

Publications.

Monthly Advice to Canegrowers. *Queensland Agricultural Journal*, vol. xxxvi., pp. 388, 389, 462, 542; vol. xxxvii., pp. 18, 92, 155, 296-298; vol. xxxviii., pp. 6, 293.

Cane Grub Parasite for North Queensland from the Philippines. *Queensland Agricultural Journal*, vol. xxxvii., pp. 93-97 (1 plate).

REPORT OF Mr. R. W. MUNGOMERY, ASSISTANT ENTOMOLOGIST, BUNDABERG.

General.—Extreme drought conditions have prevailed for the greater part of the period under review, and for the first eight months of the year the total rainfall recorded amounted to 6·60 inches, whereas the average rainfall for the district during this period is 32·26 inches. A series of heavy frosts was also experienced during the winter months. Obviously, the growing of cane under these adverse conditions has been most difficult, and in many cases whole fields of cane have failed and have had to be ploughed out. In other instances it was not always possible to differentiate between losses due to subterranean insect attack and those due to dry weather. In several of our experiments we have had to resort to irrigating various plots to keep the canes growing, and, on the whole, the unfavourable weather has seriously interfered with all experimental work.

Cane Grubs.—Damage by the cane grub *Pseudoholophylla furfuracea* Burm. was very severe on a number of farms in the North Isis District during January, but, with the onset of dry weather, they retired to deeper levels and did not reappear near the surface. Naturally, this influenced the percentage that could be destroyed by hand-picking, and very little soil fumigation was carried out.

Grubs of *Lepidiota frenchi* Blkb. were also responsible for the destruction of some fields in the Baffle Creek area, and growers there would do well to remember the biennial occurrence of this pest, and, as far as possible, make conditions inimical to its wholesale development. Ratooning should not be carried on further than the second ratoon crop, and when a field becomes heavily infested it should be ploughed out and hand-picked while the grubs are still actively feeding, and not after they have completed their damage and disappeared. Further, in regard to areas not subject to frost damage, many do not fully appreciate the advantages to be derived from planting in autumn over the more common practice of planting during spring. In the first case, one is almost assured of a satisfactory strike and freedom from grub attack in the early stages of growth, whereas spring planting under grubby conditions means certain destruction of the young plants.

It is becoming more evident that growers will now have to concentrate on the control of this pest by preventive measures incorporated with their cultivation work. Especially is this so since the recent fall in the price of sugar, and soil fumigation as a control measure in South Queensland will become correspondingly less popular on account of its high cost.

7. Work of the Division of Entomology—continued.

Rotary Hoe Cultivator Experiments.—During the past year experiments were carried out with the "Howard" Rotary Hoe Cultivator, with the object of determining its effect on cane grubs in a heavily infested field. The weakness of the standard model lies in the fact that it can only treat the soil to a depth of 3-4 inches in the one operation, and the mortality in the treated area amounted to approximately 49 per cent. Taken over the whole depth of distribution of the grubs, the percentage accounted for was not greater than 25 per cent., which was not considered satisfactory. However, by incorporating the same principles into a more powerful machine, which they had constructed especially for this purpose, the Fairymead Sugar Company have been able to treat the soil to a depth of 5 inches, and have obtained a mortality varying from 65 per cent. to 80 per cent. in the few trials the machine was subjected to. Adverse weather conditions prevented further experimenting with it, but it is hoped to carry out another series of experiments as soon as the distribution of the grubs in the soil is favourable, and, if found necessary, alterations will then be made. An encouraging feature of these investigations is the fact that Dr. Drake and others in Iowa have quite recently been successful in killing 96·7 per cent. of the *Lachnosterna* grubs infesting grassland by the use of a rotary plough, and their appears to be no reason why the machine which we have at present under test cannot be brought up to the same state of efficiency. Such an implement giving similar results here would materially lessen costs in cleaning up grub-infested fields. However, to perfect such an implement, further co-operation is essential between the machinery manufacturing companies and some of the larger plantation owners, who are able to finance the construction and testing of these machines.

