1919.

QUEENSLAND.

NINETEENTH ANNUAL REPORT OF THE BUREAU OF SUGAR EXPERIMENT STATIONS

(AS REQUIRED BY "*THE SUGAR EXPERIMENT STATIONS ACT OF* 1900").

Presented to both Houses of Parliament by Command.

TO THE HONOURABLE THE SECRETARY FOR AGRICULTURE AND STOCK.

SIR,—I have the honour to submit the Annual Report of the General Superintendent of Sugar Experiment Stations up to the end of October, 1919.

E. G. E. SCRIVEN,
Director.

Brisbane, 1st November, 1919.

The Annual Report of the Bureau for this year comprises :—

1. Introduction.
2. Approximate Estimate of the 1919 Cane Crop.
3. General Work, with Brief Survey of the Various Sugar Districts.
4. Varieties of Cane Introduced.
5. Work of the Southern Sugar Experiment Station, Bundaberg.
6. Work of the Central Sugar Experiment Station, Mackay.
7. Work of the Northern Sugar Experiment Station, South Johnstone, Innisfail.
8. Sugar Canes, Seedlings, Varieties at Kairi, &c.
9. Work of the Laboratories.
10. Work of the Division of Entomology.
11. Variety Plots.
12. Lime, Green Manures, and Fertilisers.
13. Economics of the Industry.
14. General.

1.—INTRODUCTION.

During the present year the Sugar Industry has been marking time. The agreement with the Commonwealth by which £21 per ton is paid for raw sugar terminates at the end of this season. Sugar in every other country is now commanding very high prices; £50 per ton and upwards is being paid. The Australian consumers are, therefore, getting their sugar at very much lower rates than elsewhere, but, notwithstanding this fact, we see an agitation at the present moment amongst the jam manufacturers in the South for cheap sugar. The Queensland cane farmer has never asked for war prices for his product, but has accepted the lowest price in the world for it. This should be remembered in his favour if prices are again fixed. During the year the industry has again been made the subject of a Federal Royal Commission, which has for some months past been making inquiry into the various conditions under which the refiners, millers, growers, and labourers work, and the relation of the industry to the consumer. Its report has not yet been furnished.

The drought which commenced in Queensland towards the end of last year, following on the amount of damage to cane caused in the Mackay, Babinda, and Innisfail districts, not only had a prejudicial effect on last year's crop, but has materially affected the yield of the present year in many of our sugar districts. About the middle of the 1918 season it was estimated that some 206,000 tons of sugar would be realised, but owing to the cane generally cutting out much lighter than was anticipated, the total yield only reached 189,978 tons of sugar, or 117,736 tons less than were manufactured in the preceding record year of 1917. The present season is even worse. While the variation in our cane crops is of course largely due to climatic conditions there is still room for great improvement in methods of cultivation and fertilising. Unfortunately the bulk of our cane farmers do not possess sufficient capital to launch out in these directions,

and the high prices of fertilisers and implements during the past five years have militated strongly against any marked improvement. It is not good business to have to send millions of pounds out of this country to buy sugar which could be manufactured here if conditions were sufficiently encouraging. During the past few years there has been no stability in the industry, and, were growers once assured that this would be rectified, there would be a considerable expansion in sugar growing and manufacturing.

2.—APPROXIMATE ESTIMATE OF THE 1919 CANE CROP.

The outlook for the present season owing to the drought at the end of 1918, which has continued in many of our sugar districts during most of the present year, is not too promising as far as the total yield of sugar is concerned. The districts of Bundaberg and Childers are particularly backward, and a very small crop will be harvested there this year. What rains did set in fell too late to benefit the crop, and subsequent frosts did much damage in the Southern districts. In the North, where the summer heat is retained longer, the late rains greatly stimulated the present crop and materially increased the estimated yield in nearly all the Northern sugar districts. This, however, fell away again after a long period of dry weather.

The Lower Burdekin district is also a good deal behind this season owing to the drought. The 1919 crop will therefore be much under its two immediate predecessors.

The following table shows the rough approximate estimate made in May and the approximate estimate furnished by the different mills during the month of October. It will be noted that seven of the mills are not crushing at all this year. Six of these are not operating due to the drought, while Invicta, the seventh, is in process of removal from the Bundaberg district to the Haughton River near Townsville. It will be seen that a material reduction has had to be made in the estimate between May and October due to the drought continuing instead of breaking as was at that time hoped :—

Mill.	Rough Approximate Estimate Made in May.	Approximate Estimate in October, Furnished by the Mills.	Remarks.
Mossman	60,000	56,000	
Babinda	150,000	150,000	If weather conditions enable crushing to be extended till end of January.
Hambledon	78,000	85,000	
Mulgrave	75,000	74,000	
South Johnstone	85,000	80,000	
Goondi	90,000	75,000	Reduction due to poor tonnage of ratoons.
Mourilyan	60,000	58,000	
Victoria	75,000	88,000	
Macknade	75,000	75,000	
Kalamia	30,000	25,000	Cane being crushed at Pioneer.
Pioneer	51,000	35,700	Reduction due to severe dry weather.
Inkerman	50,000	50,000	
Proserpine	50,000	40,000	Reduction due to severe dry weaher.
Plane Creek	38,000	35,000	
Homebush	45,000	43,000	
Cattle Creek	36,000	30,000	
North Eton	23,000	26,000	
Marian	35,000	40,000	
Farleigh	42,000	30,000	Reduction due to severe dry weather.
Racecourse	40,000	35,000	
Palms	..	..	Cane will be crushed at Pleystowe this season.
Pleystowe	45,000	54,000	
Qunaba	..	..	Not crushing this season.
Millaquin	27,000	26,000	
Bingera	35,000	14,500	Reduction due to drought.
Fairymead	35,000	20,000	
Gin Gin	..	..	
Invicta	..	..	In process of removal to Haughton River.
Doolbi	..	..	
Isis Central	..	..	
Childers	25,000	9,000	Reduction due to drought and frost.
Maryborough	7,000	2,000	Reduction due to drought frost, and the fact that part of the crop has been sold for feeding purposes.
Mount Bauple	..	..	
Moreton	27,000	25,000	
Logan and Albert	500	500	Very dry weather has been experienced and part of the crop has been sold for fodder.
Junction	1,500	1,200	
Steiglitz	2,500	2,000	
Rocky Point	4,000	4,000	
Eagleby	850	500	
Carbrook	700	650	
Totals	1,399,050	1,290,050	

The above figures are approximate only. The commercial cane sugar has been so high in the cane this season that it will perhaps be safe to say that a ton of sugar may be made from 8·3 tons of cane this season. If that is so, then we may expect that a yield in the vicinity of 155,000 tons of sugar should be obtained, providing matters continue to run smoothly and the high sugar content remains in the cane. Unfortunately, partly owing to the maritime strike, ships are not coming along very fast to take away the raw sugar, and as large stocks had been stored loose in many of the Northern mills, due to lack of sacks, it is quite possible that a good deal of this sugar may deteriorate if the wet season were to set in before it is all shifted. During the crushing some of the Northern mills that had commenced work were forced to close up again for periods of a fortnight to three weeks due to supplies of sugar-bags not coming forward. However, should the cane crop yield 155,000 tons of sugar as estimated, this will be about 35,000 tons of sugar less than was made last year, and 152,714 less than was made in 1917. The estimated yield of New South Wales sugar is not known, but putting it and that of Victoria (beet) at 10,000 tons would give the yield of Australian sugar as 165,000 tons. This would leave a shortage of at least 100,000 tons, but probably more, as the consumption has been stated to be about 280,000 tons this year.

Comparative Progress of the Industry during the past Twenty Years.

Taking the yield of cane and sugar per acre and the tons of cane required to make one ton of sugar over the past 20 years as shown in the following table, it may be noted that during the last 10 years there has been an average increase in the production of cane and sugar and a decrease in the amount of cane required to make a ton of sugar. This last figure is even better than it appears, as it is only during recent years that the yield of sugar has been calculated to the basis of 94 net titre :—

Table showing Yield of Cane and Sugar per Acre and Tons of Cane required to make One Ton of Sugar during Twenty 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	14·76	1·60	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	17·37	1·99	8·68

The improvement shown in the last column can no doubt be attributed to some extent to greater efficiency in mill work ; but it is also large due to the improved varieties of sugar-cane grown by farmers and better cultivation during recent years. Many of these varieties have been distributed from the Bureau of Sugar Stations.

The following table shows the improvement in the areas and amount of cane harvested and sugar made during the past 20 years :—

TABLE SHOWING TOTAL ACRES CRUSHED AND TOTAL YIELDS OF CANE AND SUGAR PER ACRE FOR A PERIOD OF TWENTY YEARS.

