1931.

QUEENSLAND.

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

REPORT OF THE DIRECTOR

TO

THE HON. THE SECRETARY FOR AGRICULTURE AND STOCK

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

PRESENTED TO PARLIAMENT BY COMMAND.

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DIRECTOR'S REPORT.

TO THE HONOURABLE THE SECRETARY FOR AGRICULTURE AND STOCK.

SIR,—I have the honour to submit the Thirty-first Annual Report of the Bureau of Sugar Experiment Stations up to the 15th November, 1931.

H. T. EASTERBY,
Director.

Brisbane, 24th November, 1931.

1.—Introduction.

The agreement between the Commonwealth Government and the State of Queensland for the renewal of the embargo against the importation of sugar expired on the 31st August of the present year. Before entering into a new agreement the Commonwealth Government, as mentioned in last year's report, decided to appoint a Committee of Inquiry to report on the sugar industry generally. This Committee consisted of eight members, viz., a Chairman, and one representative each of the Commonwealth Government, the Australian Sugar Producers' Association, the Queensland Cane Growers' Council, the employees in the sugar industry, the consumers, the manufacturers, and the fruit-growers. Fourteen points which were set out in the last Annual Report were submitted for investigation.

The Committee commenced taking evidence in Brisbane on the 15th October, 1930, visited all the important sugar centres in Queensland, and all the capital cities of the various States.

As might have been foreseen a committee of this size, and representing conflicting interests, could hardly be expected to agree on all issues, consequently it was not surprising when the work was finished, that three reports were submitted—namely, a joint report, a majority report, and a minority report.

The joint report dealt with four of the fourteen points which were referred to it, upon which the whole of the Committee were in agreement. These were—(*a*) the conditions of the workers employed in the sugar industry; (*b*) the values of land used for sugar growing; (*c*) alien penetration; and (*d*) the utilisation of sugar by-products, and incidentally the suchar process of manufacturing sugar, mill white sugar, and the beet sugar industry. On the remaining ten points, excepting the term of the embargo, the Committee were divided in opinion.

The majority of the Committee which included the Commonwealth representative and the fruit-growers' representative, in addition to the Queensland representatives, making five in all, recommended :—

1. That the embargo upon the importation of sugar into Australia be renewed and continued for a period of five years.

2. That subject to our third recommendation hereunder the prices for sugar and the conditions of the sale thereof as set out in the present agreement be maintained for three years; and for the balance of the term, namely, two years, such prices and conditions be reviewed by the Commonwealth Government in the light of the circumstances then existing.

1. Introduction—*continued.*

3. That the provision in the present agreement for the special price payable by manufacturers engaged in processing all fruit products for home consumption, and the provision for the rebate on sugar contents of fruit products exported, be eliminated, and in lieu thereof a clause be inserted providing that a sum of £315,000 per annum be made available by the sugar industry for the assistance of the fruit industry. . . . This provision to be subject to review as in the case of the rest of the sugar agreement at the end of the three years' period above mentioned.

The Minority Report was signed by the remaining three members, namely, the chairman and the representatives of the domestic consumers of sugar in Australia and the Australian manufacturers who use sugar as a raw material in their products.

The summary of recommendations made by the minority were :—

1. That the industry take definite steps to reduce the unprofitable surplus production.

2. That the prohibition of the importation of sugar be continued for a period of five years commencing from the date of the termination of the existing agreement between the Commonwealth Government and the Government of Queensland (31st August, 1931).

3. That prices for sugar to Australian consumers be reduced by £2 6s. 8d. per ton for the two years ending 31st August, 1933, and that at that time a review of the conditions of the industry be made by the Commonwealth Government with a view to determining the practicability of a further reduction in price. . . . . The responsibility of seeing that the proposed reductions are passed on to domestic consumers to be placed on the industry, and that the present rebate of £6 5s. 1d. per ton to manufacturers engaged in processing fruit products for home consumption be continued.

The Minority report also recommended that a committee of the various interests concerned should be established for the purpose of disbursing the rebate of £6 5s. 1d. per ton, together with the reduction of £2 6s. 8d. recommended, and that the rebate paid to exporters in respect to cane sugar contents in manufactured goods exported be continued.

The Majority report was, in all essential conditions, the one adopted by the Commonwealth, with certain additional clauses which were included in the new agreement between the Commonwealth and the State providing for the establishment of necessary committees, the rigid enforcement of the peak year scheme, and system of assignment of sugar-cane lands, &c.

This was a matter for congratulation, and its acceptance constituted a complete vindication of the Queensland sugar industry after a most searching and exhaustive inquiry. Great credit is due to the Sugar Associations concerned which combined to form a Sugar Defence Committee to collect such evidence as would prove convincing to the Committee. The Inquiry demonstrated everything that the industry has claimed for years past—namely, that it was not unduly favoured, that the profits made by cane-growers were exceedingly low, and that the industry was perfectly efficient. It was shown that the average profit to the Queensland cane-grower was only 2·2 per cent., as against the 7 per cent. regarded as a fair and reasonable return. As regarded alien penetration the whole Committee was able to declare that only 10 per cent. of those engaged in the industry were wholly foreign, and that of the sugar mill hands 94 per cent. were British or Australian.

Turning now to the crop results for 1930 the yield was less than in the two previous years, the figures being :—

1928	.. ..	520,620 tons 94 net titre sugar
1929	.. ..	518,516 tons 94 net titre sugar
1930	.. ..	516,783 tons 94 net titre sugar

In addition, some 19,568 tons of sugar were made in New South Wales. The total Australian production, however, was much in excess of Australia's requirements, and it was necessary to export 203,605 tons.

1. Introduction—*continued.*

The tons of cane required to manufacture 1 ton of 94 net titre raw sugar were 6·83, being slightly less than the previous year, and was a record in this respect.

The actual proportion of the whole of the sugar manufactured in Queensland and New South Wales during the 1930 season which was deemed to have been delivered for consumption and use in Australia was 60·8277 per cent., and the net value of the 94 net titre surplus sugar sold abroad was £8 5s. In respect of the raw sugar deemed to have been delivered and required for consumption and use in Australia, the Sugar Board declared a payment of £1 per ton of 94 net titre sugar in addition to the price of £26 prescribed for such sugar. The average price paid to those mills that did not exceed their "peak year" was £19 13s. 1d. To such mills (five in number) that produced sugar beyond the limit assigned the price was less.

The consumption of sugar in Australia continues to be on a lower level than heretofore, consequently the export is increasing. The export of sugar each year since 1924 when the first large surplus occurred is as under. This is actual sugar in the bag and 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	265,000 (estimated)

The price received for sugar overseas in 1930 declined still further. The following figures show the reduction :—

	£	*s.*	*d.*
1926	14	18	10
1927	12	2	6
1928	10	10	0
1929	9	17	0
1930	8	5	0

The pooled price for sugar this year will be lower than last year, which is unfortunate for the industry. Wage costs, however, have come down to some extent, which will help out in a degree.

Mr. Albert Townsend of the Department of Trade and Customs—who acts as the Commonwealth representative 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 fruit, &c. :—

	Tons.
1924–1925	5,500
1925–1926	6,535
1926–1927	4,807
1927–1928	5,067
1928–1929	5,632
1929–1930	5,931
1930–1931	3,932

It is anticipated that a slight increase will be evident in 1931–1932 due to exports of canned fruits from Australia to Canada.

2.—Approximate Estimate of the 1931 Crop.

The crop this season will be larger than that of last year, and should be the record to date.

The industry has been fortunate again this season inasmuch as no floods, cyclones, or severe frosts have injured the cane.

2. Approximate Estimate of the 1931 Crop—*continued.*

The following table gives as usual the earlier or June estimate of the cane yield together with the figures supplied by the mills at the end of October :—

Estimated Crop of Cane, 1931 Season.

Mill.	Preliminary Estimate formed in June.	Approximate Estimate Furnished by Mills at end of October.
	Tons.	Tons.
Mossman	85,000	92,000
Hambledon	194,000	221,000
Mulgrave	215,000	237,500
Babinda	225,000	228,000
Goondi	187,000	196,000
South Johnstone	230,000	234,000
Mourilyan	173,000	166,000
Tully	234,000	246,000
Victoria	205,000	192,000
Macknade	165,000	207,000
Invicta	72,520	76,300
Pioneer	117,800	120,000
Kalamia	121,000	139,000
Inkerman	146,000	168,000
Proserpine	100,000	115,000
Cattle Creek	50,000	54,000
Racecourse	87,500	91,000
Farleigh	90,000	99,000
North Eton	45,000	46,000
Marian	90,000	106,000
Pleystowe	80,000	105,000
Plane Creek	115,000	126,000
Qunaba	49,000	49,000
Millaquin	102,000	103,500
Bingera	100,000	119,000
Fairymead	112,539	123,000
Gin Gin	30,000	37,000
Childers	72,000	65,000
Isis	65,000	64,500
Maryborough	23,000	27,600
Mount Bauple	24,276	26,600
Moreton	48,000	51,000
Rocky Point	9,000	9,500
Alberton	1,300	978
Eagleby	1,500	1,100
Totals	3,665,435	3,942,578

The large increase in the October estimate is remarkable.

Should the estimate formed by the Sugar Mills in October be realised the cane crop should amount to about 3,942,578 tons for Queensland.

The tons of cane required to make 1 ton of sugar are expected to be a little higher that in 1929 and 1930, due to the commercial cane sugar in the cane not being quite so high. If we estimate that the tons of cane to 1 ton of sugar will be seven, this would give an approximate yield of 563,000 tons of 94 net titre sugar for Queensland, which, if realised, would be 46,000 tons more than manufactured last season, and some 42,000 tons more than the previous record in 1928.

The yield of sugar from the three sugar mills in New South Wales is estimated to be about 24,000 tons of 94 net titre, which, when added to the Queensland output would mean, possibly, a total tonnage of 587,000 tons raw sugar of 94 net titre for Australia. The necessary export must be large.

In addition, the Victorian Sugar Factory manufactured this year, 5,095 tons of white granulated sugar from 36,968 tons of beets. The area harvested was 3,045 acres. It took 7 tons of beet to produce 1 ton of white sugar. This was somewhat better than the previous year. The average sugar in beet was 16·48 per cent.

COMPARATIVE PROGRESS OF THE INDUSTRY DURING THE PAST THIRTY-TWO YEARS.

As pointed out in previous reports the acreage from which cane is crushed has just about trebled, but the yield of sugar (when the earlier yields of 88 net titre sugar are converted into terms of the present standard, *i.e.*, 94 net titre) is now practically six times as great as it was in 1900. The following tables show the advance the industry has made since then :—

2. Approximate Estimate of the 1931 Crop—*continued.*

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

* This is raw sugar of 88 net titre to 1904. † This is raw sugar of 94 net titre to 1930.

Table showing Yield of Cane and Sugar per Acre and Tons of Cane required to make One Ton of Sugar during Thirty-two 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	8·0
1921	18·60	2·30	8·11
1922	15·39	2·04	7·53
1923	14·75	1·94	7·60
1924	18·92	2·44	7·75
1925	19·36	2·56	7·55
1926	15·45	2·06	7·52
1927	17·45	2·38	7·32
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	6·93

‡ This year (1917) upsets 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 1·99 tons of sugar, which is a much fairer comparison, and shows that the improvement which has taken place each decade is progressive.

2. Approximate Estimate of the 1931 Crop—*continued*.

The lowest average district tonnage of cane per acre last year was 8·35 at Proserpine, and the highest 21·20 at Ayr.

The Development of the Sugar Industry in Districts North of Townsville since 1910.

Year.	Locality.	Number of Mills.	Tons of Sugar Produced, 94 net titre.
1910	Above Townsville	7	57,135
	Below Townsville	42	153,621
1913	Above Townsville	7	62,414
	Below Townsville	41	180,423
1916	Above Townsville	9	98,396
	Below Townsville	38	78,577
1919	Above Townsville	9	101,351
	Below Townsville	33	60,785
1922	Above Townsville	9	120,617
	Below Townsville	31	167,618
1923	Above Townsville	9	161,227
	Below Townsville	29	107,948
1924	Above Townsville	9	189,947
	Below Townsville	29	219,189
1925	Above Townsville	10	216,755
	Below Townsville	27	268,830
1926	Above Townsville	10	221,104
	Below Townsville	26	168,168
1927	Above Townsville	10	228,839
	Below Townsville	25	256,906
1928	Above Townsville	10	255,188
	Below Townsville	25	265,432
1929	Above Townsville	10	273,820
	Below Townsville	25	244,696
1930	Above Townsville	10	258,919
	Below Townsville	25	257,864

3.—Figures of the 1930 Crop.

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

District.	Tons Cane per acre.	Tons 94 N.T. Sugar per acre.
Mossman to Ingham	18·13	2·70
Lower Burdekin District	21·20	3·29
Proserpine	8·35	1·25
Mackay to St. Lawrence	12·24	1·88
Bundaberg, Gin Gin, &c.	14·08	1·81
Maryborough, Childers, &c., to Gympie	12·64	1·64
Nambour and Beenleigh	15·32	2·04
Total State Average	15·89	2·33

In the 1930 report of the Registrar-General the average acreage grown by cane planters in Queensland is as under :—

	Acres.
Cairns to Townsville	52
Ayr to Mackay	46
Bundaberg to Bauple	31
Maroochy (Nambour) to Logan (Beenleigh)	10
Average	41

This brings the average acreage per farmer to 41, which is very slightly higher than the previous year.

The number of sugar mills in Queensland remains at 35, with 2 refineries—one at Brisbane and one at Bundaberg ; other refineries for sugar are situate at Sydney, Melbourne, Adelaide, and Perth.

3. Figures of the 1930 Crop—*continued.*

The value of the Queensland output in 1930 is given by the Registrar-General at £12,035,456.

Molasses Produced.

The 1930 production of molasses is as under :—

How disposed of—	Gallons.
Sold to distilleries	4,442,809
Burnt as fuel	4,354,350
Used or sold for feed	2,342,609
Sold other purposes	86,552
In stock	1,206,050
Used for manure	714,670
Run to waste	1,311,453
Total	14,458,484

The amount of molasses run to waste is still decreasing.

Estimated and Actual Yields of Cane, 1930.

The following table shows the amount of cane which was estimated to be crushed by the mills in October, 1930, compared with their final returns for the purposes of assessment made early in 1931 :—

Mill.	Approximate Estimate Furnished by Mills at end of October.	Tonnages Actually Crushed at end of Season 1930.
	Tons.	Tons.
Mossman	74,596	74,595
Hambledon	172,000	175,832
Mulgrave	177,000	179,109
Babinda	213,000	212,556
Goondi	177,000	177,681
South Johnstone	230,000	234,615
Mourilyan	160,000	164,952
Tully	210,000	215,022
Victoria	137,000	139,577
Macknade	145,000	142,611
Invicta	58,218	58,179
Pioneer	136,420	131,711
Kalamia	125,000	126,573
Inkerman	169,000	171,000
Proserpine	78,000	76,800
Cattle Creek	45,000	45,064
Racecourse	92,000	95,823
Farleigh	77,000	76,819
North Eton	62,000	62,949
Marian	89,500	90,371
Pleystowe	97,000	95,332
Plane Creek	119,000	129,456
Qunaba	54,500	56,194
Millaquin	101,000	102,046
Bingera	110,000	114,581
Fairymead	105,000	108,188
Gin Gin	37,000	37,049
Childers	58,000	58,619
Isis	76,000	66,250
Maryborough	28,650	28,682
Mount Bauple	26,625	27,512
Moreton	53,000	47,980
Rocky Point	9,511	9,511
Alberton	1,344	1,344
Eagleby	1,810	1,813
Totals	3,503,174	*3,528,553

*These figures agree closely with those supplied to the Registrar-General, viz., 3,528,609

No mills were closed during the year, and the number remains at 35, but the Tully and Proserpine Mills were transferred by the Government to the suppliers of cane to those factories. The Tully Mill was taken over on 1st February, 1931, and Proserpine on 1st July, 1931.

4.—Work of the Bureau.

The work of the Bureau outside the general and administrative section is now carried out by four divisions as under, the officers mentioned being in charge :—

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. N. Bennett, Sugar Technologist.

The officer in charge of each division is responsible for the work of his branch, and lays out same in consultation with the Director.

Reports from the officers in charge of their 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).

Laboratories for investigation and research work on soils and sugar-cane pathology have been erected in Brisbane, and are now in full working order. The Director and those of the staff of the Bureau occupying the Brisbane building will be pleased to meet canegrowers visiting Brisbane, at all times, to discuss their needs and difficulties and to render them all the help possible.

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

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

A review of the work of the Division of Soils and Agriculture for the past year reveals definite progress along the lines of the policy formulated at the time of the re-organisation of the Bureau. Both field and station staffs have been engaged in investigational duties up to the limit of their capacity, and the results of this work present some valuable and interesting data. With the adoption of the modernised plot technique developed by Fisher at Rothamsted, results of a high degree of precision are now possible, and the results of plot trials on the Stations bear a high degree of consistency amongst themselves. This adds considerably both to the value and interest of the work, and it is expected that the experimental work over the next few years will provide us with a much clearer understanding of the peculiarities of the particular soil types involved.

Results from the South Johnstone Station are very flattering, and show what can be effected with a uniform area of experimental land, when trials are carried out with the utmost care and personal attention of the officer in charge. It will be observed in the section of the report devoted to that Station that some of the comparative results carry a standard error of only 0·1 per cent., with an experimental lay-out which could scarcely be described as cumbersome.

The Brisbane laboratory staff has been kept fully occupied with the work on hand. In the absence of an adequate central laboratory for so many years, there has naturally been an accumulation of problems awaiting investigation. Moreover, much of this work is of a strictly routine nature, and the volume of original research work which might be expected is restricted accordingly. In many cases it is necessary to develop suitable methods of investigation, involving a considerable bulk of preliminary work in the establishment of their adaptability.

The chemical work of the past two years has, nevertheless, provided a wealth of valuable data ; and it is to be regretted that no suitable publication medium exists for the presentation of these technical papers as they become available, for the guidance of other workers in the industry. A modest journal of this nature would provide for the ready dissemination of technical data from all branches of the Bureau, as well as forming a contribution to the literature of the Sugar World, from which we have drawn freely for many of our valuable advances.

Laboratory Soil Studies.

The principle of sampling all farm experimental blocks has been continued. The results of analysis of these soils may be compared with the returns from plot harvesting a year later, and it is hoped that the rapid chemical tests may assist in reducing the number of necessary plot trials in the future. At the present time, an unfortunately high degree of confusion surrounds the question of correlations between field results and laboratory tests. On the far Northern lands, where our knowledge of soil types and their

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

performance is moderately complete, our results are in fair agreement; but in the Central and Southern areas, where the variability from soil to soil is great, and where climatic conditions are capricious, we are confronted with many anomalies. It must be conceded, however, that the seasons in the Mackay area during the past three years have been decidedly adverse, with the past season as the driest on record. With but slight response to fertilizer treatment on low crop yields, in many instances, one must not expect overmuch from the results. It is hoped that with the accumulation of further data, the position will become appreciably clarified.

In connection with the preliminary soil survey work which was initiated a year ago, a selection of soil type samples was secured. These are being subjected to a complete analytical examination, in order to give us a clearer picture of the fundamental differences between soil types.

Field Soil Tests.

It is our aim to reduce routine soil tests of proven value to the status of rapid field or experiment station determinations. In this regard a convenient acidity testing outfit has now been prepared and supplied to out country officers. The agreement between our accurate laboratory tests and the field method is exceedingly close, and our field officers are able to advise growers at very short notice as to the need for lime on their lands. This service is much appreciated by farmers, particularly those in many of the Northern areas, where preliminary liming has so frequently been found a necessity, if the best returns from fertilizer are to be obtained.

