1930.

QUEENSLAND.

THIRTIETH 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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THIRTIETH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS.

DIRECTOR'S REPORT.

TO THE HONOURABLE THE SECRETARY FOR AGRICULTURE AND STOCK.

SIR,—I have the honour to submit the Thirtieth Annual Report of the Bureau of Sugar Experiment Stations up to the 15th November, 1930.

H. T. EASTERBY,
Director.

Brisbane, 5th December, 1930.

1.—Introduction.

The yield of sugar for the year 1929 did not quite reach that of the previous year, the figures being—

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

This, however, was in excess of the requirements of Australia, and in consequence 197,000 tons were exported.

The tons of cane crushed were considerably lower than in 1928, but the percentage of sugar in the cane was remarkably high, so that the tons of cane required to manufacture one ton of sugar were lower than ever before, viz., 6·91, this constituting a world's record.

The actual proportion of the whole of the sugar manufactured in Queensland and New South Wales during the 1929 season which was deemed to have been delivered for consumption and use in Australia was 61·605 per cent., and the net value of the 94 net titre surplus sugar sold abroad was £9 17s. per ton, again showing a decrease on previous years' prices. 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 16s. per ton of 94 net titre sugar in addition to the price of £26 prescribed for such sugar. The average price that the industry received for the whole crop was £20 5s. 10·09d., this being lower than in 1926, 1927, and 1928.

The consumption of sugar, not only in Australia but in the world generally, is stated to be lower than it was in recent years. In Australia, the lower consumption of sugar is most probably due to the large amount of unemployment.

The exports of sugar each year since 1924, when the first large surplus occurred, are as follows :—

	Tons.		Tons.
1924	74,000	1928	186,703
1925	211,000	1929	197,000
1926	74,777	1930 (estimated) ..	195,000
1927	152,384		

Unfortunately, the price of sugar overseas has fallen to an unprecedentedly low figure. Before the present crushing season commenced, the Sugar Board, by proclamation, fixed the price payable for sugar deemed to be surplus sugar and excess sugar at £7 14s. per ton, but by October of this year oversea prices had fallen still further, so that it became necessary to reduce this price to £5 12s. per ton of 94 net titre. This will, of course, be reflected in a lowered price for cane this season. It is gratifying, however, to learn from an announcement that the British preference to Dominion sugar is to be continued for a further three years.

1. Introduction—*continued.*

Mr. A. R. Townsend, the representative of the Commonwealth Government on the Export Sugar Committee, has been kind 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, confectionery, &c.

	Tons.		Tons.
1924-1925	5,500	1927-1928	5,003
1925-1926	6,555	1928-1929	5,632
1926-1927	4,807	1929-1930	3,981

The agreement for the embargo against sugar produced by coloured labour expires in August of next year, practically before the 1931 crushing season. Efforts were made to have this renewed for a further period in July last, when a deputation representing the industry waited on the Prime Minister. At first it was thought that the embargo would be renewed for a short period pending an inquiry, but this was reversed, and it was determined by the Commonwealth Government to appoint a Committee of Inquiry to report on the Sugar Industry generally, to the Prime Minister, the following being the terms of the reference :—

(1) Costs, wages, profits, and prices in relation to the production, manufacture, and distribution of sugar ;
(2) The financial condition of the growers of sugar in Australia ;
(3) The conditions of the workers employed in the sugar industry ;
(4) The terms of the existing agreement known as the Sugar Agreement, 1928-1931, and any variation of it considered to be desirable ;
(5) The efficiency of the industry in field and factory ;
(6) Values of land used for sugar-growing ;
(7) Economies which might be effected in relation to sugar production ;
(8) The effect of sugar prices on manufacturing industries, and on fruit-growing and fruit-processing ;
(9) Any possible reduction in sugar prices ;
(10) The necessity for the continuance of the present prohibition of the importation of sugar ;
(11) The relation of sugar prices abroad to the sugar industry ;
(12) Over-production of sugar and the sale of surplus sugar abroad ;
(13) The utilisation of by-products of sugar-cane ;
(14) Alien penetration into the sugar industry.

The Committee appointed embraces the following :—Chairman, the Hon. John Gunn, together with a representative of the Commonwealth, two joint representatives of sugar mills and cane-growers, and one representative each of the Australian Workers' Union, domestic consumers, manufacturers, and fruit-growers, being eight in all.

This Committee was to have commenced the inquiry on 17th September, but due to the illness of two of the representatives the opening of the inquiry was postponed till 15th October. At the time of writing, the Committee is still taking evidence in the other States, having finished the Queensland inquiry, which embraced a visit to the Northern sugar areas, about the middle of November.

2.—Approximate Estimate of the 1930 Crop.

The cane crop this season is expected to be somewhat below that of 1929, and the yield of sugar will not be so high, due to the lateness of the wet season this year. Good rains fell in January, but in February the fall was lighter while March and April were unusually dry, and the really "wet" season did not commence till May. Heavy rain fell in May, June, and July, and again in October, so that conditions for next year are at present highly favourable.

No serious floods or frosts occurred this year, and no labour or shipping troubles have been experienced. In fact many of the mills have been enjoying the rare experience of getting their sugar away as soon as manufactured.

The following table gives the earlier estimates of the crop in June, together with the figures supplied by the mills at the end of October, from which it will be seen that the total crop yield has apparently slipped back by about 66,000 tons. Most of this decrease took place in the mills above Townsville.

2. Approximate Estimate of the 1930 Crop—*continued.*

Estimated Crop of Cane, 1930 Season.

Mill.	Preliminary Estimate formed in June.	Approximate Estimate Furnished by Mills at end of October.	Remarks.
	Tons.	Tons.	
Mossman	75,000	74,596	..
Hambledon	197,000	172,000	Reduction due to early dry weather
Mulgrave	185.000	177,000	Reduction due to early dry weather
Babinda	220,000	213,000	..
Goondi	186,000	177,000	Reduction due to early dry weather
South Johnstone	200,000	230,000	..
Mourilyan	165,354	160,000	Reduction due to early dry weather
Tully	210,000	210,000	..
Victoria	184,000	137,000	Reduction due to early dry weather
Macknade	156,000	145,000	Reduction due to early dry weather
Invicta	66,000	58,218	Reduction due to early dry weather
Pioneer	133,000	136.420	..
Kalamia	125,000	125,000	..
Inkerman	172,000	169,000	..
Proserpine	70,000	78,000	..
Cattle Creek	48,000	45,000	..
Racecourse	95,000	92,000	..
Farleigh	80,000	77,000	..
North Eton	57,000	62,000	..
Marian	85,000	89,500	..
Pleystowe	80,000	97,000	..
Plane Creek	116,000	119,000	..
Qunaba	53,000	54,500	..
Millaquin	106,000	101,000	..
Bingera	100,000	110,000	..
Fairymead	105,000	105,000	..
Gin Gin	33,000	37,000	..
Childers	70,000	58,000	..
Isis	66,000	70,000	..
Maryborough	29,300	28,650	..
Mount Bauple	29,625	29,625	..
Moreton	56,000	53,000	..
Rocky Point	12,000	9,511	..
Alberton	1,300	1,344	..
Eagleby	2,000	1,810	..
Totals	3,568,579	3,502,174	

If the October estimate of the mills is realised this should amount to 3,502,174 tons of cane. It may be safe to estimate that 6·90 tons of cane will be required to manufacture 1 ton of raw sugar of 94 net titre. This would give an approximate yield of 507,560 tons of 94 net titre, which would be 10,956 tons less than that made last year. There is, however, a probability that the total crop may exceed the figure given.

It is anticipated that the yield of sugar from the three sugar-mills in New South Wales will be about 20,000 tons, which, added to the Queensland output, will make the Australian production of raw sugar approximately 527,560 tons of 94 net titre.

The Victorian beet sugar factory this year manufactured 3,472 tons of white granulated sugar, which is not included in the Sugar Pool. The sugar content in the beet at Maffra, Victoria, this year was not so high as last year, being 17 per cent. as against 17·94 per cent. The area under beets was 2,500 acres, which produced 26,525 tons; of this 25,088 tons entered into manufacture, so that it took 7·22 tons of beet to make 1 ton of white granulated sugar, which was good work.

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

During this period the acreage from which cane is crushed has just about trebled, but the yield of sugar when the earlier yield of 88 net titre sugar is converted into terms of 94 net titre sugar is now six times as great as it was in 1899. The following tables show the great progress that has been made especially of recent years :—

2. Approximate Estimate of the 1930 Crop—*continued.*

Table showing Total Acres Cultivated and Crushed and Total Yields of Cane and Sugar per Acre for a Period of Thirty-one 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	1,674,329	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

* This is raw sugar of 88 net titre to 1904. † This is raw sugar of 94 net titre to 1929.

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

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

2. Comparative Estimate of the 1930 Crop—*continued.*

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

3.—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 immediately following this section.

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 cane-growers visiting Brisbane at all times, to discuss their needs and difficulties and to render them all the help possible.

The Director desires to acknowledge the willing assistance of Dr. H. W. Kerr and Messrs. Bell, Jarvis, and Bennett in the many problems in their respective divisions which arise from time to time, and to state that the remainder of the Bureau staff have carried out their duties with commendable activity and zeal.

The general work of the Bureau consists of supervision, the attending to correspondence, preparation of reports for press, farmers' associations, the Government, and other interested parties, visiting sugar districts, collection of sugar data for statistical purposes, advising visiting farmers and persons desirous of taking up sugar-growing, &c., and the administration of the sugar fund for Sugar Experiment Station activities.

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

REPORT BY Dr. H. W. KERR, SOILS CHEMIST, FOR THE YEAR ENDING 31st OCTOBER, 1930.

During the past year very definite progress was made along the lines of the policy formulated last year. The first series of farm experimental plots was harvested successfully, and the majority of these were fertilized once again for the first ratoon crop. In addition, about forty fresh blocks were selected and laid out under fertilizer treatments.

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

Parallel investigations of the chemical composition of these soils were carried out in the Brisbane laboratory, in order to determine the correlation between the analytical and field results. The completion and equipment of this laboratory early in 1930 supplied much-needed facilities for the carrying out of a large volume of chemical analytical work, much of which had accumulated during the preceding eighteen months. It also opened up the way for a complete study of the agricultural value of the by-products of the industry, and preliminary results of these investigations will be published shortly. Molasses, filter-press cake and subsider muds, and trash have come under review. A molasses manurial field trial was harvested at the Bundaberg Station in October; the results of the experiment are recorded under the work of that station, and they demonstrate conclusively the value of this by-product on the red volcanic soils which are characteristically deficient in potash. It is intended to extend trials with this material to the Mackay and South Johnstone Stations, in order to embrace divergent soil types. Further, trials designed to determine the manurial value of the other by-products will be taken in hand at the first opportunity.

A study of the irrigation waters of the Burdekin Delta was commenced in May, following the appointment of Mr. N. G. Cassidy as Research Assistant. This officer spent several weeks at Ayr, during which time a number of water analyses was put through. The June rains caused a cessation of the irrigation pumps, and the collection of further samples was hampered. The work is now being continued in Brisbane, where, it is hoped, an analysis of every irrigation water in the Burdekin district will be completed in the near future. These samples are being collected and forwarded by the field officer in that area.

During the past four months the services of Mr. N. J. King, Soil Survey officer in training, were made available to us. Mr. King has been able to visit the majority of our cane areas, and set out a considerable amount of very useful data, in the course of a reconnaissance survey of the Queensland cane soils. His results, though necessarily incomplete, will form a very valuable foundation on which to construct a more complete and detailed survey of our lands. It is unfortunate that we are not able to secure the services of a full-time survey officer for this work, which forms a most important link between our fieldwork and laboratory studies.

Staff.

The field and laboratory officers have performed their duties in a very satisfactory manner during the year. As was pointed out last year, our extension service is hampered considerably by the restricted number of officers on our field staff. To carry out effectively the full and detailed supervision of all farm experiments, besides answering calls from farmers for advice on soils, agricultural, entomological, and pathological problems, is beyond the capacities of the four officers at present engaged in the work. Indeed, it has been necessary to call upon the services of the Experiment Station Chemists to render assistance in fieldwork on frequent occasions.

Work of the Experiment Stations—Experimental Trials.

During the harvesting season, some very interesting experiments were harvested, particularly at the South Johnstone and Bundaberg Stations. The first series of Latin Square and randomised block trials were carried through; the results indicate the decided value of the experimental technique as developed by Fisher at Rothamsted, over the older type of experimental lay-out. It will be observed that two trials harvested at South Johnstone show experimental errors of only 1·4 and 0·3 per cent. respectively: the latter value is the lowest which has come to the notice of the writer in the records of world-wide trials. At Bundaberg, many of the anomalies which were so evident in past experimental results have been eliminated by the use of the 5 x 5 Latin Square trial. The high degree of variability displayed by the red volcanic loam of this station is scarcely credible, as judged by field observation, and it is very gratifying to know that we have been able to surmount the difficulties involved in field trials there. Indications up to the present are that the desirable degree of precision on this soil may require six replicates of each treatment for most trials.

In order to allow of a redistribution of the experimental blocks at the Mackay Station, to render them more suitable for our revised experimental plan, no new blocks were planted to cane this year. At the close of the harvest all will be ploughed out. After a resurvey, one-half of the area will be worked up for early plant next year, while the remainder will be put under experiments in the following spring.

Seedling Propagation.

Our attempt in 1929 to grow seedlings from arrows at the Mackay and Bundaberg Stations was not successful. Conditions throughout Queensland were not suitable for the work, due to the cold dry winter experienced. The percentage of germinations, even under the best of conditions, was not high. This year, special provision was made at the

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

central and southern stations, so that the seed could be germinated and the young seedlings grown under heating frames. Results were very satisfactory and more than 1,000 seedlings have been set out at each of these stations. These have been fertilized and irrigated to force them along during the spring and early summer months, so that a selection may be effected by next winter. With a number of necessary improvements in technique, it is anticipated that several thousands of seedlings may be raised quite comfortably in future seasons, and this work will become a major project of these two stations.

Results of Varietal Trials.

High hopes were entertained for one of the seedlings raised at South Johnstone a few years ago—S.J. 4. This variety showed up very well on that station (*see* report) in comparison with the standard variety, Badila. When planted out on some of the poorer soils of the Cairns district, however, and with the incidence of a particularly dry spring, a high degree of leaf-scald infection manifested itself, and many of the stools died out completely. It is not to be inferred that the variety does not carry some moderate degree of resistance or tolerance to this disease. The explanation appears to be rather in the fact that the stocks from which our supply of the variety was propagated have become highly infected in the past; and though the diseased nature of the cane was not revealed on the Experiment Station, a change to poorer growing conditions made it very evident.

For the time being we are discouraging the growing of S.J. 4; meanwhile, we will attempt to build up a supply of disease-free canes of this variety, when a further distribution will be made, if desired.

Our observations and field trials with P.O.J. 2714 in the Mackay area indicate that this recent importation from Java is a cane well adapted to conditions in this district. It has a few notable defects—susceptibility to certain diseases, tendency to pithiness, and early arrowing—but it is finding considerable favour amongst growers. It is a vigorous grower with high sugar content. The results from a variety trial in the area will be found in the report from the Mackay Station.

Fertilizer Trials.

The following is a list of the farmers on whose lands fertilizer trials were harvested during the year:—

Northern Division—
Pringle Bros., Mossman
R. L. Hearn, Mossman
A. J. Kelly, Aloomba
R. Matthews, Pawngilly
W. Thiele, Pawngilly
J. P. McGowan, Daradgee
M. Caldera, Mourilyan
S. Pagano, Mourilyan
J. A. Wolff, South Johnstone
W. Jones, Silkwood
Allison Bros., Midgenoo
S. J. French, Midgenoo

Central Division—
J. Trevaskis, Farleigh
J. Gibson, Racecourse
H. Single, Foulden
H. Ivers, Rosella

Central Division—continued.
C. H. Walz, Marian
P. Petersen, Sarina
P. Brooks, Sarina
E. K. Glen, Pleystowe
H. R. Swanson, Homebush
H. Rowe, Mirani

Southern Division—
P. Peterson, Bingera
C. N. Dahl, Woongarra
Eardley Bros., Bundaberg
A. Adie, Cordalba
C. H. Tench, Pialba
J. Mungomery, Tokura
T. Beatty, Bauple
C. Trewin, Nambour
F. W. Kirk, Nambour
Burrage Bros., Maroondan

The crop returns from the fertilizer have been very satisfactory. With few exceptions, highly profitable returns have resulted from even the heaviest fertilizer applications, which range from 600 to 800 lb. per acre. The season was not a favourable one, in general, but where good spring rains were experienced, as in local areas of the Mackay district, gains of 10 to 11 tons of cane per acre were recorded. The full returns from these plots are now being prepared for separate publication in pamphlet form. These will be distributed freely amongst the growers in the particular areas.

Naturally, our experiments have not yet taken in all of the major soil types of our cane areas, and our results are for one year only. The plots already harvested are

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

being fertilized for the first ratoon crop, and in addition the following farms have been selected for a fresh set of experiments which were laid down during the planting season :—

Northern Division—
Coulthard and Cox, Mossman
W. Chapman, Hambledon
W. Pittman, Gordonvale
J. H. Jackson, Babinda
F. Penfold, South Johnstone
F. N. King, Jaffa
F. N. King, Silkwood
A. Cousin, Feluga

Central Division—
G. E. Watt, Ayr
Hoey Bros., Ayr
Ferguson Bros., Ayr
B. Tapiolas, Ayr
S. Gibson, Home Hill
H. Backhaus, Home Hill
P. Simonsen, West Plane Creek
Comerford Bros., Finch Hatton
F. Letchford, Finch Hatton

Central Division—continued.
E. Webb, Walkerston
C. H. Miles, Te Kowai
H. Barfield, Tannalo
A. Breadsall, Pleystowe
P. Hand, Wandaru
Laws & Baker, North Eton
Palms Estate, Branscombe
Palms Estate, Te Kowai
Palms Estate, Palms (Standover)

Southern Division—
W. J. Tutin, Gooburrum
J. Black, Gooburrum
A. F. Shaw, Bucca
M. Oakes, Childers
Irwin Bros., Cordalba
Wadsworth and Son, Gin Gin
J. Kaye, Gin Gin
J. W. Tatnell, Nambour

We would place on record our appreciation of the assistance afforded by the following firms in again making available all the fertilizer required for our farm experimental blocks set out during the year :—

A.C.F. and Shirley's Fertilizers, Ltd. ;
Imperial Chemical Industries (Aust.), Ltd. ;
Dominions Potash Supply Company.

The fertilizer has been passed on gratuitously to the growers, as some measure of compensation for the added duties which the trials impose upon them.

Field Days.