Year.	Acres Crushed.	Yield.	
		Tons Cane.	Tons Sugar.
1899	79,435	1,176,466	123,289
1900	72,651	848,328	92,554
1901	78,160	1,180,091	120,858
1902	59,102	641,927	76,626
1903	60,375	823,875	91,828
1904	82,741	1,326,989	147,688
1905	96,093	1,415,745	152,722
1906	98,194	1,728,780	184,377
1907	94,384	1,665,028	188,307
1908	92,219	1,433,315	151,098
1909	80,095	1,163,569	134,584
1910	94,641	1,840,447	210,756
1911	95,766	1,534,451	173,296
1912	78,142	994,212	113,060
1913	102,803	2,085,588	242,837
1914	108,013	1,922,633	225,847
1915	94,459	1,152,516	140,496
1916	75,914	1,579,514	176,973
1917	108,707	2,704,211	307,714
1918	111,572	1,674,829	189,978

3.—GENERAL WORK, WITH BRIEF SUMMARY OF SUGAR DISTRICTS.

The work of the General Superintendent and the Field Assistant embraces the policy of moving around the sugar districts and keeping in touch with the cane farmers and the industry generally. The Field Assistant is constantly moving from farm to farm endeavouring to assist cane farmers in every way. The General Superintendent gives frequent addresses to cane farmers on methods of cultivation and treatment of cane lands. Farmers requiring analyses of their soils and advice as to manuring are aided by the Sugar Bureau.

The Field Assistant is Mr. J. C. Murray, who has been carrying out the work during the past 12 months in a satisfactory manner. In addition to instructing farmers he receives instructions to make the following observations on each farm visited. These notes are tabulated and sent in to the General Superintendent every month :—

NOTES UPON FARMS VISITED.

(*a*) *Soils.*—Classification, type, colour. Are they shallow or deep, forest or scrub, dry or wet ? Condition of tilth, nature of subsoil ; acidity or alkalinity of soil to be tested with litmus papers. Presence of rocks, gravel, stones, and washaways.

(*b*) *Crops.*—What number of cane crops have been grown, and during how many years ? What are the highest and lowest tonnages of cane secured ? Does land grow good crops at present time ; and, if not, to what does the farmer attribute the reason ?

(*c*) *Lime.*—Ascertain if any farmers have used lime, and what the results have been ; also note if there are any probable sources of lime on the district.

(*d*) *Green Manures.*—What farmers are using green manures ? What crops have been or are being grown, and with what success as to the crop itself, and its after effect on the cane crop ?

(*e*) *Fertilisers.*—What (if any) fertilisers are being used ? Times of application, in drills with cane, or at sides of rows ; what quantities are employed ? Are machines used for the purpose ; if so, what type ; or is application by hand ? Has application been successful ?

(*f*) *Drainage.*—Is any form of drainage used ; if so, of what nature?

(*g*) *Irrigation.*—Is irrigation in use? How much applied per acre at each watering ? How applied ?

(*h*) *Weather.*—Rainfall statistics. Notes of heavy rains can be made, severe winds causing damage to cane, thunderstorms, frosts, floods, &c.

(*i*) *Ploughing.*—How many ploughings are usually given ? Types of ploughs. Are disc or swing ploughs most common ? Diameter of disc in general use. Make of disc most favoured. Are any motor ploughs or steam ploughs in use ; and, if so, are they successful ? Get details as to cost of ploughing per acre where possible. To what depth is it usual to plough ? Is ground usually stirred by a subsoiler below the ordinary depth reached by the plough ?

(*j*) *Planting.*—Are top plants usually taken? Number of eyes on each plant, width of rows, and distance between plants. Do farmers use cane-planters? What depth is the furrow in which the cane is planted? Are canes laid on hard bottom, or is some earth left; and, if so, how much? What are the shallowest and the deepest coverings used? How are the plants covered—by hand or implement. How much cane is used per acre? Do farmers change plants to any extent? Average cost of planting.

(*k*) *Cultivation.*—What implements are in general use? Are cultivators generally fitted with digging tines, or broad sweeps, or hoes? Is the plough used to any extent between the rows? Are disc harrows or other cutting machines in use? Note what damage, if any, is caused to roots of growing cane by these latter implements. What is the common depth to which cultivation is carried? Average cost of cultivation, including that done by hand.

(*l*) *Harvesting.*—What are the current rates paid in each district for harvesting? Is it the general practice to burn cane before cutting? Is much top or cabbage left? Are canes cleaned from trash before going to mill? Are stools cut well below the ground?

(*m*) *Labour.*—State general feeling as to labour in each district.

(*n*) *Trash.*—Is trash usually burned? If not, how is it treated?

(*o*) *Ratooning.*—How is ratooning done? Do any farmers volunteer ratoons; and, if so, what percentage?

(*p*) *Pests and Diseases.*—Note what pests, vermin, or diseases are prevalent in each district, and what is being done to combat same.

(*q*) *Varieties of Cane.*—Note the varieties of cane and behaviour of each in every district.

(*r*) *Arrowing.*—Note time of arrowing of different varieties each year.

In pursuance of these instructions the Field Officers have so far sent in reports upon 1,391 farms. Upon these 153 farmers have used lime, 344 have practised green manuring, and 287 have used fertilisers. The percentage of growers using lime, green manures, and fertilisers is much higher in the North than in the South. Now that the indications are that fertilisers will probably be much reduced in price, it is hoped that a much freer use of them will be made. This matter and the use of lime will be dealt with at a later stage.

During the year papers have been read before Conferences of the Australian Sugar Producers' Association and the United Canegrowers' Association of Australia, while a series of articles on cane cultivation have been prepared for the "Agricultural Journal." It is intended to reprint these in the form of a Bulletin, when completed.

Since the publication of the last Annual Report the General Superintendent has visited as many sugar districts as possible. These visits are made during intervals away from the Bureau Office, to which frequent returns are necessary to deal with accumulation of correspondence and other Bureau matters. As far as time has allowed, farms have been visited, and advice as to the methods of cultivation given on the spot. District visits also comprise inspection of canefields and probable yields, the noting of cane varieties in use, and the endeavour in many districts to persuade farmers to take up the trial of new ones. When this is successful, as it nearly always is, crates of new kinds of cane varieties are despatched from the Sugar Experiment Stations at Mackay and Bundaberg. Wherever possible, meetings of cane farmers have been held, and short, plain addresses upon the maintenance of soil fertility by tillage operations, the intelligent use of lime and green manures, methods of planting, cultivation, ratooning, and fertilising have been delivered. These have been followed by conversational discussions, at which a large amount of useful information is elicited. It may be stated that this portion of the work is highly appreciated by the Farmers' Associations, the larger proportion of which take a very keen interest in such matters. It has been found also that good results follow these addresses, which have enabled the writer to come into touch with a large body of practical cane farmers. The linking-up of one sugar district with another by these visits is also undoubtedly beneficial. It is found that a much larger interest is being taken in the sugar experimental work as its methods are brought before the farmer and discussed. There is not the slightest room for doubt that an upward tendency towards improvement has been made in cane cultivation during the past few years, which is directly attributable to the constant advice of the Sugar Bureau in the direction of better methods of cultivation.

In addition to the above the clerical work of the Bureau has largely increased. Farmers are being constantly invited to submit their difficulties to the Sugar Bureau, and they are now doing this to a very much greater extent than hitherto, either by writing direct or putting their questions to the Field Assistants for transmission. Samples of soil have been analysed during the year for cane farmers by the Agricultural Chemist and the Mackay laboratory. With each of these a letter of advice is also sent. Every possible effort is now being made to assist cane farmers, and it is gratifying to record that the efforts made in this direction are appreciated.

The supervision of the Sugar Experiment Stations at Bundaberg, Mackay, and South Johnstone and the initiation of new experiments upon these stations occupies a large part of the writer's time.

Brief Survey of Sugar Districts.

Mossman.—One mill. This district has to some extent suffered from the prevailing dry weather during the growing season, though not to the same extent as many other localities.

The conditions, however, were severe enough to lead to a reduction in the original estimate of the cane to be crushed. Some time ago 75 per cent. of the Mossman crop was of the variety known as D. 1135, but this is now being largely discarded in favour of H.Q. 426, N.G. 24B (Green Goru), and N.G. 15 (Badila). The canes known as Badila Seedling, Hybrid No. 1, and certain Queensland canes known as Q. 813, 1121, &c., introduced by the Sugar Experiment Stations are also being grown. Two seedlings found on the Mowbray River near Mossman were giving excellent results and appear most promising canes. The wet season this year was late in putting in an appearance and did not last very long. Advantage of favourable weather in March was taken to plant up good areas of cane for next year, while further areas were planted up later in the year. Due to the shipping strike the mill was unable to start at the time originally fixed, but good work is now being done and the cane sugar content is very high.