Irrigation Waters.

The analysis of irrigation waters from the Burdekin area has now reached the stage where the results to date are being compiled. Very shortly a bulletin will be issued, embodying the analytical results, and giving a general review of the situation. The completion of this work was necessarily long drawn out, as samples had to be collected by the field officer in the area, as opportunity presented itself, and forwarded to Brisbane for analysis. In all, about 300 water samples were examined.

Starch in Sugar-cane.

With the introduction of disease-resistant canes in the Southern areas, certain of the Co. canes from India have received some attention. The question of difficulty of milling these varieties has been raised. It has been reported that Uba cane, which is known to give trouble in the mills, contains appreciable quantities of troublesome starch when grown on acid soils, and it was thought advisable to carry out parallel analyses of Uba and the Co. varieties grown in close proximity, on both acid and non-acid soils. The results of the investigation promise to yield some very interesting data on the question. Samples of D. 1135 and Q. 813 were also included in the series as controls.

Farm Fertility Trials.

The results of the first season's trials were compiled in bulletin form, and freely distributed to growers in all areas. The project has been advanced still further during the past year. The response to fertilizer on most of out soil types indicates clearly the absolute necessity for an adequate application of the essential plantfoods, if high crop yields are to be maintained. Now that ratoon crops have been harvested, the importance of this advice becomes even more clearly demonstrated. In many instances, the ratoons have shown yields equal to those of the plant crop, provided the correct fertilizer has been applied; whereas by the use of inappropriate mixtures, or where fertilizer has been withheld, the yields have diminished very seriously.

Acting on our advice, most of the growers farming acid alluvial soils have discovered the value of lime and superphosphate as essential corrective agents; and it is reasonable to claim that at least a proportion of the heavily increased tonnages in the South Johnstone and Tully areas, during the past two years, is due to the employment of more suitable fertilizers in increasing amounts.

Recent experiments all indicate the necessity for heavier dressings of nitrogen fertilizers on all of our cane lands, particularly for ratoon crops. Returns for plant crops harvested in the Burdekin area have shown remarkable increases in yield due to the use of modest amounts of sulphate of ammonia, whereas phosphates and potash showed little results. It is predicted that much of the trouble connected with unsatisfactory ratoons in that district, is associated with an inadequate supply of available nitrogen early in the life of the ratoons. Certain of our plot trials have been ratooned and the crop returns are awaited with interest.

The oft-repeated claim that nitrogenous fertilizers seriously depress the C.C.S. content of the cane is found to be largely without foundation, provided that the fertilizer is applied early. This point is well substantiated by figures appearing in both this and earlier reports.

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

The following are the names of growers who have set aside portion of their lands for fertilizer trial purposes during 1931 :—

Northern Division.

Johnson Bros., Mossman.	H. J. Thomas, Pawngilly
J. Rice, Redlynch	Adams Bros., South Johnstone
E. Cole, Edmonton	L. Grima, South Johnstone
A. Johnson, Gordonvale	B. B. Ross, Mourilyan
A. Ridolfi, Gordonvale	G. Marano, Mourilyan
M. Feldman, McDonnell Creek	H. Spencer, Feluga

Central Division.

C. O. Missing, Ayr	Dew Bros., Balnagowan
J. Ahern, Ayr	B. F. Hogan, Mia Mia
F. Pratt, Kolijo	F. George, Mia Mia
A. Watt, Kuttabul	J. J. Hackett, Shinfield
A. Garnham, Mount Martin	P. H. McLean, Pinnacle

Southern Division.

H. Bjerring, Tirroan	C. J. Olsen, Melrose
O. L. Powell, Maroondan	J. C. V. Dowling, Magnolia
H. Bates, Koolboo	A. Mergard, Mount Bauple
H. C. Pressler, Kalkie	C. Wood, Mount Bauple
C. Zielke, South Kalkie	W. Niemi, Maroochy River
A. Saunders, Nikenbah	

We would place on record our appreciation of the assistance afforded us by all growers on whose lands our plots have been set out; and also to the following companies who have graciously made available the fertilizer required for all farm trials :—

A.C.F. and Shirley's Fertilizers Limited,

Imperial Chemical Industries (Aust. and New Zealand), Limited,

Pacific Potash Limited.

Cane Breeding.

The work of the past season shows a marked advance on that of previous years. The quality and range of our breeding-cane collection are of a high order; and now that the characteristics of many of these have been established, the work can be kept under better control. A full report of the work at South Johnstone, together with notes on seedling raising at Mackay and Bundaberg, are found under the section on cane breeding.

Varieties.

Of the seedlings raised at the South Johnstone Station during the past few years, several promising varieties are now undergoing preliminary yield trials, in order to determine which of these show sufficient promise to warrant field trials with standard canes. The results of the disease trial under way at Meringa should serve to indicate those possessing the desired standard of resistance to leaf scald.

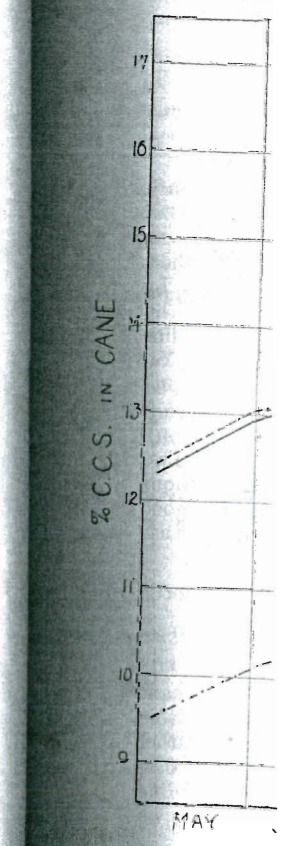
A number of varieties, which have acquitted themselves favourably in gumming resistance trials in the Southern areas, are now being propagated to enable rigorous yield trials to be set out, in comparison with commercial varieties. Amongst this number is P.O.J. 2878, supplies of which are being raised as rapidly as possible. It is hoped that by next year at least one plot of this variety will be established in each mill district.

Field Days.

The scheme of Farmers' Field Days designed to replace those hitherto conducted on the Experiment Stations, was inaugurated during the past winter. In all, twenty-five farmers' gatherings were met and addressed by the writer, with the assistance of other officers of the Bureau wherever possible. It is felt that the revised plan will play a very important part in promoting a free interchange of ideas amongst growers, as well as providing an excellent opportunity for presenting to farmers the results of our recent investigations. The scheme has received very favourable comment, in general; and with a little assistance from Farmers' Committees in organising local arrangements in the future, the success of the project should be assured.

The numbers and distribution of field gatherings was as follows :—

Bundaberg, Childers, and Maryborough Districts	6
Mackay District	4
Innisfail–Tully Areas	9
Mossman–Cairns–Babinda Areas	6
	25



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

Summary of Analyses Performed at the Brisbane Laboratory, 1930-31.

Soils	312
Waters	213
By-products	20
Sugar-canes	34
Evaporator Scales	15
Sugars	5
Limes and fertilizers	10
Miscellaneous	4
Total	613

WORK OF THE EXPERIMENT STATIONS.

The following are the detailed reports from the three Experiment Stations, giving the full results of the experiments harvested during the year, together with an account of other work performed on the stations :—

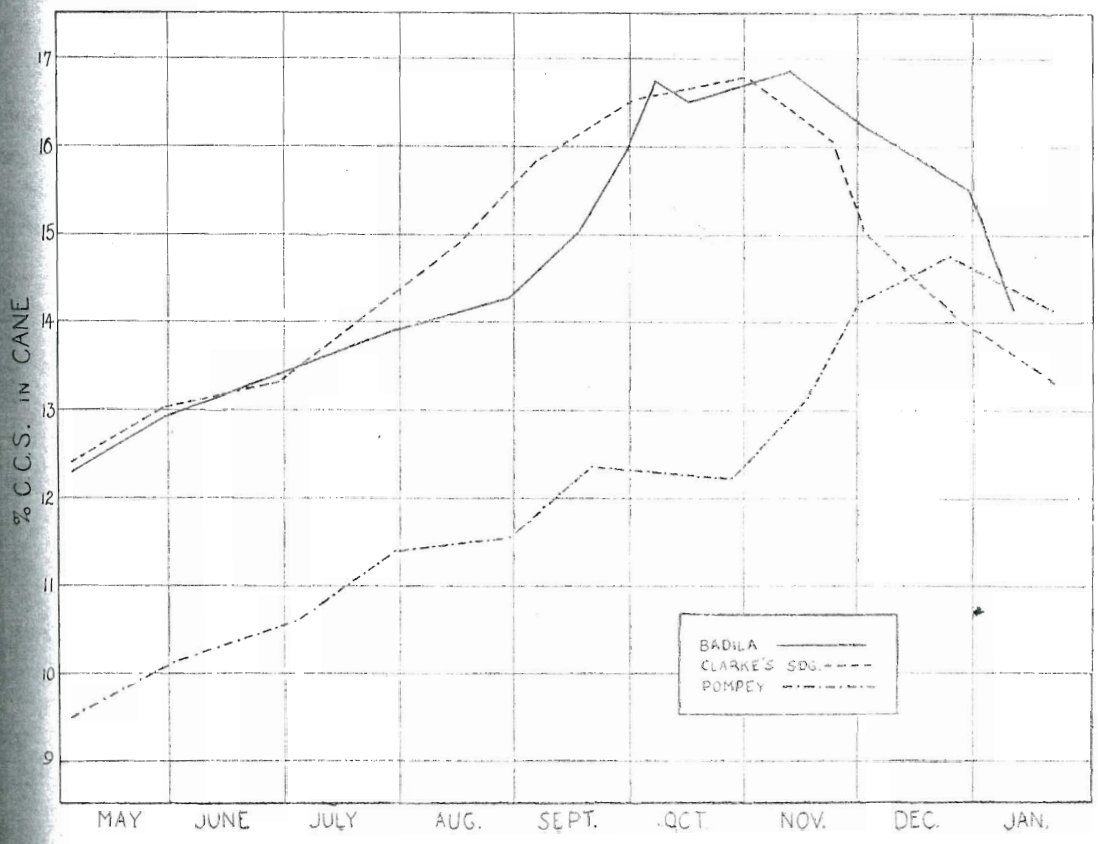
SEEDLING PROPAGATION.

E. J. R. Barke, Cane Breeder.

The problems of the Queensland sugar-cane breeder are many and varied. The sugar-producing districts are scattered over a thousand miles of a narrow coastal belt, extending from 16 to 30 degrees south latitude, and the variations of soil, rainfall, and general climatic conditions are greater than those of any other sugar-cane producing country. It is necessary to produce canes suited to this range of conditions, with regard to both vigour of growth and period of maturing, combined with resistance to specific major diseases.

The C.C.S. scale of payment for canes demands that only varieties with a high sugar content be grown ; this requires, further, that suitable varieties be available which mature early in the season, as well as those which will mature rather later. The present standard variety of the early maturing class is Clarke's Seedling (H.Q. 426) which is fast losing favour due to its disease susceptibility, and there is urgent need for a variety to take its place.

A further desideratum in a suitable variety is that it should retain its high sugar content for an extended period following its having matured. It is well known that varieties differ markedly in this regard, and the characteristics of the three main varieties grown in the Innisfail district are brought out clearly in Graph I.



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

These curves are composited from the mean C.C.S. values over a period of three years, and show to what extent these varieties fall short of the desired characteristics.

The most urgent requirements which must be considered in our breeding programme are—(*a*) Disease resistance, (*b*) early maturity, (*c*) canes which maintain a high sugar content for a considerable proportion of the harvesting period.

Breeding Work for 1931.

In the past all cross pollinations have been made at South Johnstone. In a general way, this has been fairly satisfactory, but the frequent incidence of wet weather at arrowing time has been responsible for unsatisfactory results both in the shedding of pollen and the setting of seed. During 1930 an attempt was made to establish a breeding sub-station in the Cairns area. A plot of varieties was set out on the farm of Mr. G. Guides, at Freshwater, to whom our thanks are extended for this courtesy.

The departure proved eminently successful, and the fuzz obtained from the Freshwater plot yielded a much higher proportion of viable seed than that from South Johnstone. A number of interesting features are brought out in a comparison of the performance of varieties planted in the two areas. The parents used were as follows :—

South Johnstone Experiment Station.		Freshwater, Cairns.	
Females.	Males.	Females.	Males.
Badila	E.K. 28	P.O.J. 2364	Badila
Horn	S.W. 3	Oramboo	Goru
Oramboo	S.W. 499	Nanemo	P.O.J. 2878
Daniel Dupont	S.C. 12/4	Pompey	P.O.J. 2940
P.O.J. 213	W. 4	N.G. 16	Co. 213
P.O.J. 2364	Ewa 371	S.J. 4	Co. 227
P.O.J. 2722	H.Q. 409	H.Q. 458	E.K. 28
P.O.J. 2875	Q. 813		S.C. 12/4
P.O.J. 2878	D. 1135		Ewa 371
P.O.J. 2940	S.J. 3		W. 4
Co. 210	S.J. 18A		R.P. 6
Co. 213	S.J. 41A		R.P. 8
Co. 227	S.J. 46A		Black Innis (M. 189)
Black Cheribon	S.J. 42B		S.J. 3
N.G. 16	S.J. 47B		Q. 813
Uba	S.J. 78B		D. 1135
R.P. 6	S.J. 103B		H.Q. 409
B. 208	Glagah		
M.Q. 1	*S. robustum*		
S.J. 16			
S.J. 42A			
S.J. 48A			
S.J. 46B			
S.J. 49B			
S.J. 82B			
S.J. 94B			
S.J. 96B			

It will be noticed that a number of canes that are used as females at South Johnstone behave as males at Freshwater. These canes—Badila, Goru, P.O.J. 2878, P.O.J. 2940, R.P. 6, Co. 213, Co. 227—had, at South Johnstone, yellow anthers containing no viable pollen, and in most cases the anthers remained closed. At Freshwater the anthers were reddish in colour, and contained a high percentage of viable pollen as measured by the Iodine test. They also gave, with the exception of the Co. canes, good healthy progeny when crossed with true females in that district. These facts open up a new line of investigation on the conditions that govern anther maturity; and on the practical side, they also allow of a greater number of combinations in crossing.

Crossing Technique.

Only seed from controlled crosses, and in special instances selfs, were planted. Two crossing methods were employed :—(1) Hawaiian sulphurous acid method, with and without the use of cages, (2) open crossing in isolated plots. Both methods gave equally good results and only a slight reduction in the germination index figure was found by the use of cages.

The detailed technique of these methods has been fully described in past reports, and no further modifications have been made to date.

Pollen and Anther Studies.

Observations of anthers of all parents are made daily and pollen counts made weekly, using the Iodine test. The amount of viable pollen varies greatly, both within the same and between different varieties. It is found that the time of optimum anther protrusion and dehiscence varies according to weather conditions, and ranges from 6.30 a.m. to 9 a.m. Different varieties under normal conditions have definite pollen-shedding times.

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

Pollination.

Dusting operations are commenced each day as soon as anther dehiscence is noticed, and each cross is treated twice. The work is completed by not later than 9.30 a.m. Dusting is continued until the last flowers of the female have opened—the period varying from 10 to 24 days. The arrows are then allowed to mature, collected in thin cotton bags, allowed to air-dry for six days, and planted. Germinations take place in from 2 to 10 days.

Summary of Data of Various Combinations of Parents.

Parents. ♀ × ♂	Vigour.	Stooling.	Sucrose Content.	Remarks.
P.O.J. 2364 × S.C. 12 (4)	Good +	Good +	Low	Thin sticks of Glagah-Kassoer type
P.O.J. 2875 × S.C. 12 (4)	Good	Good	Fair to good	Thick sticks, long internodes
P.O.J. 2940 × S.C. 12 (4)	Fair	Poor	Medium	Thick sticks, internodes often malformed
P.O.J. 2878 × S.C. 12 (4)	Good	Good	Fair to good	Thick sticks, all canes even of fine appearance
P.O.J. 213 × S.C. 12 (4)	Good	Good	Low to fair	Thin sticks
Oramboo × S.C. 12 (4)	Good	Good	Good	Thick sticks, foliage heavy
N.G. 16 × S.C. 12 (4)	Fair	Fair	Fair	Sticks not uniform, very thin to medium thick
N.G. 24 × S.C. 12 (4)	Fair to good	Good	Good	Matures early
S.J. 4 × S.C. 12 (4)	Good	Good	Low	Sticks medium thick, foliage heavy
N.G. 15 × S.C. 12 (4)	Fair	Good	Good +	Badila type, matures late
N.G. 15 × E.K. 28	Fair	Fair to good	Good +	Badila type, but longer internodes
N.G. 15 × R.P. 6	Good	Good	Good	Large sticks, soft tissue
N.G. 15 × R.P. 8	Fair to good	Fair	Good	Large sticks, soft tissue
N.G. 15 × Q. 813	Good	Fair to good	Good +	Large sticks, fast early growth
S.J. 4 × R.P. 8	Good	Good	Low	Medium sticks, foliage heavy
N.G. 24 × Q. 813	Good	Fair to good	Good	Matures early
N.G. 16 × Q. 813	Fair	Fair	Fair	Lodges early, poor rooting system
Oramboo × Q. 813	Good	Good	Fair to good	Thick sticks, fast early growth.
Oramboo × E.K. 28	Fair	Poor	Low to fair	Matures late
N.G. 16 × E.K. 28	Poor to fair	Poor	Low to fair	Long sticks, rooting system poor

Time of Planting Seed.

The seed is usually germinated during the months of June to September, and seedlings are ready for selection at 12-14 months. During the past season seed from a selection of crosses made in Hawaii was forwarded through the courtesy of the Experiment Station of the Hawaiian Sugar Planters' Association. This was received in March, 1931, and seed of each cross was germinated immediately at each of our Experiment Stations. The results were highly satisfactory. Germinations and early seedling growth were rapid under the favourable climatic conditions. Artificial heating was unnecessary, and the seedlings became well established before the winter months.

As this period of the year is also one at which harvesting and planting operations are not in progress, the practice of storing seed from the previous season is now being tried on our stations. Should this prove successful, two plantings will be made annually in future, thus enabling a larger number of seedlings to be handled successfully and conveniently.

Disease Resistance.

It is most important that all seedlings bred for commercial purposes in North Queensland possess a high degree of resistance to leaf scald. An attempt has been made during the past spring, to carry out a trial along these lines, in co-operation with the Division of Pathology. About 1,000 seedlings, representing a large number of distinctive crosses, were planted out at Meringa, in comparison with our standard variety. The setts were inoculated with a suspension of the leaf scald organism, and the results are expected to give us some valuable information with respect to parental qualities.

Seedling Work at Mackay and Bundaberg.

Seedling propagation is now one of the major duties of the officers in charge of each of our stations. Due to unfavourable conditions for cross pollination in the Central and Southern areas, the entire supply of seed is obtained from South Johnstone.

During 1930 about 1,100 seedlings were planted in the field at Mackay and despite a most adverse season the majority grew to fair stools of cane. In all, thirteen distinctive crosses were tested, and a selection of forty seedlings was made for further trial purposes. This year about 1,500 seedlings have been planted out and these will be further augumented by seedlings germinated in the coming summer.

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

At the Bundaberg Station the initial attempt at seedling raising resulted in 350 finding their way to the field; these represented six crosses. The number planted out during the 1931-32 season will be in the neighbourhood of 5,000 seedlings.