The Experiment Station field days which were held as an annual function for many years past were suspended during 1930. In the coming season district field days will be substituted, by which means it is hoped to reach a larger proportion of growers, and meet them in smaller groups under their own particular district conditions. The establishment of the farm trials enables us to discuss and demonstrate the local requirements of the important soil types, and matters pertaining to cultural treatments, varietal requirements, and pest and disease control will be dealt with. The details of the plan will be developed, in collaboration with the local growers' executives.

Summary of Analyses Performed at the Brisbane Laboratory, 1929-30.

Soils	328
Waters	82
By-products	30
Cane plant analyses	21
Canes and juices	26
Limes and fertilisers	5
Miscellaneous	13
Total	505

Below are detailed reports from the three Experiment Stations, giving the full results of the experiments harvested during the year, and of other work performed on the stations :—

NORTHERN SUGAR EXPERIMENT STATION, SOUTH JOHNSTONE.

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

METEOROLOGICAL.

Very favourable conditions for early planting were experienced during April, May, and June 1929, and excellent germinations resulted. During these three months 8·27 in. of rain fell, distributed over 37 wet days. The early spring months were unusually dry for these parts, the rainfall amounting to only 5·29 in. for the period July to October. The late planted cane suffered somewhat as a consequence. The November and December rains yielded 2·6 and 3·32 in. respectively, which are considerably below the average for these months.

The cane up to this period was backward, but heavy soaking rains and conditions of high humidity were experienced throughout the remainder of the growing season, and by April 1930 the crops had attained normal growth.

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

Year.	Rainfall. Inches.	Year.	Rainfall. Inches.
1919	97·61	1925	118·94
1920	123·92	1926	77·50
1921	202·52	1927	138·11
1922	107·14	1928	118·63
1923	84·78	1929	129·53
1924	146·71	1930 (9 months)	122·09

Abstract of Meteorological Observations made at the Northern Sugar Experiment Station, South Johnstone, from 1st September, 1929, to 31st August, 1930—Covering Period of Growth of Experiment Canes.

Month.	Rainfall in Inches.	Number of Wet Days.	Average Rainfall, 10 Years, 1920-1929.	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 1929	1·59	14	3·72	85·5	76·0	81·4	66·5	41·5	59·4	39·2	57·0	22·0	72·5	75·0
October 1929 ..	0·34	5	2·33	95·0	82·0	88·1	72·8	54·5	63·1	53·5	61·0	25·0	78·3	66·0
November 1929	2·60	8	3·99	100·2	86·5	91·9	78·0	55·0	69·1	54·0	66·8	22·8	83·5	70·0
December 1929	3·32	11	9·79	104·5	87·5	92·0	76·0	61·8	69·5	59·5	67·0	22·5	85·2	68·5
January 1930 ..	34·92	20	18·99	97·5	81·0	88·9	76·0	67·7	70·5	66·0	68·0	18·4	81·8	84·0
February 1930	12·14	19	21·61	91·8	82·0	89·0	75·5	62·5	71·9	60·5	69·6	17·1	80·5	81·2
March 1930 ..	35·76	23	29·75	91·0	80·5	88·0	73·0	63·0	71·0	61·0	69·0	17·0	76·6	86·0
April 1930 ..	6·26	17	14·14	86·5	80·0	84·4	69·0	60·0	63·9	58·0	61·5	20·5	75·2	84·0
May 1930 ..	18·24	28	9·82	88·5	75·5	82·0	72·5	59·0	65·5	57·2	63·2	16·5	73·1	85·0
June 1930 ..	4·95	11	6·29	84·0	68·2	79·4	69·0	48·0	59·0	46·0	57·0	20·4	67·5	80·2
July 1930 ..	4·64	15	3·99	81·5	72·0	77·2	68·5	46·5	57·4	44·5	54·8	19·8	66·3	82·0
August 1930 ..	3·16	8	2·66	84·0	72·5	78·9	70·5	36·0	55·5	34·5	53·2	23·4	68·5	81·8
	127·92	179	127·08	..	..	..	..	..	..	..	..	..	..	*78·6

* Average.

Experiments Harvested during 1930.

1. Cultivation and manurial experiment—second ratoon crop.
2. Liming experiment—second ratoon crop.
3. Coral lime experiment—first ratoon crop.
4. Soaking plants experiment—first ratoon crop.
5. Varietal trial—first ratoon crop.
6. Interspace distance experiment—plant crop.
7. Fertilizer experiment—Amounts of nitrogen and phosphate; fallowed and nonfallowed—plant crop.
8. Fertilizer and liming experiment—amounts of nitrogen and potash—plant crop.

Wo.k of the No thern Sugar Experiment Station—*continued*.

CULTIVATION AND MANURIAL EXPERIMENT (Second Ratoon Crop).

1. Ordinary cultivation. No manure.
2. Subsoiled to 18 in. No manure.
3. Ordinary cultivation. 650 lb. mixed manure per acre.
4. Subsoiled to 18 in. 650 lb. mixed manure per acre.

Block.—B1.

Variety.—Badila.

Harvested.—September 1930.

Age of Crop.—12 months.

Experimental Plan.—Single plots of each cultural treatment, with and without fertilizer.

Plots.—0·489 acre.

Cultivation.—The first ratoon crop was harvested in September 1929, and plots 1 and 3 ratooned in the usual manner to a depth of 12 inches. Plots 2 and 4 were ratooned with plough and subsoiler to a depth of 18 inches.

Fertilization.—In November 1929, plots 3 and 4 received an application of fertilizer at the following rate per acre :—

150 lb. sulphate of ammonia ;
100 lb. nitrate of soda ;
300 lb. superphosphate ;
100 lb. sulphate of potash.

Yields.

Plot No.	Treatment.	Juice.			Cane.		Cane per Acre.	C.C.S. per Acre.
		Brix.	Polarisation.	Purity.	Polarisation.	% C.C.S.		
							Tons.	Tons.
1	Ordinary cultivation (no manure) ..	22·0	20·74	94·2	17·63	16·9	**25·2**	**4·26**
2	Subsoiled to 18 in. (no manure) ..	22·0	20·60	93·6	17·51	16·7	**28·8**	**4·81**
3	Ordinary cultivation (650 lb. mixed manure)	21·7	20·22	93·1	17·19	16·3	**33·5**	**5·46**
4	Subsoiled to 18 in. (650 lb. mixed manure)	21·5	20·14	93·6	17·12	16·3	**35·2**	**5·74**

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

Plot No.	Treatment.	Plant Crop—13 Months.		First Ratoon Crop—12 Months.		Second Ratoon Crop—12 Months.		Average for 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	Ordinary cultivation (no manure)	35·5	6·16	30·0	5·15	25·2	4·26	**30·3**	**5·19**
2	Subsoiled to 18 in. (no manure)	39·2	6·67	33·1	5·60	28 8	4·81	**33·7**	**5·69**
3	Ordinary cultivation (650 lb. mixed manure)	41·0	6·79	36·2	6·00	33·5	5.46	**36·9**	**6·08**
4	Subsoiled to 18 in. (650 lb. mixed manure)	46·3	7·60	41·1	6·77	35·2	5·74	**40·9**	**6·70**

CONCLUSIONS.

This experiment demonstrates clearly two important points :—

(1) The value of deep cultivation on this type of clay loam is marked—an average increase of 3·7 tons per acre of cane resulting from subsoiling ;

(2) Results from manuring are greater with subsoiling than where ordinary cultivation methods are employed.

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

LIMING EXPERIMENTS (Second Ratoon Crop).

Block I.	1. Burnt lime, 1 ton.
	2. Burnt lime, 2 tons.
	3. No lime.
Block II.	4. Burnt lime, 1 ton.
	5. Burnt lime, 2 tons.
	6. No lime.

Block.—A3.

Variety.—Badila.

Harvested.—September 1930.

Age of Crop.—12 months.

System of Replication.—Duplicate plots of each treatment.

Plots.—0·35 acre.

Land Preparation.—At the commencement of this experiment the land was prepared by sowing with cowpea; the green crop ploughed under and allowed to rot. The field was ploughed four times to a depth of 12 inches; the lime was applied after the final ploughing and harrowed in. The first ratoon crop was harvested in September 1929, and all the plots ratooned in a uniform manner.

Manurial Treatment.—No fertilizer was applied to the plant or first ratoon crop. All plots of the second ratoons received fertilizer at the following rate per acre:—

Sulphate of ammonia, 200 lb.;
Superphosphate, 300 lb;
Sulphate of potash, 100 lb.

Yields.

Block.	No Lime.			1 Ton Burnt Lime.			2 Tons Burnt 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.	Cane per Acre.	% C.C.S. in Cane.	C.C.S. per Acre.
	Tons.		Tons.	Tons.		Tons.	Tons.		Tons.
I.	31·2	16·7	5·21	33·8	16·6	5·61	39·2	16·4	6·43
II.	30·1	16·7	5·03	34·6	16·7	5·78	37·8	16·6	6·27
Averages	**30·65**	16·7	**5·12**	**34·2**	16·65	**5·69**	**38·5**	16·5	**6·35**

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

Treatment.	Plant Crop—13 Months.		First Ratoon Crop—12 Months.		Second Ratoon Crop—12 Months.		Average for 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 lime	32·9	5·61	31·1	5·35	30·65	5·12	**31·55**	**5·36**
1 ton burnt lime	39·1	6·12	35·4	6·09	34·2	5·69	**36·23**	**5·96**
2 tons burnt lime	40·8	6·12	38·7	6·61	38·5	6·35	**39·33**	**6·36**

CONCLUSIONS.

This experiment has yielded results of considerable value, as it emphasises the need for liming acid soils—particularly those of our highly leached alluvial lands of North Queensland. The total return from liming was as follows:—

(1) 1 ton burnt lime—14 tons cane;

(2) 2 tons burnt lime—23 tons cane.

The superiority of the heavier dressing of lime is most marked.

The complete results fully substantiate the statement which was made last year, that on the acid soils of the North a lime application of at least 1 ton of burnt lime once in every rotation (five years) is necessary to maintain soil conditions favourable for optimum crop production.

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

CORAL LIME EXPERIMENTS (First Ratoon Crop).

I.	1 ton coral lime.	No lime.
II.	No lime.	1 ton coral lime.
III.	1 ton coral lime.	No lime.

Block.—A 2.

Variety.—Badila.

Harvested.—September 1930.

Age of Crop.—12 months.

System of Replication.—Three plots limed, three unlimed.

Plots.—0·0692 acre.

Treatment.—All plots were ratooned to a depth of 12 inches, and no fertilizer or further lime applied.

Growth.—The limed plots showed a slight advantage in growth two months after ratooning and this advantage was maintained up to the time of harvesting.

Yields.

Block.	No Lime.			1 Ton Coral 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.		Tons.	Tons.		Tons.
I.	34·2	15·9	5·44	35·8	15·8	5·66
II.	33·0	16·1	5·31	36·4	15·9	5·79
III.	35·1	16·0	5·62	37·8	15·8	5·97
Averages	**34·1**	16·0	**5·45**	**36·6**	15·8	**5·81**

Summary of Crop Yields—Plant and First Ratoon Crops.

Treatment.	Plant Crop—12 Months.		First Ratoon Crop—12 Months.		Average for 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.
No lime	37·7	6·07	34·1	5·45	**35·9**	**5·76**
1 ton coral lime per acre	39·4	6·28	36·6	5·81	**38·0**	**6·04**

DISCUSSION.

As was anticipated, the coral lime showed better results on the first ratoon crop than it did on the plant. When compared with the response to burnt lime, it will be found that the results are consistent with the generally accepted principle that crushed limestone is slower in its action than burnt or slaked lime. Over a period, however, the crushed limestone will probably prove quite as effective as the burnt lime, when compared on the basis of equal lime contents. (One ton of burnt lime is equivalent to $1\frac{3}{4}$ tons of limestone.)

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

SOAKING PLANTS (First Ratoon Crop).

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.
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 1930.

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.

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.	39·2	6·3	39·5	6·3	40·5	6·6	38·8	6·4	39·6	6·5
II.	40·2	6·5	40·0	6·4	39·2	6·3	40·75	6·5	40·4	6·5
Average ..	**39·7**	**6·4**	**39·75**	**6·35**	**39·85**	**6·45**	**39·77**	**6·45**	**40·0**	**6·5**

Summary of Crop Yields—Plant and First Ratoon Crops.

Treatments.	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.
1. Plants unsoaked	38·2	5·87	39·7	6·4	39·0	6·14
2. Plants soaked in lime water + 1 lb. magnesium sulphate to 50 gallons	41·4	6·38	39·8	6·34	40·6	6·37
3. Plants soaked in lime water	40·2	6·19	39·9	6·45	40·0	6·32
4. Plants soaked in water	40·4	6·15	39·8	6·45	40·1	6·30
5. Plants soaked in lime water + 5 lb. nitrate of soda in 50 gallons	41·9	6·49	40·0	6·5	41·0	6·50

DISCUSSION.

Though the plant crop yields reflected a definite increase in yield due to soaking the setts before planting, the returns from the first ratoon are quite uniform. The indication is, then, that the advantage gained in the plant crop is not maintained in the ratoons.

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

VARIETAL TRIAL (First Ratoon Crop).

I.	II.	III.
S.J. 4	S.J. 16	S.J. 3
S.J. 3	Badila	S.J. 28
S.J. 28	S.J. 4	S.J. 16
S.J. 16	S.J. 3	Badila
Badila	S.J. 28	S.J. 4

Block.—B2.

Harvested.—September 1930.

Age of Crop.—12 months.

System of Replication.—Three randomised blocks.

Plots.—0·1561 acre.

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

Meatworks	200 lb.
Sulphate of potash	100 lb.
Sulphate of ammonia ..	100 lb.
Nitrate of soda	100 lb.

Growth.—S.J. 4 displayed the most vigorous growth quite early and maintained its advantage until harvested.

Yields.

Block.	Badila.			S.J. 3.			S.J. 4.			S.J. 16.			S.J. 28.		
	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.	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.	Cane per Acre.	% C.C.S. in Cane.	C.C.S. per Acre.
	Tons.		Tons.	Tons.		Tons.	Tons.		Tons.	Tons.		Tons.	Tons.		Tons.
I. ..	35·4	16·3	5·77	36·2	15·0	5·43	54·8	14·6	8·00	42·0	14·8	6·22	39·3	14·7	5·78
II. ..	34·0	16·0	5·44	33·1	14·6	4·83	52·1	15·2	7·92	40·7	15·2	6·19	40·2	14·2	5·71
III. ..	32·6	16·3	5·31	34·4	15·1	5·19	54·0	15·0	8·10	38·8	15·0	5·82	38·4	14·5	5·57
Averages	**34·0**	16·2	**5·50**	**34·6**	14·9	**5·15**	**53·6**	14·9	**8·00**	**40·5**	15·0	**6·08**	**39·3**	14·5	**5·68**

Summary of Crop Yields—Plant and First Ratoon Crops.

Variety.	Plant Crop.			First Ratoon Crop.			Average of Two Crops.		
	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.	Cane per Acre.	C.C.S. in Cane.	C.C.S. per Acre.
	Tons.	%	Tons.	Tons.	%	Tons.	Tons.	%	Tons.
Badila	40·2	16·1	6·49	34·0	16·2	5·50	**37·1**	16·15	**6·00**
S.J. 3	42·5	14·9	6·31	34·6	14·9	5·15	**38·6**	14·9	**5·73**
S.J. 4	58·8	15·5	9·09	53·6	14·9	8·00	**56·2**	15·2	**8·55**
S.J. 16	46·2	15·2	7·02	40·5	15·0	6·08	**43·4**	15·1	**6·55**
S.J. 28	44·6	14·6	6·52	39·3	14·5	5·68	**42·0**	14·55	**6·13**

DISCUSSION.

In the first ratoon crop S.J. 4 once again showed its marked superiority in cane yield over all other varieties. Unfortunately this cane has two inherent qualities which prevent its adoption as a superior commercial variety:—

(1) Its C.C.S. content is appreciably below that of the standard, Badila;

(2) It succumbs readily to leaf-scald disease when growing conditions are adverse.

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

INTERSPACE DISTANCE (Plant Crop).

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

Block.—B5.

Variety.—Badila.

Harvested.—September 1930.

Age of Crop.—13 months.

System of Replication.—Single plots.

Manurial Treatment.—All 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 prepared according to the usual practice.

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

Block II.—Rows, 5 feet apart ;
Plants per acre, 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.	**41·6**	16·0	**6·65**
II.	5 ft.	**40·2**	16·0	**6·43**

DISCUSSION.

The results indicate that planting at 4 feet 6 inches interspace will lead to a slight increase in cane yield. The gain for the plant crop was 1·4 tons per acre, and the narrower interspace did not cause any decrease in the C.C.S. of the crop. This system of planting required 6 cwt. of plants more than the standard practice.

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

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

Treatment and Yields (Tons Cane per Acre).

	Fallowed.	Non-Fallowed.
	2N 2P 37·00	1N 2P 29·91
	1N 1P 32·92	1N 1P 29·38
I.	1N 2P 36·70	2N 2P 31·90
	2N 1P 33·70	2N 1P 30·13
	C 30·60	C 26·49
	C 29·96	2N 2P 32·90
	2N 2P 37·20	2N 1P 31·62
II.	2N 1P 33·07	C 25·40
	1N 2P 36·02	1N 1P 28·09
	1N 1P 32·22	1N 2P 30·77

III.

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

IV.

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.—

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.—Previous cane stools ploughed out July 1929. Land ploughed and harrowed four times. Planted August 1929.

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

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Squares.	Half $\log_e$ (Mean Square).
Blocks	1	0·11	0·11	0·0483
Fallowed *v.* non-fallowed	1	91·59	91·59	3·4699
Fertilizers	4	104·52	26·13	2·8428
Errors	13	10·72	0·825	1·0552
Total	19	206·94	..	..

Standard error = $\sqrt{4 \times 0{\cdot}825} = \sqrt{3{\cdot}300} = 1{\cdot}82$, or 1·43 per cent.

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	**30·3**	16·1	**4·88**	**25·9**	16·4	**4·25**
1N 1P ..	**32·6**	16·0	**5·22**	**28·7**	16·2	**4·65**
1N 2P ..	**36·35**	15·9	**5·78**	**30·3**	15·9	**4·82**
2N 1P ..	**33·4**	16·0	**5·34**	**30·9**	15·9	**4·91**
2N 2P ..	**37·1**	15·7	**5·82**	**32·4**	15·9	**5·15**

DISCUSSION.

This experiment provides some very interesting data. It shows the difference in cane yield following a green manure crop as against a "plough-out and replant," and gives us some clue as to the reason for the lower returns from the latter practice.