Cairns.—Three mills. At Mulgrave and Hambledon, climatic conditions have been very dry. The crops were backward before the rain set in late in March and during April and part of May. Due to the absence of rain in the period of the ordinary wet season the crops did not make their usual growth. The late rains gave a considerable impetus to the cane, which then commenced to grow vigourosly. Unfortunately dry weather again followed, and while the crops are fair they are not what they would have been with normal weather conditions. The sugar content in the cane this year, however, is exceptionally high, and high prices were being paid to the farmers for their cane. Owing to the shipping strike the Mulgrave and Hambledon Mills were forced to close down for about three weeks for want of bags, and this was at a time when the cane was at its best. At Babinda, like Innisfail, the rainfall is generally so excessive that a smaller precipitation is of great advantage. There is a particularly fine crop in this sub-district estimated at 150,000 tons, and the fine mill at Babinda will need to work at high pressure in order to deal with it all. This locality was devastated by a terrific cyclone last year, but while its ravages can still be seen in the scrubs, the plant crop of cane is looking well, although the older ratoons were reported not to be cutting out so well. The sugar content in the cane was at first lower here than at Mulgrave and Hambledon but it has recently much improved. New lands are being opened up on the Russell River, and the future of the district appears highly promising. Plantings throughout the Cairns areas had been remarkably good, so that with favourable conditions there should be large crops for next year. New Guinea borer was still badly affecting the Badila cane, but it is trusted that the introduction of the Tachinid fly by the Bureau's Entomologist will have the desired effect of limiting the damage caused by the borer.

Johnstone River.—Three mills. In this district, as at Babinda, the amount of rainfall is usually much more than the cane crop needs. Consequently when less rain falls than ordinarily the crops are as a rule better and sweeter. In the spring of this year, the Innisfail and Babinda areas were the only ones that looked luxuriantly green and beautiful, every other cane district appearing more or less dry and, in some instances in the South, drought-stricken. This year the crops in this district presented a marked contrast to the cyclone-smitten cane of last year. The heavy rainfall in March and April and portion of May was followed by intermittent showers and had a fine effect on the cane generally. This was succeeded by many weeks of fine dry weather, which had an extremely favourable effect on ripening up the cane and rendering its yield of sugar high. Farmers were obtaining most satisfactory prices for their product. The South Johnstone Mill was working smoothly and satisfactorily, and growers were feeling more confident in the ultimate success of the factory. The Goondi and Mourilyan Mills were also working well, but these plants had also to close for several days owing to dislocation in the supply of bags to hold sugar. A good deal of planting has been done for next year.

Herbert River.—Conditions on this river were even drier than at Mulgrave and Hambledon, but the standing crop looked well, and the amount of cane to be put through the two mills will be satisfactory. Rain, however, was badly required for the young cane, of which a good deal had been planted for next year. Fortunately some good showers fell towards the end of September, but these will need to be followed by more. The sugar content of the cane in this district was also high. Unfortunately the mills had to close down for some days due to the non-delivery of bags during the shipping strike. This meant that the crushing would have to be prolonged into a time of the year when the cane would not be so good.

Lower Burdekin District.—These areas have been suffering greatly from dry weather, so that the plantings for 1919 were not so good as usual. Due to the continuance of the drought this year the cane was very backward. Where irrigation had been carried out early the crops were much better, but in the hope of the usual wet season setting in, many farmers had postponed irrigation and some were only commencing to irrigate when the cane was showing signs of distress. The yield therefore this year will be a small one. At the Sugar Experiment Plot of Mr. Mackersie the new Papuan Canes were making good progress, while the Queensland seedlings had done remarkably well. Some fine big cane of these latter varieties was seen at Mr. Craig's farm, viz., Q. 1121, Q. 813, and Q. 903. The Q. 813 was a 50-ton crop, and large quantities of this kind were being sent to Proserpine for plants. These varieties, raised by the Queensland Acclimatisation Society some years ago, were taken in hand by the Bureau of Sugar Experiment Stations, and after careful nursing were ultimately distributed. They appear to be giving excellent results from Bundaberg to the Lower Burdekin. The Invicta Mill is now being transferred to the Haughton River, and with this and the irrigation scheme at Home Hill in full work, the district should regain its old prestige.

Proserpine.—This district has also suffered from dry weather, and only a fair crushing is anticipated. Most of the crop is plant cane this year. Plantings for next season have been good.

Mackay.—No regular wet season was experienced in Mackay this year, but good rains fell in April and May, which had a fine effect on the existing crop. After that very dry weather was again experienced, and no rain has fallen for a long time. The young cane planted for next year now requires rain urgently. A good deal of cane has been planted for next season, and with favourable conditions the harvest next year should be a good one. The sugar contents in the cane in this district are also very high—a matter of great satisfaction to farmers. Clark's Seedling (H.Q. 426), a cane of high density, is now being extensively grown, but a good deal of anxiety is being felt as to its permanence. In many of the sub-districts of Mackay it is developing disease. The sticks are inclined to die and wither in the middle, while the foliage also dies away. This disease strongly resembles one that attacked the Old Rappoe or Rose Bamboo in 1902-04 in the Mackay district.

Bundaberg and Childers.—Dry as some of the Northern districts appear, they are relatively moist when compared with Bundaberg. Here the cane has made no growth for months, and of what there was a great deal had been frosted. Bingera Mill ran for a very short season, Millaquin and Fairymead will soon close up, and it is anticipated that the amount of sugar to be manufactured in the district will be under 7,000 tons. The Childers district is even worse than Bundaberg; planting in both districts has been considerably interfered with, and unless rain falls shortly next year's crop will also suffer materially.

Since 1917 these districts have been unfortunate. Severe frosts have done considerable damage in both years. The young plant cane is struggling along, and unless good rains speedily fall there will be little late planting.

Maryborough and Mount Bauple.—These districts have also suffered considerably in the dry weather. The crushing at Maryborough Factory will only be about 2,000 tons, and the Mount Bauple Mill will not crush at all this season.

Moreton.—The fine sugar areas about Nambour were looking exceedingly well earlier in the year. The cane upon the Maroochy River was very fine. This district did not suffer so severely from drought as other Southern districts, and the mill expects to have a fair crushing.

Logan and Albert.—These crops were backward and much in the same condition as the Bundaberg cane. A fair amount of this cane has been sold for forage.

4.—VARIETIES OF CANE INTRODUCED.

During the year the following varieties were introduced from Mauritius, by the courtesy of the Director of Agriculture:—32^{10}, 28^{10}, 131^{168}, 55^{1182}, and 55^{11}.

These canes were a long time in transit, and opened up in rather poor condition. The greatest care and attention have been given them, and it is hoped that the majority will survive.

5.—WORK OF THE SOUTHERN SUGAR EXPERIMENT STATION AT BUNDABERG.

The Chemist in charge of the Sugar Experiment Station at Bundaberg is Mr. James Pringle, an officer who has given the greatest satisfaction in the execution of his duties and his loyal carrying out of the instructions of the General Superintendent. The data in connection with the experiments have been compiled by him, and he has also supplied notes for the use of the General Superintendent in connection with climatic and crop observations.

Mr. Pringle has a field staff consisting of Messrs. A. E. Evans, foreman, and Mr. J. C. Thomsen, a returned soldier. Both men carry out their duties in a most satisfactory manner.

METEOROLOGICAL.

From a climatic standpoint the 1918-1919 growing season has been most unfavourable. It followed a severe dry winter. The spring months of 1918 were fairly dry, and although an inch or so of rain fell at various times it was in each case followed by drying winds, so that the cane derived little or no benefit. In February, 1919, more favourable weather set in and continued till the end of April. This however, was too late for the cane, the best portion of the growing period having been lost. The winter of the present year was also very cold, several severe frosts being experienced. The dry conditions which set in at the end of May have prevailed up to the present and will seriously affect the crops for 1920. There is little moisture in the soil to bring the ratoons away, and the germination of the cane planted in August and September is doubtful. It may be stated here that, though the frost during the past winter was not so general nor extensive as in 1918, a worse condition of things has resulted owing to the shortness of the cane not allowing of low topping, as was done last year, to keep up the quality of the damaged cane. It will be seen from the following comparison that the total rainfall for the period in question—*i.e.*, August, 1918, to September, 1919—has been the lowest for the same period of any two years since the institution of this station in 1913, that for 1914-15 being 34·72 inches; 1915-16, 36·212 inches; 1916-17, 62·647 inches; 1917-18, 51·277 inches; and 1918-1919, 24·159 inches.

METEOROLOGICAL.