All stations are planning for a decided expansion in this work and now that a good selection of breeding canes has been established at South Johnstone, the results of the next few years are eagerly anticipated. The preliminary work of the past two seasons has yielded valuable data on the performance of the progeny of different matings under varied environmental conditions.

NORTHERN SUGAR EXPERIMENT STATION, SOUTH JOHNSTONE.

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

METEOROLOGICAL.

The growing season of the 1930–31 cane crop was somewhat more favourable than that for the preceding year. There was an abundance of rain during the early planting period of April, May, and June, which permitted of excellent germinations and rapid early growth. Conditions for the period from July to October, 1930, were more favourable than for the corresponding period of 1929, the rainfall being above the average and well distributed. There was a dry spell during the months of November and December, and this was responsible for a slight check in growth. Normal conditions prevailed from January to the end of the growing period and the average tonnage of cane per acre will be above that of the 1929-30 season.

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

Year.	Rainfall.	Year.	Rainfall.
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 (9 months)	97·02
1925	118·94		

Abstract of Meteorological Observations made at the Northern Sugar Experiment Station, South Johnstone, from the 1st September, 1930, to 31st August, 1931—Covering Period of Growth of Experiment Canes.

Month.	Rainfall in Inches.	Number of Wet Days.	Average Rainfall, 11 Years, 1920–1930.	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 1930	2·02	9	3·56	85·0	75·0	80·7	64·0	52·0	61·5	50·5	59·5	19·2	72·0	74·5
October 1930	16·97	19	3·66	89·5	82·5	84·5	69·5	53·0	66·1	52·0	64·5	18·4	77·1	77·0
November 1930	2·20	13	3·83	96·0	84·0	89·4	69·8	59·0	67·4	57·5	65·6	22·0	80·5	76·0
December 1930	4·06	13	9·27	99·8	83·8	91·2	73·5	63·5	70·2	62·0	68·6	21·0	83·2	77·5
January 1931	23·61	17	19·41	98·5	80·0	90·0	76·0	70·0	74·2	68·5	72·5	15·8	84·1	86·5
February 1931	15·27	17	21·03	100·4	82·0	90·6	77·0	67·0	75·3	66·0	73·7	15·3	82·6	85·0
March 1931	8·89	21	27·85	96·5	84·0	89·5	75·0	66·8	72·6	65·0	70·8	16·9	80·9	84·8
April 1931	15·31	19	14·24	93·0	82·5	86·1	75·5	63·0	71·0	61·3	69·4	15·1	78·7	79·8
May 1931	11·52	21	9·97	88·0	79·0	82·3	69·5	51·0	66·8	49·5	64·9	15·5	75·4	82·5
June 1931	14·76	23	7·06	83·0	77·0	80·5	69·0	50·0	66·0	48·0	64·0	14·5	71·5	83·5
July 1931	2·18	9	3·82	86·0	75·8	78·3	72·0	44·8	65·8	43·0	64·0	12·5	68·5	77·0
August 1931	4·63	16	2·84	84·0	73·0	77·6	66·5	51·8	61·3	50·0	59·6	16·3	66·5	78·5
	121·42	197	126·54	..	..	..	..	..	..	..	..	..	..	*80·2

* Average.

Experiments Harvested during 1931.

1. Soaking plants experiment—second ratoon crop.
2. Interspace distance experiment—first ratoon crop.
3. Fertilizer experiment—amounts of nitrogen and phosphates; fallowed and non-fallowed—first ratoon crop.
4. Fertilizer and liming experiment—amounts of nitrogen and potash—first ratoon crop.
5. Fertilizer experiment—amounts of nitrogen, phosphates, and potash—plant crop.
6. Fertilizer experiment—value of phosphates in different fertilizers—plant crop.

Work of the Northern Sugar Experiment Station—*continued.*

SOAKING PLANTS (Second Ratoon Crop).

I.	1. Plants unsoaked.
	2. Plants soaked in saturated solution of lime water + 1 lb. magnesium sulphate to 50 galls.
	3. Plants soaked in saturated solution of lime water.
	4. Plants soaked in water.
	5. Plants soaked in saturated solution of lime water + 5 lb. nitrate of soda in 50 galls.
II.	6. Plants unsoaked.
	7. Plants soaked in saturated solution of lime water + 1 lb. magnesium sulphate to 50 galls.
	8. Plants soaked in saturated solution of lime water.
	9. Plants soaked in water.
	10. Plants soaked in saturated solution of lime water + 5 lb. nitrate of soda in 50 galls.

Block.—A2.

Variety.—Badila.

Harvested.—September, 1931.

Age of Crop.—12 months.

System of Replication.—Duplicate plots of each of five treatments.

Plots.—0·119 acre.

Object.—

(1) Plant Crop. To obtain information as to the effect, on germination and yield, of soaking plants for 48 hours in different solutions.

(2) Ratoon Crop. To determine if the advantage gained in the plant crop would carry on to the ratoons.

Fertilizer.—All plots uniformly fertilized with a complete mixture.

Yields.

Block.	Unsoaked.		Lime Water + Mag. Sulph.		Lime Water.		Water.		Lime Water + Nitrate of Soda.	
	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.
I.	37·2	6·2	36·4	6·15	35·6	6·05	37·4	6·3	38·2	6·3
II.	36·5	6·1	38·1	6·3	37·6	6·3	36·2	6·1	36·35	6·1
Average ..	**36·85**	**6·15**	**37·25**	**6·23**	**36·6**	**6·18**	**36·8**	**6·2**	**37·23**	**6·2**

Summary of Crop Yields—Plant and Ratoon Crops.

Treatments.	Plant Crop.		First Ratoon Crop.		Second Ratoon Crop.		Average of Three Crops.	
	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.
1. Plants unsoaked	38·2	5·87	39·7	6·40	36·85	6·15	38·25	6·14
2. Plants soaked in lime water + 1 lb. magnesium sulphate to 50 gallons	41·4	6·38	39·8	6·34	37·25	6·23	39·48	6·32
3. Plants soaked in lime water ..	40·2	6·19	39·9	6·45	36·6	6·18	38·90	6·27
4. Plants soaked in water	40·4	6·15	39·8	6·45	36·8	6·20	39·00	6·27
5. Plants soaked in lime water + 5 lb. nitrate of soda in 50 gallons	41·9	6·49	40·0	6·50	37·28	6·29	39·72	6·46

DISCUSSION.

The results of the second ratoon crop bear out the remarks made last year—that the advantage gained in the plant crop from soaking setts prior to planting is not maintained in the ratoons.

Work of the Northern Sugar Experiment Station—*continued.*

INTERSPACE DISTANCE (First Ratoon Crop).

I.	Interspaces 4 ft. 6 in.
II.	Interspaces 5 ft.

Block.—B5.

Variety.—Badila.

Harvested.—September, 1931.

Age of Crop.—12 months.

Experimental System—Single plots.

Manurial Treatment.—Both plots received fertilizer at the following rate per acre :—

Sulphate of ammonia ..	300 lb.
Superphosphate	300 lb.
Sulphate of potash	100 lb.

Preparation of Land.—The land was ratooned according to the usual practice.

Planting—Block I.—Rows, 4 feet 6 inches apart.
Plants per acre used in plant crop, 7,616;
Weight, 2 tons 3 cwt.

Block II.—Rows, 5 feet apart;
Plants per acre used in plant crop, 6,812;
Weight, 1 ton 17 cwt.

Yields.

Block.	Distance Between Rows.	Cane per Acre.	% C.C.S. in Cane.	C.C.S. per Acre.
		Tons.		Tons.
I.	4 ft 6 in.	**41·5**	16·2	**6·72**
II.	5 ft.	**40·8**	16·4	**6·69**

Summary of Crop Yields—Plant and First Ratoon Crops.

Block.	Distance between Rows.	PLANT CROP.		FIRST RATOON CROP.		AVERAGE OF TWO CROPS.	
		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.
I.	4 ft. 6 in.	41·6	6·65	41·5	6·72	**41·55**	**6·68**
II.	5 ft.	40·2	6·43	40·8	6·69	**40·5**	**6·56**

DISCUSSION.

The increased yield on the ratoons for the narrower interspace was less than on the plant crop. Further, the C.C.S. was slightly reduced by the closer planting, so that the yield of C.C.S. per acre was practically the same from both blocks. The cane at 5 feet interspace had a better appearance and carried thicker sticks than at 4 feet 6 inches, and is to be preferred as the standard for Badila.

Work of the Northern Sugar Experiment Station—*continued.*

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

Treatment and Yields (Tons Cane per Acre).

	Fallowed.	Non-Fallowed.
I.	2N 2P 36·8	1N 2P 31·3
	1N 1P 31·2	1N 1P 29·2
	1N 2P 36·05	2N 2P 32·5
	2N 1P 33·5	2N 1P 30·6
	C 25·2	C 22·3
II.	C 24·4	2N 2P 33·9
	2N 2P 37·1	2N 1P 31·8
	2N 1P 34·1	C 20·1
	1N 2P 34·35	1N 1P 27·8
	1N 1P 32·2	1N 2P 31·9

III. IV.

Block.—B3.

Variety.—Badila.

Harvested.—September, 1930.

Age of Crop.—12 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 Crop.—

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

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Squares.	Half $\log_e$ (Mean Square).
Blocks	1	0·05	0·05	..
Fallowed *v.* non-fallowed	1	56·11	56·11	3·1650
Fertilizers	4	357·02	89·26	3·3971
Errors	13	8·59	0·661	0·9443
Total	19	421·77	..	

Standard error = $\sqrt{4 \times 0{\cdot}661} = \sqrt{2{\cdot}664} = 1{\cdot}63$, or 1·32 per cent.

ceived fertilizer

300 lb.
300 lb.
100 lb.

ce.

C.C.S. Cane.	C.C.S. per Acre.
	Tons.
16·2	**6·72**
16·4	**6·69**

AVERAGE OF TWO CROPS.	
Cane per Acre.	C.C.S. per Acre.
Tons.	Tons.
41·55	**6·68**
40·5	**6·56**

ss than on the
g, so that the
cane at 5 feet
feet 6 inches,

Work of the Northern Sugar Experiment Station—*continued.*

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	24·8	16·4	4·07	21·2	16·6	3·52
1N 1P ..	31·7	16·3	5·17	28·5	16·4	4·67
1N 2P ..	35·2	16·3	5·74	31·6	16·3	5·15
2N 1P ..	33·8	16·2	5·47	31·2	16·4	5·12
2N 2P ..	36·95	16·05	5·93	33·2	16·3	5·41

Summary of Crop Yields—Plant and First Ratoon Crops.

Treatment.	Plant Crop.				First Ratoon Crop.				Average of Two Crops.			
	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	27·55	4·47	23·55	3·88
1N 1P	32·6	5·22	28·7	4·65	31·7	5·17	28·5	4·67	32·15	5·19	28·60	4·66
1N 2P	36·35	5·78	30·3	4·82	35·2	5·74	31·6	5·15	35·77	5·76	30·95	4·98
2N 1P	33·4	5·34	30·9	4·91	33·8	5·47	31·2	5·12	33·60	5·40	31·05	5·01
2N 2 P	37·1	5·82	32·4	5·15	36·95	5·93	33·2	5·41	37·02	5·87	32·80	5·28

DISCUSSION.

With the plant crop, it was found that fallowed and non-fallowed land re-acted quite differently towards nitrogenous and phosphatic fertilizers. Following a green manure crop, the plant cane responded very definitely to superphosphate, and showed but slight increase from the application of sulphate of ammonia; with the non-fallowed land, the situation was reversed. The results of the first ratoons add further interesting data, which may be summarised as follows:—

Pre-treatment.	Increase due to 200 lb. dressing of—			
	Superphosphate.		Sulphate of Ammonia.	
	Plant Crop.	1st Ratoons.	Plant Crop.	1st Ratoons.
	Tons.	Tons.	Tons.	Tons.
Following green manure	3·7	3·3	0·8	1·9
"Plough-out and replant"	1·6	2·6	2·2	2·2

The differences which were so marked with the plant crop tend to disappear with the ratoons, indicating that the influence of the green manure is fading out with successive cane crops. This supports the point which has been emphasised frequently, that although the response to sulphate of ammonia is slight on a crop of plant cane following green manure, the ratoons will benefit from liberal applications of nitrogen. The average increase in cane yield for the second 200-lb. application of sulphate of ammonia was more than two tons, indicating that the dressing could probably be increased profitably even in excess of 400 lb. per acre.

Work of the Northern Sugar Experiment Station—*continued.*

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

Plan and Yields.

No Lime	2N	C
	N	N K
Lime	C	2N
	N	N K
No Lime	N	C
	N K	2N
Lime	2N	N K
	N	C

I. *Block.*—B6.
Variety.—Badila.
Harvested.—October, 1931.
Age of Cane.—12 months.
System of Replication.—Two randomised blocks.
Plots.—0·0913 acre.
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. First Ratoon Crop : The plots were ratooned by ploughing away from cane and centres busted with skeleton plough to a depth of 12 inches.

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

Yields.

Treatment.	Lime (1 Ton per Acre).			No Lime.		
	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	**32·2**	16·5	**5·31**	**29·3**	16.7	**4·89**
N	**36·5**	16·5	**6·02**	**33·6**	16·6	**5·58**
2N	**39·4**	16·4	**6·46**	**35·7**	16·5	**5·89**
N K ..	**36·2**	16·5	**5·97**	**34·1**	16·6	**5·66**

Summary of Crop Yields—Plant and First Ratoon Crops.

Treatment.	Plant Crop.				First Ratoon Crop.				Average of Two Crops.			
	Lime (1 Ton per Acre).		No Lime.		Lime (1 Ton per Acre).		No Lime.		Lime (1 Ton per Acre).		No Lime.	
	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	39·8	6·37	34·8	5·60	32·2	5·31	29·3	4·89	36·00	5·84	32·05	5·24
N	40·8	6·57	36·2	5·86	36·5	6·02	33·6	5·58	38·65	6·29	34·90	5·72
2N	42·1	6·69	37·8	6·05	39·4	6·46	35·7	5·89	40·75	6·57	36·75	5·97
NK	41·8	6·69	37·1	5·94	36·2	5·97	34·1	5·66	39·00	6·33	35·60	5·80

DISCUSSION.

A comparison of the results from the plant and first ratoon crops reveals the following interesting features :—

Increase due to—	Plant Crop.	1st Ratoon Crop.
1 ton burnt lime	4·65 tons	2·9 tons
300 lb. sulphate ammonia	2·75 tons	6·8 tons
150 lb. muriate potash	0·95 tons	0·1 tons

Work of the Northern Sugar Experiment Station—*continued.*

It is seen that one ton of burnt lime applied prior to planting continue to give a substantial increase on the first ratoons. To date the net increase has been 7·55 tons of cane. The need for potash was slight on both plant and ratoon crops, which is in accordance with previous findings. The results from nitrogen are particularly interesting. Following a crop of cowpeas ploughed under before the plant crop, the increase from 300 lb. sulphate of ammonia was 2·75 tons. On the ratoons, where the nitrogen supply from the green manure was practically exhausted, the increased return was 6·8 tons of cane per acre. Even 300 lb. of sulphate of ammonia appears to be below the economic limit, and once again the necessity for heavier nitrogenous dressings on ratoons is emphasised. Applied early, no serious depressing influence on C.C.S. is experienced.

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

Plan and Crop Yields.

I.	N 2P 3K 48·8	2N P 3K 47·1	N P 3K 47·1	N 2P K 48·0	2N 2P 3K 49·4	2N P K 46·7
	N 2P 2K 48·6	N P K 45·8	2N 2P K 49·1	2N P 2K 47·5	2N 2P 2K 49·5	N P 2K 46·3
II.	2N 2P 2K 51·1	N 2P K 49·75	N P K 47·0	N P 3K 47·8	2N 2P K 50·4	2N 2P 3K 50·8
	2N P 2K 48·45	2N P 3K 48·4	2N P K 47·9	N 2P 2K 50·05	N 2P 3K 49·8	N P 2K 47·3
III.	2N 2P K 49·9	N P K 46·4	2N 2P 2K 50·1	2N 2P 3K 50·5	2N P 3K 47·5	2N P 2K 47·25
	N P 3K 47·2	N 2P 3K 49·6	N P 2K 47·0	N 2P K 49·4	2N P K 47·6	N 2P 2K 49·8
IV.	N P 3K 47·6	2N P 2K 49·0	2N P K 48·6	2N 2P K 51·1	2N 2P 3K 51·3	2N P 3K 49·1
	N P K 47·2	2N 2P 2K 51·4	N 2P 2K 50·2	N 2P K 49·8	N P 2K 47·7	N 2P 3K 50·7

Block.—B4.

Variety.—Badila.

Harvested.—October, 1931.

Age of Crop.—13 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.—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 August, 1930.

Yields.

Treatment.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	Per Cent.	Tons.
N P K	46·6	16·32	7·60
N P 2K	47·1	16·35	7·70
N P 3K	47·4	16·45	7·80
N 2P K	49·2	16·15	7·94
N 2P 2K	49·65	16·20	8·04
N 2P 3K	49·7	16·37	8·13
2N P K	47·7	16·25	7·75
2N P 2K	48·05	16·42	7·89
2N P 3K	48·0	16·35	7·85
2N 2P K	50·1	16·29	8·16
2N 2P 2K	50·5	16·12	8·14
2N 2P 3K	50·5	16·35	8·26

Work of the Northern Sugar Experiment Station—*continued.*

Summary of Yields.

——	100 lb. Sulphate of Ammonia.	200 lb. Sulphate of Ammonia.	300 lb. Super-phosphate.	600 lb. Super-phosphate.	100 lb. Muriate of Potash.	200 lb. Muriate of Potash.	300 lb. Muriate of Potash.
Cane, tons per acre	48·29	49·15	47·48	49·96	48·42	48·83	48·92
Cane, percentage of mean yield	99·1	100·9	97·5	102·5	99·4	100·2	100·4
C.C.S. in cane	16·31	16·30	16·36	16·25	16·25	16·27	16·38
C.C.S., tons per acre	7·88	8·01	7·77	8·12	7·87	7·94	8·01
C.C.S., percentage of mean yield	99·1	100·9	97·8	102·2	99·1	100·0	100·9
Standard error	0·11		0·11		0·15		

DISCUSSION.

An attempt was made primarily to determine the optimum economic dressing of potash on this soil type, when heavy dressings of nitrogenous and phosphatic fertilizers are applied.

The summary of results show that 100 lb. of muriate of potash per acre gave practically a maximum yield; the increments for the increased dressings, though definite, were very slight.

The result from a double dressing of superphosphate (600 lb. per acre) as against a single (300 lb. per acre) is most marked. The increase (2·48 tons cane) is in accordance with our findings in the past.

Following a heavy crop of Mauritius beans which were ploughed under prior to planting, the response to added dressings of sulphate of ammonia are small, as would be anticipated. However, the increase due to the double dressing (0·86 tons cane) was payable.

The ratoons from this trial should yield very interesting returns.

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

Plan and Crop Yields.

N E Ps 46·2	N E Pm 46·3	N E Pb 47·8	N L Ps 45·9	N E Ps 48·1
N E Pm 46·9	N E Pb 46·7	N L Pb 46·05	N L Pb 46·2	N L Pb 45·4
N L Pb 46·6	N L Ps 45·05	N E Pm 46·05	N E Ps 45·5	N E Pm 45·2
N L Pm 45·4	N E Ps 46·85	N L Ps 46·35	N E Pb 47·05	N E Pb 46·2
N E Pb 46·8	N L Pb 45·3	N E Ps 47·2	N E Pm 47·2	N L Ps 44·7
N L Ps 45·7	N L Pm 45·9	N L Pm 46·1	N L Pm 46·4	N L Pm 46·8

Block.—A1.