Toxicity of Fumigants to Cane.—An experimental plot, set out in randomised blocks, and having as its object the testing of the effect of various fumigants on the growth of sugar-cane, was harvested during August, and results confirm the conclusions arrived at last year by observation. Plots treated with liquid dichlorbenzene (90 per cent. ortho-dichlorbenzene) yielded 3·25 tons of cane per acre, and those treated with paradichlor-benzene yielded 6·17 tons of cane per acre, as against the check plots yielding 14·38 tons per acre, but there is no doubt that the harmful effects were accentuated by the continued dry weather. Plots treated with the same quantity of carbon bisulphide yielded 14·92 tons per acre, but the increase in yield was not significant.

Introduction of Tachinid Parasites.—Following on the trial shipment of 500 Lachnosterna grubs parasitised by the Tachinid, *Microphthalma michiganensis* Towns., which were received from Canada in 1930, Dr. Gibson, Dominion Entomologist, again kindly supplied us with a further 3,500 parasitised grubs for breeding work in connection with an attempt to more effectively control the Melolonthid *Pseudoholophylla furfuracea* Burm., by biological means.

By effecting improvements in the packing and transport of these specimens, the percentage surviving the journey from Canada to Australia was raised from 20 per cent. in 1930 to 63 per cent. in 1931. However, of those grubs surviving, a large proportion had failed to become parasitised under the conditions of induced parasitism, and these had to be destroyed later. From the remainder, about 200 adult flies were bred out, and an attempt was made to breed a generation in the Insectary. Owing to the flies being so active under confined conditions, many suffered injury through loss of wings and legs, and this attempt had to be abandoned. The remainder, numbering over 100, were liberated at North Isis, adjacent to areas heavily infested with grubs.

Soldier Fly (*Metoponia rubriceps* Macq.).—An unusually large but localised emergence of soldier flies occurred this year, and advantage was taken of this outbreak to study the bionomics of this minor cane pest. Pairing took place from about 9 a.m. until 11 a.m. on the day the flies emerged, and soon afterwards they laid their eggs in batches of 100 or more in the ground just beneath the surface. Hatching took place in fifteen days, at a mean temperature of 64 deg. F. The eggs were found to be unable to withstand the drying effect of the air, when the soil layer containing them was disturbed and placed in such a position that it would dry out. The full-grown larvæ likewise approach to within ¼-inch of the surface when they are on the point of pupating, and if an implement such as the disc harrows be kept operating at regular intervals in these infested fields, from April to June, many of the pupæ and eggs will be destroyed by exposure and subsequent dessication.

Fiji Disease Transmission Experiments.—These investigations have been pursued throughout the year, but dry weather has seriously handicapped the work, and the number of cases of secondary infection in our experiments has been too small to incriminate any one insect as a vector. Alterations have had to be made in the technique of these experiments, owing to the difficulty of keeping diseased plants or stools alive when growing in calico-covered cages. In many cases they died soon after the plants struck, and consequently they did not remain as a source of infection for a sufficiently long period. Another difficulty lies in the almost impossible task of preventing the entry of certain insects into this type of cage, thus tending to obscure any results. Canes are now being grown in tubs, some being isolated from the ground, and others being placed so that ants and other insects are able to enter the tubs. In addition, small plots of healthy plants have been laid out in several private gardens within the city area of Bundaberg. These plots are isolated from each other, and attempts are being made to

infect these by transferring sap-sucking insects from diseased cane in other parts of the district to these plots of healthy cane, one species being tested on each plot. Owing to the high degree of susceptibility of M. 1900 Seedling and P.O.J. 2714 to Fiji disease, and their suitability from a growth standpoint, these varieties have been grown in the garden plots.