Month.	Rainfall.	Month.	Rainfall.
August, 1918	1·200	April, 1919	1·735
September, 1918	·580	May, 1919	5·795
October, 1918	·150	June, 1919	·350
November, 1918	1·590	July, 1919	·090
December, 1918	1·690	August, 1919	·760
January, 1919	·860	September, 1919	Nil.
February, 1919	4·180		
March, 1919	5·179	Total	24·159

SUBJECTS DEALT WITH IN THE FOLLOWING SECTION.

1. Liming, cultivation, and manurial trials with D. 1135, third ratoon crop.

2. Experiments with planting cane sets by hand *versus* machine planting of same ; results of first ratoon crop, 1918.

3. Experiments with ordinary cultivation *versus* no subsequent cultivation ; results of first ratoon crop, 1918.

4. Experiments with planting Badila Cane.

5. Analytical results of new canes from Java, Mauritius, and India.

6. Analytical results of miscellaneous canes.

7. Commercial cane sugar in 16 of the best Papuan canes selected from Well's collection.

8. Analytical results of cane from Hawaii known as H.109.

1.—LIMING, CULTIVATION, AND MANURIAL EXPERIMENTS.

These comprise—

(*a*) Liming experiments with and without subsoiling ;

(*b*) Liming experiments with and without mixed manure ;

(*c*) No lime used ; plots treated with and without mixed manures.

These experiments were in the third ratoon stage when cut. Due to the dry weather conditions it was intended to allow them to stand over till next season, but, unfortunately, they were so much affected by frost that it became imperative to cut them. This accounts for the comparatively low tonnage in each of the series. This was a repetition of the experience last year. The experiments run in three series as shown above. The analytical and crop results of (*a*) liming experiments with and without subsoiling are given hereunder :—

ANALYTICAL RESULTS OF LIMING EXPERIMENTS WITH AND WITHOUT SUBSOILING—D. 1135, THIRD RATOON CROP—SEPTEMBER, 1919.

No. of Plot.	Variety of Cane.	Treatment.	Age of Cane.	Date of Analysis.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Sucrose in Cane.	% C.C.S. in Cane.
1	D. 1135	Subsoiled ; Lime applied before Plant Crop, 1 ton per acre	12 months	5-9-19	22·0	20·12	·29	91·4	17·90	15·90
2	D. 1135	Not subsoiled ; Lime as in Plot 1	do.	5-9-19	21·9	19·83	·35	90·6	17·64	15·58

CROP RESULTS OF LIMING EXPERIMENTS WITH AND WITHOUT SUBSOILING—D. 1135, THIRD RATOON CROP—SEPTEMBER, 1919.

Plot Number.	Treatment.	Age of Cane.	Yield of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
1	Subsoiled ; Lime applied to Plant Crop, 1 ton per acre	12 months	9·03	1·43
2	Not subsoiled ; Lime as in Plot 1	12 months	11·59	1·80

In the following tables will be found the analytical and crop results of series (*a*)—four crops and averages. It will be noted that, contrary to experience at Mackay and upon alluvial soils generally, the average returns from the non-subsoiled plot are somewhat better than where the subsoiler was used :—

ANALYTICAL RESULTS TO DATE OF LIMING EXPERIMENTS WITH AND WITHOUT SUBSOILING.

Plot Number.	Variety of Cane.	Treatment.	Plant Crop, 1915.				First Ratoon Crop, 1917 (Standover).				Second Ratoon Crop, 1918.				Third Ratoon Crop, 1919.				Average of Four Crops.		
			Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	Density of Juice (Brix.	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Sucrose in Juice.	Purity of Juice.	C.C.S. in Cane.
1	D. 1135 ..	Subsoiled ; Lime applied before Plant Crop, 1 ton per acre	21·8	19·82	·17	90·9	18·9	17·99	·37	95·1	19·2	17·20	·62	90·6	22·0	20·12	·29	91·4	18·78	91·6	14·85
2	D. 1135 ..	Not Subsoiled ; Lime as in Plot 1	20·8	19·56	·17	94·0	18·7	17·78	·41	95·1	18·8	16·70	·64	82·3	21·9	19·83	·35	90·6	18·47	91·8	14·63

CROP RESULTS TO DATE OF LIMING EXPERIMENTS WITH AND WITHOUT SUBSOILING.

Plot Number.	Variety of Cane.	Treatment.	Plant Crop, 1915.		First Ratoon Crop, 1917 (Standover).		Second Ratoon Crop, 1918.		Third Ratoon Crop, 1919.		Average of Four Crops.	
			Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.
1	D. 1135	Subsoiled ; Lime applied before Plant Crop 1 ton per acre	20·69	3·23	57·56	8·39	17·32	2·33	9·03	1·43	26·15	3·84
2	D. 1135	Not Subsoiled ; Lime as in Plot 1 ..	19·43	3·05	58·54	8·40	18·14	2·34	11·59	1·80	26·92	3·90

Series (*b*)—Liming experiments with and without manures : The analytical and crop results for this year are shown hereunder :—

ANALYTICAL RESULTS OF LIMING EXPERIMENTS WITH AND WITHOUT MIXED MANURES—D. 1135, THIRD RATOON CROP—SEPTEMBER, 1919.

Plot Number.	Variety of Cane.	Treatment.	Age of Cane.	Date of Analysis.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Sucrose in Cane.	% C.C.S. in Cane.
1	D. 1135 ..	Mixed manure, consisting of Sulphate of Ammonia, 1 cwt., Nitrate of Soda, 1 cwt., Meatworks Manure 1 cwt., and Sulphate of Potash 1 cwt., Lime at the rate of 1 ton per acre applied before Plant Crop	12 months	5-9-19	21·6	19·59	·35	90·7	17·43	15·39
2	D 1135 ..	No manure ; but lime applied to Plant Crop as in Plot 1	12 months	5-9-19	21·0	19·21	·31	91·5	17·10	15·18

CROP RESULTS OF LIMING EXPERIMENTS WITH AND WITHOUT MIXED MANURES—D. 1135, THIRD RATOON CROP—SEPTEMBER, 1919.

Plot. Number.	Treatment.	Age of Cane.	Yield of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
1	Mixed manure, consisting of Sulphate of Ammonia 1 cwt., Nitrate of Soda 1 cwt., Meatworks Manure 1 cwt., and Sulphate of Potash 1 cwt. Lime at the rate of 1 ton per acre applied before Plant Crop.	12 months	15·29	2·35
2	No manures, but lime applied to Plant Crop as in Plot 1 ..	12 months	12·26	1·86

Below are set out the analytical and crop results of this experiment for four crops with the averages :—

ANALYTICAL RESULTS TO DATE OF LIMING EXPERIMENTS WITH AND WITHOUT MIXED MANURES.

Plot Number.	Variety of Cane.	Treatment.	Plant Crop, 1915.				First Ratoon Crop, 1917 (Standover).				Second Ratoon Crop, 1918.				Third Ratoon Crop, 1919.				Average of Four Crops.		
			Density of Juice (Brix.)	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	Density of Juice (Brix.)	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	Density of Juice (Brix.)	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	Density of Juice.	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Sucrose in Juice.	Purity of Juice.	C.C.S. in Cane.
1	D. 1135 ..	Mixed manure, consisting of Sulphate of Ammonia 1 cwt., Nitrate of Soda 1 cwt., Sulphate of Potash 1 cwt., and Meatworks Manure 1 cwt. Lime at the rate of 1 ton per acre applied before Plant Crop	20·5	19·14	·14	93·36	18·2	16·76	·69	92·1	19·7	17·73	·71	90·0	21·6	19·59	·35	90·7	18·31	91·6	14·47
2	D. 1135 ..	No Manure, but Lime applied to Plant Crop as in Plot 1	20·4	19·00	·16	93·10	18·8	17·56	·66	93·3	18·8	16·80	·62	89·3	21·0	19·21	·31	91·5	18·14	92·0	14·36

CROP RESULTS TO DATE OF LIMING EXPERIMENTS WITH AND WITHOUT MIXED MANURES.

Plot Number.	Variety of Cane.	Treatment.	Plant Crop, 1915.		First Ratoon Crop, 1917 (Standover).		Second Ratoon Crop, 1918.		Third Ratoon Crop, 1919.		Average of Four Crops.	
			Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.
1	D. 35	Mixed Manure, consisting of Sulphate of Ammonia 1 cwt., Nitrate of Soda 1 cwt., Sulphate of Potash 1 cwt., and Meatworks Manure 1 cwt. Lime at the rate of 1 ton per acre applied before Plant Crop	20·79	3·21	77·63	10·32	26·63	3·69	15·29	2·35	35·13	4·89
2	D. 1135	No Manure, but Lime applied to Plant Crop, as in Plot 1	20·79	3·16	64·50	9·04	18·81	2·46	12·26	1·86	29·09	4·13

The above experiment again demonstrates the wisdom of applying manures to ratoons, rather than to plant cane. It will be seen that in the plant crop absolutely no increase was given for the use of fertilisers, while each of the succeeding ratoon crops showed marked differences, the averages being 6·04 tons of cane more per acre for the use of manures.