Variety.—Badila.

Harvested.—September, 1931.

Age of Crop.—15 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 drill at time of planting.

L—Two months after planting.

Preparation of Land.—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.

Work of the Northern Sugar Experiment Station—*continued.*

Yields.

—	ALL PLOTS RECEIVED EQUIVALENT OF 150 LB. SULPH. /AMMON. + 100 LB MUR. / POT. PER ACRE.				
	400 lb. Super-phosphate.	467 lb. Basic Super-phosphate.	177 Monam-monium Phosphate.	Fertilizer applied Early.	Fertilizer applied Late.
Cane, tons per acre	**46·16**	**46·41**	**46·23**	**46·67**	**45·86**
Cane, percentage of mean yield	99·8	100·3	99·9	100·9	99·1
C.C.S. in cane	**16·12**	**16·13**	**16·12**	**16·19**	**16·05**
C.C.S., tons per acre	**7·44**	**7·49**	**7·45**	**7·56**	**7·36**
C.C.S., percentage of mean yield	99·7	100·4	99·9	101·3	98·7
Standard error		**0·50**		**0·41**	

DISCUSSION.

This experiment was designed to determine the relative values of phosphoric acid, supplied as superphosphate, basic superphosphate, and a new form of concentrated synthetic manure, monammonium phosphate. The results from the plant crop indicate that, when applied in equivalent amounts, they are all equally effective.

The influence of time of application of the manure is interesting. The *Early* manure was applied in June, and the *Late* in August. Although the crop was not harvested until September, 1931, the effect of the time of application is quite evident. The results show an increase in cane yield of 0·81 tons per acre due to earlier manuring. Further, a small though definite improvement in the C.C.S. content of the earlier manured cane was effected.

DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE, FROM 1st NOVEMBER, 1930, TO 31st OCTOBER, 1931.

Materials.	Number of Analyses.
Sugar-canes for growers	112
Sugar-canes for South Johnstone Show	25
Sugar-canes for Experiment Station	2,426
Sugar-cane fibres	86
Coral lime	6
Agricultural lime	11
Burnt lime	4
Fertilizers	16
Waters	6
Soils	232
Molasses	12
Mill ash	2
Juices (P_2O_5)	42
Total	2,980

YIELD OF CANE HARVESTED FROM THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE, SEASON 1931.

	Tons.
Cane sent to mill	730·15
Used for plants	20·25
Distributed to farmers, used for analysis, seedling propagation, and show exhibits	16·4
Total	766·8

Nature of Crop—	Per cent.
Plant cane	23·6
First ratoon	59·1
Second ratoon	17·3

Tonnages—	Tons.
Badila plant	219·35
Badila first ratoon	401·35
Badila second ratoon	86·1
Varieties	59·96
Acreage under cane	**18·9**
Tons of cane per acre	**40·57**

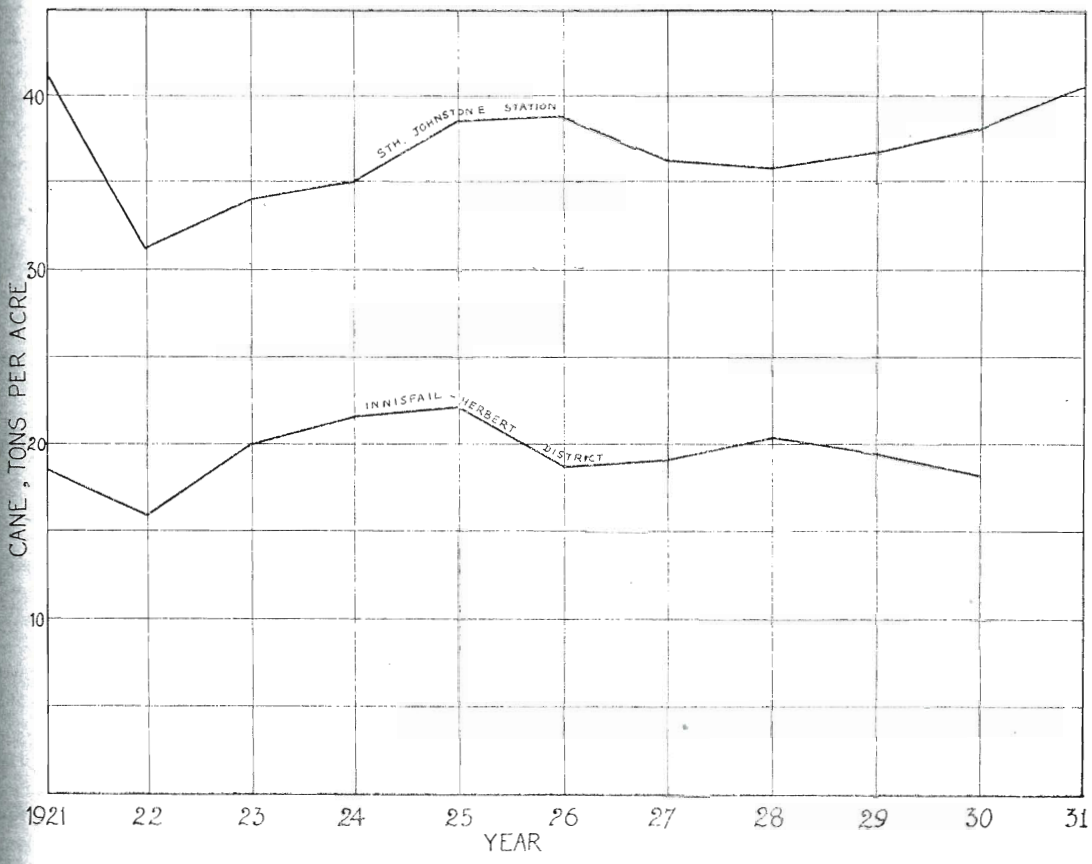
Work of the Northern Sugar Experiment Station—*continued.*

YIELDS OF CANE AT SOUTH JOHNSTONE EXPERIMENT STATION COMPARED WITH AVERAGE YIELDS INNISFAIL-HERBERT RIVER DISTRICT.

The average yield of cane per acre at the South Johnstone Station for the past ten years is 36·60 tons. The average for the Innisfail-Herbert River districts for the same period is only 19·46 tons. The marked difference should demonstrate clearly what can be accomplished by consistently good cultivation combined with adequate manuring.

The standard procedure at South Johnstone is to carry all experiments through plant, first and second ratoons, which is in accordance with customary farm practice. A study of the data from experimental plots reported here will show that there is little variation in yield for all classes of crop, provided the fertilizer programme has been suitable. Where crops are not manured, or receive only incomplete treatment, the falling off in ratoon yields is most marked.

The annual yields per acre for the above comparison are shown by the subjoined graph :—



CENTRAL SUGAR EXPERIMENT STATION, MACKAY.

MR. F. KEOGH, Chemist in Charge.

METEOROLOGICAL.

Good rains fell in May and June, 1930, and conditions for planting during the winter and spring months were favourable. The germinations were uniformly good, and the cane stooled much better than in 1929. The rainfall from July to the end of November was very much below the average, and resembled the previous season in this respect. A moderate rainfall in December was decidedly beneficial, but the customary wet season rains were very considerably below the average, and from the end of March no rains of value to the growing crop were received.

The rainfall for the past season is the lowest recorded in Mackay; the total fall for the growing period (12 months) registering only 22·99 inches. As a consequence, the crops for the whole district are poor, and in many cases the foliage was dying in July.

The following table gives a comparison of the rainfall records for the driest four growing seasons on record in Mackay:—

Rainfall over growing period from 1st August to 31st July, for dry years:—

Month.	1901-02.	1922-23.	1925-26.	1930-31.
August	4·72	0·05	3·93	0·60
September	2·90	1·45	1·40	0·28
October	0·84	1·45	0·21	0·62
November	1·66	1·74	0·53	1·01
December	0·22	4·85	12·77	2·71
January	3·38	5·95	3·62	4·12
February	8·46	2·44	3·89	5·32
March	4·17	2·82	9·36	5·31
April	6·28	3·66	1·12	1·27
May	0·94	..	0·53	1·66
June	1·30	5·25	1·51	0·26
July	0·37	0·74	0·07	0·19
Totals	35·24	30·40	38·94	23·35

Total from 1st July, 1930, to 31st September, 1931 = 24·54 in. in 15 months.

RAINFALL SINCE 1920 AT THE SUGAR EXPERIMENT STATION, MACKAY.

Year.	Rainfall in Inches.	Year.	Rainfall in Inches.
1920	57·27	1926	34·69
1921	95·89	1927	83·87
1922	34·47	1928	78·28
1923	25·23	1929	64·03
1924	53·37	1930	55·81
1925	54·80	1931 (10 months)	18·17

Abstract of Meteorological Observations made at Sugar Experiment Station, Mackay, from 1st September, 1930, to 31st August, 1931.

Month.	Rainfall in Inches.	Number of Wet Days.	Average Rainfall, 30 Years, 1901–1930.	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, Saturation equalling 100 at 9 a.m.	Mean Daily Evaporation in Inches.
Sept. 1930	0·28	2	1·83	89·2	75·9	83·6	61·1	48·0	55·0	46·0	52·0	28·6	73·1	69·5	0·24
Oct. 1930	0·62	8	1·73	98·1	76·6	87·1	73·6	53·6	63·2	50·4	60·6	23·9	79·3	69·0	0·26
Nov. 1930	1·21	4	2·87	98·2	87·3	91·3	73·7	58·9	65·7	57·0	64·3	25·6	84·6	62·5	0·38
Dec. 1930	2·71	9	7·99	99·2	83·6	90·9	76·0	63·9	68·5	62·6	67·2	22·4	84·0	72·0	0·29
Jan. 1931	4·12	8	15·68	102·6	80·0	87·0	78·9	65·4	72·3	63·9	70·5	17·7	87·0	74·0	0·33
Feb. 1931	5·32	7	9·57	97·0	79·0	89·0	75·2	65·1	70·0	61·2	67·3	19·0	81·3	75·2	0·26
Mar. 1931	5·31	17	10·44	96·7	82·5	90·1	76·2	67·2	71·1	64·4	68·7	19·0	81·8	81·0	0·18
Apr. 1931	1·27	8	5·77	90·7	79·2	84·5	73·9	53·7	63·7	52·1	63·0	20·8	74·8	83·4	0·24
May 1931	1·66	11	3·27	89·8	74·1	82·7	69·0	43·8	61·3	39·1	59·5	21·4	72·6	80·0	0·22
June 1931	0·26	6	2·59	86·0	69·6	80·4	64·2	43·7	57·3	41·0	55·8	23·1	68·2	79·0	0·27
July 1931	0·19	4	1·33	85·3	73·2	79·2	62·1	37·0	49·8	35·0	46·5	29·4	66·9	68·9	0·29
Aug. 1931	0·04	2	1·02	86·2	75·6	81·4	62·5	41·0	51·5	39·1	49·0	20·2	69·9	67·5	0·28
	22·99	86	64·09	..	..	..	..	..	..	..	..	..	..	*73·4	..

*Average.

Work of the Central Sugar Experiment Station—*continued.*

Work of the Station.

Due to the modifications in plot experimental technique recently introduced, it was thought desirable to plough out all blocks at the conclusion of the 1930 harvest, to fallow the land until early 1931, and redistribute the experimental blocks along more suitable lines.

It is felt that the alterations thus effected will lead to a considerable improvement in the precision of experimental trials. The station land is extremely variable over the small area embraced by its boundaries, and the range in soils is from sands to clays. A fairly effective separation of distinctive types has now been provided for, and extreme types have been excluded from experimental blocks.

Experiments Laid Down 1931.

Commencing with the May planting season, the several blocks were replanted successively, and the following experiments are included in this year's work :—

Method of Planting.—Machine v. Hand.

Fertilizer Trial.—Amount of nitrogen.

Fertilizer Trial—

(*a*) Lime v. no lime.
(*b*) Forms of nitrogenous fertilizer.
(*c*) Amount of fertilizer.
(*d*) Early v. late application.

Fertilizer Trial—

(*a*) Forms of phosphatic fertilizers.
(*b*) Forms of potash.
(*c*) Forms of nitrogenous manures.

Molasses Trial.

DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT SUGAR EXPERIMENT STATION, MACKAY, FROM 1st NOVEMBER, 1930, TO 31st OCTOBER, 1931.

Materials.	Number of Analyses.
Sugar-canes for growers	100
Sugar-canes for Station	80
Sugar-canes, Mackay Show	72
Sugar-canes, Gin Gin Show	4
Milk samples, Mackay Show	18
Limestones	10
Water	3
Soils (acidity tests)	10
Juices	16
Total	313

SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG.

MR. J. PRINGLE, Chemist in Charge.

METEOROLOGICAL.

Following on a mild winter in 1930, during which 11·19 inches of rain fell, the early part of the past growing season was good and the cane made vigorous growth till the end of October. Hot, dry conditions during the following three months practically brought growth to a standstill, but after the good rainfall at the end of January the cane made a rapid recovery and grew vigorously until checked by cool weather in May, and continued to make a little headway up to the commencement of harvesting.

The past winter was very mild with a few light frosts which caused no damage to the cane crops. Warm, dry conditions prevailed during the spring months of the current year, but fortunately a fall of 1·75 inches on the 4th October was sufficient to produce a satisfactory germination in the spring plantings; otherwise the crops are backward.

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

Month.	Rainfall. Inches.	Number of Wet Days.
August, 1930	2·44	5
September, 1930	2·25	5
October, 1930	1·16	8
November, 1930	0·45	6
December, 1930	1·53	8
January, 1931	2·57	6
February, 1931	20·18	11
March, 1931	8·75	21
April, 1931	1·20	5
May, 1931	3·67	13
June, 1931	1·82	14
July, 1931	0·52	3
August, 1931	0·87	7
September, 1931	0·74	5
October, 1931	1·90	4
Total	50·05	121

Experiments Harvested during 1931.

1. Fertilizing Trial—Second ratoon crop.
2. Nitrogen Trial—First ratoon crop.
3. Potash Trial—First ratoon crop.
4. Molasses Trial—First ratoon crop.
5. Ratooning Trial—Second ratoon crop.
6. Sulphate v. Muriate of Potash Trial combined with Nitrogen and Time of Application Trial—Second ratoon crop.
7. Varietal Trial with Co. 210, Co. 213, Co. 227, and D. 1135—Plant crop.

New Experiments Initiated.

1. Fertilizer Trial to show the relative values of different forms of nitrogen and potash on cane growth.
2. Fertilizer Trial using different forms of phosphates combined with single and double dressings of potash and nitrogen with and without phosphates.
3. Subsoiling v. Non-subsoiling combined with hand and machine planting.

Work of the Southern Sugar Experiment Station—*continued.*

FERTILIZING TRIAL (Second Ratoon Crop).

I.	1. 200 lb. sulphate of ammonia. 200 lb. superphosphate.
	2. 200 lb. sulphate of ammonia. 200 lb. sulphate of potash.
	3. 200 lb. sulphate of ammonia. 200 lb. superphosphate. 200 lb. sulphate of potash.
	4. No manure.
II.	5. 200 lb. sulphate of ammonia. 200 lb. superphosphate.
	6. 200 lb. sulphate of ammonia. 200 lb. sulphate of potash.
	7. 200 lb. sulphate of ammonia. 200 lb. superphosphate. 200 lb. sulphate of potash.
	8. No manure.

Block.—C1.

Variety.—Q. 813.

Harvested.—August, 1931.

Age of Crop.—12 months.

System of Replication.—Duplicate plots of each treatment.

Plots.—0·182 acre.

Cultivation.—The first ratoon crop was harvested in August and ratooned with the grubber twice in row. The manures were applied at the beginning of December.

Growth.—The cane in all plots came away well, particularly those receiving fertilizer, and made rapid growth until checked by dry weather in January, but responded again to the favourable conditions in February, the manured plots taking the lead.

Yields.

Block.	No Manure.		200 lb. Sulph. Ammonia. 200 lb. Superphosphate.		200 lb. Sulph. Ammonia. 200 lb. Sulph. Potash.		200 lb. Sulph. Ammonia. 200 lb. Superphosphate. 200 lb. Sulph. Potash.	
	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.
I.	5·53	0·83	8·55	1·32	13·59	2·07	12·43	1·89
II.	5·53	0·80	5·94	0·96	14·00	2·23	12·22	2·00
Average ..	**5·53**	**0·82**	**7·25**	**1·14**	**13·80**	**2·15**	**12·33**	**1·95**

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

Treatment.	Plant Crop.		First Ratoon Crop.		Second Ratoon Crop.		Average—Three Crops.	
	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.
No manure	11·9	1·61	9·9	1·45	5·5	0·82	**9·1**	**1·29**
200 lb. Sulph. Amm. .. .. 200 lb. Super.	12·9	1·89	14·0	2·05	7·3	1·14	**11·4**	**1·69**
200 lb. Sulph. Amm. .. .. 200 lb. Sulph. Pot.	14·2	1·94	19·9	3·02	13·8	2·15	**16·0**	**2·37**
200 lb. Sulph. Amm. .. .. 200 lb. Super. .. .. .. 200 lb. Sulph. Pot.	13·9	1·92	18·5	2·76	12·3	1·93	**14·9**	**2·21**

CONCLUSIONS.

The yields from the second ratoon crop show very clearly that those plots receiving no potash manure have now become so depleted in available potash that the crop was almost a complete failure. In the absence of potash, the sulphate of ammonia and superphosphate give but little return. The results of this trial once again emphasise the absolute need for the consistent use of potash-rich fertilizer on the red volcanic loam.

Work of the Southern Sugar Experiment Station—*continued.*

NITROGEN TRIAL (First Ratoon Crop).

Block.—E1.

Variety.—Q. 813.

Harvested.—September, 1931.

Age of Crop.—12 months.

System of Replication.—5 x 5 Latin Square.

Plots.—0·0665 acre.

Treatment.—

C — No manure.

N — 150 lb. sulphate of ammonia per acre.

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

P — 200 lb. superphosphate per acre.

K — 300 lb. muriate of potash per acre.

Method of Application.—All potash and superphosphate applied at time of ratooning. Sulphate of ammonia in N plots as single top dressing, in November, and in 2N plots as top dressing—half in November and remainder six weeks later.

Cultivation.—The plant crop was harvested in September, and the cane ratooned with the grubber twice in row, early in October.

Growth.—The cane came away well with the exception of three of the check plots, and made good headway till checked by adverse conditions in January, but after the rain in February rapid growth commenced, the heavily manured plots taking the lead.

Plan and Crop Yields.

2N P K (1) 27·81 (2) 4·76	P K 19·16 3·18	N P K 23·86 3·82	C 6·01 0·95	K 13·15 2·25
K (1) 21·32 (2) 3·73	2N P K 23·48 3·90	C 18·97 3·34	N P K 18·79 3·31	P K 15·03 2·46
C (1) 17·66 (2) 3·01	N P K 19·16 3·30	K 15·40 2·71	P K 13·15 2·26	2N P K 14·62 2·49
N P K (1) 20·29 (2) 3·52	K 16·20 2·76	P K 17·85 2·99	2N P K 15·03 2·70	C 5·82 0·98
P K (1) 19·91 (2) 3·40	C 17·47 2·89	2N P K 21·97 3·58	K 15·40 2·65	N P K 16·20 2·84

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

Results.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Rows	4	64·99	16·25
Columns	4	286·35	71·59
Treatment	4	171·72	42·93
Errors	12	55·50	4·63
Total	24	578·56	..