The results may be summarised as follows :—

Treatment.	Increase due to 200 lb. Dressing of—	
	Superphosphate.	Sulphate of Ammonia.
	Tons.	Tons.
Following green manure	3·7	0·8
"Plough-out and replant"	1·6	2·2

As might be expected, the leguminous crop has supplied practically all the available nitrate which the crop needs, and little response to sulphate of ammonia is observed; here the available phosphate is the limiting factor. With the unfallowed land the phosphate gives a lesser increase, as the nitrogen is the more serious limiting factor. In either case, the increase due to the double dressings of fertilizer are very marked (except for nitrogen following green manuring), and undoubtedly much heavier dressings of fertilizer—particularly of phosphate—would have returned profitable increases in crop yield. The heaviest dressings amounted to 900 lb. fertilizer per acre.

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

FERTILIZER AND LIMING EXPERIMENT—AMOUNTS OF NITROGEN AND POTASH.

Plan and Yields.

No Lime	2N 37·36	C 34·46	I.
	N 35·71	N K 36·67	
Lime	C 39·01	2N 41·90	
	N 40·52	N K 41·48	
No Lime	N 36·67	C 35·16	II.
	N K 37·50	2N 38·18	
Lime	2N 42·30	N K 42·17	
	N 41·07	C 40·52	

Yields, tons cane per acre.

Block.—B6.

Variety.—Badila.

Harvested.—October 1930.

Age of Crop.—13 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.

Preparation of Land.—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.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half Log$_e$ (Mean Square)
Blocks	1	2·61	2·61	2·7822
Lime	1	86·77	86·77	4·5341
Fertiliser	3	16·40	5·47	3·1522
Errors	10	0·58	0·058	0·8524
Total	15	106·36	..	..

Standard error = $\sqrt{4 \times 0{\cdot}058} = \sqrt{0{\cdot}232} = 0{\cdot}482$, or 0·31 per cent.

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	39·8	16·0	6·37	34·8	16.1	5·60
N	40·8	16·1	6·57	36·2	16·2	5·86
2N	42·1	15·9	6·69	37·8	16·0	6·05
N K ..	41·3	16·0	6·69	37·1	16·0	5·94

DISCUSSION.

These results further confirm the need for lime on the acid alluvial soils of the area. The increased crop due to lime was 4·65 tons of cane per acre. Following the ploughing in of a leguminous crop, the gains from sulphate of ammonia were not great. Further, the application of 150 lb. muriate of potash per acre resulted in an increased yield of only 1 ton of cane per acre. This supports the conclusion drawn from previous experiments on this station, that the potash deficiency on this soil type is quite small.

DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE, FROM 1st NOVEMBER, 1929, TO 31st OCTOBER, 1930.

Materials.	Number of Analyses.
Sugar-canes for growers	108
Sugar-canes for South Johnstone Show	34
Sugar-canes for Experiment Station	1,644
Sugar-cane fibres	62
Coral lime	8
Agricultural lime	12
Burnt lime	6
Fertilizers	25
Waters	10
Soils	133
Mill ash	12
Filter muds	8
Molasses	8
Total	2,070

SEEDLING PROPAGATION FOR SEASON 1930.

During the year the first arrows from the Javan varieties, imported for breeding purposes, were collected at this station. These were crossed with varieties either grown commercially in Queensland or utilised because of some specially desirable characteristic. The early results indicate that the introduction of the *spontaneum* blood imparts a high degree of vigour to the seedlings; in this respect they are far ahead of those having both parents of the species *officiniarum*.

Each year an attempt is made to combine as many suitable parents as is possible in order to obtain data regarding the values of the different crosses. To date, about 15 per cent. of the crosses have yielded seedlings showing sufficient promise to warrant a selection being made for preliminary field trials. Selfing of all varieties producing fertile pollen has also been carried out. In this way, the degree of self-fertility is determined. Further, by rigorous selection of the progeny it is hoped to eliminate marked defects in otherwise desirable canes. At a later date these will be mated to determine the degree of hybrid vigour which may result from the crossing of parents carrying a high degree of homozygosity. The results from these various crosses up to the past season will be made available at an early date.

During the year nearly 20,000 germinations were carried through, and a good selection of these was transferred to the field. In addition, a number of germinated flats and potted seedlings were transferred to the Mackay and Bundaberg Stations for propagation in those districts. This was effected quite successfully, and these advanced seedlings provide a useful supplement to the seedlings produced in these centres by local germination of arrows raised at South Johnstone.

With an increase next year in the number of arrows from the Javan varieties, it is anticipated that the numbers of seedlings of *spontaneum* blood raised at each of our three stations will be very materially increased.

YIELD OF CANE HARVESTED FROM THE SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE, SEASON 1930.

	Tons.
Cane sent to mill	881·6
Used for plants	13·1
Distributed to farmers, used for analysis, seedling propagation, and show exhibits	5·4
Total	900·1
Nature of Crop—	Per cent.
Plant cane	56·1
First ratoon	20·6
Second ratoon	23·2
Tonnages—	Tons.
Badila plant	487·1
Badila first ratoon	91·0
Badila second ratoon	157·9
Variety second ratoon	51·4
S.J. seedling plant	18·2
S.J. seedling first ratoon	94·5
Acreage under cane	23·6
Tons of cane per acre	38·14

CENTRAL SUGAR EXPERIMENT STATION, MACKAY.

MR. F. KEOGH, Chemist in Charge.

METEOROLOGICAL.

Conditions were again unfavourable for early planting during the autumn of 1929. The first four months of the year yielded 56·72 in. of rain on 47 wet days. Following the heavy rains of April (15·45 in.), May was comparatively dry; 2·45 in. of soaking rain fell in mid-June, and this assisted materially in providing suitable planting conditions in July. In many cases the August plant was seriously affected by soil moisture deficiency. Many fields gave indifferent germinations, whilst others were complete failures.

Certain scattered areas benefited from spring thunderstorms, but the major portion of the district received little rain of value until December. This was followed by 29 in. in January, but February, March, and April were characterised by rainfalls appreciably below the average.

May and June rains provided conditions for continued growth and assured a healthy condition for the crop during harvesting.

On the whole, the past season has been decidedly unfavourable for cane growth, and in many respects was very similar to that of 1928. In each year there was a dry period from June to December, followed by a poor distribution of rain in the wet season. Plant crops in the district were fair, but the ratoons suffered badly.

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 (10 months) ..	51·89
1925	54·80		

Abstract of Meteorological Observations made at Sugar Experiment Station, Mackay, from 1st September, 1929, to 31st August, 1930.—Covering Growth of Experimental Cane Crops.

Month.	Rainfall in Inches.	Number of Wet Days.	Average Rainfall, 29 Years, 1901-1929.	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. 1929	0·92	2	1·89	90·4	74·1	81·6	61·9	38·1	53·4	32·4	43·4	29·2	72·5	71·5	0·30
Oct. 1929	0·56	3	1·77	94·2	82·7	87·7	72·4	54·3	62·2	52·9	61·1	25·5	81·0	70·0	0·28
Nov. 1929	0·90	1	2·93	104·4	84·9	92·6	76·2	57·5	69·0	56·0	57·5	23·6	86·0	54·0	0·50
Dec. 1929	2·73	6	8·18	102·0	88·6	94·6	77·0	61·9	70·5	60·1	69·4	24·1	85·8	62·0	0·48
Jan. 1930	28·94	22	15·22	96·2	74·1	87·9	77·9	67·0	73·1	66·1	72·5	14·8	81·2	85·0	0·18
Feb. 1930	4·38	14	9·75	94·2	79·9	86·7	73·0	64·9	70·3	62·9	69·2	16·4	78·5	83·0	0·21
Mar. 1930	4·39	14	10·65	90·1	77·9	85·1	73·0	61·4	68·1	59·8	66·1	17·0	78·4	80·0	0·28
Apr. 1930	1·14	3	5·93	87·2	80·5	83·9	70·9	56·2	61·5	53·7	59·0	22·4	74·5	79·0	0·22
May 1930	7·88	10	3·11	84·8	72·5	77·4	63·3	47·3	50·7	45·0	53·6	16·7	69·4	77·5	0·21
June 1930	3·38	7	2·57	80·3	65·2	71·2	65·1	45·2	54·6	37·0	47·8	16·6	64·5	80·0	0·17
July 1930	0·28	4	1·36	90·1	70·3	76·1	65·0	39·8	50·9	36·2	46·8	25·2	64·1	78·0	0·18
Aug. 1930	0·60	4	1·03	87·0	68·1	78·4	68·5	37·2	51·8	34·0	48·5	26·6	65·9	79·0	0·19
	55·20	95	64·49	..	..	..	..	..	..	..	..	..	..	*75·0	..

* Average.

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

Experiments Harvested during 1930.

1. Varietal Trial, South Johnstone Seedlings, second ratoon crop.
2. Cultivation Experiment, methods of ratooning, first ratoon crop.

VARIETAL TRIAL (Second Ratoon Crop).

1. S.J. 2.
2. S.J. 4.
3. S.J. 5.
4. S.J. 15.
5. S.J. 16.

Harvested.—October 1930.

Age of Crop.—12 months.

Experimental Method.—Single plots of each variety.

Plots.—0·183 acre.

Cultivation.—After harvesting the first ratoons, ratooned by ploughing three furrows 6 in. deep and harrowing down.

Fertilizer.—All plots received the following mixture :—

Sulphate of ammonia, 250 lb. per acre.
Meatworks, 250 lb. per acre.
Sulphate of potash, 75 lb. per acre.

Growth.—All varieties ratooned well, but owing to dry soil conditions and the poor distribution of summer rains, the growth was poor. S.J. 5 again exhibited a characteristic pale variegated foliage.

Yields.

Variety.	Juice.			Cane.			Cane per Acre.	C.C.S. per Acre.
	Brix.	Pol.	Purity.	Fibre.	Pol.	C.C.S.		
	%	%	%	%	%	%	Tons.	Tons.
S.J. 2	24·4	22·71	93·1	13·2	18·57	17·7	11·5	2·04
S.J. 4	23·9	22·00	92·0	13·8	17·86	16·8	11·7	1·97
S.J. 5	21·5	18·85	87·7	13·3	15·40	14·1	9·9	1·40
S.J. 15	24·0	21·95	91·4	14·3	17·71	16·6	9·3	1·54
S.J. 16	23·0	21·47	93·3	16·0	16·96	16·1	12·1	1·95

Summary of Crop Yields.—Plant, 1st and 2nd Ratoons.

Variety.	Plant Crop—14 Months.		First Ratoon Crop—11½ Months.		Second Ratoon Crop—12 Months.		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.
S.J. 2	29·2	5·45	31·2	5·96	11·5	2·04	24·0	4·48
S.J. 4	31·1	5·23	34·0	5·85	11·7	1·97	25·6	4·35
S.J. 5	26·6	3·46	30·3	4·30	9·9	1·40	22·3	3·05
S.J. 15	29·5	5·09	28·8	5·01	9·3	1·54	22·5	3·55
S.J. 16	28·1	4·88	26·7	4·70	12·1	1·95	22·3	3·84

DISCUSSION OF RESULTS.

S.J. 2 has shown up to the best advantage in this trial. Each year it has given the best C.C.S. and the highest sugar yield per acre. It is probably the cane of the highest sucrose content grown in Queensland, and, though not a prolific yielder, has come into favour to some extent in the Mackay area.

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

CULTIVATION EXPERIMENT—Method of Ratooning, First Ratoon Crop.

1. Spring-toothed.
2. Ploughed.
3. Ploughed.
4. Spring-toothed.
5. Spring-toothed.
6. Ploughed.
7. Spring-toothed.
8. Spring-toothed.
9. Ploughed.
10. Ploughed.

Variety.—P.O.J. 2714.

Harvested.—September 1930.

Age of Crop.—12 months.

Experimental Plan.—Five plots ratooned according to each of two plans :—

1. *Ploughed.*—Three furrows 6 in. deep, worked level with harrows. Subsequent cultivation with Planet Junior.

2. *Spring-toothed.*—Ratooned with spring-tooth cultivator until cane was 2 ft. high; subsequent cultivation with Planet Junior.

Fertilizer.—All plots received a uniform dressing per acre as follows :—

Sulphate of ammonia	250 lb.
Meatworks	250 lb.
Sulphate of potash	75 lb.
	575 lb.

Yields.

Plot No.	Treatment.	Juice.			Cane.			Cane per Acre.	C.C.S. per Acre.
		Brix.	Pol.	Purity.	Fibre.	Pol.	C.C.S.		
		%	%	%	%	%	%	Tons.	Tons.
1	Spring-toothed	22·6	21·64	95·7	14·5	17·40	16·9	**24·4**	**4·10**
4	Ditto	22·8	21·55	94·5	14·5	17·34	16·6	**19·2**	**3·19**
5	Ditto	22·8	21·50	94·3	14·5	17·31	16·7	**18·5**	**3·07**
7	Ditto	23·1	21·89	94·7	14·5	17·61	16·9	**20·0**	**3·38**
8	Ditto	23·2	21·95	94·6	14·5	17·66	16·9	**12·5**	**2·11**
2	Ploughed	23·9	22·49	94·1	14·5	18·10	17·3	**20·2**	**3·49**
3	Ditto	22·9	21·65	94·5	14·5	17·43	16·7	**22·0**	**3·65**
6	Ditto	22·9	21·72	94·8	14·5	17·48	16·8	**18·9**	**3·18**
9	Ditto	22·8	21·64	94·9	14·5	17·40	16·7	**15·5**	**2·57**
10	Ditto	22·7	21·57	95·0	14·5	17·35	16·7	**17·3**	**2·87**

Average Yields :—	Tons Cane per Acre.	Tons C.C.S. per Acre.
Spring-toothed	**18·9** ..	**3·17**
Ploughed	**18·8** ..	**3·15**

DISCUSSION OF RESULTS.

The yields indicate that in a dry spring, at least, light surface cultivation of ratoons is quite as effective as the usual ratooning method of ploughing the middles. This experiment will be repeated as opportunity presents itself, to obtain data for different sets of climatic conditions.

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

FARM EXPERIMENTAL TRIALS.

During the year ten farm fertility trials were harvested and refertilized for the ratoon crop. The yields obtained from the various treatments are very encouraging, and demonstrate the value of fertilizers on the old lands of this area. In addition, eleven new trials were initiated, and we hope that the accumulated results obtained within the next few years will give us very definite data on the exact fertilizer requirements of the major soil types.

Handicapped as we are by the inadequate numbers on our field staff, it was necessary for the Chemist in Charge of the Station (Mr. Keogh) to devote a considerable proportion of his time to the farm experimental plots, in the supervision of harvesting, fertilizing of ratoons, and laying out of new experiments.

The results of the trials harvested this year will be issued in pamphlet form and freely circulated amongst interested growers within a short period.

Of the varietal trials set out on the farms of the area, one is of particular interest, as it links up closely with the yield trial of the South Johnstone seedlings reported herewith. This experiment was located on the farm of Mr. A. Petersen, Homebush. The varieties under review were the most promising two seedlings released from South Johnstone to date, S.J. 2 and S.J. 4, in comparison with P.O.J. 2714 and the standard variety Q. 813.

The results are as follows :—

VARIETAL TRIAL—Plant Crop.

Yields.

P.O.J. 2714. (1) 39·00 (2) 6·51	S.J. 2 28·40 4·88	S.J. 4 39·80 6·33	Q. 813 31·00 5·24
S.J. 2 (1) 31·60 (2) 5·15	Q. 813 41·20 6·84	P.O.J. 2714 41·80 6·67	S.J. 4 40·60 5·93
Q. 813 (1) 33·80 (2) 5·64	S.J. 4 37·60 6·28	S.J. 2 29·20 5·02	P.O.J. 2714 39·80 6·50
S.J. 4 (1) 37·40 (2) 5·80	P.O.J. 2714 36·60 5·97	Q. 813 37·40 6·10	S.J. 2 28·40 5·03

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

Location.—A. Petersen's farm, Homebush.

Experimental Method.—4 x 4 Latin Square.

Plots.—$\frac{1}{16}$ acre.

Harvested.—October 1930.

Age of Crop.—14½ months.

Growth Notes.—The canes germinated well, and were favoured by a local thunderstorm in the spring. The plots maintained a good even growth until harvested.

Summary.

Average Yield.	Q. 813.	S.J. 2.	S.J. 4.	P.O.J. 2714.
Cane, tons per acre	35·85	29·40	38·35	39·30
C.C.S., percentage in cane	16·3	17·1	15·65	15·3
C.C.S., tons per acre	5·96	5·02	6·09	6·41

Standard error = 3·14 per cent. or { 1·5 tons Cane. / 0·18 tons C.C.S.

REMARKS.

S.J. 4 and P.O.J. 2714 both gave significantly higher yields in cane and C.C.S. than the standard Q. 813. P.O.J. 2714, with its higher sugar content, appeared to be the best variety under these conditions.

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

SEEDLING PROPAGATION.

During the past season an attempt has been made to propagate seedlings on the Mackay Station. Some years ago this project was tried, but was not successful, due to the failure of the locally produced arrows to carry fertile seed.

To overcome this difficulty, recourse was had to material produced at South Johnstone. This was forwarded to Mackay in the three following states :—

(1) As potted seedlings (about 6 in. high) ;

(2) As germinated flats—seedlings 1-2 in. high, to be potted later in Mackay ;

(3) As cross-pollinated arrows, to be planted out in flats in Mackay for germination.

Each method gave very satisfactory results. The young seedlings carried well, and the arrows yielded good germinations when planted under heating frames. As a trial effort, about 1,200 selected seedlings will be planted out in the field before the end of November, and it is hoped that by next August they will be sufficiently well advanced to allow a selection to be made of the most promising individuals.

If success should attend these efforts, the breeding programme will be expanded next year, so that in future several thousands of seedlings may be raised at Mackay annually.

DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT SUGAR EXPERIMENT STATION, MACKAY, FROM 1st NOVEMBER, 1929, TO 31st OCTOBER, 1930.

Materials.	Number of Analyses.
Sugar-canes for growers	121
Sugar-canes for Station	15
Sugar-canes, Mackay Show	117
Sugar-canes, Gin Gin Show	71
Sugar-cane fibre	10
Milk samples	14
Water	1
Total	349

YIELD OF CANE FROM THE SUGAR EXPERIMENT STATION, MACKAY, SEASON 1930.

	Tons.
Cane sent to mill	130·9

Nature of crop—	Acres.
Plant crop	2·63
First ratoons	1·78
Second ratoons	4·23
	8·64

Tonnages—	Tons.	Tons per Acre.
Plant crop	64·32	27·1
First ratoons	27·46	15·4
Second ratoons	38·71	9·1
	130·49	
Average tons per acre		15·1

SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG.