Series (*c*). No lime used ; plots treated with and without mixed manures.

The analytical and crop results for the present season are given below :—

ANALYTICAL RESULTS OF EXPERIMENTS WITH AND WITHOUT MIXED MANURES—D. 1135, THIRD RATOON CROP—SEPTEMBER, 1919.

Plot Number.	Variety of Cane.	Treatment.	Age of Cane.	Date of Analysis.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Sucrose in Cane.	% C.C.S. in Cane.
1	D. 1135 ..	Mixed manure, consisting of Sulphate of Ammonia 1 cwt., Nitrate of Soda 1 cwt., and Meatworks 1 cwt., Sulphate of Potash 1 cwt. No Lime ; no Subsoiling	12 months	5-9-19	20·0	18·61	·56	93·1	16·56	14·86
2	D. 1135 ..	No Manure ; no Lime ; no Subsoiling	12 months	5-9-19	20·9	19·12	·44	91·4	17·03	15·12

CROP RESULTS OF EXPERIMENTS WITH AND WITHOUT MIXED MANURES—D. 1135, THIRD RATOON CROP—SEPTEMBER, 1919.

Plot Number.	Treatment.	Age of Cane.	Yield of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
1	Mixed manure, consisting of Sulphate of Ammonia 1 cwt., Nitrate of Soda 1 cwt., Sulphate of Potash 1 cwt., and Meatworks Manure 1 cwt. No Lime ; no Subsoiling	12 months	16·13	2·40
2	No Manure ; no Lime ; no Subsoiling	12 months	12·60	1·90

Immediately following are the analytical and crop results for the four crops with the averages :—

ANALYTICAL RESULTS TO DATE OF EXPERIMENTS WITH AND WITHOUT MIXED MANURES.

Plot Number.	Variety of Cane.	Treatment.	Plant Crop, 1915.				First Ratoon Crop, 1917 (Standover).				Second Ratoon Crop, 1918.				Third Ratoon Crop, 1919.				Average of Four Crops.		
			Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Sucrose in Juice.	Purity of Juice.	C.C.S. in Cane.
1	D. 1135 ..	Mixed Manure, consisting of Sulphate of Ammonia 1 cwt., Nitrate of Soda 1 cwt., Meatworks Manure 1 cwt., Sulphate of Potash 1 cwt. No Lime ; no Subsoiling	20·6	19·22	·20	93·6	19·4	18·46	·39	95·1	19·2	17·07	·88	88·9	20·0	18·61	·56	93·1	18·34	92·6	14·59
2	D. 1135 ..	No Manure ; no Lime ; no Subsoiling	20·0	18·84	·25	94·2	20·3	19·19	·31	94·5	17·9	15·97	·76	87·4	20·9	19·12	·44	91·4	18·28	92·3	14·49

CROP RESULTS TO DATE OF EXPERIMENTS WITH AND WITHOUT MIXED MANURES.

Plot Number.	Variety of Cane.	Treatment.	Plant Crop, 1915.		First Ratoon Crop, 1917 (Standover).		Second Ratoon Crop, 1918.		Third Ratoon Crop, 1919.		Average of Four Crops.	
			Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.
1	D. 1135	Mixed Manure, consisting of Sulphate of Ammonia 1 cwt., Nitrate of Soda 1 cwt., Meatworks Manure 1 cwt., Sulphate of Potash 1 cwt. No Lime, no Subsoiling	21·90	3·37	80·75	12·04	37·29	4·93	16·13	2·40	39·02	5·68
2	D. 1135	No Manure ; no Lime ; no Subsoiling ..	20·04	3·03	60·54	9·66	14·62	1·82	12·60	1·90	26·95	

In this series the increase in tonnage for the use of manures is much higher than it is from the plots upon which lime was used. This is remarkable, to say the least of it. It is intended, however, to carry out further experiments with lime used at varying rates from 1 to 6 tons per acre. This experiment is now finished, and the cane will be ploughed out. The only conclusion that can be drawn at present is that small quantities of lime on the red soils have no apparent result, while subsoiling does not pay either. The experiments, however, will be repeated before a definite verdict is given. A summary is appended for convenience :—

Series.	Treatment.	Average Tons of Cane per Acre in English Tons.	Average Yield of Sugar per Acre in English Tons.	Average Differences for Use of Fertilisers.
(a)	Lime and Subsoiling	26·15	3·84	..
	Lime and not Subsoiled	26·92	3·90	..
(b)	Lime with Manure	35·13	4·89	6·04
	L me ; no Manure	29·09	4·13	..
(c)	No Lime but Manure	39·02	5·68	12·07
	No Lime ; no Manures	26·95	4·10	..

2.—Experiments with Planting Cane Sets by Hand versus Machine Planting of Same—Results of First Ratoon Crop, 1918.

These plots were planted in March, 1916, for the purpose of determining how much loss took place when cane sets were planted by the machine known as the " Cane-planter " in place of planting by hand. These experiments were carefully made and every care was taken, so that the preparation of the two pieces of land was identical and all other conditions, except planting, absolutely uniform.

The results of the plant crop harvested in 1917 have already appeared in last year's report. The results of the first ratoon crop cut in 1918 did not come to hand sufficiently early to be included in the 1918 report, so they are here presented :—

Analytical Results from Experiments in Machine Planting versus Hand Planting With and Without Mixed Manures—D. 1135, First Ratoon Cane—September, 1918.

Plot Number.	Variety of Cane.	Method Used and Treatment.	Age of Cane.	Date of Analysis.	Density of Juice (Brix.)	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Sucrose in Cane.	% C.C.S in Cane.
1	D. 1135..	Plant Crop planted by machine known as the "Cane-planter." Mixed manure applied to First Ratoons consisting of 1 cwt. Sulphate of Ammonia, 1 cwt. Nitrate of Soda, 1 cwt. Sulphate of Potash, and 2 cwt. Meatworks per acre	11 months	17-9-18	17·9	15·40	1·28	86·4	13·70	11·73
2	D. 1135..	Plant Crop planted by hand. Mixed manures applied to First Ratoons consisting of 1 cwt. Sulphate of Ammonia, 1 cwt. Nitrate of Soda, 1 cwt. Sulphate of Potash, and 2 cwt. Meatworks per acre	11 months	17-9-18	17·1	15·56	1·42	90·9	13·84	12·25
3	D. 1135..	Plant Crop planted by machine known as the "Cane-planter." No manure applied to First Ratoons	11 months	17-9-18	18·0	15·67	·94	87·1	13·96	12·01
4	D. 1135..	Plant Crop planted by hand. No manure applied to First Ratoons	11 months	17-9-18	16·5	14·77	1·33	89·5	13·14	11·55

CROP RESULTS FROM EXPERIMENTS IN MACHINE PLANTING VERSUS HAND PLANTING WITH AND WITHOUT MIXED MANURES—FIRST RATOON CANE, D. 1135—1918.

Plot Number.	Method Used and Treatment.	Age of Cane.	Weight of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
1	Plant Crop planted by machine known as the "Cane-planter." Mixed manure applied to First Ratoon Crop consisting of 1 cwt. Sulphate of Ammonia, 1 cwt. of Nitrate of Soda, 1 cwt. Sulphate of Potash, and 2 cwt. of Meatworks per acre	11 months	17·55	1·39
2	Plant Crop planted by hand. Mixed manures applied to First Ratoon Crop consisting of 1 cwt. Sulphate of Ammonia, 1 cwt. Nitrate of Soda, 1 cwt. Sulphate of Potash, and 2 cwt. of Meatworks per acre	11 months	16·28	1·99
3	Plant Crop planted by machine known as the "Cane-planter." No manure applied to First Ratoons	11 months	13·66	1·64
4	Plant Crop planted by hand. No manures applied to First Ratoons	11 months	13·06	1·51

It will be seen from the above crop results that the method of machine planting is slightly leading this year, both in the manured and unmanured plots. The manures have given fair results considering the dry weather but not enough to pay the cost of the fertilisers. The cane on these plots is not being cut this year, but will stand over till next season. It is hoped that the fertilisers will then give a better account of themselves.

As the plant crop gave a difference of 3½ tons of cane per acre in favour of hand planting, the results of the complete experiment will be awaited before drawing conclusions.

3.—EXPERIMENTS WITH ORDINARY CULTIVATION VERSUS NO SUBSEQUENT CULTIVATION—RESULTS OF FIRST RATOON CROP, 1918.