Standard Error (5 plots) = $\sqrt{5 \times 4{\cdot}63} = \sqrt{23{\cdot}15} = 4{\cdot}71$, or 5·43 per cent.

Summary of Yields.

Crop.	——	No Manure.	300 lb. Muriate of Potash.	200 lb. Super. + 300 lb. Mur. of Potash.	150 lb. Sulph. Ammonia + 200 lb. Super. + 300 lb. Muriate of Potash.	300 lb. Sulph. Ammonia + 200 lb. Super + 300 lb. Muriate of Potash.
Plant ..	Cane, tons per acre..	**16·15**	**18·11**	**18·82**	**21·00**	**22·47**
	C.C.S., tons per acre	**2·51**	**2·89**	**2·98**	**3·17**	**3·36**
First Ratoons	Cane, tons per acre..	**13·19**	**16·29**	**17·02**	**19·66**	**20·58**
	C.C.S., tons per acre	**2·23**	**2·82**	**2·86**	**3·36**	**3·49**
Average (2 crops)	Cane, tons per acre..	**14·67**	**17·20**	**17·92**	**20·33**	**21·53**
	C.C.S., tons per acre	**2·37**	**2·86**	**2·92**	**3·27**	**3·43**

DISCUSSION.

The results for the first ratoon crop follow very closely those for the plant. There has been a very definite response to potash, and to single and double dressings of sulphate of ammonia, with but little increase due to superphosphate.

In the case of the plots receiving complete fertilizer, there is actually a small increase in C.C.S. per acre for the ratoon over that from the plant crop.

Work of the Southern Sugar Experiment Station—*continued.*

POTASH TRIAL—First Ratoon Crop.

Block.—E2.
Variety.—D. 1135.
Harvested.—September, 1931.
Age of Crop.—12 months.
System of Replication.—5 x 5 Latin Square.
Plots.—0·0665 acre.
Treatment.—
C—No manure.
N—200 lb. sulphate of ammonia per acre.
P—150 lb. superphosphate per acre.
1K—100 lb. muriate of potash per acre.
2K—200 lb. muriate of potash per acre.
3K—300 lb. muriate of potash per acre.
4K—400 lb. muriate of potash per acre.
5K—500 lb. muriate of potash per acre.

Cultivation.—The plant crop was harvested in September, and the cane ratooned with the grubber twice in the row early in October. The potash and superphosphate were applied at time of ratooning, and the sulphate of ammonia as a top dressing in November.

Growth.—The cane in all plots came away well and made rapid growth until checked by dry conditions in January, but commenced to grow vigorously after the favourable weather in February.

Plan and Crop Yields.

N P 5K (1) 23·86 (2) 3·63	N P 1K 17·66 2·75	N P 3K 23·29 3·63	N P 2K 21·04 3·32	N P 4K 22·54 3·55
N P 4K (1) 24·60 (2) 3·84	N P 5K 22·54 3·46	N P 2K 24·22 3·80	N P 3K 23·57 3·72	N P 1K 22·72 3·28
N P 1K (1) 12·95 (2) 1·99	N P 3K 20·67 3·12	N P 5K 22·17 3·49	N P 4K 22·35 3·48	N P 2K 22·72 3·29
N P 3K (1) 19·19 (2) 2·95	N P 2K 20·29 3·26	N P 4K 23·29 3·71	N P 1K 21·04 3·37	N P 5K 24·42 3·76
N P 2K (1) 18·97 (2) 3·09	N P 4K 22·17 3·36	N P 1K 24·98 3·78	N P 5K 24·98 3·64	N P 3K 26·48 4·10

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

Results.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Rows	4	38·95	9·74
Columns	4	60·55	15·14
Treatments	4	43·57	10·89
Errors	12	47·41	3·95
Total	24	190·48	..

Standard Error (5 plots) = $\sqrt{5 \times 3{\cdot}95} = \sqrt{19{\cdot}75} = 4{\cdot}44$, or 4·02 per cent.

Summary of Yields.

Crop.		All plots received 200 lb. sulphate of ammonia + 150 lb. superphosphate +				
		+ 100 lb. Muriate of potash.	+ 200 lb. Muriate of potash.	+ 300 lb. Muriate of potash.	+ 400 lb. Muriate of potash.	+ 500 lb. Muriate of potash.
Plant ..	Cane, tons per acre..	20·35	21·91	21·39	21·67	21·68
	C.C.S., tons per acre	2·74	2·98	2·85	2·89	2·90
First Ratoons	Cane, tons per acre..	19·87	21·45	22·64	22·99	23·59
	C.C.S., tons per acre	3·03	3·35	3·50	3·59	3·60
Average (2 crops)	Cane, tons per acre..	20·12	21·68	21·97	22·03	22·64
	C.C.S., tons per acre	2·89	3·17	3·18	3·24	3·25

DISCUSSION.

The results from varying potash dressings were much more pronounced on the ratoons than on the plant crop. The first ratoon crop was, on the average, heavier than the plant crop, and this was particularly true where the heavier fertilizer dressings were given. The second ratoon yields should be particularly interesting.

Work of the Southern Sugar Experiment Station—*continued.*

MOLASSES TRIAL (First Ratoon Crop).

Plan and Crop Yields.

I.	A	(1)	29·06
		(2)	4·54
	B	(1)	22·88
		(2)	3·72
II.	B	(1)	16·88
		(2)	2·58
	A	(1)	33·37
		(2)	4·72
III.	B	(1)	17·44
		(2)	2·76
	A	(1)	35·44
		(2)	5·12
IV.	A	(1)	33·94
		(2)	4·79
	B	(1)	12·19
		(2)	1·95
V.	A	(1)	34·31
		(2)	4·15
	B	(1)	9·00
		(2)	1·38

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

Block.—A1.

Variety.—Q. 813.

Harvested.—September, 1931.

Age of Crop.—11 months.

System of Replication.—Five randomised blocks.

Plots.—$\frac{1}{15}$ acre.

Treatment.—

A—10 tons molasses per acre applied to plant crop.

B—No molasses.

Cultivation.—Plant crop harvested in October, and the soil being in a moist condition the cane was ratooned immediately with the grubber twice in row. No molasses or other manure was applied to the ratoons.

Growth.—The ratoons in all molasses plots came away well and grew vigorously, until checked by dry conditions in January, but recovered quickly and grew rapidly after good rain in February. The cane in the check plots came away very poorly and in places died out during the dry weather in January.

Results.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Blocks	4	32·91	8·23
Treatments	1	769·66	192·42
Errors	4	104·22	26·06
Total	9	906·79	..

Standard Error (5 plots) = $\sqrt{5 \times 26{\cdot}06} = \sqrt{130{\cdot}30} = 11{\cdot}41$, or 9·33 per cent.

Summary of Yields.

Treatment.	Plant Crop.		First Ratoon Crop.		Total—Two Crops.		Average—Two Crops.	
	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.
Molasses, 10 tons per acre	37·09	4·84	33·22	4·76	70·31	9·60	35·16	4·80
No molasses ..	22·69	2·96	15·68	2·71	38·37	5·67	19·19	2·84

CONCLUSIONS.

The results from the use of molasses as a fertilizer, on the red volcanic loam, are outstanding. Following the 10-ton per acre application, the plant crop showed an increased yield of 14·4 tons of cane per acre. No further fertilizer was applied on the ratoons, yet we find a carry-over effect equal to 17·5 tons of cane per acre. The gain for the two crops has been 31·9 tons cane—equal to 3·2 tons of cane per ton of molasses applied.

Undoubtedly, further increases would be recorded for the second ratoon crop, but as much of the cane on the untreated areas will not ratoon, the experiment will be disbanded. The whole block will be treated uniformly to a further application of molasses.

Work of the Southern Sugar Experiment Station—*continued.*

RATOONING TRIAL (Second Ratoon Crop).

Plan and Crop Yields.

I.	A	(1)	13·76
		(2)	2·16
	B	(1)	14·92
		(2)	2·25
	C	(1)	13·52
		(2)	2·14
II.	B	(1)	13·38
		(2)	2·18
	A	(1)	12·79
		(2)	1·97
	C	(1)	12·66
		(2)	1·80
III.	A	(1)	14·53
		(2)	2·26
	C	(1)	12·61
		(2)	1·95
	B	(1)	11·79
		(2)	1·81
IV.	C	(1)	10·97
		(2)	1·67
	A	(1)	11·50
		(2)	1·58

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

Block.—D.

Variety.—Q. 813.

Harvested.—August, 1931.

Age of Crop.—11 months.

System of Replication.—Four randomised blocks.

Plots.—0·172 acre.

Treatments—Ratooning Method.—

A.—Ploughed three furrows between rows and harrowed level.

B.—Grubber twice in row.

C.—Disked with Cotton King.

Fertilizer.—All plots received the following application at the beginning of December :—

150 lb. sulphate of ammonia per acre.
150 lb. superphosphate per acre.
250 lb. muriate of potash per acre.

Cultivation.—On the removal of the first ratoon crop in September, 1930, the soil being in a moist condition, the cane was immediately ratooned.

Growth.—All plots came away well, and were apparently uniform.

Yields.

——	A.—Ploughed 3 Furrows and Harrowed Down.	B.—Grubber Twice in Row.	C.—Disked with Cotton King.
Cane, tons per acre	13·15	13·36	12·44
C.C.S., tons per acre	1·99	2·08	1·89

CONCLUSIONS.

As for the first ratoon crop, all ratooning methods tested were equally effective.

Work of the Southern Sugar Experiment Station—*continued.*

POTASH AND NITROGEN TRIAL (Second Ratoon Crop).

Sulphate v. Muriate, and Time of Application of Nitrogen.

Plan and Crop Yields.

2N Ks E (1) 14·85 (2) 2·42	N Ks L 13·25 2·12	N Km E 13·69 1·98	2N Ks L 11·25 1·67
N Ks L (1) 12·45 (2) 1·93	2N Ks L 15·60 2·56	N Ks E 12·75 1·89	2N Km L 11·55 1·76
N Km L (1) 11·85 (2) 1·87	2N Km L 14·25 2·30	2N Km E 12·15 1·71	N Ks E 11·40 1·73
2N Km L (1) 13·69 (2) 2·26	N Km E 13·69 2·22	2N Km E 13·69 2·31	N Km L 12·00 1·79
2N Ks E (1) 14·25 (2) 2·25	2N Ks L 16·35 2·59	N Km E 13·05 2·01	N Ks L 12·00 1·80
N Ks E (1) 13·69 (2) 2·21	N Km L 15·60 2·47	2N Ks L 11·25 1·66	2N Km E 12·00 1·73

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

Block.—C2.

Variety.—Q. 813.

Harvested.—August, 1931.

Age of Crop.—10½ months.

Plots.—$\frac{1}{12}$ acre.

Fertilizer and Application.—All plots received 150 lb. superphosphate.

N—100 lb. sulphate of ammonia per acre.

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

Ks—318 lb. sulphate of potash per acre.

Km—300 lb. muriate of potash per acre.

All potash and superphosphate applied in the furrow at ratooning.

For the nitrogen—E—one-quarter sulphate of ammonia in furrow at ratooning, remainder as top dressing in December.

L.—One-half sulphate of ammonia as top dressing in early December, remainder at end of January.

Cultivation.—Ratooned with grubber twice in row in early November.

Growth.—All plots came away well and grew steadily till checked by dry weather in January, but made further good growth after the rain at the end of that month.

Summary of Yields.

	Potash.		Sulphate of Ammonia.		Time of Application.	
	Sulphate.	Muriate.	100 lb. per Acre.	200 lb. per Acre.	Early.	Late.
Cane, tons per acre	**13·26**	**13·10**	**12·95**	**13·41**	**13·40**	**12 96**
C.C.S. in cane	15·61%	15·50%	15·44%	15·66%	15·60%	15·51%
C.C.S., tons per acre	**2·07**	**2·03**	**2·00**	**2·10**	**2·09**	**2·01**

DISCUSSION.

The response to treatment has been slight for all plots. Sulphate and muriate appear equally suitable forms of potash for cane, which is in accordance with our previous findings. A double dressing of sulphate of ammonia was but little superior to the single amount, and the influence of time of application of the top dressing was much slighter than is usually experienced.

Work of the Southern Sugar Experiment Station—*continued.*

VARIETAL TRIAL (Plant Crop).

Block.—B4.

Harvested.—October, 1931.

Age of Crop.—19 months.

System of Replication.—Five randomised blocks.

Plots.—$\frac{1}{10}$ acre.

Manurial Treatment.—All plots received fertilizer at the following rate per acre:—

250 lb. muriate of potash.
75 lb. superphosphate.
100 lb. sulphate of ammonia.

Cultivation.—In August, 1929, the stools from the previous crop were ploughed out and the block harrowed. Further cross-ploughings were given in October and February. No green manure was applied. The cane was planted in mid-March, and each variety germinated well, though there were a few misses in the D. 1135. These were supplied in April, but owing to the cold nature of the soil, did not come on well.

Growth.—Co. 210 though slower in germinating than the other three varieties, very quickly took the lead, followed by 227, 213, and D. 1135. The latter, with the exception of plots in Blocks I. and V., was practically swamped by the Co. canes early in the growing period, and no doubt this affected the growth of the other three plots.

Plan and Crop Yields.

I.	D. 1135 (1) 16·63 (2) 2·83	Co. 210 37·00 5·15	Co. 227 21·13 3·01	Co. 213 27·00 4·09
II.	Co. 227 (1) 19·88 (2) 2·97	D. 1135 16·12 2·66	Co. 213 23·00 3·41	Co. 210 39·63 4·96
III.	Co. 213 (1) 21·38 (2) 3·34	Co. 210 36·50 5·20	D. 1135* 15·13 2·14	Co. 227 22·50 3·09
IV.	Co. 227 (1) 20·50 (2) 3·06	Co. 213 27·87 4·34	Co. 210 36·75 5·10	D. 1135 13·88 2·98
V.	Co. 210 (1) 37·00 (2) 4·92	Co. 227 25·00 3·44	Co. 213 30·88 4·47	D. 1135 19·50 2·94

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

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.
Blocks	4	42·20	10·55
Varieties	3	1202·21	400·74
Errors	12	57·12	4·76
Total	19	1301·53	..

Standard Error (4 plots) = $\sqrt{4{\cdot}76 \times 4} = \sqrt{19{\cdot}04} = 4{\cdot}36$ or 4·30 per cent.

Summary of Yields.

——	D. 1135.	Co. 210.	Co. 213.	Co. 227.
Cane, tons per acre	16·25	37·38	26·03	21·80
Cane, percentage of mean yield	64·1	147·4	102·6	85·9
C.C.S. in cane	15·57%	13·57%	15·15%	14·32%
C.C.S., tons per acre	2·56	5·07	3·94	3·12
C.C.S., percentage of mean yield	69·7	138·1	107·3	84·9

DISCUSSION.

All Co. varieties gave significantly higher yields than the standard D. 1135. Co. 210 was outstandingly superior, though the C.C.S. in cane was two units lower. Co. 213 compared very favourably both in cane yield and C.C.S. percentage. The plots were harvested towards the end of October, which accounts for the high C.C.S. values recorded. Unfortunately, the Co. varieties are all late in maturing.

Work of the Southern Sugar Experiment Station—*continued.*

DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, FROM 1st NOVEMBER, 1930, TO 31st OCTOBER, 1931.

Materials.	Number of Analyses.
Sugar canes and juices for growers	585
Sugar canes and juices for Agricultural Show, Bundaberg	211
Sugar canes and juices for Agricultural Show, Maryborough	37
Sugar canes and juices for Agricultural Show, Gin Gin	225
Sugar canes and juices for Agricultural Show, Pialba	26
Sugar canes and juices for Experiment Station	508
Total	1,592

TOTAL TONNAGE OF CANE HARVESTED FROM THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, DURING 1931.

	Tons.
Cane sent to mill	403·56
Cane used for plants	7·00
Total	410·56
Nature of Crop—	
Plant cane	131·48
First ratoon cane	159·26
Second ratoon cane	119·82
Tonnages—	Per cent.
Q. 813	51·09
D. 1135	10·95
M. 1900 Seedling	7·18
Co. varieties	28·64
Other varieties	2·14
Area harvested	**22·50**
Average tons per acre	**18·25**

6.—Work of the Division of Pathology.

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

The work performed in the Laboratory has consisted chiefly in studies of the organisms causing leaf-scald and red stripe diseases, and the description and classification of sugar cane varieties. In the field the main interest has been centred on disease resistance trials, particular attention being paid to gumming disease. Routine farm inspections have been carried out and the services of officers have been greatly in demand in the matter of assisting farmers in the selection of disease-free planting material. In addition, a large quantity of cane for planting purposes has been transported, under the supervision of the Bureau, from disease-free areas to districts not so fortunately situated. During the latter part of the year the facilities of the Division were greatly enhanced by the addition of a pathology garden, consisting of an acre of land situated about a quarter of a mile from the laboratory. This garden will remedy a serious defect, for without such an adjunct to the laboratory intensive investigations of pathological problems are impracticable.

Variety Isolation Garden.

The Variety Isolation Garden on Stradbroke Island has been extended and now contains sixty varieties. A number of these represent imported canes recently released from quarantine and now undergoing disease resistance trials in the field; should they prove to possess inadequate powers of resistance they will be discarded from the collection.

Variety Descriptions.

The systematic description of varieties mentioned in last year's report has been carried out and some 128 varieties have been fully described. The descriptions include details of morphological characters, including classification according to the Jeswiet hair group system, together with notes on history, distribution, performance, and disease resistance. In addition, an attempt has been made to construct a key to facilitate the identification of any particular variety.

Dwarf Disease.

A destructive new disease has been found in the Mackay district and has caused a considerable amount of concern. This disease, which does not appear to have been recorded elsewhere in the sugar world, has been tentatively called "Dwarf Disease" on account of the characteristic and very pronounced dwarfing of diseased plants. The general appearance of diseased stools very much resembles that of stools affected with Fiji disease—both primary and secondary infection. On close examination, however, it is seen that instead of the small galls typical of Fiji disease the short stiff leaves bear fine, yellowish, longitudinal stripes. These stripes are quite distinct on the younger leaves, but gradually become masked on passing to the older leaves. They are usually short, ½-2 in. long, but may be up to 6 in. in length; they follow the direction of the veins and are about $\frac{1}{16}$-in. wide, but may run together to give comparatively broad yellowish bands, particularly at the leaf margins. Such markings are always more pronounced at the base of the leaves and are rarely evenly distributed across the leaf blade.

As in the case of Mosaic and Fiji diseases, healthy and diseased canes of all sizes may frequently be observed in the same stool; following these cases of apparently secondary infection, growth soon ceases and the top of the stalk tapers off to a point, giving rise to a stiff fan-like top. The spindle and younger leaves typically become twisted and deformed and of a lighter colour than normal. Plants grown from infected cuttings have a most striking appearance. Here the stool consists of a larger number of stunted shoots which form no cane and resemble a tuft of grass, while the life of the individual shoots of the cluster is frequently short. There is no marked shooting at the eyes or production of aerial roots on the part of diseased stalks, and when dissected they exhibit no internal discoloration.