Mr. J. Pringle, Chemist in Charge.

METEOROLOGICAL.

Following the severe winter of 1929, the past growing season was for the most part favourable. The autumn plant cane suffered from frost and low soil temperatures through the winter and early spring, and, with the early ratoons, made little progress until the good rains of mid-October. The cane then made rapid progress until December. A hot dry spell early in that month caused a slight check, but a fall of 3·85 in. of rain towards the end of December produced further vigorous growth which continued until the end of February.

Dry cool conditions in March brought about retarded growth, but the cane continued to make a little headway until further checked by cold weather in May. The past winter was very mild and only a few light frosts were recorded. These caused no damage to the crop, and good rains which were received during the winter and spring months maintained the crop in good condition throughout the harvesting.

Rainfall at the Southern Sugar Experiment Station, Bundaberg, during the Growing Season.

Month.	Rainfall. Inches.	Number of Wet Days.
August 1929	·40	2
September 1929	·17	3
October 1929	2·82	9
November 1929	2·36	4
December 1929	5·79	5
January 1930	12·90	21
February 1930	4·92	13
March 1930	1·66	6
April 1930	2·00	5
May 1930	2·58	6
June 1930	7·44	11
July 1930	1·17	5
August 1930	2·44	5
September 1930	2·25	5
October 1930	1·16	8
Total	49·96	108

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

Experiments Harvested during 1930.

1. Fertilizing Trial—First ratoon crop.
2. Nitrogen Trial—Plant crop.
3. Potash Trial—Plant crop.
4. Phosphate Trial—Plant crop.
5. Molasses Trial—Plant crop.
6. Amount of Nitrogen and Time of Application Experiment—First ratoon crop.
7. Ratooning Trial—First ratoon crop.

FERTILIZING TRIAL (First Ratoon Crop).

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.
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.

Variety.—Q. 813.

Harvested.—August 1930.

Age of Crop.—11 months.

System of Replication.—Duplicate plots of each treatment.

Plots.—0·182 acre.

Cultivation.—Ratooned with grubber twice in each row, in September.

Growth.—During the dry conditions following ratooning the cane did not make much headway. After the October rains, all plots came away well, particularly those receiving fertilizer. Manures were applied towards the middle of November.

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.	10·57	1·56	16·05	2·38	20·88	3·29	19·25	2·95
II.	9·32	1·33	11·94	1·71	18·89	2·74	17·80	2·57
Average ..	**9·95**	**1·45**	**13·00**	**2·05**	**19·89**	**3·02**	**18·53**	**2·76**

Summary of Crop Yields—Plant and First Ratoon Crops.

Treatment.	Plant Crop.		First Ratoon Crop.		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.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
No manure	11·9	1·61	9·9	1·45	10·9	1·53
200 lb. Sulph. Amm.	12·9	1·89	14·0	2·05	13·5	1·97
200 lb. Super.						
200 lb. Sulph. Amm.	14·2	1·94	19·9	3·02	17·1	2·48
200 lb. Sulph. Potash						
200 lb. Sulph. Amm.	13·9	1·92	18·5	2·76	16·2	2·34
200 lb. Super.						
200 lb. Sulph. Potash						

DISCUSSION.

As was anticipated, a greater response to fertilizer was obtained on the ratoon crop than on the plant. The results confirm the fact which has been observed repeatedly on the red volcanic loams of the area—that potash gives a considerable increase in crop, while nitrogen and phosphate appear to be necessary at least for the ratoons.

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

NITROGEN TRIAL (Plant Crop).

Block.—E 1.

Variety.—Q. 813.

Harvested.—September 1930.

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 in the drill at the time of planting. The sulphate of ammonia was applied as a top dressing in December.

Cultivation.—Cowpeas sown in November 1928, and a fair crop of green manure ploughed under in February 1929. Cross-ploughed and harrowed in March, ploughed again in June and later harrowed. Planted in September.

Growth.—The cane germinated well, and for a time all plots were uniform in growth. During the period of vigorous growth, the heavily fertilized plots showed up to a slight advantage.

Plan and Crop Yields.

2N P K (1) 33·63 (2) 4·91	P K 28·93 4·56	N P K 32·50 4·83	C 16·16 2·61	K 21·23 3·52
K (1) 21·04 (2) 3·16	2N P K 22·55 3·39	C 21·04 3·26	N P K 18·22 2·93	P K 14·28 3·52
C (1) 16·16 (2) 2·44	N P K 19·54 3·00	K 17·84 2·93	P K 12·02 1·86	2N P K 15·59 2·39
N P K (1) 19·16 (2) 2·67	K 16·72 2·70	P K 20·48 3·27	2N P K 15·78 2·42	C 10·51 1·71
P K (1) 18·40 (2) 2·89	C 16·90 2·53	2N P K 24·80 3·69	K 13·71 2·14	N P K 15·59 2·44

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

Results.

Analysis of Variance.

Due to—	Degrees of Freedom.	Variance.	Mean Square.
Rows	4	281·33	70·33
Columns	4	356·01	89·00
Treatment	4	122·46	30·62
Errors	12	29·97	2·498
Total	24	789·77	..

Standard Error (5 plots) = $\sqrt{5 \times 2{\cdot}498} = \sqrt{12{\cdot}290} = 3{\cdot}53$, or 3·65 per cent.

Summary of Yields.

——	No Manure.	300 lb. Muriate Potash.	200 lb. Super. + 300 lb. Mur. Potash.	150 lb. Sulph. Ammonia + 200 lb. Super. + 300 lb. Mur. Potash.	300 lb. Sulph. Ammonia + 200 lb. Super. + 300 lb. Mur. Potash.
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

DISCUSSION.

The results show the customary increase due to potash, which is the rule with the red volcanic loams of the district. The response to phosphate has been insignificant, but the single and double dressings of sulphate of ammonia have both shown quite significant increases. This is rather unusual for this district, on a plant crop following on the ploughing in of a green manure crop. The explanation probably lies in the fact which has been pointed out previously, that heavy rains falling between the time of ploughing in the crop of cowpeas and the planting of the cane may leach from the soil the valuable nitrates produced by the decomposition of the legume. Apparently this has been the case in this instance; 8½ in. of rain fell between April and June 1929.

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

POTASH TRIAL—Plant Crop.

Block.—E2.
Variety.—D. 1135.
Harvested.—September 1930.
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.

Method of Application.—All potash and superphosphate applied in the drill at the time of planting. The sulphate of ammonia was applied as a top dressing in December.

Cultivation.—In November 1928, sown to cowpeas. Fair crop of green material ploughed under in February 1929; cross-ploughed in March and ploughed and harrowed again in June; harrowed and planted in September.

Growth.—The cane germinated well and all plots made uniform growth, with no outstanding treatment.

Plan and Crop Yields.

N P 5K (1) 22·92 (2) 2·94	N P 1K 20·29 2·46	N P 3K 21·59 2·88	N P 2K 21·79 3·01	N P 4K 24·98 3·49
N P 4K (1) 18·78 (2) 2·60	N P 5K 20·67 2·93	N P 2K 23·86 3·22	N P 3K 22·55 3·01	N P 1K 21·79 3·03
N P 1K (1) 15·40 (2) 2·08	N P 3K 20·84 2·78	N P 5K 20·10 2·69	N P 4K 19·53 2·62	N P 2K 24·05 3·34
N P 3K (1) 18·22 (2) 2·39	N P 2K 20·67 2·85	N P 4K 22·73 3·11	N P 1K 21·42 3·00	N P 5K 22·92 2·75
N P 2K (1) 19·17 (2) 2·47	N P 4K 19·35 2·65	N P 1K 22·92 3·12	N P 5K 21·79 3·17	N P 3K 23·29 3·21

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

Results.

Analysis of Variance.

Due to—	Degrees of Freedom.	Variance.	Mean Square.
Rows	4	14·09	3·52
Columns	4	59·86	14·97
Treatments	4	7·19	1·80
Errors	12	28·26	2·355
Total	24	109·40	..

Standard Error (5 plots) = $\sqrt{5 \times 2{\cdot}355} = \sqrt{11{\cdot}775} = 3{\cdot}43$, or 3·23 per cent.

Summary of Yields.

	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.
Cane, tons per acre ..	20·36	21·91	21·30	21·07	21·68
C.C.S., tons per acre ..	2·74	2·98	2·85	2·89	2·90

DISCUSSION.

The 200-lb. dressing of potash appears superior in crop yield to the 100-lb. dressing, but heavier applications of potash gave no further increase.

Work of the Southern Experiment Station—*continued.*

PHOSPHATE TRIAL—Plant Crop.

Plan and Crop Yields.

N 2P K (1) 26·41 (2) 3·98	C 2·43 0·36	K 17·13 2·51	N K 18·13 2·74	N P K 15·84 2·21
K (1) 19·69 (2) 2·97	N P K 16·98 2·59	N K 18·41 2·52	N 2P K 22·84 3·27	C 5·57 0·68
N K (1) 23·55 (2) 3·72	N 2P K 16·98 2·47	C 12·13 1·70	N P K 22·98 3·26	K 18·84 2·56
N P K (1) 21·12 (2) 3·35	K 17·42 2·52	N 2P K 22·41 3·30	C 7·56 0·96	N K 19·12 3·08
C (1) 9·42 (2) 1·26	N K 18·70 2·69	N P K 21·41 3·00	K 26·84 3·89	N 2P K 24·26 3·62

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

Block.—A 1.

Variety.—Q. 813.

Harvested.—September 1930.

Age of Crop.—12 months.

System of Replication.—5 x 5 Latin Square.

Plots.—0·0876 acre.

Treatment.—

C—No manure.
N—200 lb. sulphate of ammonia per acre.
P—150 lb. superphosphate per acre.
2P—300 lb. superphosphate per acre.
K—300 lb. muriate of potash per acre.

Method of Application of Fertilizer.—All potash and superphosphate applied in the drill at planting time; sulphate of ammonia applied as a top dressing towards the middle of November.

Cultivation.—This land was under lucerne for two and a-half years prior to June 1929, when it was ploughed out, harrowed, and cross-ploughed in July. In October the block was harrowed, drilled, and planted. Subsoiling in each drill to a depth of 20 in. was practised before dropping the plants.

Growth.—Germination was good, but the shoots in the check plots were weakly and yellow, while the others were strong and healthy. The fertilized plots forged ahead rapidly; the check plots made little headway and it is doubtful whether they will ratoon.

Results.

Analysis of Variance.

Due to—	Degrees of Freedom.	Variance.	Mean Square.
Rows	4	55·87	13·97
Columns	4	103·86	25·97
Treatments	4	709·88	177·47
Errors	12	65·01	5·42
Total	24	934·62	..

Standard Error (5 plots) $= \sqrt{5 \times 5{\cdot}42} = \sqrt{27{\cdot}10} = 5{\cdot}21$, or 5·84 per cent.

Summary of Yields.

——	No manure.	300 lb. muriate of potash.	200 lb. sulph. of ammonia + 300 lb. muriate of potash.	200 lb. sulph. of ammonia + 150 lb. super. + 300 lb. muriate of potash.	200 lb. sulph. of ammonia + 300 lb. super. + 300 lb. muriate of potash.
Cane, tons per acre ..	7·42	19·93	19·53	19·67	22·58
C.C.S., tons per acre ..	0·99	2·89	2·95	2·88	3·35

DISCUSSION.

As was pointed out above, this block had been under lucerne for two and a-half years, with no fertilizer applied. It is a popular belief that cane cannot be grown successfully on the red volcanic loams following lucerne, and this experiment appears to supply the solution of the problem. Lucerne is a heavy feeder, and with continuous cutting much of the scanty supply of potash naturally occuring in these soils is removed. It is seen that the application of 300 lb. of muriate of potash alone converts a total failure into a fair crop. Sulphate of ammonia gave no further increase, but superphosphate shows a significant gain. The results from this field must be regarded as abnormal.

Work of the Southern Experiment Station—*continued.*

MOLASSES TRIAL (Plant Crop).

Plan and Crop Yield.

I.	A	(1)	32·25
		(2)	3·56
	B	(1)	28·13
		(2)	3·64
II.	B	(1)	26·81
		(2)	3·32
	A	(1)	40·13
		(2)	5·26
III.	B	(1)	21·38
		(2)	2·93
	A	(1)	38·25
		(2)	5·08
IV.	A	(1)	37·70
		(2)	5·27
	B	(1)	16·70
		(2)	2·19
V.	A	(1)	37·13
		(2)	5·13
	B	(1)	20·45
		(2)	2·65

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

Block.—A 1.

Variety.—Q. 813.

Harvested.—October 1930.

Age of Crop.—12 months.

System of Replication.—Five randomised blocks.

Plots.—$\frac{1}{8}$ acre.

Treatment.—

A—10 tons molasses per acre.
B—No molasses.

Cultivation and Application of Molasses.—This block had been under lucerne for two years prior to March 1928, when it was ploughed out and fallowed.

Light ploughings were given in May and October 1928, followed by a deep ploughing in July 1929. At the end of August it was harrowed, rolled, and the molasses applied evenly over the surface of the treated plots. Dry conditions followed and the molasses remained to a large extent unchanged until the middle of October, when good rain fell. The land was harrowed, drilled out, and planted shortly afterwards.

Growth.—A good strike was obtained in all plots which grew uniformly until the wet season, when the treated plots went ahead and maintained their advantage until harvested.

Results.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Blocks	4	42·71	10·68	1·1842
Treatments	1	518·26	518·26	3·1253
Errors	4	80·86	20·21	1·5031
Total	9	641·83	..	..

Standard Error (5 plots) = $\sqrt{5 \times 20{\cdot}21} = \sqrt{101{\cdot}05} = 10{\cdot}05$, or 6·72 per cent.

Summary of Yields.

——	Molasses, 10 tons per acre.	No Molasses.
Cane, tons per acre	37·09	22·60
C.C.S. percentage on cane	13·05	13·03
C.C.S., tons per acre	4·84	2·96

DISCUSSION.

The value of molasses on the red volcanic loams is amply demonstrated by the results of this experiment, where a 10-ton application of this by-product resulted in an increase of over 14 tons of cane. Undoubtedly this is due in a large measure to the heavy supply of potash and nitrogen added in this manner. The plots will be ratooned, with no further fertilizer treatment, in order to determine the residual effect of the molasses.

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

FERTILIZER TRIAL—Amount of Nitrogen and Time of Application (First Ratoon Crop).

Plan and Crop Yields.

I.	A (1) 25·07 (2) 4·21	C 24·17 4·06	D 19·55 3·32	B 20·44 3·49
II.	B (1) 27·01 (2) 4·54	D 25·67 4·29	A 21·94 3·75	C 17·91 2·85
III.	D (1) 22·52 (2) 3·74	A 23·42 3·98	B 21·63 3·72	C 17·45 2·86
IV.	C (1) 18·94 (2) 3·12	D 21·32 3·57	B 21·19 3·66	A 16·85 2·86
V.	C (1) 18·94 (2) 3·16	B 23·42 3·98	A 17·31 2·87	D 17·31 2·89
VI.	B (1) 21·19 (2) 3·60	C 19·24 3·12	A 20·18 3·25	D 16·00 2·77

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

Block.—C 2.
Variety.—Q. 813.
Harvested.—October 1930.
Age of Crop.—13 months.
System of Replication.—Six randomised blocks.
Plots.—$\frac{1}{12}$ acre.
Treatment.—

(1) *Fertilizer.*—
A and C.—100 lb. sulphate of ammonia.
150 lb. superphosphate.
300 lb. muriate of potash.
B and D.—200 lb. sulphate of ammonia.
150 lb. superphosphate.
300 lb. muriate of potash.

(2) *Time of Application.*—
A and B.—Potash and superphosphate and one-quarter of the sulphate of ammonia applied in the furrow at ratooning. Remainder of sulphate of ammonia as top dressing in December.
C and D.—All potash and superphosphate and one-half of sulphate of ammonia in early December; remainder of sulphate of ammonia as top dressing after heavy rain early in January.

Cultivation.—Plant crop harvested in September 1929, but, owing to hard dry nature of soil, ratooning was delayed. After rain in October the usual ratooning practice was applied on all plots.

Growth.—All plots made good even growth with no outstanding treatment.

Results.

Analysis of Variance.

Due to—	Degrees of Freedom.	Sum of Squares.	Mean Square.	Half $\log_e$ (Mean Square).
Rows	5	58·20	11·64	1·2273
*Columns	1	82·14	82·14	2·2043
Treatments	3	29·06	9·69	1·0530
Errors	14	35·67	2·548	0·4677
Total	23	205·07	..	..

* Columns (2) and (4) each contain the same treatments, so calculation of position variance was possible.

Standard Error $= \sqrt{6 \times 2{\cdot}548} = \sqrt{15{\cdot}288} = 3{\cdot}91$, **or 3·14 per cent.**

Summary of Yields.

All Plots received .. { 150 lb. superphosphate; 300 lb. muriate of potash

	+ 100 lb. Sulphate of Ammonia applied early (A).	+ 200 lb. Sulphate of Ammonia applied early (B).	+ 100 lb. Sulphate of Ammonia applied late (C).	+ 200 lb. Sulphate of Ammonia applied late (D).
Cane, tons per acre ..	**20·80**	**22·48**	**19·44**	**20·40**
C.C.S., tons per acre ..	**3·49**	**3·83**	**3·20**	**3·43**

DISCUSSION.

The results from this experiment show that 200 lb. of sulphate of ammonia on ratoons gives a decided increase over the 100-lb. dressing. Further, the value of early fertilization is demonstrated. With the heavy fertilizer dressing, the plots receiving the early application showed over 2 tons better than the plots which received their fertilizer late.

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

RATOONING TRIAL (First Ratoon Crop).

Plan and Crop Yields.

I.	A	(1)	21·37
		(2)	3·11
	B	(1)	20·45
		(2)	3·01
	C	(1)	21·12
		(2)	3·25
II.	B	(1)	19·44
		(2)	2·94
	A	(1)	17·76
		(2)	2·81
	C	(1)	17·51
		(2)	2·78
III.	A	(1)	18·38
		(2)	2·91
	C	(1)	16·07
		(2)	2·38
	B	(1)	17·32
		(2)	2·49
IV.	C	(1)	15·54
		(2)	2·41
	A	(1)	17·27
		(2)	2·74

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

Block.—D.

Variety.—Q. 813.

Harvested.—September 1930.

Age of Crop.—12 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 towards the middle of November :—

150 lb. sulphate of ammonia per acre ;

150 lb. superphosphate per acre ;

250 lb. muriate of potash per acre.

Cultivation.—The plant crop was harvested in September 1929, but owing to the hard and dry nature of the soil ratooning was postponed until after October rains.