The results of these experiments did not come to hand in time for last year's report, so they are now included, and the analytical and crop results are set out hereunder :—

ANALYTICAL RESULTS FROM DIFFERENT EXPERIMENTS TO DETERMINE WHETHER SUBSEQUENT CULTIVATION WITH THE HORSE CULTIVATOR IN RED SOIL GIVES A HIGHER YIELD THAN WHERE NO SUBSEQUENT HORSE CULTIVATION IS PRACTISED—D. 1135, FIRST RATOONS—SEPTEMBER, 1918.

Plot Number.	Variety of Cane.	Method of Cultivation.	Age of Cane.	Date of Analysis.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Sucrose in Cane.	C.C.S. in Cane.
1	D. 1135	Subsequent cultivation done with the Planet Junior Cultivator; ordinary method	11 months	18-9-18	15·7	12·67	2·13	80·7	11·27	9·21
2	D. 1135	No subsequent cultivation of any kind	11 months	18-9-18	15·3	12·27	2·32	80·1	10·92	8·89

CROP RESULTS FROM EXPERIMENTS TO DETERMINE WHETHER SUBSEQUENT CULTIVATION WITH THE HORSE CULTIVATOR IN RED SOILS GIVES A HIGHER YIELD THAN WHERE NO SUBSEQUENT HORSE CULTIVATION IS PRACTISED —D 1135, FIRST RATOON—1918.

Plot Number.	Method of Cultivation.	Age of Cane.	Weight of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
1	Subsequent cultivation done with the Planet Junior Cultivator ; ordinary method	11 months	10·32	·95
2	No subsequent cultivation of any kind	11 months	7·68	·68

The red soils in the Woongarra are so open and porous that methods of cultivation which give good results in other places often fail here. It was determined to ascertain to how great an extent frequent shallow stirring of the soil by means of a Planet Junior Cultivator, fitted with duck-foot hoes, would increase the crop compared with cane treated similarly in every other way but with no subsequent cultivation at all: The results in the plant crop gave an increase of 1·14 tons per acre in favour of cultivation and in the first ratoon crop an increase of 2·64 tons per acre was secured. The crop will now go on to second ratoon standover.

4.—EXPERIMENTS WITH PLANTING BADILA CANE OF WHICH THE TOP PLANTS ONLY, MIDDLE PLANTS ONLY, AND BOTTOM AND MIDDLE PLANTS ONLY WERE SEPARATELY PLANTED.

Due to the severe frosts this experiment in the third ratoon stage was obliged to be cut. It was intended to allow the cane to stand over till next year. Unfortunately the cane at time of cutting was too short to be weighed separately in the cane trucks. The analyses of the three preceding crops and the average analytical results, together with the total crop results and the averages, follow in the succeeding table :—

Analytical Results to Date of Experiments in Planting Tops, Middles, and Bottoms and Middles.

Plot Number.	Variety of Cane.	Seed Used.	Plant Crop, 1915.					First Ratoon Crop, 1917 (Standover).					Second Ratoon Crop, 1918.					Average for Three Crops.		
			Density of Juice (Brix.)	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% C.C.S. in Cane.	Density of Juice (Brix.)	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% C.C.S. in Cane.	Density of Juice (Brix.)	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% C.C.S. in Cane.	% Sucrose in Juice.	Purity of Juice.	% C.C.S. in Cane.
1	Badila ..	Tops only Planted	22·6	21·17	·06	93·6	16·94	21·4	20·26	·35	94·6	16·31	20·4	19·03	·17	90·3	15·70	20·15	92·8	16·32
2	do. ..	Middles only Planted	22·1	21·18	·04	95·8	17·18	21·2	20·16	·22	95·1	16·25	20·3	18·87	·18	92·9	15·32	20·07	94·6	16·25
3	do. ..	Bottoms and Middles only Planted	22·0	20·87	·06	94·8	16·81	22·2	21·33	·24	96·0	17·32	19·9	18·33	·21	92·1	14·80	20·18	94·3	16·31

Crop Results to Date of Experiments in Planting Tops, Middles, and Bottoms and Middles.

Plot Number.	Variety of Cane.	Seed Used.	Plant Crop, 1915.		First Ratoon Crop, 1917 (Standover).		Second Ratoon Crop, 1918.		Total Results for Three Crops.		Average for Three Years.	
			Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of C.C.S. per Acre in English Tons.
1	Badila	Tops only Planted	17·84	3·02	50·52	8·14	10·27	1·61	78·63	12·77	26·21	4·26
2	ditto	Middles only Planted	8·08	1·39	42·47	6·90	6·68	1.02	57·23	9·31	19·08	3·10
3	ditto	Bottoms and Middles Planted	6·95	1·17	42·18	7·31	7·55	1·12	56·68	9·60	18·89	3·20

It will be noticed from the crop results that where top plants were used the yield of cane is much greater than where other parts of the cane were used for plants, the total increase for the use of top plants being 21·40 tons per acre. It is evident therefore that, when top plants can be easily procured, as they may be during harvesting operations, it will always pay to use them. The experience of planters in other countries bears this out. It is intended to carry out experiments with planting various portions of the stick, a matter that will be referred to later.

5.—Analytical Results of New Canes from Java, Mauritius, and India.

The analyses of the new Java canes, E.K. 1, E.K. 2, E.K. 28, as shown in the table below, are satisfactory. There is another Java cane in the series known as 100 Bont, a very promising cane. It has, however, recently presented suspicious symptoms which may possibly be due to the abnormally dry weather. It is, therefore, being kept under strict observation for the present. The Java varieties are good strikers, rapid growers, and good stoolers. Mauritius 168^{04} is a good cane, similar to Badila in appearance, but a much more rapid grower; it is also a good striker, stooler, and ratooner. The Indian cane known as Shahjahanpur No. 10 is a cane of promise, being a good striker and ratooner, a rapid grower with great drought-resisting qualities, and also a cane which does not easily succumb to frost. Last year it was the only variety that withstood the very severe frost, and appeared beautifully green among the other canes which were frosted to the ground, and again this year it was quite undamaged by the recent frost. It will be seen from the analysis that the per cent. of fibre is somewhat high, 13·6 per cent., but at the same time, the C.C.S. calculated out on that per cent. fibre, is good, and though it is inclined to be a thin cane, it is likely to prove of great value in our low-lying localities. This cane was sent from the Shahjahanpur Sugar Experiment Station in India to this Bureau accompanied by a letter from the Shahjahanpur Chemist to the Government, stating: "We find it a good variety for the Rohilkhand country where the winter is severe." If this cane fulfils its present promise, we shall be pleased to distribute it to growers requiring a cane adapted to frost conditions.

Analytical Results of New Canes from Java, Mauritius, and India. First Ratoon Crop—September, 1919.

Country.	Name or Number of Variety.	Age of Cane.	Date of Analysis.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Fibre in Cane.	% Sucrose in Cane.	% Commercial Cane Sugar in Cane.
Java	E.K. 1	13 months	6-9-19	22·4	19·63	1·67	87·6	10·4	17·59	14·91
Java	E.K. 2	13 months	6-9-19	19·7	15·94	1·89	80·9	11·6	14·14	11·53
Java	E.K. 28	13 months	6-9-19	20·9	16·76	1·76	80·2	9·3	15·20	12·47
Java	247 Generatie ..	13 months	6-9-19	20·9	16·95	1·86	81·1	11·5	15·00	12·30
Mauritius ..	M. 168^{04}	13 months	6-9-19	20·3	17·65	·83	86·9	10·9	15·73	13·53
India	Shahjahanpur No. 10	13 months	6-9-19	23·0	21·27	·18	92·5	13·6	18·38	16·38

6.—Analytical Results of Five Unknown Canes.

These five canes are at present of unknown origin. They were reported to have come from Childers originally. The majority are good canes, No. 4 being rather low. Provided good weather follows they will be available for distribution next year.

First Ratoon Crop—September, 1919.

Country.	Name or Number of Variety.	Age of Cane.	Date of Analysis.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Sucrose in Cane.	% C.C.S. in Cane.
Unknown	1	12 months	16-9-19	22·3	20·41	·28	91·0	18·17	16·12
Ditto	2	12 months	16-9-19	22·0	20·45	·22	92·9	18·21	16·40
Ditto	3	12 months	16-9-19	20·5	18·93	·34	92·3	16·85	15·03
Ditto	4	12 months	16-9-19	18·1	16·01	·66	88·4	14·25	12·40
Ditto	5	12 months	16-9-19	21·4	20·08	·29	93·8	17·88	16·09

7.—Wells's Collection of New Guinea Canes.

Of the 120 varieties introduced, the following numbers have been selected for planting out in competition, and for distribution purposes:—N.G. 81, 89, 90, 93, 94, 102, 103, 107, 108,

123, 147, 148, 164, 167, 173, and 177. Of this list Nos. 81 and 147 appear to be the best all-round canes, while 103 and 177 are also promising, and the others may be termed medium quality canes.