Minor Sugar-cane Pests.—Whilst investigating disease transmission, sap-sucking insects in any way associated with cane have been under close observation. This has resulted in the finding of several minor pests not previously known to exist here on sugar-cane. These include the mealy bugs, *Pseudococcus boninsis* Kuwana, and *Pseudococcus brevipes* Ckll., both of which were found in the Bundaberg district in widely separated localities. In addition to *Trionymus sacchari* Ckll., another pink species of mealy bug, probably *Pseudococcus calceolariæ* Mask., is thought to occur in the Cairns district. *Margarodes* sp. have been taken on the roots of sugar-cane in many parts of the Southern sugar districts, more especially in the forest and poorer scrub soils. Very little is yet known concerning its life-history. Two species of thrips have been taken on cane foliage, namely *Haplothrips lucasseni* Kruger and *Neophysopus flavicinctus* Karny.

REPORT OF Mr. W. A. McDOUGALL, ASSISTANT ENTOMOLOGIST, MACKAY.

Cane Grubs.—During the past three seasons the quantities of cane grubs and cane beetles collected within the Mackay District mill areas (Plane Creek mill area not included) are as follows:—

Season.	Pounds of Beetles.	Pounds of Grubs.
1929–30	77,183	839
1930–31	77,138	790
1931–32	16,500 (approx.)	1,500 (approx.)

The beetles were practically all *Lepidoderma albohirtum* Waterh. (grey-backs), and the majority of the grubs were, at any rate during the last-mentioned season, those of *Lepidiota frenchi* Blkb.

Grub damage has not been extensive or heavy during the past three years, but losses this year were heavier than would be expected after a consideration of the smallness of last season's flight and the sizes of the previous flights, together with the amounts of damage following them. However, the usually grubby areas were fairly free from grubs this year; most of the damaged cane was on comparatively new lands adjacent to scrubby creeks. In many instances grey-back damage was showing up for the first time in the localities concerned. Good rains in May and June freshened up much of the cane suffering from light infestations. Of those seriously damaged, one or two blocks were plant cane, but most of them were ratoons. The usual possible tonnage of the latter in most of the districts visited by officers from this station would make any fumigation of them an unprofitable procedure; especially has that been so during the last two seasons. Farmers in these localities have been advised to get rid of as many of the chief feeding trees of the beetles as possible. Some of these trees are within one hundred yards of the cane.

On the older forest lands in close proximity to Mackay, patches of poor ratoons were damaged by grubs of *Lepidiota frenchi* Blkb.

General.—The moth borer, *Phragmatiphila truncata* Walker, has been prevalent during this spring.

Pentodon australis Boisd. continues to damage a fair percentage of strikes each planting.

Two more false wireworms, *Dimorphochilus pascœi* Macl. (a Cistelid) and *Dystalica mackayensis* Cart. (a Tenebrionid), have been bred from larvæ taken in various canefields.

Wireworms.—Damage by these insects was fairly heavy during the early plant of this year, both at Proserpine and Mackay. The pest species has now been bred from the egg to the adult. At first thought to be at least two years, the normal life-cycle has been found to occupy but one year. Collectively, at any rate, this species has a lengthy laying period, which is partly responsible for the different sizes of this wireworm being found in any one field at the same time. Numerous further species have been taken in the fields, but no other than the one *Lacon* sp. has been found to be a serious cane pest. The older larvæ of the pest species can withstand lack of moisture and absence of food for a considerable time, but not so the smaller ones which are present in the fields during January, February, and March, and which must have a damp environment.

No chemical yet tried has been a success in controlling this insect. Fertilizer plots against them have given negative results also. At least some of the larvæ will be found to be feeding as late as October, so impracticable out-of-season planting would be the only way of missing their attack if they are in any particular field.

Drainage experiments this year have been a distinct success. To obtain reasonable strikes on low-lying wireworm-infested fields it seems that thorough drainage over the wet season, immediately prior to planting, is necessary.

8.—Work of the Division of Sugar Mill Technology.

REPORT OF MR. E. R. BEHNE, ASSISTANT SUGAR TECHNOLOGIST.

Organisation and Staff.