Growth.—All plots grew evenly, with no apparent difference except in Block I., where the land is naturally superior.

Yields.

——	A.—Ploughed 3 Furrows and Harrowed Down.	B.—Grubber Twice in Row.	C.—Disked with Cotton King.
Cane, tons per acre	**18·70**	**19·07**	**17·56**
C.C.S., tons per acre	**2·89**	**2·81**	**2·70**

DISCUSSION.

The influence of the different systems of ratooning is not marked, and under last year's conditions no method was definitely superior to the others.

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

SEEDLING PROPAGATION.

During the past season seedling raising was initiated at the Bundaberg Station. Potted seedlings, germinated flats, and cross-pollinated arrows from South Johnstone were transferred to Bundaberg during the late winter, and all have made satisfactory progress. About 1,000 seedlings will be planted out in the field before the end of November, and an attempt will be made to have them sufficiently well advanced to allow of a selection about next August.

The promising seedlings raised here will be submitted as soon as possible to a gumming resistance trial by the pathological staff, and only those canes which exhibit a high degree of resistance to the disease will be carried along.

It is hoped that it may be possible to secure in this way new varieties peculiarly suited to our sub-tropical conditions, and possessing the factor of resistance to disease which is so essential in these areas.

Should this year's seedling raising project prove successful the programme will be expanded, and in future years several thousands of seedlings will be dealt with annually at Bundaberg. It will be necessary always to secure the materials for their propagation from South Johnstone, as the production of fertile arrows at Bundaberg is not practicable.

DISTRIBUTION OF CANE VARIETIES.

During the spring planting season of 1930, several tons of the Coimbatore seedlings —Co. 210, Co. 213, and Co. 227—were sold to growers desirous of securing these canes.

DETAILED REPORT OF ANALYTICAL WORK PERFORMED AT THE LABORATORY OF THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, FROM 1st NOVEMBER, 1929, TO 31st OCTOBER, 1930.

Materials.	Number of Analyses.
Sugar canes and juices for growers	590
Sugar canes and juices for Agricultural Show, Bundaberg	208
Sugar canes and juices for Agricultural Show, Maryborough	25
Sugar canes and juices for Agricultural Show, Gin Gin	319
Sugar canes and juices for Agricultural Show, Pialba	60
Sugar canes and juices for Experiment Station	155
Total	1,357

TOTAL TONNAGE OF CANE HARVESTED FROM THE SOUTHERN SUGAR EXPERIMENT STATION, BUNDABERG, DURING 1930.

	Tons.
Cane sent to mill	475·25
Cane sold for plants	25·50
Cane used for plants	1·50
Total	502·25
Nature of Crop—	
Plant cane	189·96
First ratoon cane	234·06
Second ratoon cane	57·14
Standover plant cane	21·09
Tonnages—	Per cent.
Q. 813	69·80
D. 1135	7·48
M. 1900 seedling	7·17
Other varieties	15·55
Acres harvested	**24·40**
Average tons per acre	**20·57**

5.—Work of the Division of Pathology.

REPORT OF Mr. A. F. BELL, SUGAR PATHOLOGIST, FOR THE YEAR ENDING 31st OCTOBER, 1930.

Since the presentation of the last Annual Report the Pathology Laboratory has been completed, and the division has now the advantage of convenient and well-equipped quarters which compare very favourably with similar laboratories elsewhere in the sugar world. Unfortunately, we have not yet been able to obtain land for a pathology garden, a fact which is seriously retarding the investigational work. Investigations now being carried out in the laboratory include comparative studies of the morphology and physiology of the organisms causing gumming, leaf-scald, red stripe, and mottled stripe diseases; the question of alternate hosts and over-wintering of the red stripe organism, identification and classification of cane varieties, toxicity of selected ions to the causal agents of gumming and leaf-scald diseases.

Following the transfer of the staff to the laboratory, district inspections and seed selection have this year been left mainly in the hands of the field officers of the Bureau and certain of the mills. In order to assist these officers in their work, collections of preserved and coloured specimens of some fifteen diseases have been deposited at various centres, and, in addition, detailed accounts of the present-day knowledge of the major cane diseases have been furnished in mimeographed form.

At the request of a number of Agricultural Societies, displays of photographs and preserved specimens, illustrating the symptoms of a number of diseases, were made at Agricultural Shows.

Sugar-cane Quarantine Districts.

Due to the fact that the different major diseases of sugar-cane are by no means uniformly distributed throughout the State it is very important that there be no haphazard interchange of cane plants between the different areas of infection. Accordingly, under "*The Diseases in Plants Act of* 1929" there was issued a proclamation in which the movement of sugar-cane for planting purposes, from or into a sugar-cane quarantine district, was prohibited, except upon the authority of an Inspector under the Diseases in Plants Act. The sugar belt was then divided into nine naturally defined quarantine districts as follows:—

(1) *Far Northern.*—The area lying north of a line drawn due west through Cardwell.

(2) *Herbert.*—The area lying between a line drawn due west through Cardwell, on the north, and a line drawn due west through Townsville, on the south.

(3) *Lower Burdekin.*—The area lying between a line drawn due west through Townsville, on the north, and a line drawn due west through Bowen, on the south.

(4) *Proserpine and Mackay.*—The area lying between a line drawn due west through Bowen, on the north, and Alligator Creek, on the south.

(5) *Plane Creek.*—The area lying between Alligator Creek, on the north, and a line drawn due east and west through Rockhampton, on the south.

(6) *Bundaberg-Childers.*—The area lying between a line drawn due east and west through Rockhampton, on the north, and a line following the Burrum River to its junction with the North Coast Railway, near Howard, and thence due west, on the south.

(7) *Maryborough.*—The area between the southern boundary of the Bundaberg-Childers district, on the north, and a line drawn due west from Hook Point (on the southernmost end of Great Sandy Island), on the south.

(8) *Moreton.*—The area lying between the southern boundary of the Maryborough district, on the north, and a line drawn due east and west through Brisbane, on the south.

(9) *Logan.*—The area lying between a line drawn due east and west through Brisbane, on the north, and the boundary of the State of New South Wales, on the south.

Variety Isolation Garden.

For the same reasons as those which prompted the establishment of quarantine districts it became evident that a central source of disease-free cane, from which distributions could be made, was an absolute necessity. During the year a site was acquired on one of the islands in Moreton Bay for the purpose of establishing an adequately isolated variety garden. The site selected is practically ideal from all points of view.

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

It is not proposed to accumulate an extensive variety collection as such, but to restrict it to varieties which are likely to be required for commercial and breeding purposes. In addition, this land will be used for the propagation of varieties released from quarantine, and will serve as a source of supply for foreign exchanges.

At the present time the collection consists of thirty-four varieties, while a further twenty are being grown in quarantine preparatory to transfer to the collection.

Cane Plant Nurseries.

Isolation plots, to provide disease-free cane for planting purposes, have been established in the districts of Cairns, Tully, and Bundaberg. In each case the scheme is operated by the local Farmers' Association, under the supervision of this Bureau. The Cairns District Association has established a plot on the Atherton Tableland at an elevation of about 2,500 ft.; the initial distribution was made this year, and the standard of the plants provided, and the subsequent germination, have been very gratifying.

It must be emphasised that the successful use of disease-free cane depends upon sufficient being purchased to enable the entire field to be planted. Furthermore, any subsequent supplies of cuttings which have failed to germinate must be drawn from the isolation plots also. In order to minimise the dangers of knife infection it is desirable that the cane be cut into sets before leaving the nursery.

Introduction of Varieties.

Only one variety was introduced from abroad during the year, viz., P.O.J. 2725, which was received from Java in February.

In addition, several varieties were received from the Colonial Sugar Refining Company for inclusion in the Variety Isolation Garden, and as gumming resistant canes.

Description of Varieties.

The many conflicting reports regarding disease resistance, due to mistaken identity of varieties, have proclaimed the need for a simple scheme for variety classification. For example much confusion exists as to the identity of the Q. seedlings, which differ greatly in their resistance to gumming disease, and in regard to old varieties which have several synonyms. Accordingly, an attempt is being made to construct a variety key based on constant and readily discernible characters and supplemented by detailed descriptions.

Disease Resistant Seedlings.

In order to produce varieties suitable for each of the three broad types of climatic conditions, and resistant to the important diseases of each district, seedling raising is now being undertaken at each of the three Experiment Stations. In this connection it is planned to test promising seedlings for resistance to the diseases of the district as soon as possible, and only those which attain the required standard will be liberated for farm yield trials. By this means it is hoped eventually to make disease control automatic. At present the required standard of resistance to certain diseases is very high, but, if necessary, this could be lowered when the situation improved.

To ensure the best use of available material, information is being collected by means of systematic trials on the resistance of the various blood lines to all the important diseases.

P.O.J. 2714.

It is considered that a word of warning is necessary in regard to P.O.J. 2714. There is little doubt that this variety (a full sister to P.O.J. 2878) is the most vigorous cane at present in Queensland, and, consequently, is being rapidly extended. Unfortunately, excepting only mosaic it appears to be susceptible to all the major diseases—gumming, leaf-scald, downy mildew (leaf stripe), red rot, and red stripe (top rot), and, in addition, is susceptible to many of the minor diseases. Consequently, the planting of this variety in the presence of any of the abovementioned diseases is attended by a good deal of risk, and should not be undertaken without due appreciation of this fact. It appears to be better suited to Mackay conditions than to those of other districts.

Fiji Disease at Bundaberg.

Towards the end of last year an extension of the initial outbreak of Fiji disease was discovered in the Bundaberg area. At present the disease is known to exist on 21 properties distributed as follows:—Tirroan, 8; Bingera, 4; Elliott, 3; Qunaba, 6.

Regular inspections of these and adjoining properties are being carried out, and it is expected that the disease will be kept under control with the co-operation of the farmers concerned. In order to familiarise farmers with the symptoms of the disease a window display was set up in one of the stores, and all the various stages of Fiji disease were exhibited.

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

Gumming Diseases.

Following the mild and relatively wet winter which was experienced in Southern Queensland this year, the intensity of gumming disease has been generally less than was the case last year. On the other hand the frequent periods of wet weather caused intense spreading of the disease within most fields. On the dryer soils a considerable amount of death occurred, mainly in the variety M. 1900 Seedling.

In order to make available supplies of disease-free cane for planting purposes in the Bundaberg district, regular inspections were made on more or less isolated farms, and a list of those considered suitable was circularised. In addition eight isolation nursery plots for the supply of disease-free plants have now been established.

As a result of last year's gumming resistance trials it was concluded that the three Coimbatore canes—Co. 210, Co. 213, and Co. 227—possessed considerable powers of resistance. Accordingly, these three varieties were placed in a series of farm yield trials by the Division of Soils and Agriculture. The promise of resistance has been generally maintained, and this, coupled with vigorous growth, has attracted a great deal of attention to these canes. Considerable areas have been put under Co. 210, and to a less extent Co. 213, although no definite information regarding sugar content had been obtained. The variety Co. 213 bears profuse streaks at times and at present does not appear of the same order of resistance as Co. 210. Attention is also directed to the fact that Co. 213 exhibits definite susceptibility to mosaic disease (*see* below); Co. 210 appears quite resistant to mosaic, but when it does contract the disease the effects are very marked.

Germination Trial.

To test the effects on germination when badly diseased and knife-infected cuttings are used, the following experiment was carried out. Duplicate plantings of fifty cuttings each were made using — (*a*) Healthy cane; (*b*) badly diseased cane, oozing freely; and (*c*) healthy cane, but the cuttings of which were cut alternately with the diseased cuttings. The conditions for germination were good; the variety was M. 1900 Seedling.

RESULTS.

—	No. 1.	No. 2.	Percentage Germination.
a. Healthy	46	46	92
b. Diseased	1	2	3
c. Knife Infected	31	34	65

These results demonstrate the marked reduction in germination by the use of badly diseased plants, and also the dangers of carrying the disease to healthy cuttings by means of knife infection.

Resistance Trials.

Trials for the purpose of finding varieties resistant to gumming disease form an important feature of the work in the Southern districts. Naturally the system of trial is still very much in the experimental stage, but that in use at present is as follows:—

Ten cuttings of each variety are planted in a preliminary resistance trial and when the resultant plants are 2-3 ft. high they are inoculated in the leaves with a suspension of *B. vasculorum*. Inspections are made at regular intervals and the apparent resistance and vigour recorded by a numerical scheme of classification. At maturity all varieties in which death has occurred are discarded (assuming no death in the main standard). The remainder are harvested, sweated, and planted out in a confirmatory trial in duplicate plots of fifty stools each. Several disease-free standard varieties are included in all trials. In the meantime the varieties which have advanced to the confirmatory trial are propagated in isolation in order to provide supplies for yield trials if the resistance is confirmed. However, the accumulating evidence tends to suggest that a ten-stool trial, if left unharvested until about 15th November, will in most cases yield sufficiently reliable results to render further trials unnecessary.

Two Preliminary Trials.

Two preliminary trials were planted in the Moreton district on 30th August, 1929, and inoculated on 26th November, 1929. Owing to a shortage of plants and in order to have the confirmatory trials planted in good time, these were cut out at the end of September, and sweated before cutting into plants. In this case it was assumed that canes which did not sweat gum at that date would not die during the next month or so.

Trial No. 1 was located in an area where the effects of the disease are more marked than in that in which Trial No. 2 was located.

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

Results.

TRIAL No. 1.

Varieties in which Death occurred.	No Death, but Gum Oozed from Stick.	No Death or Oozing.	Planted in Further Trial.
Q. 116	Q. 813	Korpi	Q. 813
Q. 812A (?)	Malabar	Oramboo	Korpi
Q. 970	S.C. 12/4*	Nanemo	Oramboo
H.Q. 285	H. 227	Uba	Nanemo
Pompey	26 C. 148*	Chin Chin	S.C. 12/4
D. 1135		B.H. 10/12	B.H. 10/12
M. 189		Co. 210	Malabar
M. 1900		Co. 213	Uba
Petite Senneville		Co. 227	Co. 210
Ewa 371		P.O.J. 2878	Co. 213
McBryde 6			Co. 227
McBryde 7			H. 227
25 C. 4			26 C. 148
25 C. 28			P.O.J. 2714
26 C. 52			P.O.J. 2878
26 C. 118			
26 C. 182			
26 C. 254			
27 C. 340			
27 C. 503			
22 C. 556			
E.K. 28			
P.O.J. 2714			

* Denotes a single stalk.

TRIAL No. 2.

Varieties in which Death occurred.	No Death, but Gum Oozed from Stick.	No Death or Oozing.	Planted in Further Trial.
Q. 116	H.Q. 285	Q. 813	Q. 813
Q. 812A (?)	M. 189	Uba	S.C. 12/4
Q. 970	26 C. 48	S.C. 12/4	B.H. 10/12
S.J. 3	26 C. 113	B.H. 10/12	Co. 213
S.J. 4	26 C. 122*	Co. 213	Co. 227
N.G. 15	26 C. 188*	Co. 227	Chin Chin
N.G. 16	26 C. 270*	Chin Chin	H. 227
Pompey		H. 227	Manoa 304
D. 1135		Manoa 304	26 C. 48
M. 1900 S.		26 C. 99	26 C. 99
Garvan's Black		P.O.J. 2878	26 C. 113
H. 8988			26 C. 122
Wailuku 4			26 C. 188
Wailuku 12			26 C. 270
26 C. 88			P.O.J. 2714
26 C. 149			P.O.J. 2878
26 C. 250			
E.K. 28			
P.O.J. 2714			

* Denotes a single stalk.

Discussion of Results.

It must, of course, be borne in mind that the above are preliminary trials, and it remains to be seen whether such results will be consistent.

S.J. 4 was undoubtedly the most susceptible cane, the death rate being 100 per cent. before the stools made any cane. The Co. canes, particularly Co. 210, exhibited a high order of resistance. Co. 213 appears to be the least resistant, and one or two cases of slight oozing have been found in other plantings. The Hawaiian canes (imported in 1928) proved rather susceptible on the whole, but one or two show promise, especially Manoa 304. P.O.J. 2714, as in previous trials, looks rather too susceptible, but has been planted out in further trial for demonstration purposes on account of the fact that farmers are inclined to extend plantings. The resistance so far shown by P.O.J. 2878 is very encouraging, and the growth of this variety in the trials was satisfactory.

Another small trial, which included P.O.J. 2878, P.O.J. 2364, Kassoer, and Glagah, gave indications of a high order of resistance in all four. In fact no symptoms of the disease were seen in Kassoer and Glagah, although they were artificially inoculated.

From a consideration of the above trials it will be seen that there are possibly fifteen varieties with resistance of a degree at least equal to Q. 813. A number of these have already been placed in yield trials, and the remainder will be treated in this manner as soon as possible. The Plant Pathologist of the Colonial Sugar Refining Company is conducting extensive gumming resistance trials on the Northern Rivers of New South Wales, and several resistant varieties were received from him this spring.

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

Included in our trials planted out this year are a number of interesting varieties, among which are some Uba-D. 1135 seedlings from Hawaii, two Coimbatore canes of reputed high sugar content (one an early maturing cane), and one of our own Uba-Badila Seedlings. On the whole the outlook for the control of gumming disease in the near future must be regarded as distinctly promising.

Leaf Scald.

Leaf-scald is general throughout the area north of Townsville, but is responsible for most damage in the districts of Lower Tully, El Arish, and the poorly drained country between Babinda and Aloomba. This situation should be kept in hand, since in the future supplies of disease-free plants should be available under the Tableland and Tully nursery schemes.

In Queensland this disease is second in importance only to gumming. Hitherto the attention of the Division has been directed mainly towards the latter disease, but this situation is now more promising and as soon as a pathology garden is available leaf-scald will become the major project. A preliminary resistance trial of ten varieties has been set out at South Johnstone. It is questionable whether the climatic and soil conditions of that area are suitable for this purpose, and it may be found that such trials will need to be carried out in Brisbane.

Red Stripe (Top Rot).

An investigation of this disease, commonly known as top rot or Burdekin top rot, has been in progress during the year, and the identity of the disease with the red stripe of other countries can now be accepted. Furthermore, it has been demonstrated that a top rot and stem decay, not accompanied by the red streaking of the leaves, is caused by the same organism and follows where infection takes place through wounds in the stem. The morphology and cultural characteristics of the causal organism have been studied and found to agree closely with those described for *Phytomonas rubrilineans* Lee *et al.* It has been shown that the disease is readily transmitted in the field by means of wind-blown rain, and that the causal organism may remain viable in dried leaf lesions for a period of at least six months.