The following table shows the commercial cane sugar in each of the selected varieties :—

COMMERCIAL CANE SUGAR IN SIXTEEN PAPUAN CANES SELECTED FOR PLANTING OUT IN COMPETITION IN 1919.

Country.	Number of Variety.	% Commercial Cane Sugar in Cane.
New Guinea	N.G. 81	14·91
Ditto	N.G. 89	14·70
Ditto	N.G. 90	14·32
Ditto	N.G. 93	12·00
Ditto	N.G. 94	13·79
Ditto	N.G. 102	14·92
Ditto	N.G. 103	15·18
Ditto	N.G. 107	12·70
Ditto	N.G. 108	15·86
Ditto	N.G. 123	14·60
Ditto	N.G. 147	16·61
Ditto	N.G. 148	15·49
Ditto	N.G. 164	14·94
Ditto	N.G. 167	15·07
Ditto	N.G. 173	15·23
Ditto	N.G. 177	16·56

8.—CANE BROUGHT FROM HAWAII, KNOWN AS H. 109.

A small quantity of this cane was obtained some time ago through the courtesy of the Hawaiian Planters' Association, and has been again planted out. An analysis was made before planting, and, while the result is for the present low, it is hoped that as the cane becomes acclimatised it may improve in sugar.

ANALYSIS OF NEW CANE FROM HAWAII—FIRST RATOON—OCTOBER, 1919.

Country.	Name or Number of Varety.	Age of Cane.	Date of Analysis.	Density of Juice (Brix).	% Sucrose in Juice.	% Glucose in Juice.	Purity of Juice.	% Fibre in Cane.	% Sucrose in Cane.	% C.C.S. in Cane.
Hawaii	H. 109	13 months	3-10-19	19·3	16·26	1·38	84·2	11·5	14·34	12·11

"COMMERCIAL CANE SUGAR."

The expression "Commercial Cane Sugar" is one that has been adopted by the Queensland Cane Prices Board, and is calculated as follows :—

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

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

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

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

Since the establishment of the Bundaberg Station a large number of canes have been examined. The following table shows what has been done with each one :—

LIST OF CANE VARIETIES INTRODUCED, EXAMINED, DISCARDED, AND UNDER EXAMINATION AT THE SUGAR EXPERIMENT STATION, BUNDABERG, SINCE 1913.

Country.	Name or Number of Variety.		Final Result of Variety in Question.
Queensland	Queensland	58	Discarded
Ditto	ditto	59	ditto
Ditto	ditto	112	ditto
Ditto	ditto	115	ditto
Ditto	ditto	116	Retained
Ditto	ditto	135	ditto
Ditto	ditto	137	Discarded
Ditto	ditto	286	ditto
Ditto	ditto	303	ditto
Ditto	ditto	307	ditto
Ditto	ditto	365	ditto
Ditto	ditto	437	ditto
Ditto	ditto	554	ditto
Ditto	ditto	558	ditto
Ditto	ditto	684	ditto
Ditto	ditto	694	Retained
Ditto	ditto	695	Discarded
Ditto	ditto	698	ditto
Ditto	ditto	719	ditto
Ditto	ditto	721	ditto
Ditto	ditto	745	ditto
Ditto	ditto	748	ditto
Ditto	ditto	750	ditto
Ditto	ditto	763	ditto
Ditto	ditto	767	ditto
Ditto	ditto	768	ditto
Ditto	ditto	779	Retained
Ditto	ditto	795	Discarded
Ditto	ditto	812	ditto
Ditto	ditto	812A	Retained
Ditto	ditto	813	ditto
Ditto	ditto	822	ditto
Ditto	ditto	840	Discarded
Ditto	ditto	855	Retained
Ditto	ditto	887	Discarded
Ditto	ditto	900	ditto
Ditto	ditto	903	Retained
Ditto	ditto	970	ditto
Ditto	ditto	999	Discarded
Ditto	ditto	1001	ditto
Ditto	ditto	1004	ditto
Ditto	ditto	1009	ditto
Ditto	ditto	1013	ditto
Ditto	ditto	1025	ditto
Ditto	ditto	1049	ditto
Ditto	ditto	1092	Retained
Ditto	ditto	1098	ditto
Ditto	ditto	1110	ditto
Ditto	ditto	1112	ditto
Ditto	ditto	1121	ditto
Ditto	ditto	1133	ditto
Ditto	Hambeldon, Queensland	5	Discarded
Ditto	ditto	10	ditto
Ditto	ditto	77	Retained
Ditto	ditto	114	ditto
Ditto	ditto	285	ditto
Ditto	ditto	426	ditto
Ditto	ditto	458	ditto
Ditto	ditto	409	Under examination
Mauritius	Mauritius	55	Retained but failed
Ditto	ditto	87	Retained
Ditto	ditto	89	ditto
Ditto	ditto	779	ditto
Ditto	ditto	998	Retained but failed
Ditto	Mauritius, Malagache		Retained
Ditto	Petite Senneville		ditto
Ditto	Black Innes (M. 189)		ditto
Ditto	1900 Seedling		ditto
Barbadoes	Barbadoes	147	Discarded
Ditto	ditto	156	Retained
Ditto	ditto	224	ditto
Ditto	ditto	306	ditto
Ditto	ditto	3412	ditto
Ditto	ditto	3747	ditto
Ditto	ditto	3922	ditto
Demerara	Demerara	115	ditto
Ditto	ditto	145	Discarded
Ditto	ditto	625	ditto
Trinidad	Trinidad	211	ditto
New Guinea	Badila (N.G.)	15	Retained
Ditto	New Guinea	16	Retained but failed
Ditto	Mahona (N.G.)	22	Retained

LIST OF CANE VARIETIES, ETC.—*Continued.*

Country.	Name or Number of Variety.	Final Result of Variety in Question.
New Guinea	New Guinea 67	Discarded
Ditto	ditto 68	ditto
Ditto	ditto 69	ditto
Ditto	ditto 70	ditto
Ditto	ditto 72	ditto
Ditto	ditto 73	ditto
Ditto	ditto 74	ditto
Ditto	ditto 75	ditto
Ditto	ditto 76	ditto
Ditto	ditto 77	ditto
Ditto	ditto 78	ditto
Ditto	ditto 79	ditto
Ditto	ditto 80	ditto
Ditto	ditto 81	Retained
Ditto	ditto 82	Discarded
Ditto	ditto 83	ditto
Ditto	ditto 84	ditto
Ditto	ditto 85	ditto
Ditto	ditto 86	ditto
Ditto	ditto 87	ditto
Ditto	ditto 88	ditto
Ditto	ditto 89	Retained
Ditto	ditto 90	ditto
Ditto	ditto 91	Discarded
Ditto	ditto 92	ditto
Ditto	ditto 93	Retained
Ditto	ditto 94	ditto
Ditto	ditto 95	Discarded
Ditto	ditto 96	ditto
Ditto	ditto 97	ditto
Ditto	ditto 98	ditto
Ditto	ditto 99	ditto
Ditto	ditto 100	ditto
Ditto	ditto 102	Retained
Ditto	ditto 103	ditto
Ditto	ditto 104	ditto
Ditto	ditto 105	Discarded
Ditto	ditto 106	ditto
Ditto	ditto 107	Retained
Ditto	ditto 108	ditto
Ditto	ditto 109	Discarded
Ditto	ditto 110	ditto
Ditto	ditto 111	ditto
Ditto	ditto 112	ditto
Ditto	ditto 113	ditto
Ditto	ditto 114	ditto
Ditto	ditto 115	ditto
Ditto	ditto 116	ditto
Ditto	ditto 117	ditto
Ditto	ditto 118	ditto
Ditto	ditto 119	ditto
Ditto	ditto 120	ditto
Ditto	ditto 122	ditto
Ditto	ditto 123	Retained
Ditto	ditto 124	Discarded
Ditto	ditto 125	ditto
Ditto	ditto 126	ditto
Ditto	ditto 127	ditto
Ditto	ditto 128	ditto
Ditto	ditto 129	ditto
Ditto	ditto 130	ditto
Ditto	ditto 131	ditto
Ditto	ditto 132	ditto
Ditto	ditto 133	Retained (same as No. 103)
Ditto	ditto 134	Discarded
Ditto	ditto 135	ditto
Ditto	ditto 136	ditto
Ditto	ditto 137	ditto
Ditto	ditto 138	ditto
Ditto	ditto 139	ditto
Ditto	ditto 140	ditto
Ditto	ditto 141	ditto
Ditto	ditto 142	ditto
Ditto	ditto 143	ditto
Ditto	ditto 144	ditto
Ditto	ditto 145	ditto
Ditto	ditto 146	ditto
Ditto	ditto 147	Retained
Ditto	ditto 148	ditto
Ditto	ditto 149	Discarded
Ditto	ditto 150	ditto
Ditto	ditto 151	ditto
Ditto	ditto 152	ditto
Ditto	ditto 153	ditto
Ditto	ditto 154	ditto
Ditto	ditto 155	ditto