Since the last Annual Report some changes have taken place in the staff. In January, the Technologist, Mr. Norman Bennett, resigned to take up the position of Manager at the Racecourse Central Mill, Mackay. Following Mr. Bennett's resignation, the whole Division was transferred from its old headquarters at the Mackay Experiment Station to the Head Office in Brisbane. At the same time, Mr. Leece, who held the position of clerk to the Division at Mackay, was also transferred to Brisbane, whilst the writer (Mr. Behne) was advanced to the classification of Assistant Technologist.

Individual mill inspections have been continued, and, in addition, special work was carried out at various mills. With the reduction in staff, naturally, the scope in this direction was greatly diminished. At the end of the 1931 season the tests on the measurement of clarified juice by means of a flow meter were completed. The indications were that "as installed" the meters were useless, due to contamination of the water in the meter by juice. It was hoped to continue the experiment this year, using isolation chambers to keep the juice from the meter, but lack of time prevented it.

Boiler tests were carried out at Kalamia and Giru Mills. At the former mill, two Cook's furnaces have been installed. These are the first of their kind in Australia, although the type has been used in other countries for many years. The results are very satisfactory, and show that this type of furnace could be used to advantage in Queensland.

Laboratory.

As in previous years, the laboratory work was practically confined to standardisation of apparatus. A short investigation was made on the constituents of cane fibre after prolonged treatment with cold water. The results showed that to remove all the sucrose the present hot water treatment was essential.

Standardisation of Apparatus.

During the past year the following apparatus has been tested:—

Brix Spindles.—One hundred and eighty-nine were tested, and 137 were found to have errors of less than ± 0.1; official certificates were issued for these and unofficial certificates for the other 52.

Polariscope Tubes.—Fifty-three tubes were tested, and 6 were found to be in error by more than 1 per cent. These tubes were destroyed.

Flasks.—Forty-four flasks were tested, and 25 were found to have errors lying outside the tolerances allowed. These flasks, when in error, were not returned to the particular mills, but were destroyed.

Pipettes and Burettes.—Twenty-two were tested, and 6 were found to be in error.

Analytical Weights.—Eleven sets were tested.

Thermometers.—Seven thermometers were tested.

Polariscopes.—Two polariscopes were received at the Experiment Station for cleaning and checking. During the visits of the Assistant Technologist to the mills 20 other polariscopes were checked. Most mills now have modern polariscopes, which are very accurate and suitable for the work.

From the above, it would seem that the item needing most attention is volumetric glassware, particularly flasks. The attention of the firms supplying these articles has been drawn to this, and it is hoped that in future more accurate articles will be supplied.

Mutual Control.

The scheme has been continued with one or two minor alterations. During the visits to the various mills concerned, the Assistant Technologist discussed the control with the various Mill Managers. All, without exception, agreed that it would be advisable to disclose to the mills in the Control the identity of the numbers allotted to each mill. Next year each mill in the Control will be furnished with a key to the numbers under which individual returns are reported.

An attempt is being made this year to draw up an annual synopsis of the mill work for the current season, following more or less on the lines of other countries. A plant census is at present being made, and at the end of the season a comparative sheet, including the average season's figures and average plant capacity figures for each mill, will be sent to each mill in the Control.

It was hoped to get all mills into line for next season, but one or two still hold aloof.

8. Work of the Division of Sugar Mill Technology—continued.

Mill Work for Season 1931.

Crushing for the season 1931 was commenced on 3rd June, and was not completed till 20th January, 1932. The first mill to commence crushing was Mulgrave, and the last one to finish was Hambledon.

All the Northern mills were crushing by 8th July. The maximum harvesting period was 231 days (Hambledon), and the minimum 123 days (Mossman).

In the Central district the maximum period was at Kalamia (156 days), and the minimum at North Eton (105 days).

In the Southern district (exclusive of the small Beenleigh mills) the maximum crop was at Fairymead (148 days), and the minimum at Moreton (78 days).