Following (and probably on account of) the very dry spring of last year this disease was quite prevalent in the Tully and Johnstone districts this year. The spectacular nature of the disease caused it to attract a good deal of attention on the part of growers, but it is thought that the losses actually sustained were, in the aggregate, practically negligible. Preliminary investigations indicate that the death of a proportion of the stems benefits the survivors by the reduction of crowding, thus introducing a compensating factor. During the coming season an attempt will be made to evaluate the magnitude of the losses by means of topping experiments.

A yellowish stripe, mottled with red, has frequently been observed in the field during the course of these investigations. A bacterium has been found associated and it would appear that this stripe is identical with the " mottled stripe" recently reported from Louisiana.

Mosaic.

Mosaic disease continues to be an economic factor in only a few localities ; it is of interest to note that the Northern Field Officer has seen only one stool of mosaic during the past year. While seed selection and periodic roguing will suffice as control measures, in the vast majority of cases there do exist areas, particularly in the foothills, where these measures are inadequate. In such areas highly resistant varieties are needed, and with this need in view duplicate trials of six varieties were carried out in the Mackay area, while a further trial of seven varieties has been commenced in the Gin Gin area.

Trial No. 1 was placed in an area of moderately rapid secondary spread and Trial No. 2 in an area of extremely rapid secondary spread. In common with other trials in this district the value was greatly reduced by the poor germination resulting from the excessively dry spring.

RESULTS.

Variety.	Trial No. 1.		Trial No. 2.		Combined 1 and 2.	
	Total Stools.	Diseased Stools.	Total Stools.	Diseased Stools.	Total Stools.	Diseased Stools.
S.J. 4	38	12	30	30	68	32
Black Innis	38	19	18	15	56	34
P.O.J. 213	29	7	9	9	36	16
P.O.J. 2714	36	0	15	*1	51	1
Co. 210	41	0	20	0	61	0
Co. 213	37	8	30	15	67	23

* One stick of one stool.

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

CONCLUSIONS.

The varieties—Co. 210 and P.O.J. 2714—appear to have a high degree of resistance and are being further tested this year in another area. On the other hand S.J. 4, Co. 213, and P.O.J. 213 are obviously too susceptible to be grown in areas of rapid secondary spread. It should be mentioned that both P.O.J. 2714 and Co. 210 are extremely sensitive to mosaic when they do contract the disease.

Loss in Yield due to Mosaic.

In order to furnish local figures for the losses caused through planting mosaic-infected sets of susceptible varieties, an experiment was carried out in the Proserpine district. Forty sets of healthy and forty sets of diseased H.Q. 426 (Clark's Seedling) and M. 1900 Seedling were planted in single two-row plots. In order to equalise the initial conditions as far as possible the cane was selected so that the weight of the diseased sets equalled that of the healthy. The cane was grown under unfavourably dry conditions and the differences in yield were probably accentuated thereby. The resultant crop was weighed stool by stool and the deficiencies in weight, due to fewer and smaller sticks in the diseased stools, were as follows :—

H.Q. 426	75 per cent. approximate.
M. 1900 Seedling	50 per cent. approximate.

Mechanical Transmission.

Mechanical transmission of mosaic disease by means of the "pin-prick" method was readily effected in young plant cane during the summer months, but proved very difficult in the winter months. It is proposed to explore fully the possibilities of this method with a view to adapting it for the purpose of testing varietal resistance under controlled conditions.

The knife-cut method of transmission, reported from Java, was tried but without success.

Downy Mildew.

This disease is of economic importance only in the Burdekin district, but a distinct improvement in the situation has been brought about under the careful supervision of the district field officer. He reports increased plantings of the variety B. 208 which had been regarded as rapidly going out on account of this disease.

Leaf Burn or Sun Scald.

Several cases of leaf-burn were reported from the Bundaberg area in December 1929, the variety affected in each case being H.Q. 285 (early maturer). This trouble occurs to an appreciable extent only in a few varieties. It is brought about by the continued action of hot weather and drying winds, especially after a period of rapid growth. In a typical case the leaf which is about to become fully unfolded is dead, ashy grey in colour, and quite flaccid, for at least two-thirds of the distance from the leaf-tip (i.e., the whole of the exposed portion). The outer leaves appear quite normal, and the immature leaves contained within the dead enfolding leaf appear quite normal also. The effect is at times very alarming owing to the rapid increase in the amount of dead tissue in the leaf ; the entire exposed portion of the leaf may change from green to an ashy colour within a day. The condition, however, has no permanent effects and shortly after rain the only remaining sign is the presence of a few cases of tangle top.

Pollen Viability.

Pollen viability was further investigated at the South Johnstone Experiment Station during June and July. The basic method used was the iodine-starch test. The analyses of a large number of daily and hourly samples collected in the field have demonstrated that pollen viability varies so greatly from arrow to arrow, and from day to day in the same arrow, that the viability cannot be determined with any exactitude under South Johnstone conditions. For all practical purposes the rapid qualitative iodine-starch test carried out in the field is quite as reliable as the most detailed count. As far as this test indicated, there was no great difference in viability between pollen from the field and from cane standing in sulphurous acid solution.

Attempts to germinate pollen on various media were moderately successful, but these results also were extremely variable. They ranged from 0 per cent. to 14·5 per cent.

6.—Work of the Division of Entomology.

The Entomological Laboratories of the Bureau are situated at Meringa (near Cairns), Mackay, and Bundaberg.

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

Before mentioning the various phases of control work and scientific research engaged in during the period 1929-30, it will be interesting to briefly review early efforts in connection with the long fight against our primary insect pests of sugar-cane; tracing at the same time the nature of progress achieved during past years.

When first taking up this important work in North Queensland, in the month of September, 1914, I found that previous research carried out by Mr. A. A. Girault had consisted mainly in study of the life-cycle and habits of our scarabæid beetles, which enabled me to enter at once upon the very urgent problem of cane-grub control. Determination of the life-history and economy of other species of lepidoptera, orthoptera, &c., which were found to be devouring the leaves or boring the sticks and young shoots of plant or ratoon crops, was also a matter claiming immediate attention.

An official reference collection of insects was at once started, embracing all species found in canefields, whether injurious, useful, or of minor economic interest.

The plan of campaign initiated by the present writer at that time (1914), as being worthy of close investigation, consisted of experimentation in connection with the following phases of control work:—

(1) Trapping beetles by means of attractive odours;
(2) Poisoning food-plants of the beetles;
(3) Soil deterrents against the grubs of our "greyback";
(4) Stomach poisons for the grubs;
(5) Enlisting the services of insect enemies of cane-beetles and their grubs.

During the course of these first ten years (1914–24) several additional lines of research were also investigated, in the hope of controlling to some extent the ravages of *Lepidoderma albohirtum* Waterh. during its larval or grub condition. The most promising of these was found to be that of fumigation of infested cane land with some deadly volatile gas, heavier than the air. At the same time the relief attainable from the systematic practice of good cultural conditions was not overlooked, while various common-sense, simple methods of combating the activities of cane-beetles and their larvæ also received a full share of investigation.

During recent years (1925-30) the insecticidal merits of both paradichlorobenzene and carbon bisulphide as efficient grub destroyers have been amply demonstrated by practical experiments in the field; the value of the former fumigant having fully come up to expectations voiced in an early report on the result of initial laboratory tests carried out at Gordonvale during April 1915 (*Queensland Agricultural Journal*, vol. iii., p. 263).

Alluding very briefly to experiments carried out in connection with less promising remedial measures, it may be stated that during the course of such study more or less success resulted from the following methods of control against cane-insects in general:—

(1) Application of insecticidal solutions to grub-infested cane stools;
(2) Collecting grubs and beetles by hand;
(3) Encouraging root development by conservation of moisture and judicious manuring;
(4) Ploughing in suitable poison-bait on grub-infested land;
(5) Poisoning the leaves of feeding-trees of the beetles;
(6) Working the soil at a time when grubs are feeding close to the surface;
(7) Stopping invasion of "army worms" with lead arsenate spray;
(8) Checking increase of moth-borers by cutting out "dead-hearts";
(9) Preventing increase of weevil borer by breeding and liberation of the Tachinid parasite of same;
(10.) Checking increase of locusts by means of arsenical sprays and poison-baits.

Present Position with regard to the Economic Importance and Control of Insects Attacking Sugar-cane.

The notorious "greyback" cockchafer (*Lepidoderma albohirtum* Waterh.) still continues to be the chief cane-insect in northern portions of the State.

Being an indigenous species it naturally proves difficult to combat, in view of the fact that the present acreage under cane happens to be more or less surrounded by virgin scrub or forest country, much of which embraces enormous areas, over which this native insect continues to breed as of old.

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

Our primary cane pests should, I think, be classed as follows, arranged according to probable degree of destructiveness :—

(1) *Lepidoderma albohirtum* Waterh. ;
(2) *Rhabdocnemis obscurus* Boisd. ;
(3) *Pseudoholophylla furfuracea* Burm. ;
(4) *Lepidiota frenchi* Blkb. ;
(5) *Lepidiota caudata* Blkb. ;
(6) *Lepidiota trichosterna* Lea ;
(7) *Mastotermes darwiniensis* Frogg. ;
(8) *Cirphis unipuncta* Haw.

It is gratifying to report that damage from weevil-borer (*Rhabdocnemis obscurus*) has been reduced to a minimum for the present, owing to the effective work of *Ceromasia sphenophori* Vill. This useful Tachinid fly has been reared here and liberated in sufficient numbers to enable it to hold its own, and gradually become established in many borer-infested localities. About the beginning of the year (1930) growers ceased to apply for consignments of this parasite, so that the work of rearing specimens was discontinued for a time.

Farmers have not yet fully realised the value of such biological control work, for on selections where this beneficial insect has succeeded in establishing itself it too often happens that no provision is made by the owner for its future breeding. Indiscriminate burning of all the cane during the cutting season doubtless operates as a severe check on the activities of these Tachinid flies, or, by exterminating them altogether, necessitates the work of liberation of additional consignments being done all over again.

Control of the Greyback Cockchafer.

During the last twelve months I have not had reason to depart from the opinion voiced in my annual report for 1924-25, regarding the most promising means of controlling the grubs of this formidable insect. After sixteen years of considerable experimentation against its various life-cycle stages it appears that fumigation of grub-infested cane land offers the best chance of ultimate control.

At the same time it should not be forgotten that the winged or beetle condition presents important possibilities in this direction ; since, by collecting, trapping, or otherwise destroying these cockchafers during a period of about three weeks after their first appearance on the wing, we can prevent the laying of an enormous quantity of eggs.

As soon as they are noticed flying at dusk—which usually takes place a day or so after the first heavy rainfall in November—it is advisable to start collecting these beetles from the foliage of favourite food-plants, such as " Weeping Figs," " Moreton Bay Ash" trees, &c., chancing to grow, or previously planted for such purpose by the farmer, on or close to his headlands. To facilitate such work, the surface of the ground under these trap-trees should be cleared of vegetation, in order that all beetles falling upon it may be easily seen and picked up. A careful note should be made of this date of commencement of the flighting season, as in the event of any farmer wishing later on to fumigate his soil for cane-grubs such information would enable him to determine the age of the grubs present, together with the correct time for starting control work.

Notes on Grub Fumigation.

The principal grub fumigants made use of by growers during the last year have been paradichlorobenzene and carbon bisulphide. In field practice the latter was used as a carrier, in order that the paradichlor. might be applied in liquid form with a Danks hand-injector ; no machine for burying the dry crystalline nodules being procurable at present.

When adopting the above method of application, from 80 to 85 lb. of paradichlor. dissolved in about the same quantity of carbon bisulphide are used per acre, while the maximum amount (given to a large stool of cane) is about 22 c.cms., applied in separate small injections of 4 to 5 c.cms.

Results from Station Experiment Plots.

This branch of control work was carried out by the Assistant Entomologist, Mr. J. H. Buzacott, who during the last grub season pegged out various experiment plots, varying in size from one-twentieth to one-tenth of an acre, at Little Mulgrave, Sawmill Pocket, Aloomba, and in the district of Mossman. " Two factors," reported Mr. Buzacott, " seriously interfered with fumigation experiments in the field during 1930. Firstly, the drought experienced during the latter six months of 1929 throughout the Gordonvale district. The exceptionally dry weather rendered it difficult to locate high lands which were usually grub attacked, with a sufficiently even crop of cane to show results when fumigated. Secondly, when the rain eventually came it was in January and merged into the wet season, thereby making fumigation difficult." " In no case was a sufficient infestation of grubs in the fields examined except at Little Mulgrave, where experiments with ortho-dichlorobenzene mixed with carbon bisulphide and with benzine were tried, giving distinctly negative results. Although great care was taken to inject well

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

away from the cane, an appreciable checking was to be seen in the stools fumigated with o-dichlor. Examined in July and August the cane in the plots was still slightly backward and a fortnight after fumigation grubs were found under some of the stools."

At Sawmill Pocket a 34 per cent. kill was obtained after two days with a solution of benzine 80 parts, creosote 20 parts, by volume. After four days, however, the fumigated and check plots showed the same number of grubs.

A solution of potassium cyanide (5 oz. to 1 quart water) yielded a mortality of 13 per cent. after 48 hours, the dosage used being ¼ oz. injected 2 in. from stools and 3 in. deep. Carbon bisulphide at the rate of about 31 c.cms. per stool gave a mortality of 38·1; this poor result being attributed by Mr. Buzacott to the soil treated having set very hard, owing to not having been worked for a long time, and the grubs being fairly deep.

Some plots laid down at Aloomba and in the Mossman district were injected with paradichlor. mixed with benzine and with carbon bisulphide. The cane, both on treated and check plots, proved to be very poor, not more than 6 tons to the acre. A plot treated with the latter mixture, however, appeared to be better than any of the surrounding cane.

An interesting example of the effectiveness of carbon bisulphide when used by itself occurred last season on a cane farm at Little Mulgrave, where the grower obtained a mortality of 100 per cent. against grubs of the greyback cockchafer, those lying 22 in. away from points of injection and 18 in. deep being killed by the fumes; thus demonstrating the efficiency of this well-known fumigant which has so often been pointed out in various reports from Meringa Experiment Station.

Experiments against Grubs with Ortho-dichlorobenzene.

Although deadly to grubs confined in cages containing moist soil—a mortality of 100 per cent. occurring within three days—ortho-dichlor. when injected in doses of 7 c.cms. within 3 in. of cane-stools causes wilting and ultimate death of the plant. The Assistant Entomologist, Mr. Buzacott, who carried out these experiments, believes this form of dichlorobenzene to be extremely poisonous to plant life.

Results obtained later, under field conditions, showed that when mixed with carbon bisulphide and injected 6 in. from cane plants slight wilting took place, and living grubs were found under stools so treated.

Interesting Notes on the Oviposition of Lepidoderma albohirtum Waterh.

Some original research work was carried out by us last December in connection with the egg stage of our "greyback" cockchafer. This study, which was commenced at the beginning of its aerial life, consisted in collecting quantities of living beetles from the foliage of their feeding-trees, separating the sexes, and confining each female specimen in a suitable cage containing about 16 cubic in. of moist soil, prepared in a manner calculated to induce the captive to lay eggs. About 500 females were treated in this way between the dates 19th November to 20th December. Such collecting, coupled with that of a few additional hundreds used in other experiments during the same period, afforded opportunity for acquiring further data on percentages of the sexes in *albohirtum* occurring at different times in the flighting season.

Beetles captured from six to ten days after emergence from the ground oviposited more freely than those which had not remained longer than three or four days upon their food-plants. Many specimens which had been confined in cages a day or two after emergence from the soil died without having laid eggs. These were replaced a week or so later by females which had been on the wing nearly a fortnight.

Eggs were first observed in cages amongst the soil about 12th December, these hatching twelve to fourteen days later; while the total number of tiny grubs procured by this method of rearing was 1,226. During the fourteen days occupied by the egg condition the average shade temperature of our laboratory was 80·25 deg. Fah.

Habits of Grubs of First Instar.

As a result of investigations made by the writer it appears that tiny grubs of this species are very easily killed by earth pressure, such as that brought about by cultivation of the soil in their immediate vicinity. Possibly, sudden pressure from coarse particles of earth on all sides of the body would not only tend to prevent movement through the soil, but also be likely to cause more or less injury to the skin, which at such early stage of growth is probably more delicate than that of grubs of the third instar. Under natural conditions these newly hatched grubs enter the soil overhead by gradually tunnelling through the wall of their egg-chamber; so that during the course of subterranean progression through compact earth they would not at any time be subjected to earth pressure.

Factors Accountable for Alarming Local Outbreaks of Greyback Cockchafers.

Natural laws governing the movements of certain insects are too varied and complex to deal with here, but it may be mentioned that several species, including our "greyback" cockchafer, when chancing to multiply exceedingly over restricted areas, often seek to migrate when possible in order to ensure wider distribution of their eggs and grubs on different classes of soil;

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

thereby tending possibly to reduce the percentage of mortality likely to be caused by birds, parasitic insects, and other natural enemies. The danger which naturally threatens any animal (man included), when happening to increase abnormally, not only sounds a note of warning, but at the same time calls for wider dispersion of the species, as being the simplest and most effective remedy.

We will assume that the "greybacks" noticed destroying the cane at Banna last January had migrated from forest country, and upon reaching the green cane-lands in the Aloomba district decided to come to rest there. In the event of this having happened, the source of such invasion would probably have originated either on some portion of the forest reserved for a National Park in the parishes of Sophia and Bellenden Ker, or else on the State Forest Reserve in Cadgarra, lying south-west of Sophia and south of the parish of Grafton. In the former case the line of flight chosen by these beetles would have taken a south-easterly direction, over the country lying between the Mulgrave River and the Pyramid Range. It seems more likely, however, that the breakaway in the present instance would have occurred in the Cadgarra area, in which case the course of flight would have skirted the western slopes of the Pyramid Range, thus landing these cockchafers in the middle of Banna.

Meteorological Control of Cane Insects.

Effect of Low Temperatures on Hymenoptera and Diptera.

Certain insects are able to resist excessive cold or heat better than others, although many species are killed when subjected to a few degrees below freezing point.

The activities, for instance, of some locustids are greatly influenced by such changes, becoming practically dormant under conditions varying from 25 to 40 degrees Fah., and succumbing to an exposure for about 12 hours to a temperature of 17 degrees Fah. An exposure for about ten minutes to 130 degrees Fah. has been found to be equally fatal to grasshoppers; while, on the other hand, the greatest degree of activity in such orthopterous insects occurs between 70 and 100 degrees Fah.

During the course of breeding work with our Scoliid wasps at this Experiment Station, it was found that, in the case of *Campsomeris tasmaniensis* Sauss., the period occupied by its entire life-cycle during the hottest part of the year was 47 days for male and 50 for female wasps; the mean shade temperature during this period being 87 degrees Fah.