Fortunately, the outbreak was discovered in its early stages and appears to be limited to about ten farms in the Mackay district, with a maximum infection in any one field of less than 0·5 per cent. The variety concerned is in each case P.O.J. 2714, while on one farm, five similarly diseased stools of P.O.J. 213 were also found. The origin of the disease is unknown, but available evidence strongly discounts the probability of introduction from abroad in imported cane setts. An article describing the symptoms of the disease in detail is in course of preparation and will be published shortly. The leaf markings bear some resemblance to those associated with the streak disease of South Africa, but after perusing a description of the symptoms and examining photos and

6. Work of the Division of Pathology—*continued.*

coloured specimens, both Dr. H. H. Storey, of the Amani Institute, and Mr. A. P. D. McClean, of the Natal Herbarium, are of the opinion that the disease is distinct from streak, an opinion also formed by Mr. E. F. S. Shepherd, of Mauritius, during his visit here in January.

Gumming Disease.

Gumming continues to be the most important disease of Southern Queensland and has been the subject of a good deal of attention in the field, particularly in the Bundaberg district, which is the main centre of infection. As in previous years a systematic inspection has been made of farms which have a disease-free record. A list of such disease-free farms was compiled, and from these, together with the clean seed nurseries, there was available approximately 6,000 tons of healthy cane suitable for plants.

The question of possible soil transmission of gumming disease is frequently raised by farmers, and it was thought advisable to carry out a local trial to demonstrate that this was not likely to be the case. Accordingly, an isolated plot of about $\frac{1}{10}$-acre was prepared and roots and stubble of diseased cane incorporated in the soil. These were allowed to rot in the soil for nearly three months, after which the plot was planted with healthy setts of the susceptible varieties H.Q. 426 and B. 208. No trace of the disease was observed in the resultant crop.

Variety Resistance Trials.

Five variety resistance trials were conducted for the purpose of investigating various aspects of the problem of determining relative varietal resistance to gumming disease, and our thanks are due to Messrs. D. McDonald, Bli Bli, Elliott Bros., Maroochy River, and Millaquin Sugar Company, for their co-operation in carrying out the trials.

Windermere Trail (*No.* 13).

A routine resistance trial was carried out on Windermere Plantation, on deep red volcanic soil of poor water-holding capacity. Some 6–10 stools of each variety were planted, each row of the varieties under test being directly in contact with an inoculated guard row of M. 1900 S.; for the purposes of general comparison every fourth row was either D. 1135 or Q. 813. The trial was planted on 3rd September, 1930, inoculated in November and February, and harvested on 21st October, 1931.

RESULTS.

Varieties in which much death occured (more than 10 per cent approximately.)	Slight death (less than 10 per cent approximately.)	No death but gum oosed from cut canes.	No death or oosing.
M. 1900 Seedling	D. 1135	U.D. 1 (2/87)	U.D. 39
U.D. 75	H. 8911	U.D. 50	U.D 58
H 456	H. 8994	U.D. 65 (2/36)	U.D. 100
H. 86484	H. 86465	Q. 855 (3/30)	U.D. 110
26 C. 163	25 C. 28		Co. 281
26 C. 182	26 C. 89		Co. 290
26 C. 189	20 S. 16		M. 55
27 C. 445	Paia F.		Kassoer
Manoa 301	Manoa 198		P.O.J. 213
Wailuku 2	" B " 103		P.O.J. 2364*
Kohala 107	Q. 1098		P.O.J. 2878
D. 109			Q. 813
P.O.J. 2714			
E.K. 2			
Q. 1092			

* Two wilting canes oozed gum on 3rd September, 1931.

Discussion of Results.

This trial gave very clear-cut results, and has yielded valuable information. The high resistance of P.O.J. 2878 has now been established beyond question, and on present indications this variety should play a big part in the control of gumming disease in Southern Queensland. Contrary to general expectation P.O.J. 2364, which crossed with the highly susceptible variety E.K. 28, gave rise to P.O.J. 2878, has usually borne more leaf streaks than the latter variety, and in September two wilting canes were found to ooze gum. P.O.J. 213 was included for retrial and has performed satisfactorily, although bearing profuse leaf streaks at times; this is a strong rooting variety of good sugar content, but is susceptible to Mosaic disease.

With one exception the U.D. seedlings (Uba × D. 1135) have proved highly resistant, but with the exception of U.D. 1 they did not show any great promise from an agricultural point of view.

6. Work of the Division of Pathology—*continued.*

The two Coimbatore seedlings (Co. 281 and Co. 290) have a much higher sugar content than Co. 210, Co. 213, and Co. 227, while Co. 281 is reputed to be an early maturing cane. They have high resistance and promising vigour, but they give indications of having considerable quantities of starch in the immature portions of the stem.

The new varieties listed in column two were all lacking in vigour and it is not thought that any are worthy of further trial; included in this lot is "B" 103, a Uba-Badila seedling raised at South Johnstone.

An outstanding feature of the trial is the great variation in the resistance in the four Q. seedlings, emphasising the necessity of being certain of the identity of reputed Q. 813 before planting.

Continuation of Trials to First Ratoons.

Two preliminary trials reported last year were ratooned and re-inoculated in order to determine (*a*) in the event of a plant trial having to be abandoned through some circumstance (such as a severe frost) could satisfactory results be obtained from a re-inoculation of the ratoons, and (*b*) whether the ratoons would yield any additional information not obtained in the examination of the plant crop. The ratoon trials were treated in exactly the same manner as the original plant trials.

(*a*) The results of the large confirmatory trials, which were composed mainly of highly resistant varieties taken from the original plant trials did not differ markedly from those of the ratoon trials, but in the case of the few susceptible varieties, the ratoons were the more resistant. As compared with the original plant trials, all but the most resistant varieties proved definitely less susceptible and consequently, owing to the decreased range of effect, the evaluation of the relative resistance of the different varieties could not be made with the same certainty as in the plant crop. It therefore appears unlikely that ratoon trials would prove reliable except for the elimination of highly susceptible varieties.

(*b*) In no case were the ratoons more susceptible than the plant crops, and no additional information was obtained except in so far as the trials afforded further confirmation of our observations—that moderately susceptible varieties can usually be ratooned without any great loss from gumming disease. The main consideration is to endeavour, by the use of clean seed, &c., to delay infection so that losses in the plant crop will be reduced to a minimum.

Confirmatory Trials.

In 1929 two preliminary trials, involving 6–10 stools of slightly over 100 varieties were planted in the Nambour district. These trials were harvested in September of last year, and, with the object of testing the validity of the selections made on the basis of these preliminary trials, sixteen varieties were selected from each and planted in confirmatory trials. Trial No. 11 contained the varieties P.O.J. 2878, P.O.J. 2714, S.C. 12/4, B.H. 10/12, Q. 813, H. 227, Uba, Co. 210, Co. 213, Co. 227, Malabar, Korpi, Oramboo, Nanemo, 26 C. 48, and 26 C. 148; while trial No 12 contained the varieties P.O.J. 2878, P.O.J. 2714, S.C. 12/4, B.H. 10/12, Q. 813, H. 227, Co. 210, Co. 213, Co. 227, Manoa, 304, 26 C. 99, 26 C. 113, 26 C. 122, 26 C. 188, 26 C. 270, Chin Chin, and Malabar. These varieties were planted in duplicate in double row plots of 50 stools each, every fifth row being a guard row of susceptible varieties, H.Q. 285 in Trial 11, and N.G. 125 in Trial 12.

In each case the classification of the relative resistance of the sixteen varieties did not differ significantly from that made at the conclusion of the preliminary trial. In a few cases a slightly lower order of resistance was apparent, but in this connection it should be remembered that the preliminary trials were harvested one month earlier than the confirmatory trials. The differences were such as might have been expected from the variation in time of harvesting. The results of the trials indicated quite definitely that with the possible exception of a few border-line cases, a definite pronouncement on varietal resistance to gumming disease can be made on the basis of a well-planned 6–10 stool trial. This evidence has received strong support from the consistent results obtained in respect to a number of commercial varieties which have been included in successive 6–10 stool trials. In addition to varieties whose reaction to gumming disease had already been established by planting in parallel trials, the following varieties maintained a satisfactory standard of resistance under the conditions of the trials, viz.:—P.O.J. 2878, Oramboo, Korpi, and Nanemo, Manoa 304, 26 C. 99, 26 C. 122, 26 C. 148, and 26 C. 270.

During the course of these trials it has appeared that, under the conditions of high, and frequently excessive, soil moisture content obtaining in the Nambour district, the resistance of some varieties is greater than is the case on the deep red volcanic soils of

6. Work of the Division of Pathology—*continued.*

low moisture-holding capacity such as are found in the Bundaberg-Childers district. Consequently, duplicate plantings of some of these varieties will be made in the latter class of soil to determine how far generalisations may be made. The variety P.O.J. 2714 is of interest in this connection, inasmuch as it has proved very susceptible in Bundaberg trials, but only moderately so in the Nambour trials.

Position of Guard Rows.

An essential requirement in gumming resistance trials is that the varieties under test should be continuously exposed to infection, and this is most conveniently achieved by planting guard rows of a known susceptible variety at intervals throughout the plot. Inasmuch as gumming disease is transmitted from plant to plant under the influence of wind-blown rain, the question of whether the cane is to windward or leeward of the centre of infection might be expected to have some bearing on the rate and intensity of infection. Accordingly, double row plots were planted in duplicate so that one plot lay to the windward of the inoculated guard row while its duplicate lay to the leeward. The degree of infection was recorded periodically by means of a numerical system of recording and from an examination of the results it would appear that the intensity of infection in the windward plots was slightly less than in the leeward plots. Accordingly, it has been decided that in future all trials will be planted so that each row of experimental canes is directly in contact with a guard row.

Further Trials.

A trial of thirty varieties has been planted for observation during the current year and next year it is anticipated that the first series of seedlings raised at Bundaberg will be available for test. It is considered that the testing of varieties for resistance to gumming disease has now been developed to the stage of being a purely routine operation, to be carried out according to a simple well-defined plan. In addition to yielding the required information as to disease resistance, these trials give valuable information on growth and habit of the varieties, and at the conclusion of the trial promising varieties are analysed to determine sugar content. As a result of gumming resistance trials carried out during the past two years there are now available for propagation and subsequent field trial some 15–20 new varieties of high resistance and probable adequate sugar content. It therefore does not require an undue spirit of optimism to predict that serious losses from gumming disease will soon be a thing of the past.

Red Stripe Disease.

Although the spring of 1930 was extremely dry throughout the sugar belt, the subsequent rainy season in the tropical zone was neither intense nor prolonged, and associated with this combination of circumstances the incidence of red stripe disease was low and no reports of appreciable damage were received.

Estimation of Losses.

Field observations made during the past three years suggested that the losses due to the top rot caused by red stripe disease were probably over estimated, inasmuch as there seemed to be a compensating factor in the greater growth of the remaining stalks, due to the decreased competition. In order to estimate the probable magnitude of maximum losses an experiment was carried out on the farm of R. Low, Jarvisfield. The preliminary work necessary for the laying out of such an experiment proved to be quite arduous, since individual stalks are not attacked at random, but there exists a relation between the number of stalks per stool and the liability to top rot. Consequently it was necessary to make population counts in particularly bad natural infection centres, and the distribution of treated stalks in the plots was made on the basis of the frequency tables so obtained. The variety selected was autumn plant Badila, and the form of the experiment was a 5 x 5 Latin Square, the treatments being as follows :—20 per cent. stalks killed by inoculation, 20 per cent. topped, 10 per cent. topped, 5 per cent. topped, and the control. Inoculations and topping were carried out at the end of February and the plot was harvested in August. An examination of the results by the methods developed by Fisher did not indicate any significant differences between treatments and control. Due, doubtless, to the uneven irrigation, the variance due to error was high, and the trial will be repeated this year under natural rainfall conditions. The effect of fertilizers on rate of spread and relative susceptibility will also be the subject of investigation this year.

Resistance Trial.

The initial red stripe resistance trial has been laid out, the varieties P.O.J. 2878, P.O.J. 2714, E.K. 28, B. 208, H.Q. 426, Korpi, Oramboo, and Nanemo, being interplanted with Badila. The site chosen for the trial has a loose sandy sub-soil and top rot is consistently observed within this area.

6. Work of the Division of Pathology—*continued.*

Leaf Scald.

The investigation of leaf scald disease has now been constituted the chief problem of the Division in an effort to elucidate some of the many unknown factors associated with this complex disease. Amongst others it is proposed to inquire into the following points:—Rate and methods of spread under natural conditions; periods for which and conditions under which the disease remains latent; variation of symptoms under special conditions; nature of various types of leaf-streaks differing from typical scald streaks; methods for the accentuation of symptoms; methods for the treatment of plants before distribution.

A preliminary laboratory investigation has been directed towards obtaining a more satisfactory culture medium in order to permit of greater ease of isolation of the causal organism and the testing of relative toxicity of various substances to the organism. It was well known that in order to ensure growth on artificial culture media it was necessary to use a large inoculum, and the problem was approached on the basis of the theory that the organism produced in culture some substance which favourably influenced growth. This has been shown to be the case and it was found that the addition of pasteurised liquid culture to Wilbrink's agar will give excellent "germination" and growth at a seeding rate many times lower than the minimum requiredfor growth on or dinary Wilbrink's medium. Further investigation has indicated that this adjustment of the medium is possibly associated with the oxidation-reduction potential and similar results are obtained by the addition of sodium sulphite.

Resistance Trials.

An experimental resistance trial of the varieties D. 1135, Uba, N.G. 24, P.O.J. 2714, E.K. 28, "B" 103, Co. 210, Co. 213, N.G. 15, and H.Q. 426, was laid out at the South Johnstone Experiment Station.

Inoculations were made at planting, and judged by varieties of known suspectibility a very satisfactory degree of infection was obtained. Subsequently, however, excellent growing conditions prevailed and the disease became almost completely masked in most cases, and no adequate evaluation of the results was possible. Arrangements have, therefore, been made to conduct future trials at the Meringa Station where growing conditions are much less favourable, and two trials were laid out this year. Of these, one is a mass trial consisting of 3–5 stools of approximately 1,000 seedlings, the object being to determine the relative standard of resistance of the progeny of particular trial marriages. The second consists of a variety resistance trial containing forty imported varieties and selected seedlings inter-planted with guard rows of susceptible varieties.

Fiji Disease.

Fiji disease is the chief disease problem of the Maryborough district, but with the exception of a small outbreak at Yerra, there has been no extension of the area of infection. Although the percentage of infection has decreased slightly over the district as a whole, it has not been reduced on the river flat lands, and the extensive planting of the resistant Q. 813 should be practised in these localities.

In the Bundaberg district a fresh centre of infection was found in the Ringera area at Mullett Creek, and an outbreak in the Childers–Isis area was investigated in February. The number of infected farms found is as follows, last year's figures being given in parentheses:—Tirroan 7 (8), Ringera 4 (4), Elliott 1 (3), Querba 3 (6), and Childers 7.

Resistance trials so far conducted have proved rather unsatisfactory, due to the small amount of total infection obtained. This failure may be due to the scanty knowledge of the nature and mode of transmission of the disease, and in order to remedy this state of affairs, arrangements have been made with the Southern Entomologist to carry out transmission experiments, the preliminary results of which are contained in his report.

Mosaic Disease.

A number of field experiments have been made to determine the suitability of mechanical transmission as a method for inoculating resistance trials, but so far consistent results have not been obtained. The amount of infection appears to be influenced greatly by the age of the cane and condition of growth at the time of inoculation, and the period of the year in which the inoculations are made.

7.—Work of the Division of Entomology.

The work of the above Division is carried out in the Northern, Central, and Southern sugar areas, entomological laboratories being situated at Meringa, near Cairns, Mackay, and Bundaberg. Mr. Edmund Jarvis is the Chief Entomologist to the Bureau, and he is assisted by Messrs. R. W. Mungomery, J. Buzacott, and W. A. McDougall.

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

Our sphere of entomological research during the last twelve months has been considerably enlarged owing to its having embraced work of a biological nature in connection with the control of scarabæid grubs attacking sugar-cane.

Activities in this direction have consisted in an exchange of the principal species of scoliid wasp-parasites of our greyback cockchafer for those known to destroy the grubs of cane beetles in the Philippine Islands.

The first consignment of nine cocoons of *Campsomeris aureicollis* Lep. were received here from Negros, Philippine Islands, on 4th January from Dr. A. W. Lopez, Entomologist to the Philippine Sugar Association, and when opened up were seen to be free from mould or hyperparasites.

While under quarantine conditions at our laboratory a female wasp emerged from one of these cocoons: the only specimen obtained by us from this first consignment. Upon being confined in a suitable breeding-cage it oviposited readily upon grubs of *Lepidiota frenchi* Blkb. and *Lepidoderma albohirtum* Waterh., which are two of our most injurious cane-chafers. Between the dates 16th January to 17th February this wasp laid twenty-two eggs which produced thirteen cocoons.

Being derived parthenogenetically, however, these eggs all produced wasps of the male sex, thus preventing further breeding of *aureicollis* for the time being.

Two additional lots of cocoons of the above species were received by us from the Philippines, and, in return, we sent Dr. Lopez three consignments of the cocoons of our Queensland scoliids *Campsomeris tasmaniensis* Sauss. and *C. radula* Fab. during the months of February to April.

As a result of this biological control work much valuable data has been secured on both sides, since we have proved that the Philippine scoliid *C. aureicollis* Lep. will freely attack the grubs of our most formidable cockchafer beetle, while Dr. Lopez has found that our common scoliid wasp *Campsomeris tasmaniensis* readily oviposits on the grubs of *Lepidiota pruinosa* and *Leucopholis irrorata*, Chevr. which happen to be two of the most destructive cane-grubs in the Philippine Islands.

On 30th July a large consignment of live specimens of Scoliidæ arrived in Cairns from Manila under the charge of Mr. George E. Fairchild, Secretary-Treasurer to the Philippine Sugar Association. A total of 252 specimens were sent, eighty-six of which reached Meringa Experiment Station alive; these comprising eighty-three females and three males of *C. aureicollis*, and three female specimens of *Scolia manilæ* Ashm.

In return for this very fine consignment we were able during the month of August to collect eighty-eight specimens of our digger-wasp parasites, which were shipped to Manila on 26th August under the care of Mr. Fairchild. Of these thirty-seven females and three males of *C. tasmaniensis*, and eleven females of *C. radula* arrived at Negros alive.

Breeding *Scolia formosa* Guer.

The life-history and economy of this little-known Queensland scoliid wasp was worked out by the writer last December, when the results were published in illustrated leaflet form in the *Queensland Agricultural Journal* (vol. xxxv., pp. 6-9, two plates). This paper deals with—Descriptions of the adult wasps (both sexes); habits of the female; details of life-cycle stages; host-grubs of the species; and honey-bearing flowers frequented by the adult wasps.

The single specimen used in this breeding work was captured on 23rd May, and between that date and 21st July (59 days), deposited thirty-five eggs on grubs of *Lepidoderma albohirtum* Waterh. From these six male and three female wasps were bred, the average length of life-cycle from deposition of egg to emergence of the adult wasp, being 106 days, during an average shade temperature of about 68 deg. Fahr.

7. **Work of the Division of Entomology**—*continued.*

Biological Control of *Rhabdocnemis obscurus* Boisd.