The crop for the 1931 season—4,025,357 tons—was 503,653 tons greater than that for 1930. The sugar produced at 94 net titre was 581,276 tons, and tons of cane per ton of 94 net titre sugar was 6·925, which is appreciably higher than the previous season's record low figure of 6·84.

In the Northern District South Johnstone, Babinda, and Hambledon were the only mills to exceed 7 tons of cane per ton of sugar, and in the Central district North Eton was the only mill. The lowest figure in the Southern district was at Bingera (7·183).

The tons of cane to produce 1 ton of 94 net titre sugar has been decreasing, but the figure for 1931 is higher than for the previous two years, as will be seen from the following table :—

1927	7·32
1928	7·18
1929	6·91
1930	6·84
1931	6·92

Season 1931.	Tons Cane Crushed.	Tons 94 N.T. Sugar made.
Mossman	94,561	13,547
Mulgrave	241,910	34,903
Babinda	238,536	33,670
South Johnstone	233,752	33,251
Tully	256,569	38,049
Mourilyan	168,802	25,342
Macknade	213,373	32,034
Victoria	198,401	29,069
Goondi	196,646	28,768
Hambledon	235,588	31,656
Total, Northern District	2,078,138	300,289
Pioneer	124,508	45,780
Inkerman	175,231	
Invicta	74,591	11,486
Kalamia	144,736	21,843
Proserpine	117,347	17,259
Farleigh	99,802	14,741
North Eton	46,474	6,390
Cattle Creek	54,049	7,690
Racecourse	89,338	12,827
Marian	106,567	16,344
Pleystowe	106,659	16,247
Plane Creek	126,442	18,833
Total, Central District	1,265,744	189,440
Childers	66,246	9,624
Millaquin	108,378	14,235
Qunaba	49,154	6,491
Fairymead	123,984	15,862
Bingera	121,117	15,609
Isis Central	67,599	9,367
Gin Gin	38,247	5,105
Maryborough	26,745	3,714
Bauple	27,375	3,456
Moreton	50,932	6,778
Rocky Point	6,391	1,151
Eagleby	1,160	125
Alberton	978	88
Total, Southern District	691,247	91,546

8. Work of the Division of Sugar Mill Technology—continued.

—	Northern.	Central.	Southern.	Totals and Averages.
Tons cane crushed	2,078,138*	1,265,744*	691,247*	4,035,129*
Tons sugar made (94 n.t.)	300,289*	189,440*	91,546*	581,276*
Net titre	97·01	96·43	95·58	96·51
Tons cane per ton sugar (94 n.t.)	6·920*	6·682*	7·551*	6·942*
Fibre, per cent. in cane	10·61	12·42	15·40	12·28
Pol., per cent. in cane	15·56	16·73	15·01	15·94
Bagasse—				
Moisture	53·57	52·69	50·35	52·56
Pol.	3·28	3·76	2·65	3·31
Purities—				
1st Expressed Juice	89·94	89·93	88·25	89·59
Clarified Juice	89·79	88·88	87·77	89·06
Syrup	90·02	89·20	87·37	89·28
Brix of Syrup	67·15	67·61	69·44	67·78
Gallons molasses per ton cane	3·61	4·65	4·73	4·18
Purity of final molasses—				
Apparent	35·33	40·45	40·90	39·19
True	46·56	48·03	49·92	48·49
Pol. of sugar	98·51	98·27	97·35	98·18
Fuel used—B.T.U.'s added per lb. cane	145	230	181	182
Gallons, E.S.J., per ton cane	218	216	230	220
Pol. extraction	94·77	93·43	94·12	94·10
Extraction ratio	·493	·529	·382	·480
Milling loss	7·776	8·849	5·730	7·662
Pol. in sugar—				
Per cent. pol. in cane	87·67	85·35	85·13	86·37
Per cent. pol. in mixed juice	92·40	91·35	90·45	91·79
Crop days	1,846	1,274	1,257	4,377

* All mills. Other figures exclude C.S.R., Pioneer, and Inkerman Mills.