When rearing the winter brood, however, the time required for completion of the combined egg and larval stages of this parasite was found to be 18 to 24 days, as against 12 days for these stages during summer weather; while the complete life-cycle in the winter (from laying of egg to emergence of adult wasp) during June to September varied from 90 to 100 days, under an average shade temperature of 68 degrees Fah. Thus it appears that a fall of about 18 degrees is sufficient to account for this difference of about two months in the length of summer and winter broods of the parasite in question.

With regard to the effect of cold on certain dipterous insects, I may mention an instance which occurred at our Experiment Station last September in connection with the breeding of the Tachinid fly *Ceromasia sphenophori* Vill.

It so happened that on the 12th of that month a consignment of these parasites was wanted by an Innisfail grower, but at 7.30 a.m., when they should have been collected for transmission on the early train, nearly all the specimens were seen lying motionless on the floor boards of a large breeding cage. The thermometer registered 38 degrees Fah., with the result that these flies when examined were lying on their backs, a few only being able to feebly move a leg or two, while the remainder appeared upon first inspection to be quite dead. When some of the latter were transferred to a warm place they soon recovered and became strong enough to take to wing. By 10.30 a.m. (three hours later) after the air had become somewhat warmer the majority of specimens were found resting as usual on the sides of the cage or on cane-sticks. About 5 per cent., however, died, and it would be interesting to determine what percentage of mortality would have occurred had the temperature chanced to be a few degrees lower.

Futility of Arsenic for Cane-Grub Destruction.

Although the supposed value of white arsenic as a remedy for cane-grubs has been fully exposed, yet even at the present time some of our cane farmers in the Burdekin and elsewhere still continue to adopt a method which can only result in disappointment and financial loss.

Dr. Illingworth commenced his experiments with this arsenical in the year 1918, carrying them on throughout a period of about three years. Data filed by him at our Experiment Station in 1921 (about a couple of months before he left Queensland) show that on the 23rd of March, at a time of year when grubs were doing the greatest damage, no difference was apparent between plots treated with 100 lb. of white arsenic and those which had received 200 lb. per acre.

The cane on Block H2 at Greenhills was found to be uniformly grub-infested, no difference being observed between blocks which had been treated with this poison, and cane in the untreated check plots.

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

Notes on Cane-Grub Fumigation.

Grub fumigation cannot be carried out successfully until a spell of a few days' dry weather has allowed time for excessive wet to drain away. When this happens, the water which during rainy weather fills the spaces between the tiny soil particles is gradually replaced by air, and the land is then said to be "open," that is to say, aerated. During very wet conditions, such as occurred last season on some cane areas, it is useless to fumigate the soil at a time when grubs are in the first or second instar of development, and one can only hope that the benefit derived by the plants from such generous rainfall may counterbalance injuries received from grub attack.

When unable, through any cause, to treat grub-infested cane land during January, there is always a likelihood, also, even in years of average rainfall, that such fumigation may be stopped or even prevented by the setting in of the wet season.

It should be noted that by using paradichlorobenzene in dry crystalline state no harm can come should rain fall a few hours later, seeing that volatilisation from these nodules, although held in check temporarily while the soil remains water-logged, becomes operative again directly excess of moisture has drained away, the fumes continuing their deadly work throughout a period of three to four weeks before complete evaporation of the crystals.

Visits Paid to Sugar-growing Districts.

During the last twelve months visits of inspection, and for the purpose of liberating Tachinid fly parasites amongst cane attacked by the beetle-borer, have been made.

Notes on the "Giant Termite" of the Burdekin District.

A period of five weeks spent in this district by Mr. J. H. Buzacott (Assistant Entomologist) brought to light some interesting facts regarding the economy of the formidable "white ant" *Mastotermes darwiniensis* Frogg., and resulted in discovery of the eggs of this pest.

The actual laying of these eggs was not observed, but Mr. Buzacott is of opinion that "they may be laid by a modified type of worker, as *Mastotermes* is known to be a primitive genus." "The eggs," he reports, "are elongate, about ·05 in. in length, of a uniform brown colour, and attached by one pole in groups of twelve to twenty-four. The units in each group appear usually to be arranged in two parallel rows and are bound together throughout their length by some sticky substance, which seems to be provided from the mouth of the worker. On the nests being opened, the workers immediately proceed to carry away exposed egg masses and reattach them to the nest matrix in a secluded position."

(For methods of control advocated, *see Queensland Agricultural Journal*, vol. xxxiv., pp. 131-32).

Lepidopterous Insect Pests.

Caterpillars of the "army worms" *Cirphis unipuncta* Haw. and *C. loreyi* Dup. proved troublesome in 1929 during October to December. Infestations in most cases, however, were of moderate intensity, and successfully controlled by spraying with lead arsenate.

Moth-borers have given no cause for worry of late in the Cairns and Babinda areas.

Sap-sucking Insects.

Little or no trouble was experienced from attacks of such insects as *Aphis sacchari*, *Pseudococcus* sp., Leaf-hoppers, &c.

Detailed investigation regarding control of our Mealy Bug of cane was undertaken by the writer last June, an account of which will be found in our *Agricultural Journal*, vol. xxxiv., pp. 132-35.

Entomological Exhibits at Shows.

This Experiment Station was well represented last season at the Annual Show held at Innisfail by the Johnstone River Agricultural Society. Our comprehensive exhibit included several large showcases, illustrating, amongst other things, the life-cycle stages and primary insect enemies of notable cane pests, such as the beetle-borer (*Rhabdocnemis obscurus* Boisd.) and greyback cockchafer (*Lepidoderma albohirtum* Waterh). Various coloured charts and diagrams showing certain phases of control work, &c., together with numerous spirit specimens of the grubs, pupæ, and eggs of cane-beetles, helped to form an attractive and educational display.

This exhibit was under the charge of Mr. Buzacott, who while present at the show was able to discuss with growers interested different matters in connection with the control of insects affecting their cane.

Publications.

Science Paper, contributed to the Queensland Society of Sugar Cane Technologists, entitled :—Present Position of Entomology with regard to the Control of our Chief Insect Pests of Sugar Cane (Proc. First Ann. Conf. Qld. Soc. Sug. Cane Tech., p. 144, April 1930).

Science Paper, The Control of Root-eating Scarabæid Grubs in Queensland Cane Fields (Fourth International Congress of Entomology, Ithaca, U.S.A., vol. 11, pp. 25-33, eleven illustrations).

Bulletin No. 20. Some Notes on the Economy of Cockchafer Beetles ; 36 pages of letterpress and six full-page plates in illustration.

Monthly Progress Reports and Entomological Hints to Cane Growers, appearing in the *Queensland Agricultural Journal* and other papers.

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

Report by Mr. R. W. Mungomery, Assistant Entomologist at Bundaberg and Mackay.

General.—"White grubs" still continue to be the major entomological problem of the Southern sugar-cane districts, and cane-grub damage during the past year under review was, on the whole, more severe than has been usual for the last few years. Some of the smaller holdings at Baffle Creek were eaten out by grubs of the beetle *Lepidiota frenchi*, whilst other older centres of infestation such as the Elliott Heads also suffered from the inroads of this same pest. Dead and stunted areas where the species *Lepidiota trichosterna* was operating were noticeable in the South Kalkie and Goodwood areas, and more extensive damage was done by the species *Pseudoholophylla furfuracea* in the Isis district. Infestation by this species has also been noticed in the Woongarra, where fumigation is being carried out in an endeavour to reduce the pest to its former status.

Wireworms have given serious trouble in Mackay and Proserpine, and details of investigations carried out with these pests are referred to later in this report. Minor cane pests have given little trouble during this period.

Supply of Fumigants.—With reference to the outbreaks of grubs enumerated above, it became apparent that, when outbreaks such as these occurred, farmers must have the necessary supplies of fumigants and injectors on hand, and available at the lowest possible cost, in order to combat these pests the moment damage first becomes noticeable. Waiting for supplies from Southern firms usually meant the ruination of the crops, hence the various farmers' associations, &c., were approached with regard to the financing of these schemes, and satisfactory arrangements have now been made with the Bundaberg District Cane Growers' Executive and the Millaquin Mill Cane Suppliers' Association to have fumigants and injectors made available to growers at the following rates :—Carbon bisulphide, £2 3s. 6d. per 5-gallon drum ; liquid dichlorbenzol, £2 8s. per cwt. ; Vermorel Excelsior Injectors hired at 2s. per day.

Influence of Standover Cane and Old Ratoons on Grub Infestation.—The undesirability of the practice of ratooning cane over a long number of years or of allowing cane to stand over, from the point of view of cane-grub infestation, has been clearly demonstrated during the past season when several areas in the North Isis section have become severely infested with cane-grubs where these practices have been carried out. Large acreages from which it was anticipated cane would be harvested this year have had to be ploughed out. A report dealing with the natural increase of grubs, and the influence of ratooning and standover cane in harbouring cane-grubs, was published in the *Queensland Agricultural Journal*, February 1930, page 96, and growers should try to carry out this farming programme on those farms where grubs have commenced to harass their crops.

Machine for Injecting Solid Fumigant.—Acting in co-operation with the firm of Messrs. Wyper Bros., farm implement manufacturers of Bundaberg, an implement has been constructed which will drop measured doses of paradichlorobenzene in a furrow at intervals in grub-infested land. This machine has been constructed for conditions in North Queensland where the hotter climate is reported to be more favourable for the use of this fumigant for grub control than in the South, and at present it is being further experimented with at the Meringa Entomological Laboratory.

Heat Warfare against Grubs.—Preliminary experiments undertaken with a blow-lamp have shown that cane-grubs quickly succumb to intense heat when it is directed on them for a short time. It is thought that it may be possible to utilise several such burners coupled together, with their flames directed downwards in a furrow behind a disc plough when ploughing. As well as injuring the larger third-stage grubs, this would also account for the younger first-stage grubs, which are often passed over by boys who are employed to hand-pick the grubs in the field. Inquiries are being made into the possibility of constructing some cheaply operated burner machine, with a view to carrying out further experiments along these lines in the field.

Soil Fumigants.—Many soil fumigants have been tested during the year, and the one giving most promise is a mixture of two gallons of carbon bisulphide to one gallon of liquid dichlorbenzol. The latter is a commercial product supplied by the firm of Messrs. Hickson and Partners, Ltd., England, and its analysis is approximately 16 per cent. paradichlorbenzol, the remainder being orthodichlorbenzol. Mortalities as high as 92 per cent. have been obtained with this fumigant on typical grub-infested land.

Carbon bisulphide emulsions, such as have been used against the Japanese Beetle in America, have not proved satisfactory when used against our cane-grubs, owing to their irregularity of distribution in the soil, and also to the tendency of the earth to ball where this liquid is injected and the fumes do not penetrate far beyond the point of injection. Spreading this fumigant on the surface of the ground by means of a watering can, and allowing the fumigant to soak in, would prove too costly an operation.

Submergence of Cane Grubs in Water.—Experiments have been carried out to determine the time required to kill cane-grubs by submerging them in water. For short periods up to two days the majority recovered, but after three days 60 per cent. mortality took place, increasing as the time of submergence. It is thought that, since most of the grub damage occurs on well-drained or hilly farms, no great mortality takes place from flooding during the heavy monsoonal rains. On the other hand these rains may promote the spread of fungous diseases.

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

Cane Root Aphis.—During the year we were successful in taking the winged form of the cane-root aphis, and later several specimens of this form were bred out in the Insectary from nymphs collected in the field. Mr. G. H. Hardy, of the Queensland University, has very kindly identified the species as *Geoica lucifuga* Van der Goot, this aphis being also recorded from sugar-cane roots in Java and Formosa.

Neomaskellia bergii.—This Aleyrodid, a minor cane pest, hitherto recorded by Mr. E. Jarvis in 1914-15, and which has been comparatively scarce for many years since, suddenly appeared in large numbers last year, in widely separated parts of the State. These insects were attacked by a number of predators, and were soon reduced to negligible numbers.

Attempted Transmission of Sugar-cane Mosaic Disease by Insects.—Several sap-sucking insects which migrate from grass to sugar-cane were used in experiments to endeavour to transmit the sugar-cane mosaic disease from diseased to healthy cane plants. The following insects were used: *Nesosteles dryas* Kirk., *Tetigonia albida* Walk., *Nephotettix plebius* Kirk., and *Paromius* sp.; but since the Corn Aphis (*Aphis maidis*), which was used as a check, did not transmit the disease also, it was thought possible that the time during which the experiments were carried out was not favourable for the spread of this disease by insects, and these experiments will be repeated.

Wireworms.—These pests have accounted for a high percentage of bad strikes in the low-lying canefields of Mackay and Proserpine, and the losses due to this pest amount to several thousands of pounds annually. Investigations on this pest were commenced during the latter part of this year, and apparently one species, *Lacon* sp. (?), is responsible for nearly all the damage reported from these districts.

Dipping setts in various protective arsenicals appears to be of no use, since the newly formed shoot is the part mainly attacked. Molasses-bran baits, flavoured with amylacetate or nitrobenzene, as well as potatoes, cracked corn, cowpeas, and rotted dung, all appear to be ineffective as attrahents, and several experiments have been laid out in the field using different chemicals in the hope that one or more would prove repellent to these pests. Those being tried out comprise the following:—Naphthalene, paradichlorobenzene mixed with lime as a diluent, pine tar creosote, orthodichlorobenzene, and sulphate and muriate of potash.

At the present time, although the experiments have not been finalised, these do not give promise of being effective, and it is thought that more attention will have to be paid to the preparation of the land prior to planting, the more extensive use of burnt lime on the low-lying lands, and the further investigation of the life-cycle and habits of the pest, with a view to taking advantage of any points (if any) of weakness therein.

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

REPORT BY Mr. NORMAN BENNETT, SUGAR TECHNOLOGIST, FOR THE YEAR ENDING 30th OCTOBER, 1930.

Organisation.

The work of the division during the past year has been gradually increased, and, in order to meet the extra work for and on behalf of the mills, the staff of the division has now been increased by the appointment of Mr. E. R. Behne, a graduate of the Queensland University, as Assistant Mill Technologist, and Mr. C. W. Leece, Clerical Assistant, who is in charge of the mutual control scheme.

Other appointments outlined in previous reports have been deferred owing to lack of finance.

During the year, visits were made by the Sugar Technologist to all Queensland mills with the exception of those of the Colonial Sugar Refining Company. It is still impossible to give sufficient time for the investigation of the particular problems at any individual mill, but with the additions made to staff it is hoped that this difficulty will be rectified to some extent during the 1931 season. As the Assistant Technologist had had no previous experience in sugar-mill work, it was deemed advisable that his time during the present crushing season should be occupied in getting actual practical experience in Queensland mills, and Mr. Behne therefore spent some time at the South Johnstone Mill, Mossman Mill, and more recently at Proserpine.

The managers of these mills are accordingly thanked for their hearty co-operation with the division's scheme of training University students in technical sugar work.

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

Erection of Laboratory.

For some time past, the work of this division has been hampered through lack of an adequate research and routine laboratory. This matter has finally been overcome by a reconstruction and a reorganisation of the existing laboratory at the Mackay Experiment Station. Structural alterations of the building were completed recently, and it is hoped that all the equipment will be installed and ready for use at the commencement of 1931. A cordial invitation is extended to all interested to visit this laboratory after the 1st of January, 1931. It is hoped that the Queensland mills will readily avail themselves of the opportunity afforded by a well-equipped laboratory, by submitting to this division any problems or analyses which are required for the control of manufacture.

Report of Mill Work for Season 1929.

Crushing for the season 1929 was commenced on the 16th May and was completed on the 23rd December. The first mill to commence crushing was Hambledon, and the last one to finish, Kalamia.

All the Northern mills were in operation by the 3rd July. The maximum crop period in the Northern district was 215 days (Hambledon), and the shortest 105 days (Mossman). In the Central district, the first mill to commence crushing was Pioneer, 1st May. and all mills were working by 24th July. The maximum crop period was that of Pioneer (127 days), and the minimum, Marian (95 days).

In the Southern district the season commenced later, the first mill to commence being Fairymead on the 21st July. All the mills were working by the 2nd September, and the season terminated on 7th December.

Season 1929.	Tons Cane Crushed.	Tons 94 N.T. Sugar Made.
Mossman	73,561	11,121
Mulgrave	207,857	31,647
Babinda	212,057	31,901
South Johnstone	217,936	30,979
Mourilyan	152,287	23,630
Tully	207,945	30,756
Total, Northern District	1,071,643	160,034
Giru	79,547	11,732
Inkerman	164,251	24,152
Pioneer	134,746	20,400
Kalamia	174,030	26,049
Proserpine	92,137	13,553
Farleigh	71,422	9,951
Racecourse	80,723	12,139
North Eton	54,905	7,073
Cattle Creek	46,664	6,597
Plane Creek	97,366	14,214
Pleystowe	95,507	14,624
Marian	84,429	12,715
Total, Central District	1,175,727	173,199
Millaquin	95,346	11,265
Qunaba	36,999	4,677
Fairymead	102,367	12,172
Bingera	87,859	11,461
Isis Central	62,025	7,747
Gin Gin	27,731	3,081
Maryborough	21,010	2,634
Bauple	23,261	2,740
Moreton	48,074	6,514
Rocky Point	10,380	1,202
Alberton	872	92
Eagleby	1,323	138
Total, Southern District	516,647	63,723

NOTE.—The above figures represent the tons of cane crushed and tons of 94 n.t. sugar made for all mills except those of the C.S.R. Co., from which no figures are available.

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

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

—	Average Crop Days.	Commencement.	Finish.
Northern	174	16th May	16th December
Central	136	21st May	23rd December
*Southern	100	21st July	7th December

* Excluding Eagleby and Alberton.

AVERAGE FIGURES FOR MILL WORK, 1929 SEASON.

—	Northern. Six Mills.	Central. Ten Mills.	Southern. Eight Mills.	Total. Twenty-four Mills.
Tons cane	*1,835,317	*1,175,727	*570,665	*3,581,709
Tons 94 n.t. sugar made	*273,820	173,454	*71,242	*518,516
Net titre	97·36	97·27	97·16	97·29
Tons cane per ton sugar	*6·702	*6·78	*8·024	*6·91
Fibre in cane	11·06	13·01	14·61	12·5
Pol. in cane	16·21	15·96	13·97	15·65
Bagasse—				
Moisture	53·63	50·74	50·7	51·99
Pol.	3·03	3·14	2·81	3·02
Purities—				
1st Expressed Juice	90·18	89·63	88·19	89·57
Clarified Juice	90·14	89·10	86·80	89·07
Syrup	90·21	89·40	86·90	88·49
Brix Syrup	68·81	67·61	67·48	68·17
Gallons Molasses p.t.c.	3·93	4·25	5·20	4·34
Sugar—				
Pol.	98·37	98·36	98·61	98·41
Moisture	0·422	0·423	0·284	0·398
Tons Fuel—				
Wood	15,541	30,048	22,054	67,643
Coal	17,145	542	..	17,687
Molasses	1,184	9,577	1,812	12,573
Gallons E.S.J.	216	219·5	229	220
Extraction	95·15	94·36	93·59	94·55
Extraction Ratio	0·438	0·433	0·439	0·436
Milling loss	7·11	6·92	6·13	6·83
Pol. in Sugars—				
Per cent. Pol. in Cane	88·22	87·96	84·54	87·45
Per Cent. Pol. in Mixed Juice	92·71	93·21	90·53	92·49

Note.—Figures marked * are for all Queensland mills. Other averages are from returns received from all mills except C.S.R. Co., Pioneer Sugar Mills, Eagleby, and Alberton.