The work of breeding *Ceromasia sphenophori* Vil. for fighting the weevil borer of cane was commenced on 9th November, and about ten weeks later (23rd January) fifty specimens of this parasite were liberated amongst borer-affected cane at Innisfail. The total number released during the period 23rd January to 1st July was as follows:—

23rd January,	50	parasites	liberated in	Innisfail district.
13th February,	60	,,	,,	,, Tully district.
10th March,	60	,,	,,	,, South Johnstone district.
15th April,	60	,,	,,	,, Innisfail district.
1st June,	60	,,	,,	,, Innisfail district.
8th June,	120	,,	,,	,, Mourilyan district.
10th June,	100	,,	,,	,, Tully district.
16th June,	32	,,	,,	,, Cairns district.
22nd June,	200	,,	,,	,, Goondi district.
2nd July,	30	,,	,,	,, Cairns district.

In view of *Rhabdocnemis obscurus* Boisd. being second to the greyback cockchafer in economic importance as a cane pest, it would be advisable to breed greater numbers of its Tachinid fly-parasite for distribution at Goondi and Mourilyan, where the weevil borer appears to be much in evidence.

This would necessitate the establishment of another large breeding-cage. At present we are using two cages, having a total capacity of about 629 cu. ft. of enclosed space, one of which, however, is devoted to rearing grubs of this beetle, to serve as hosts for the parasites being bred in the other cage, an activity which saves much time that would otherwise be taken up by our having to go far afield in search of canes containing larvæ of this pest which are not always easy to find.

Present Control Methods for Cane-grubs.

During the season just passed (January to June) several of our growers have taken considerable interest in the fumigation of grub-infested land. In some cases this work has been carried out with care, and due observance of the procedure necessary for obtaining successful results.

On such farms a good effect has been created on the opinion of neighbouring growers who have in this way been able to witness for themselves the benefits to be derived from soil fumigation.

It appears to be only a matter of time before the majority of those farmers who chance to be more or less troubled by cane-grubs each season, will realise the advantage of ensuring a return from such crops by using soil-fumigants, and will treat grub-infested land every year as a matter of course.

Museum of Sugar-cane Entomology.

Some additions have been made to our museum collection of insects during the last twelve months, which now totals about 7,200 specimens (2,200 species). Of these, Coleoptera forms the largest proportion, then Hymenoptera and Lepidoptera, the balance of the species finding places in the groups Hemiptera, Neuroptera, Orthoptera, Isoptera, &c.

Three large coloured wall-diagrams were also added to the museum during July last dealing with the life-histories of *Lepidoderma albohirtum* Waterh., *Ceromasia sphenophori* Vil., and *Campsomeris tasmaniensis* Sauss.

Four additional showcases were prepared in June illustrating our major and minor insect pests of sugar-cane.

Entomological Exhibits at Shows.

Our Experiment Station was well represented this year at the Cairns Agricultural Show held on 29th and 30th July, where we were fortunate in obtaining a small building devoted to exhibits from the Meringa and South Johnstone Experiment Stations. Our comprehensive collection comprised several large glass-topped exhibition cases, illustrating, amongst other things, the life-cycle stages and primary insect enemies of notable cane pests such as the greyback cockchafer, weevil borer, &c. Many coloured wall-charts and diagrams showing various phases of control work, together with numerous glass-covered boxes containing a few thousand pinned and named insect specimens, helped to form an attractive and educational display.

7. Work of the Division of Entomology—*continued.*

Short lecturettes were delivered at intervals to visitors present by Mr. Buzacott and myself, which, in some cases, were illustrated by living insect specimens.

During September we exhibited at the Innisfail Show, sending a small but representative collection of cane-insects, diagrams, and an assortment of pinned specimens.

Mr. Buzacott was in charge of this display, which attracted considerable attention, and was much appreciated.

General Occurence of Cane Insects.

The past season has, on the whole, been a good one, as no very serious outbreak of any of our primary cane pests has been recorded during the last twelve months.

Although alarm was felt in some quarters at the occurrence of two or three separate emergences of the greyback cockchafer, during November to January last, it has so happened that certain natural controlling factors, aided possibly by the much increased acreage of grub-infested cane land that was fumigated last season, has prevented this beetle from causing serious damage of a widely spread character. The cane has never looked better than at present, and, as a matter of fact, heavy crops appear to be the order of the day. No reports of grub injury by *Lepidiota frenchi* Blkb. were received last season, although this pest occured as usual locally on cane land adjoining uncleared forest country. Similarly, the scarabæids *Anomala australasiæ* Blkb., *Lepidiota rothei* Blkb., *Anoplognathus boisduvali* Boisd., and *Dasygathus australis-dejeani* Macl. gave little or no trouble.

The army worm (*Cirphis unipuncta* Haw.) made its appearance as usual, but was effectively controlled by the use of lead arsenate spray. Locusts, however, caused anxiety in the districts of Herbert River, Innisfail, South Johnstone, Tully, and other places. The species in question was *Locusta danica* Lin., one of the recognised plague locusts, which occurs in many other parts of the world.

Its last appearance in North Queensland in plague dimensions was in 1912, when a formidable invasion was reported in the Cairns district. During February last a box of soil containing numerous egg masses of this grasshopper was sent to me by Mr. A. K. Simpson, Technical Field Officer at the Victoria Mill, Herbert River district, for examination and report. These eggs, which had been in the ground since early in March, had not hatched, and subsequent investigation showed that they were likely to over-winter and produce locusts in the spring. At the present time (28th September) development of the embryo in the nutritive yolk of these eggs has commenced, so hatching of the young hoppers will probably take place about the end of October or early in November. The Giant termite (*Mastotermes darwiniensis* Frogg.) is still giving trouble in the Burdekin district, and appears to be gradually spreading locally. Concerted action, however, by the growers concerned should go far towards effecting its control in the near future.

The large moth-borer (*Phragmatiphila truncata* Walk.) was in evidence as usual, some of the local infestations being quite pronounced, but not sufficiently injurious to necessitate remedial measures. A special illustrated article dealing with the life-cycle and economy of this pest was published in vol. xxxv. of our *Queensland Agricultural Journal* (*see* under publications at end of this report).

Breeding and Study of Economic Insects.

The principal species bred and figured by the present writer were as follows :—

Pseudococcus sp.
Scolia formosa Guer.
Campsomeris tasmaniensis Sauss.
Campsomeris aureicollis Lep.
Phragmatiphila truncata Walk.
Cylindrochetas sp.

Publications.

A New and Effective Spray for Mealy Bugs. *Queensland Agricultural Journal*, vol. xxxiv., p. 132. One plate.

A Little Known Queensland Digger Wasp. *Queensland Agricultural Journal*, vol. xxxv., pp. 7-9, two plates. January, 1931.

Control of our Large Moth Borer of Cane. *Queensland Agricultural Journal*, vol. xxxv., pp. 141-43, one plate. March, 1931.

7. Work of the Division of Entomology—*continued.*

Some Coleoptera of Minor Importance Injuring Sugar Cane in North Queensland. *Queensland Agricultural Journal*, vol. xxxv., pp. 218-23, 18 inset figures. April, 1931.

Ants in Cane Fields and Buildings. *Queensland Agricultural Journal*, vol. xxxv., pp. 360-62. June, 1931.

Grasshopper Control. *Queensland Agricultural Journal*, vol. xxxv., pp. 210-11.

Monthly Advice to Canegrowers. *Queensland Agricultural Journal*, vol. xxxiv., pp. 136, 381, 486; vol. xxxv., pp. 10, 140, 217.

REPORT OF Mr. R. W. MUNGOMERY, ASSISTANT ENTOMOLOGIST, SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG.

Position of Cane Grub Pest.—The cessation of subsidies on the part of the Government to the various Pest Destruction Boards in 1930, was followed, fortunately, by a comparatively light infestation of cane grubs in the Southern sugar districts. According to the quantity of grubs collected, the year 1930 proved, in the Isis district, to be a record, and it resulted in a depletion of the Board's funds, and payments had to be temporarily suspended. However, by voluntarily imposing a levy on each ton of cane supplied to the mill, the farmers have formed another fund for the destruction of pests, and this will be carried on as in former years. Following the heavy 1930 infestations, and as was expected, the year 1931 has been one of light infestation in the areas usually suffering from the ravages of the grub pest, and this is no doubt due to the combined action of parasites and other beneficial organisms, supplemented by the system of collecting grubs.

A review of past activities of the grub pest is of interest at this point, and some idea of the variation in the intensity of infestations will be gained from the following figures, which give details of the numbers of grubs collected in the Isis district since the year 1913 when payment for grubs was first brought into operation :—

Year.	Quarts.	Year.	Quarts.
1913	6,303	1922	1,687
1914	4,963	1923	3,113
1915	7,958	1924	5,866
1916	3,136	1925	7,916
1917	1,204	1926	3,101
1918	2,206	1927	3,198
1919	3,477	1928	8,580
1920	12,368	1929	3,457
1921	786	1930	12,513

It will be seen from the above table that heavy infestations were more or less cyclical, and that one or two years of heavy infestations were usually followed by years of lighter infestations, with a gradual increase or decrease of the pest up to a certain point. It should be realised that during the years reviewed, drought periods existed when the amount of land ploughed was substantially lower than that usually ploughed in normal or wetter seasons, so that the collections do not truly represent the relative number of grubs present from year to year, but they give some idea of the effect of weather on the ecology of this pest.

Again, the abnormally high numbers collected in the Isis areas during 1930 indicate a more exaggerated position of the pest there than was really the case. Actually about 40 per cent. of this number came from one of the larger plantations alone. This, no doubt, was due to the bad influences of certain alterations which had been made in their farming programme over the past few years, whereby conditions were made favourable for the increase of this pest. These favourable conditions include :—

(1) The practice of ratooning the same crop over an unduly large number of years.

(2) The growing of varieties that take two years to mature, and on that account have to be left to "stand-over."

(3) The dispensing with an adequate fallowing period.

It further appears that in this instance too much reliance has been placed on the control of grubs by the use of soil fumigants, and not sufficient attention paid to preventive measures, which go more or less hand in hand with good cultivation. Soil fumigation is both expensive and tedious, and it should be resorted to only in such cases where the pest is actually established in plant or first ratoon cane. A system of fallowing,

7. Work of the Division of Entomology—*continued.*

green manuring, and thorough cultivation would go a long way to prevent the establishment of these pests and render soil fumigation unnecessary except in extreme cases. Other reasons put forward for the large numbers collected are :—

(1) The comparatively mild wet winter of 1930, which caused the grubs to feed and transform nearer the surface, thus causing them to be more readily exposed by the ploughs.

(2) Greater activity amongst grub pickers due to numbers of unemployed turning their attention to grub picking as a source of livelihood during the present economic depression.

Soil Fumigation Experiment.—During the past year a severe but limited outbreak of cane grubs occurred on a farm in the Woongarra district, and the affected field had to be ploughed out. Advantage was taken of this to test the comparative effects of some of our more extensively used compounds and mixtures on grub mortality. The treatment consisted in injecting doses of 4·8 ccs. of fumigant into the soil, at depths of 4 in., on both sides of the stool and as close to the cane stool as possible. The fumigants used were :—(1) Carbon bisulphide ; (2) a mixture of two parts of carbon bisulphide and one part of orthodichlorbenzene ; and (3) a saturated solution of paradichlorbenzene in carbon bisulphide. The average grub populations (*P. furfuracea*) in the three series of treatments were 19·1, 19·0, and 17·9 respectively. The mortality after eight days was—(1) 70·9 per cent. ; (2) 83·7 per cent. ; and (3) 75·1 per cent. This result confirmed previous experiments when superior results were obtained with the No. 2 treatment.

Various other insecticides which have been forwarded to us during the year by some of the manufacturing firms overseas have been tested under our conditions, but none have approached the standard of those which are at present being recommended to farmers.

Toxicity of Fumigants on Cane Plant.—To test the relative effects of carbon bisulphide, orthodichlorbenzene, and paradichlorbenzene, on the growth of sugar-cane, a block of grub-free September plant cane was fumigated with the abovementioned fumigants in February of this year. The quantity of fumigant, whether solid or liquid, which was used at each injection amounted to 4·5 grammes, and the doses were placed at each side of the stool 3½ in. deep and 4 in. away from the plant. The plots are too backward to be harvested this year to compare actual yields, but present indications show that orthodichlorbenzene has had a severe retarding effect on the growth of the plant, whilst the effect of paradichlorbenzene is not quite so pronounced. There is a tendency on the part of the plant to produce side shoots when treated with either of these chemicals. The effect of carbon bisulphide is merely a temporary wilting of the leaves, a few days after treatment, and thereafter the plant grows normally. At present there is little difference between the plots treated with carbon bisulphide and the check plots.

The Occurrence of Cane Grubs and their Relationship with the pH Value of Infested Soils.—From recent investigations carried out in the Philippines, Dwight Pearce puts forward the theory that *Leucopholis* grubs are found in slightly acid soils, and in support he submits analyses of various soils where these grubs are found.

Determinations were made of the pH or acidity factor of these soils, and they ranged from 5·75 to 6·95, the point of neutrality being 7. He therefore suggested that *Leucopholis* grubs were not "found on highly acid, neutral, or alkaline soils," and as a control measure he advocated the use of agricultural limestone, as a means of bringing the condition of the soil to a state of neutrality, and therefore unfavourable for the development of these pests.

Considerable interest was taken in this question in view of the rather limited occurrence of cane grubs of the species *Pseudoholophylla furfuracea* Burm. These grubs are found chiefly in the red volcanic soils, and to a lesser extent in the lighter coloured scrub soils, and it was decided to test out the above theory with regard to the occurrence of these grubs. Samples were taken from as many different soils as possible where these pests were found damaging the cane roots, and included in the number were samples from hillsides, flat country, red, chocolate, and lighter coloured soils. The pH values were kindly determined by the Division of Soils and Agriculture.

Results of analyses showed that infestation varied greatly between pH values of 4·68 and 7·80, which shows that this species has a wide range as far as the acidity or alkalinity of the soils is concerned. It does not, therefore, appear practicable to control this species by the same means as those advocated by Dwight Pearce for the control of the Philippine Scarabæids.

7. Work of the Division of Entomology—*continued.*

Introduction of Tachinid Parasites.—Through the courtesy of Dr. A. Gibson, Dominion Entomologist of Canada, a shipment of about 500 "white grubs" (*Lachnosterna* sp.), parasitised by the Tachinid, *Microphthalma michiganensis*, was received in October, 1930. This fly parasite was imported in the hope that it might be a factor in bringing under more effective biological control one or more of our most important Scarabæid grubs, namely, *Pseudoholophylla furfuracea*, Burm., *Lepidiota trichosterna* Lea, and *Lepidiota frenchi* Blkb.

The shipment was forwarded in cool storage from Canada to Australia, but, unfortunately, the mortality was high, only about 20 per cent. of the Lachnosterna grubs surviving the journey. Flies emerged over a period of three months, but the numbers on the wing at any particular time were not sufficient to secure mating and subsequent larviposition; hence the colony died out. However, considerable experience was gained with the handling of these parasites, and arrangements have been made to have a much larger consignment forwarded from Canada again this year, when it is to be hoped that a greater measure of success will attend our efforts in introducing this parasite.

Fiji Disease Transmission Experiments.—Experiments were carried out during the past year to test out the possibility of insects being connected with the transmission of Fiji Disease of sugar-cane from diseased to healthy stools, and to determine what insect or insects were responsible for the secondary spread. Two series of experiments were carried out, one at Bundaberg, and the other at Brisbane, in the grounds of the Department of Agriculture and Stock. For the most part, tests were carried out with sap-sucking insects generally found feeding on cane. Other insects that were experimented with included such ones as the corn aphis and similar insects, which are migrants to cane from the grasses, and which are either known to transmit other sugar-cane diseases, or may reasonably be suspected of being able to do so.

Colonies of *Aphis maidis* Fitch. were placed in some of the cages over a period of many months, and thus the healthy plants were submitted to a continued attack by aphids coming from diseased plants, but no secondary infection occurred in these cages. As a check, this aphid freely transmitted mosaic disease to the healthy canes in the same cage. It appears likely that this aphid is incapable of transmitting Fiji disease. Similarly, *Aphis sacchari* Zehn. and *Perkinsiella saccharicida* Kirk. also failed to transmit the disease under the same conditions.

One definite case of secondary infection occurred in these experiments which pointed to the probability of the common mealy bug *Trionymus sacchari* Ckll. being responsible for the spread of this disease. Unfortunately we have not yet had an opportunity to confirm this, but this work is in progress at the present time.

REPORT OF Mr. W. A. McDOUGALL, ASSISTANT TO ENTOMOLOGIST, CENTRAL SUGAR EXPERIMENT STATION, MACKAY.

General.—Spasmodic greyback flights commenced in the middle of December and collecting in the different districts continued into March. Damage to cane by this grub was light this year.

Infestations of the minor cane pests *P. truncata*, *Rhyparida* sp., and *C. unipuncta* were few in number and of no economic importance.

From inspections of cane in mill yards and also standing crops it is evident that there is a widespread but very light infestation of the New Guinea Beetle Borer (*R. obscurus* Bois.). When digging out misses this pest has been found occasionally in the sets. More care could be taken in selecting and cutting plants.

During this spring, an exceptionally dry one, both grubs and adults of *Pentadon australis* damaged sets and young shoots. In effect, the attack on shoots by this insect is similar to that by wireworms, and most of the "dead-hearts" on the higher lands were caused by it.

Wireworms.—Since taking up my duties at this station in January last, wireworm investigations have been all-important. These pests are responsible for a high percentage of bad strikes in low-lying ground. Although their damage is very evident the larvæ themselves are not easily found. Seldom do they attack the eyes until they are swollen. Young shoots are killed, and by boring into the underground portions of larger shoots, "dead-hearts" are caused. From April to October good strikes on badly drained low lands are problematical. This year the strikes on this type of country have been better

7. Work of the Division of Entomology—*continued.*

than usual. Three species are responsible for the damage. The adults of them all have been bred. One, as yet unidentified, has been found in one small locality only. The other two species are the cause of all wireworm damage in the Mackay and Proserpine districts. It is calculated that 98 per cent. of the larvæ are *Lacon* sp., the other has not been identified.

These larvæ are not found in any cultivated soils with a pH higher than 5·5 (water solution). However, in the laboratory over six months they have been taken through to adults in soils with pH up to 7.

From August to October the larvæ are to be found in the top 2 or 3 in. of the moist soil. Pupation (*Lacon* sp.) commences in early October; depth of same depending upon moisture conditions in the different fields. The pupal stage occupies 14-17 days of a life-cycle of at least two years. An emergence has not been observed.

Another three species have been collected from higher fields. So far, adults of one, *Lacon assus* Cand., have been bred out. These species are not known to have damaged cane in this district.

In the laboratory several chemicals were tried out as poisons or deterrents but with no success. Field experiments showed that even excessive treatments with naphthalene, paradichlorbenzene, orthodichlorbenzene, carbon bisulphide emulsion, kerosene emulsion, R.V.4, or sulphur would not deter wireworm attack. No baits were found to be successful even for collecting specimens. Extensive lime and fertilizer plots were laid out, but weather conditions were against even possible help from these materials. However, it was shown that dropping air-slaked burnt lime in drills whilst planting does not lessen damage from wireworms.

Some farmers have now provided better drainage for their wireworm-infested fields, and in some instances are liming them to improve the physical conditions of the soil.

False Wireworms.—During the year two species have been collected in canefields around Mackay. Neither has been found damaging cane. The smaller is the larva of *Gonocelhalum torridum* Champ. The larger is brownish-yellow in colour, cylindrical, and can be found sometimes near plants during August, in its final instar of length roughly $1\frac{1}{16}$ in. The adult, Cystelid, has been identified by Mr. Hacker of the Queensland Museum as *Hybrenia elongata* Macl.