There was a slight decrease in the pol. in cane for the Northern and Central districts, but an increase in the Southern district. The average for all districts was practically the same as for 1930—15·97 (1930) and 15·94 (1931).

The extractions in all districts this season were considerably lower, whilst the pol. in sugar per cent. pol. in cane (overall recovery) was lower by ·46 per cent., having fallen from 86·83 in 1930 to 86·37 in 1931. The recovery in the North this year was 87·67, compared with 87·63 last season. The Central district, however, showed a large drop—86·69 to 85·35. The Southern district showed a small drop also, from 85·32 to 85·13.

The reason for this lower recovery is that there were more impurities in the juices, which is indicated by lower initial purities, and also by the increased quantity of molasses produced per ton of cane. In the Mackay area of the Central district, in particular, the cane was in very poor condition, due to an adverse growing season.

For comparison, the averaged figures for the past four years are given:—

—	1928.	1929.	1930.	1931.
Tons cane per ton 94 n.t. sugar	7·18	6·91	6·84	6·92
Pol. in cane	15·42	15·65	15·97	15·94
Purity, 1st expressed juice	89·11	89·57	90·90	89·59
Pol. extraction	94·19	94·55	94·49	94·10
Pol. in sugar per cent. pol. in cane	86·57	87·45	86·83	86·37
Pol. in sugar per cent. pol. in mixed juice	91·91	92·49	91·89	91·79
Fibre in cane	12·50	12·50	12·59	12·28

Since the end of the 1931 season the Alberton Mill has ceased operations, and at the end of the 1932 season the Childers Mill will also close down.

9.—GENERAL AND BALANCE SHEET.

Cane Pests Boards.

Under the provisions of "*The Sugar Experiment Stations Act Amendment Act of* 1923," seven Cane Pests Boards have been constituted, viz.:—Plane Creek, Mackay, Lower Burdekin, Invicta (Ingham Line), Tully, South Johnstone, and Mossman. These Boards were constituted for the purpose of dealing with the various animal, bird, and insect pests occurring on their areas, and the finance for this is raised by assessment, the growers paying one-half and the mill or mills within a cane pest infested area the other half. During the past seven years the amount of assessment collected for the operation of the seven Boards has amounted to £47,172, which is all expended in the destruction of pests. In addition to the above, there are several Cane Pests Funds in existence to which farmers subscribe voluntarily. These all serve a most useful purpose in checking the depredations of cane pests.

Balance Sheet.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FROM 1st JULY, 1931, to 30th JUNE, 1932.

Receipts.	£	s.	d.
1931—			
1st July—			
To Balance	11,884	18	10
,, Assessments	8,466	10	10
,, Endowment	6,725	4	8
,, Bundaberg Station	745	0	6
,, Mackay Station	17	4	6
,, Johnstone Station	1,256	0	11
,, Gordonvale Station	58	16	6
,, Sundries	33	9	9
	£29,127	6	0

Disbursements.	£	s.	d.	£	s.	d.
1932—						
30th June—						
By Salaries				6,974	17	0
,, Contingencies—						
Salaries and Wages	1,271	18	3			
Travelling Expenses, Hires, Fares, Freights, Allowances	1,571	0	0			
Apparatus, Furniture, Books, Installations	639	18	0			
Printing, Advertising, Stationery	325	8	3			
General Expenses	474	4	5			
				4,282	8	11
,, Bundaberg Contingencies				1,002	12	7
,, Mackay Contingencies				1,330	10	3
,, Johnstone Contingencies				1,773	13	11
,, Gordonvale Contingencies				711	19	4
,, Balance, 30th June, 1932				13,053	4	0
				£29,127	6	0

C.C.S. Formula.

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

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

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

Brisbane, 28th November, 1932.

H. W. KERR,
Sugar Soils Chemist.

Price, 2*s*.]

By Authority: Frederick Pellips, Government Printer, Brisbane.