In all there was a total tonnage of 3,581,709 long tons of cane. The tons of cane required to produce 1 ton of 94 net titre sugar, viz. 6·91, is the lowest recorded to date. In the Northern district only one mill required more than 7 tons of cane per ton of 94 net titre sugar; in the Central district, three mills exceeded 7 tons of cane per ton of sugar; whilst in the Southern district, where the sugar content was lower than normal, the lowest figure recorded was 7·29 tons of cane per ton of sugar.

For some years the amount of cane required to produce 1 ton of sugar has been steadily diminishing—

Year.	Tons Cane per Ton 94 N.T. Sugar.	Year.	Tons Cane per Ton 94 N.T. Sugar.
1923	7·60	1927	7·32
1924	7·75	1928	7·18
1925	7·55	1929	6·91
1926	7·52		

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

For the 1930 season now in progress, it is anticipated that the low level reached in 1929 will be again eclipsed. From returns received from twenty-one mills which return figures to this division, the average figure to date is lower than last year's average.

The attainment of these high yields of sugar per ton of cane can be placed to the following causes :—

(1) Crushing of richer cane varieties ;

(2) Improvement in conditions of harvesting by reducing time taken to mill cane after cutting or burning ;

(3) Shorter crop harvesting periods with the result that cane is cut closer to its limits of maximum sugar content ;

(4) Increased general manufacturing efficiency.

The results of mill operations have only been available for the seasons 1928 and 1929, but the following comparisons are interesting :—

——	1928.	1929.	Increase or Decrease.
Tons cane per ton, 94 n.t. sugar	7·18	6·91	— ·27
Pol. in cane	15·42	15·65	+ ·23
Purity 1st Expressed Juice	89·11	89·57	+ ·46
Pol. Extraction	94·19	94·55	+ ·36
Pol. in sugars per cent. Pol. in cane	86·57	87·45	+ ·88
Pol. in sugars per cent. Pol. in mixed juice	91·91	92·49	+ ·58
Fibre in cane	12·50	12·50	Nil

It will be noted that the pol. in cane has increased ·23 per cent. in spite of decreases of ·07 in the Central district and of ·85 in the Southern district. Therefore, the increased density is more marked in the Northern district where the factors 2 and 3 given above are more in evidence. The results in the Southern district for 1929 were affected by early frosts and severe gumming in certain districts.

Allowing the same efficiency in millwork as in the 1928 season, the increase in pol. in cane would have resulted in a figure for tons of cane per ton of sugar of 7·07 as against an actually recorded figure of 6·91. Therefore, ·16 tons of cane per ton of sugar is the decrease due to increased manufacturing efficiency and ·11 ton of cane that due to other causes.

This marked increase in mill efficiency is most gratifying, and can be wholly ascribed to the general realisation of the fundamental essentials required for the attainment of better results.

The practical results of the Conference of Sugar Mill Managers, Engineers, and Chemists convened by the Bureau in Mackay prior to the commencement of the 1929 crushing season have been further increased by the continuation of these conferences by the Queensland Society of Sugar Cane Technologists.

In the averaged results of the 1928 season no figures were given for extra fuel used.

Large economies in the use of added fuel were apparent in 1929—more particularly in the Northern district. The application of the methods used in this district to mills in the Central and Southern districts has resulted in highly creditable fuel figures for the present season.

The first essentials for increased efficiency as set out in the first report of this Division in 1928, i.e. :—

(1) Standardised methods of sampling and analysing all products of manufacture ;

(2) Use of uniform method of calculating reports for comparative purposes ;

(3) Frequent interchange of working reports between mills ;

(4) Annual meetings of mill executives to discuss manufacturing problems based upon working operations of the preceding season ;

have been reached.

Establishment of Mutual Control.

As predicted in last year's report, a scheme for the mutual control of Queensland sugar-mills was introduced at the commencement of the 1930 crushing season. The scheme as drawn up was presented as a paper before the Cairns Conference of the Queensland Society of Sugar

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

Cane Technologists. Twenty-one mills agreed to co-operate with the division in the fortnightly distribution of manufacturing results. The details of the scheme include—

(*a*) Data sheet, filled in by mills ;

(*b*) Uniform calculation sheet used by the division—distributed to mills for checking purposes ;

(*c*) Comparative sheet, containing assembled results of all mills in the control.

The control is based upon uniform systems of sampling, preserving, and analysing mill products.

The results of the control to date have been very satisfactory, but it has been impossible to reach full uniformity at all the mills in the control. Individual results show wide variations, but these are to be expected under the present system.

Introduction of Weighing Machines for Juice, Molasses, &c.

It has been the policy of this division to stress the need for closer control of the manufacturing process. This can only be obtained by the introduction of weighing or measuring appliances for mixed juice, maceration water, final mud, and final molasses.

Two mills have already recognised this fact, and Boulogne automatic weighing machines for the measurement of final molasses are to be installed at Mulgrave and South Johnstone.

Whilst recognising that this is a step in the right direction, the division favours an attempt to control the weight of mixed juice and maceration water in preference to a control on the final molasses.

The purchase of molasses weighing machines at the two mills named was, however, influenced by other circumstances. It is hoped that the time is not far distant when machines for the measurement of mixed juice and maceration water will be installed in Queensland mills.

Standards Laboratory.

In conjunction with the mutual control scheme already established, a laboratory for the standardisation of laboratory apparatus has been established at the Mackay Sugar Experiment Station.

Standardisation of equipment will be carried out without cost to the mills, and material will be received at Mackay for testing as from 1st January, 1931.

In the past, standardisation of brix spindles, &c., has been conducted by the Government Analyst and the Agricultural Chemist. Tests carried out this year show that these standardisations are not within the limits of accuracy called for by this division.

Therefore, it is specially requested that full advantage be taken of the facilities afforded by the establishment of this section of the laboratory work in order that correct uniform standards may be introduced into mill laboratories.

Queensland Society of Sugar Cane Technologists.

This Society, formed at a meeting convened in Mackay by the Bureau of Sugar Experiment Stations in March 1929, held its first annual conference in Cairns from the 3rd to the 8th of April, 1930. Sixty-two delegates were present. The proceedings of the conference have been published in booklet form.

Utilisation of By-products.

Apart from the development of the power alcohol industry, there has been little activity in this field during the year.

However, in view of the low price of sugar, an experiment on the possibility of utilising surplus sugar for alcohol manufacture is being made by the Sugar Board at the Plane Creek Mill and the Sarina Distillery.

The experiment is confined to the manufacture of alcohol from B molasses, but the results can be generally applied to the manufacture of alcohol from all higher grade products, as the raw sugar obtainable from B molasses, though lesser in quantity than that from syrup, A molasses, or AB molasses, has the same commercial value.

Data on the experiment will not be available until February, when the distilling section of the experiment will be completed.

8.—General.

The sugar made last year (1929) was, in amount, the second highest on record, being 518,516 tons of 94 net titre as compared with 520,620 tons in 1928—the highest yet produced.

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

District.	Tons of Cane per Acre.	Tons of 94 N.T. Sugar per Acre.
Mossman to Ingham	19·71	2·94
Ayr	24·80	3·68
Proserpine	10·48	1·61
Mackay	11·54	1·71
Bundaberg, Gin Gin, &c.	12·50	1·53
Maryborough, Childers, &c.	12·20	1·56
Nambour and Beenleigh	15·28	2·00

The average tonnage of cane required to manufacture 1 ton of sugar in 1929 was 6·91, which was the lowest figure on record.

In the 1929 report of the Registrar-General it is stated that the average acreage grown by cane planters in Queensland is as under :—

	Acres.
Cairns to Townsville	53
Ayr to Mackay	44
Bundaberg to Bauple	30
Maroochy (Nambour) to Logan (Beenleigh)	10

This brings the average acreage per farmer to 40, which is the same figure as in 1928.

The number of sugar-mills in Queensland still remains at thirty-five, with two refineries—one in Brisbane and one at Millaquin (Bundaberg) ; other sugar refineries refining Queensland sugar are situated at Sydney, Melbourne, Adelaide, and Perth.

The value of the Queensland output in 1929 is given as £12,330,939 in the report of the Registrar-General.

Molasses Produced.

The output of molasses in 1929 was stated to be as under :—

How Disposed of—	Gallons.
Sold to distilleries	5,638,465
Burnt as fuel	4,202,588
Used or sold for feed	2,382,192
Sold other purposes	215,933
In stock	871,292
Used for manure	298,395
Run to waste	2,253,083
Total	15,861,948

It is notable that the amount of molasses run to waste is a decreasing figure, and that, as more molasses has been produced in recent years owing to increased crops, larger quantities are being used for economic purposes. For instance, in 1921, when only 10,734,399 gallons of molasses were made, the amount run to waste was practically the same as in 1929, when 15,861,948 gallons were manufactured. In 1921 2,262,085 gallons were sold to distilleries, but in 1929 this amount had increased to 5,638,465 gallons. Further information as to the use of molasses will be found in the report of the Mill Technologist.

8. General—*continued.*

Estimated and Actual Yields of Cane, 1929.

The following table shows the amount of cane which was estimated in October 1929 as to be crushed by the mills compared with their final returns for the purposes of assessment made early in 1930 :—

Mill.	Approximate Estimate Furnished by Mills at end of October.	Tonnages Actually Crushed at end of Season 1929.
	Tons.	Tons.
Mossman	73,561	73,561
Hambledon	218,000	216,019
Mulgrave	215,000	207,856
Babinda	215,000	212,924
Goondi	184,000	181,230
South Johnstone	220,000	217,870
Mourilyan	151,000	152,287
Tully	206,000	207,945
Victoria	215,000	209,303
Macknade	157,000	157,121
Invicta	82,000	79,507
Pioneer	136,000	134,746
Kalamia	179,000	174,030
Inkerman	167,000	164,251
Proserpine	98,000	92,118
Cattle Creek	46,665	46,644
Racecourse	82,000	80,689
Farleigh	71,422	71,422
North Eton	55,000	54,749
Marian	88,429	84,417
Pleystowe	95,500	95,507
Plane Creek	98,000	97,366
Qunaba	36,999	36,999
Millaquin	94,000	95,149
Bingera	87,000	87,859
Fairymead	94,000	102,352
Gin Gin	27,600	27,505
Childers	58,000	53,418
Isis	61,500	62,025
Maryborough	20,000	21,010
Mount Bauple	23,200	23,261
Moreton	48,000	48,074
Rocky Point	10,000	10,380
Alberton	872	872
Eagleby	1,325	1,328
Totals	3,616,073	*3,581,794

* These figures agree closely with those supplied to the Registar-General, which were 3,581,265. A later return furnished to the Sugar Mill Technologist of this Bureau gives 3,581,709 as the tonnage of cane for 1929.

Seasonal Variations.

The yield of cane in Queensland depends largely on the atmospheric conditions obtaining, and the variations in these are naturally more pronounced in the more Southern areas than in the North where the average rainfall is more assured. From a report made to the Cane Prices Board by Mr. A. J. MacGibbon, the chemical member of the Board, covering a period from 1918 to 1927, it is shown that the variations in crop yields have been as under :—

Districts.	Variation in Tons Cane per Acre.	Percentage.
Mossman to Ingham	13·8 to 21·6	57
Lower Burdekin	9·7 to 24·6	154
Mackay and Proserpine	8·9 to 16·4	84
Bundaberg and Gin Gin	7·2 to 19·6	172
Childers to Mount Bauple	7·0 to 22·1	216
*Moreton	12·0 to 23·0	92

* Moreton district possesses a heavier average rainfall than Bundaberg and Childers.

The lowest average yield of cane per acre in that period was in the Mackay-Proserpine area, viz. 12·9 tons.

Machinery.

No outstanding implements for cane cultivation have been placed on the market during the past twelve months. As far as cane harvesting machines are concerned there are at present two machines receiving trials—one is the Miller-Owen harvester being developed at Mackay, while the other is known as the Howard Harvester, invented by the originator of the rotary hoe in New South Wales, and has been tried out at Bundaberg. Neither of these machines has so far been able to fulfil all the conditions required for a successful commercial cane harvester, but both show much promise. It is trusted that they will be eventually successful.

8. **General**—*continued.*

Peak Year Scheme.

What is colloquially known as the " Peak Year " scheme came into operation this year. This was the outcome of a conference held in June 1929, at which it was decided that the highest output of sugar of each mill in Queensland in any one year since 1915 be taken as the limit of any future year's production for that particular mill. All sugar produced by any mill beyond this limit, or any sugar manufactured from cane grown on unassigned lands, shall be deemed to be extra surplus, and shall be placed in a separate export pool, the price payable being the netted price realised for all sugar exported.

The reassignments of all lands by the Central Cane Prices Board shall be finalised and simultaneously gazetted at the close of the coming crushing season.

The Sugar Board shall be deemed the authority to fix the peak years of all mills in accordance with these resolutions.

In the Proclamation of 5th June, 1930, excess sugar was defined as—

(1) Such portion of the deliveries by each millowner as the Sugar Board shall, in its sole discretion, determine, represents sugar manufactured from sugar-cane grown on lands which are not assigned pursuant to the provisions of section 5 of " *The Regulation of Sugar Cane Prices Acts, 1915 to 1922,*" the determination of the Sugar Board to be final and not subject to appeal ; and

(2) The amount (if any) by which the deliveries made by a millowner, other than deliveries of sugar provided for and described in subclause (i.) of this clause, exceed the quantity of 94 net titre sugar specified opposite the name of such millowner and his mill in the Appendix to this Schedule.

Appendix.

Peak Amount of Sugar allowed to each Mill in Proclamation of 5th June, 1930, before Sugar is Deemed Excess.

Name of Mill Owner.	Name of Mill.	Quantity of 94 Net Titre Sugar.
A. J. and H. Rehfeldt	Alberton	252
The Babinda Central Mill Company, Limited	Babinda	31,901
Gibson and Howes, Limited	Bingera	17,864
The Cattle Creek Co-operative Sugar Milling Association, Limited	Cattle Creek	8,791
The Colonial Sugar Refining Company, Limited	Childers	16,317
Eagleby Sugar Company	Eagleby	265
Fairymead Sugar Company, Limited	Fairymead	15,882
Farleigh Co-operative Sugar Milling Association, Limited	Farleigh	16,993
Gin Gin Co-operative Sugar Milling Association, Limited	Gin Gin	6,000
The Colonial Sugar Refining Company, Limited	Goondi	27,034
The Colonial Sugar Refining Company, Limited	Hambledon	31,836
Pioneer Sugar Mills, Limited	Inkerman	24,207
The Haughton Sugar Company, Limited	Invicta	11,736
Isis Central Sugar Mill Company, Limited	Isis	11,874
The Australian Estates and Mortgage Company, Limited	Kalamia	26,053
The Colonial Sugar Refining Company, Limited	Macknade	30,952
The Marian Central Mill Company, Limited	Marian	18,997
The Maryborough Sugar Factory, Limited	Maryborough	3,862
The Millaquin Sugar Company, Limited	Millaquin	14,443
Moreton Central Sugar Mill Company, Limited	Moreton	11,586
Mossman Central Mill Company, Limited	Mossman	14,972
The Mount Bauple Co-operative Sugar Milling Association, Limited	Mount Bauple	6,231
Australian Sugar Company, Limited	Mourilyan	23,630
The Mulgrave Central Mill Company, Limited	Mulgrave	31,643
North Eton Co-operative Sugar Milling Association, Limited	North Eton	9,319
Pioneer Sugar Mills, Limited	Pioneer	21,391
Plane Creek Central Mill Company, Limited	Plane Creek	18,233
Amalgamated Sugar Mills, Limited	Pleystowe	19,781
The Treasurer of Queensland	Proserpine	16,650
The Millaquin Sugar Company, Limited	Qunaba	8,940
The Racecourse Co-operative Sugar Association, Limited	Racecourse	18,066
W. Heck	Rocky Point	1,777
The South Johnstone Co-operative Sugar Milling Association, Limited	South Johnstone	30,979
The Treasurer of Queensland	Tully	30,930
The Colonial Sugar Refining Company, Limited	Victoria	32,221
Totals		611,608

8. General—*continued.*

C.C.S. Formula.

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

$$\text{Total soluble solids in juice} \times \frac{100 - (3 + \text{Fibre})}{100} = \text{total soluble solids in cane.}$$

$$\text{Sucrose in juice} \times \frac{100 - (5 + \text{Fibre})}{100} = \text{sucrose in cane.}$$

$$\text{Total soluble solids in cane} - \text{sucrose in cane} = \text{impurities in cane.}$$

$$\text{Sucrose in cane} - \frac{\text{Impurities in cane}}{2} = \text{commercial cane sugar.}$$

Balance Sheet.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FROM 1ST JULY, 1929, TO 30TH JUNE, 1930.

Receipts.	£	s.	d.	Disbursements.	£	s.	d.
1929—				1930—			
1st July—				30th June—			
To Balance	11,173	15	5	By Salaries	8,650	15	0
1930—				,, Wages, Travelling Expenses,			
30th June—				Chemicals, &c.	8,895	7	8
,, Assessments..	14,924	3	7	,, Subsidy Destruction Sugar-cane			
,, Endowment..	14,924	3	7	Pests	2,177	7	1
,, Bundaberg Station..	512	9	3	,, Bundaberg Contingencies ..	941	5	4
,, Mackay Station	587	12	1	,, Mackay Contingencies	1,688	11	5
,, Johnstone Station	1,166	6	8	,, Johnstone Contingencies ..	1,998	2	7
,, Gordonvale Station	37	0	7	,, Gordonvale Contingencies ..	1,143	3	5
,, Sundries	18	9	0	,, Balance, 30th June, 1930 ..	17,849	7	
	£43,344	0	2		£43,344	0	2

Brisbane, 5th December, 1930.

H. T. EASTERBY, Director.

Price, 1*s.* 6*d.*]

By Authority: Joseph Heeney Stanley, Acting Government Printer, Brisbane.