In the Laboratory.—Some time has been spent in studying the taxonomy and morphology of the wireworms. It is fairly easy to distinguish between species obtainable in this district. About three hundred have been kept in jars containing moist soil and potato tuber (of which they readily eat) for breeding purposes. Over the last six months of the larval period development is very slow.

Indexing of all available entomological literature concerning cane insects has been brought up to date, special attention having been paid to any works on wireworm behaviour and attempted control of them.

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

REPORT BY Mr. NORMAN BENNETT, SUGAR TECHNOLOGIST, FOR THE YEAR ENDING 30th OCTOBER, 1931.

Organisation and Staff.

The staff of the Division remains the same as in the annual report for the year 1930.

Towards the close of the 1930 season, the Assistant Technologist visited all Northern and Central mills, except those of the Colonial Sugar Refining Company.

Individual routine mill inspections have been continued by the Mill Technologist. In addition, special work was entailed with the preparation of evidence for the Commonwealth Committee of Inquiry, and the experiment at Sarina on the distillation of alcohol from B. molasses.

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

Special reports and visits have also been arranged for on the request of the mills concerned.

For the first time an attempt has been made to carry the investigational work of the Division into the field of mill practice and the Assistant Technologist has been engaged, since the commencement of the season, on experimental work at the Kalamia, Plane Creek, and Fairymead mills.

Investigations in progress are—

(1) Suitability of flow meters for maceration water and clarified juice measurement;

(2) Sugar recovery factors on boiling house products;

(3) The utilisation and baling of surplus bagasse.

In addition a complete and exhaustive series of boiler tests have been carried out at the Plane Creek Mill.

Laboratory.

Owing to shortage of staff, the laboratory work has been confined to the testing of laboratory equipment forwarded by the mills during the slack season.

It is quite evident that little or no progress in laboratory research work can be made until the services of a Research Chemist are available to the Division.

Standardisation—Brix Spindles.

The work of the Assistant Technologist towards the end of last year clearly showed the need for the Standards Bureau established by the Division.

In conjunction with the local manufacturers (Messrs. Wilson and Nafis, Brisbane), the Division has arranged for the manufacture of standard-sized and standard-ranged spindles complying with the requirements of the Division as to size, range, and accuracy.

Spindles of the following ranges:—0-10° Bx., 10°-20° Bx., 15°-25° Bx., 20°-30° Bx., 30°-40° Bx., 40°-50° Bx., 50°-60° Bx., 60°-70° Bx. can now be supplied by the manufacturers, and comply very favourably with the limit of correction required, viz., $\pm$ ·1° Bx.

These spindles are marked in red with the letters "S.B.S." (Sugar Bureau Standard) at the lower end of the paper scale.

Official certificates are issued with spindles complying with the Division requirements as to size, range, and temperature of calibration only.

During the past year a number of spindles have been tested which do not comply with these conditions, but, in future, tests will only be made on standard spindles. The size, range, and temperature of calibration has been definitely fixed by the Queensland Society of Sugar Cane Technologists, and mill chemists are strongly advised to adopt these specifications for spindles brought into laboratory use.

Glassware.

A number of flasks, pipettes, and burettes were forwarded for testing.

Analytical Weights.

Four sets of weights were calibrated—only one of which was satisfactory. Many of the mill chemists have still to realise that a set of tested standard analytical weights should not be brought into constant laboratory use, but should be used for the periodical testing of the sets that are used.

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

Polariscope and Accessories.

Only one polariscope was forwarded for cleaning, adjustment, and testing. It was thought that it would be possible to test the polariscope tubes in use at the mills, but the gauge has only recently been received. An effort will be made to test all tubes prior to the commencement of the next crushing season.

Sugar Inquiry Committee.

The evidence submitted by the Technologist on the general efficiency of the industry and on the feasibility of using surplus sugar for alcohol manufacture has been published elsewhere.

B. Molasses for Alcohol Manufacture.

The conclusions drawn up by the Committee in charge of the experiment at Sarina have been published but can bear repetition here. (*See* p. 109, Proceedings of Queensland Society of Sugar Cane Technologists, 1931.)

(1) The experiment has shown conclusively that there is no possibility of absorbing the surplus sugar production by converting it into alcohol, unless an exhorbitant price is to be charged for motor spirit.

(2) The results proved that a quantity (approximately 6·5 per cent. of the present sugar production) could be diverted to alcohol manufacture with a view to establishing this latter industry.

(3) At the present export price, the sale to the distillery of portion of the B. Molasses manufactured at the mill would result in a slightly enhanced price for the quantity of sugar so used.

(4) Should the time arrive when the alcohol industry is so expanded that the full quota of 6·5 per cent. of the present quantity of sugar produced can be absorbed, then the distillery experts are of the opinion that the corresponding reduction in manufacturing costs will enable an enhanced price to be paid for the portion of sugar produced.

Utilisation of Surplus Bagasse.

Some attention has been given to the possibilities and economics of utilising surplus bagasse by baling.

Unfortunately the mill selected for this test had little surplus product available. An attempt will be made to collect the data next season.

Mutual Control.

The mutual control system has worked smoothly since its inception. The benefit of these fortnightly returns is not yet realised by some mill executives. A study of the various items enumerated in the return will well repay the time and attention given to this work.

Report of Mill Work for Season 1930.

Crushing for the season 1930 was commenced on 4th June and was not completed until 10th January. The first mill to commence crushing was Pioneer, and the last one to finish South Johnstone.

All the Northern mills were working by 8th July. The maximum crop period was 200 days (South Johnstone), and the minimum 100 days (Mossman).

The maximum crop period in the Central district was that of Kalamia (133 days), and the minimum, Marian (95 days).

In the Southern district, the season commenced on 23rd July, and was not completed until 15th December. The maximum crop was Fairymead (139 days), closely followed by Gin Gin (134 days), and Maryborough (129 days). Exclusive of the small mills in the Beenleigh area, the minimum crop was 91 days at Childers.

It will be noted when comparing the 1930 season's figures with those of 1929 season, that the increased hourly rating of the mills is reflected in the shorter seasons.

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

Season 1930.	Tons Cane Crushed.	Tons 94 N.T. Sugar Made.
Mossman	74,596	10,874
Mulgrave	179,107	26,120
Babinda	212,605	31,293
South Johnstone	234,615	33,459
Tully	215,022	31,921
Mourilyan	164,952	24,767
Macknade	140,333	22,411
Victoria	143,255	21,678
Goondi	177,682	26,053
Hambldon	175,832	25,961
Total, Northern District	1,717,999	254,537
Pioneer	131,711	20,873
Inkerman	171,000	26,552
Giru	58,218	8,943
Kalamia	126,573	19,484
Proserpine	78,800	11,821
Farleigh	76,810	11,266
North Eton	63,549	9,053
Cattle Creek	45,108	6,585
Pleystowe	95,332	14,723
Marian	90,371	14,092
Racecourse	95,954	14,883
Plane Creek	120,486	18,344
Total, Central District	1,155,912	176,619
Childers	56,619	7,420
Millaquin	102,046	12,854
Qunaba	55,191	7,094
Fairymead	108,188	13,836
Bingera	114,581	15,172
Isis Central	66,251	8,639
Gin Gin	37,050	4,880
Maryborough	28,683	3,860
Bauple	18,527	2,225
Moreton	47,990	6,622
Rocky Point	9,511	1,162
Alberton	1,344	137·5
Eagleby	1,813	212·5
Total, Southern District	647,794	84,114

The average crop days in the three districts per mill were—

—	Average Crop Days.	Commencement.	Finish.
Northern	158	12th June	10th Jan., 1931
*Central	115	3rd July	5th Dec., 1930
†Southern	100	23rd July	15th Dec., 1930

* Excluding Pioneer and Inkerman. † Excluding Eagleby and Alberton.

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

AVERAGE FIGURES FOR MILL WORK, 1930 SEASON.

	Northern. Six Mills.	Central. Ten Mills.	Southern. Eight Mills.	Total. Twenty-four Mills.
Tons cane	1,717,999*	1,155,912*	647,794	3,521,705*
Tons 94 n.t. sugar made	254,537*	176,619*	84,114*	515,270*
Net titre	97·0	96·7	96·6	96·8
Tons cane per ton sugar	6·75*	6·53*	7·72*	6·84*
Fibre in cane	11·38	13·06	15·00	12·59
Pol. in cane	15·98	16·80	14·58	15·97
Bagasse—				
Moisture	53·10	50·36	50·7	51·8
Pol.	3·06	3·50	2·53	3·10
Purities—				
1st Expressed Juice	90·77	91·70	89·91	90·9
Clarified Juice	90·59	91·30	89·0	90·5
Syrup	90·77	91·60	88·51	90·6
Brix Syrup	67·73	69·1	69·22	68·4
Gallons Molasses p.t.c.	3·39	3·61	4·66	3·70
Sugar—				
Pol.	98·57	98·42	98·7	98·5
Moisture	0·338	0·437	0·275	0·357
Tons Fuel—				
Wood	4,658	20,415	18,054	43,127
Coal	3,225	2,778	728	6,731
Molasses	17,946	939	970	19,855
Gallons E.S.J.	212	218·2	235·7	222
Extraction	94·95	93·99	94·36	94·49
Extraction Ratio	0·443	0·460	0·376	0·437
Milling loss	7·10	7·73	5·48	6·99
Pol. in Sugars—				
Per cent. Pol. in Cane	87·63	86·69	85·32	86·83
Per Cent. Pol. in Mixed Juice	92·22	92·23	90·42	91·89

Note.—Figures marked * are for all Queensland mills. Other averages are from returns received from all mills except C.S.R. Co., Pioneer Mills Ltd., Farleigh, Bauple, Eagleby, and Alberton. It will be noted that the figures in the first two lines differ slightly from those supplied to the Registrar-General, and given on the previous page.

A total tonnage of 3,521,705 tons of cane was treated to produce 515,270 tons of sugar of 94 net titre. The figure for tons of cane per ton of 94 net titre sugar was again lower than previously recorded, viz., 6·84.

In the Northern district South Johnstone was the only mill to exceed 7 tons of cane per ton of 94 net titre sugar; similarly, North Eton for the Central district.

The South Johnstone figure was due to late crushing, and clearly reflects one of the disadvantages attending a late termination of the crop.

In the Southern district no mill obtained a figure less than 7·25 tons of cane per ton of sugar.

The sugar content of the cane was lower in the North than in the previous season, 15·98 pol. in cane, as compared with 16·21, but in the Central and Southern district, marked increases of ·84 per cent. and ·61 per cent. were noticed.

For some years past the number of tons of cane required to produce a ton of sugar has been decreasing.

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

This is due to increased efficiency in plant operation as the increase in pol. per cent. cane (apart from seasonal fluctuation which affects each district), is due to harvesting in periods of maximum sugar content.

ERN. Mills.	TOTAL. Twenty-four Mills.
794	3,521,705*
114*	515,270*
3	96·8
72*	6·84*
00	12·59
58	15·97
7	51·8
53	3·10
91	90·9
)	90·5
51	90·6
32	68·4
36	3·70
	98·5
375	0·357
654	43,127
28	6,731
70	19,855
	222
6	94·49
76	0·437
8	6·99
2	86·83
2	91·89

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

The figure recorded by Mourilyan of 6·44 tons of cane per ton of sugar in 1929 season was eclipsed by three mills in the 1930 season. The lowest figure now recorded is that of Macknade—6·28 tons per ton 94 net. titre sugar.

In general, the cane treated was of higher sugar content and of higher purity than in 1929.

The extraction per cent. pol. in cane shows a slight drop in spite of the fact that a little more maceration water was added and the overall recovery is lower, having fallen from 87·45 to 86·83. This latter drop is not noticeable in the Southern mills' average, which was better owing to the improvement in the quality of the cane.

The biggest falling off in overall recovery is shown in the Central district, the fall being from 87·96 per cent. to 86·69, a drop of 1·27 per cent.

How far this drop is attributable to an artificially high polarisation in cane is difficult to gauge.

The purities obtained at some of the Central mills were remarkably high considering the dry weather experienced, and would lead one to the belief that the polarisation of the juice was affected by the presence of increased quantities of gums or reduction in the normal amount of lævulose present.

The same difficulty in obtaining recovery is being experienced in the Central district this present season, but an examination of the analyses discloses the fact that the amount of non-sugars is considerably greater this year, and consequently the yield of molasses much higher.

Queensland mills are now reaching their peaks in so far as quantity treated in unit time is concerned; attention must now be turned to the problem of the economic exhaustion of the molasses. With such high initial juice purities it will be impossible to achieve the low molasses impurities obtained abroad.

Generally speaking, however, most of our Queensland mills could profitably consider further expenditure in increasing the capacity of the boiling house, crystallisers, and low-grade fugals.

For comparison, the averaged figures for 1928, 1929, and 1930 are given—

——	1928.	1929.	1930.
Tons cane per ton, 94 n.t. sugar	7·18	6·91	6·84
Pol. in cane	15·42	15·65	15·97
Purity 1st Expressed Juice	89·11	89·57	90·9
Pol. Extraction	94·19	94·55	94·49
Pol. in sugars per cent. Pol. in cane	86·57	87·45	86·83
Pol. in sugars per cent. Pol. in mixed juice	91·91	92·49	91·89
Fibre in cane	12·50	12·50	12·59

9.—General.

Cane Pests Boards.

Under the provisions of "*The Sugar Experiment Stations Act Amendment Act of* 1923," six Cane Pests Boards have been constituted, viz. :—Plane Creek, Mackay, Lower Burdekin, Ingham Line Suppliers, Tully, and South Johnstone. 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 six years the amount of assessment collected for the operation of the six Boards has amounted to £32,068, which is all expended in the destruction of pests. A new Board for the Mossman district is about to be constituted. In addition to the above there are a large number of Cane Pests Funds in existence to which farmers subscribe voluntarily. These all serve a most useful purpose in checking the depredations of cane pests.

MACHINERY.

Howard Cane Harvester.

Further trials of the Howard Cane Harvester have been carried out this season at Bundaberg, and the following improvements were noticed by officers of this Bureau since inspection of the machine last year :—

"Revolving arms have been placed in the same vertical plane as, and about 2 feet above, the cutting blades. This helps to rake the cane into the carrier.

"A truck or hopper arrangement has been constructed at the side of the original machine. This truck receives the cane after it has been cleaned and topped. It is run on caterpillar wheels and attached to the main body of the machine by iron beams which serve to keep the truck in the same relative position to the machine whilst in operation. Actually two men are required to operate the Harvester, (1) a driver who regulates the forward speed and also the carrier feeding mechanism, and (2) an off-sider who receives the cane after it has been cut, cleaned, and topped.

"Slings are placed in the bottom of the body of the truck, prior to starting the machine in operation, and after the cane is cut and topped it is received by the off-sider who stands in the truck, and loads the cane evenly on to these slings, much in the same manner as when loading cane on to a cane dray. When the machine has cut about 25 cwt. it is stopped and these slings are twitched tightly around the load, and the load is discharged through the back, and in this way the load is left tightly bound in the field, ready to be picked up by motor lorry and conveyed to the mill, or derrick on the railway, as the case may be. To discharge this load, the floor of the truck is provided with a bottom similar to an endless conveyor belt, and by turning a handle operating this conveyor, the load is gradually shifted to the back of the truck. At the same time the whole machine is shifted forward, causing the truck to rear slightly in front and the whole load is then dumped behind."

In a recent trial at Bundaberg the Harvester cut burnt small cane averaging about 12 tons per acre at a calculated rate of 5·7 tons per hour, and burnt cane of approximately 20 tons per acre at the calculated rate of 8 tons per hour. Taking into consideration the time of discharging the load, it took 40 minutes to cut and discharge a load of 25 cwt. in the small cane which equalled a rate of 37 cwt. per hour, or, if stoppages due to a minor breakdown be deducted, the capacity would have been at the rate of 43 cwt. per hour. In the larger cane, the machine could handle from three to four tons per hour cutting and discharging. The handling and discharging of the cane from the truck as well as preparations for the next load occupied a considerable amount of time.

There were certain defects in cutting and topping which it is trusted will be overcome.

The machine appears to be able to handle burnt crops of straight cane from 3 to 6 feet in length with a good measure of success at the rate of 2 to 4 tons per hour, this operation requiring the services of two men. Later reports state that this quantity was increased.

Miller—Owen Cane Harvester.

This is a Mackay invention and received several trials last season, when it was found that certain alterations were needed. These have been made this year and further trials have been made. The machine shows much promise, but requires developing.

Falkiner Cane Harvester.

The Falkiner Cane Harvester which was originally built in Australia, but which did not prove, at the time of its trials, an altogether unqualified success, was taken to America and very greatly improved and modified. From photographs received it now looks to be a tremendously powerful machine. Very favourable reports have appeared in the press as to its work, more particularly in Cuba. Fourteen of the machines alone were

9. General—*continued.*

ordered for the Southern Sugar Company in Florida. The best performance of a single machine in one day was the cutting of 265 tons in two 10-hour shifts. This was on heavy tonnage cane, burnt before cutting. In green lodged cane, with a heavy accumulation of trash, the machine handled about 150 tons per day. The Manager of the Southern Sugar Company stated they had proved a commercial success.

Mole Drainer.

This implement appears to have a definite value in improving drainage conditions on our wet cane lands. A complete unit has been operated in the Richmond River district of New South Wales, during the past two seasons, with encouraging results. Attempts are being made to devise a more modest implement which may be drawn by six horses or a light tractor to a depth of 15–18 in. A demonstration was given recently by Mr. S. J. Page, of Edmonton, of an implement which he has employed successfully on his farm; the improvement effected by its use on low wet land is outstanding.

A tool of this type, which has been used successfully in Fiji, has been ordered from England, and on arrival will be utilised by the Bureau in experimental work and demonstrations throughout the cane areas.

Subsoiler.

Renewed interest has been stimulated in the question of deep cultivation, and undoubtedly marked improvements in cane growth will follow the more extensive application of subsoiling. An improved subsoiler which combines satisfactory work with light draught, was built to the specification of the Bureau during the past season, and was demonstrated at several farmers field day gatherings in the Northern and Southern areas.

Balance Sheet.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FROM 1st JULY, 1930, TO 30th JUNE, 1931.

Receipts.	£ s. d.
1930—	
1st July—	
To Balance	17,849 7 7
1931—	
30th June—	
To Assessments	7,351 8 10
,, Endowment	7,351 8 10
,, Bundaberg Station	781 13 11
,, Mackay Station	319 4 11
,, South Johnstone Station	1,643 14 3
,, Meringa Station	20 3 8
,, Sundries	33 6 4
	£35,350 8 4

Disbursements.	£ s. d.	£ s. d.
1931—		
30th June—		
By Salaries		8,336 14 3
,, Contingencies—		
Salaries and wages ..	1,035 11 2	
Travelling Expenses, Hires, Freights, Fares, Allowances	2,559 15 4	
Apparatus, Furniture, Books, Installations ..	1,794 8 1	
Printing, Advertising and Stationery ..	602 4 5	
General Expenses ..	595 2 10	
Alterations—Mackay Laboratory ..	705 0 0	
		7,283 1 10
,, Subsidy—Destruction Sugar Cane Pests ..		2,136 18 9
,, Bundaberg Contingencies		1,029 16 3
,, Mackay Contingencies ..		1,707 18 3
,, South Johnstone Contingencies		2,095 7 7
,, Gordonvale Contingencies		875 12 7
,, Balance, 30th June, 1931		11,884 18 10
		£35,350 8 4

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, 24th November, 1931.

H. T. EASTERBY, Director.

Price, 1s. 9d.]

By Authority: Frederick Phillips, Government Printer, Brisbane.