LIST OF CANE VARIETIES, ETC.—*Continued.*

Country.	Name or Number of Variety.	Final Result of Variety in Question.
New Guinea	New Guinea 156	Discarded
Ditto	ditto 157	ditto
Ditto	ditto 158	ditto
Ditto	ditto 159	ditto
Ditto	ditto 160	ditto
Ditto	ditto 161	ditto
Ditto	ditto 162	ditto
Ditto	ditto 163	ditto
Ditto	ditto 164	Retained
Ditto	ditto 165	Discarded
Ditto	ditto 166	ditto
Ditto	ditto 167	Retained
Ditto	ditto 168	Discarded
Ditto	ditto 170	ditto
Ditto	ditto 172	ditto
Ditto	ditto 173	Retained
Ditto	ditto 174	Discarded
Ditto	ditto 175	ditto
Ditto	ditto 176	ditto
Ditto	ditto 177	Retained
Ditto	ditto 178	Discarded
Ditto	ditto 179	ditto
Ditto	ditto 180	ditto
Ditto	ditto 181	ditto
Ditto	ditto 182	ditto
Ditto	ditto 183	ditto
Ditto	ditto 184	ditto
Ditto	ditto 185	ditto
Queensland	Queensland, Gingor	Retained
Ditto	Queensland, Gingraya	Retained but failed
Ditto	Queensland, Gingila	Discarded
Ditto	Badila Seedling	Retained
Ditto	Hybrid No. 1	ditto
New Guinea	Oba Badila	Under examination
Queensland	Cassilis	Retained
Java	E.K. 1	Under examination
Ditto	E.K. 2	ditto
Ditto	E.K. 28	ditto
Ditto	100 Bont	ditto
Ditto	247 Generatie	ditto
Hawaii	Hawaii 109	ditto
Ditto	ditto 146	ditto
Ditto	ditto 227	ditto
India	Shahjahanpur 10	ditto
Mauritius	Mauritius 168/04	ditto

FIELD DAY AT BUNDABERG STATION.

This year, owing to the influenza outbreak and the drought, the Annual Field Day had to be abandoned. All going well it will be held again next year.

DISTRIBUTION OF VARIETIES.

Due to the drought only a minor distribution of cane was carried out. It is hoped that the usual distribution can be carried out next year, when the cane should have made better growth.

NEW EXPERIMENTS.

1. Cane has been planted upon land that has been growing lucerne for a number of years. Many farmers in the Woongarra district maintain that on the red soils cane will not grow after lucerne. An area was prepared and divided into three parts, each of which was treated as under :—

1. Plot treated with lime and green manure before planting.
2. Plot treated with lime only.
3. No lime or green manure.

In other respects the treatment of this land will be identical. The cane was planted in August of last year, but will stand over till next season.

2. Liming Experiments.—It is a matter of some doubt whether 1 ton of lime per acre is sufficient to apply. In Hawaii up to 7 tons of pulverised limestone per acre are put on. An experiment has, therefore, been laid down in which varying quantities of lime will be used :—

Plot 1 will receive no lime
Plot 2 will receive 1 ton per acre.
Plot 3 will receive 2 tons per acre.
Plot 4 willll receive 3 tons per acre.
Plot 5 will receive 4 tons per acre.
Plot 6 will receive 5 tons per acre.
Plot 7 will receive 6 tons per acre.

3. Pulverised Limestone *versus* Burnt Lime.—A series of experiments have been initiated to test this matter. Plot 1 has been treated with pulverised limestone, Plot 2 with slaked burnt lime, and on Plot 3 no lime has been applied.

4. Experiments to test the comparative value of using plant cane, first ratoon cane, second ratoon cane, and third ratoon cane for plants. The use of second and third ratoon cane is usually condemned.

5. Experiments with using different parts of the stick for plants. This has been tried in so far as tops, middles, and middles and bottoms are concerned, but it is now proposed to use all the plants in a stick separately, *i.e.*, top plants, 2nd 3 eyes, 3rd 3 eyes, and so on, including bottoms.

6. A further experiment with the subsoiler is also to be made—*i.e.*, portion of land subsoiled to 20 inches *versus* land ploughed 12 inches deep only.

7. The planting out of 16 New Guinea canes in a competitive trial.

8. Planting out of the best of the Queensland seedlings.

* Dry Weather at Bundaberg.

In common with all other parts of the Bundaberg district the Sugar Experiment Station has suffered from the drought now being experienced. This has led to the postponement of planting. Ratoons at the time of writing are coming away very slowly, and what young plant cane there is has been much retarded. The waterholes in the district are all dried up, and things generally have been in a deplorable condition. At the Station there is a very fine well, which has been made the utmost use of during the dry time. Farmers and dairymen from far and near have come daily for water, and though the demand has been very heavy, the supply has been maintained. Growers have much appreciated being able to get water at all times, and special facilities were provided so that tanks might be easily filled.

Cane Top Silage.

It may be remembered that some time ago a small silo was instituted at the Sugar Experiment Station, Bundaberg, for the purpose of siloing cane tops. These were gathered in the field immediately after the cane was cut, and chaffed up and then trodden well into the underground silage pit. As soon as this was completely filled it was weighted down with earth. After an interval of three or four months the pit was opened and a trial made of the silage contained therein. The Chemist in charge of the Experiment Station states that the station horses took very kindly to it when mixed with other feed, but did not care for it alone, while on the other hand cattle took to it at once and ate it greedily.

As there is an immense amount of cane tops usually going to waste in the canecutting season, it is evidently quite possible in those sugargrowing districts where mixed farming takes place, to silo cane tops and make use of same for feed at a time when forage is scarce. It may therefore be recommended to growers having dairy cattle.

6.—WORK OF THE CENTRAL SUGAR EXPERIMENT STATION AT MACKAY.

Mr. F. Keogh is the Chemist in charge of the Sugar Experiment Station at Mackay, and the chemical tables which are included in this portion of the report have been prepared by him. In addition to the chemical work of the station, Mr. Keogh has made a large number of cane analyses for Mackay growers, and all his work has been carried out with ability and zeal. He is assisted by Mr. W. Millard, foreman, and Messrs. Winton, Anderson, and Bailey in the field, and their duties have been most satisfactorily performed.

Meteorological.

Although the drought is not so bad in Mackay as it has been in the more Southern districts, it has had, and is still having, an adverse effect on the cane crops. After the cutting of the experiments last year, very dry weather followed. October, November, and December were very hot and dry, and rain was urgently required. Rain fell in January, but February was very sultry and rain did not fall again till the end of the month. There were no regular wet-season rains. March was a dry month also. Good rains fell in April, but a good deal of the best growing weather had been without rain. Some rains also fell in May, but since that date little or no rain has been experienced, and while not so dry as the Bundaberg and Childers districts, Mackay is urgently in need of good rains. Due to the dry cold weather from May till the end of September, the cane did not make its expected growth, and the mills were obliged to reduce their estimates—in some cases considerably.

The following table comprises the meteorological conditions experienced during the growing period of the crop from September, 1918, to August, 1919:—

---

* Note: Since the above was written fair rains fell at Bundaberg towards the end of October, but a great deal more is still required.

ABSTRACT OF METEOROLOGICAL OBSERVATIONS, MADE AT THE SUGAR EXPERIMENT STATION, MACKAY, FROM 1ST SEPTEMBER, 1918, TO 31ST AUGUST, 1919, COVERING GROWTH OF EXPERIMENTAL CROPS.

Month.	Rainfall in Inches.	Highest Shade Maximum.	Lowest Shade Maximum.	Mean Shade Maximum.	Highest Shade Minimum.	Lowest Shade Minimum.	Mean Shade Minimum.	Mean Diurnal Range.	Mean Temperature.	Mean Relative Humidity of the Air. Saturation equalling 100 at 9 a.m.	Mean Daily Evaporation in Cubic Inches.
September, 1918	1·08	84·1	78·0	80·1	68·0	47·5	57·9	22·2	70·9	87·0	·193
October, 1918	Nil	86·5	79·5	83·7	69·0	59·5	64·8	18·9	78·6	66·6	·240
November, 1918	2·63	89·5	85·5	87·8	69·5	59·5	66·6	21·2	81·3	73·0	·248
December, 1918	·33	92·5	88·0	90·3	76·5	67·5	73·3	17·0	81·8	71·6	·233
January, 1919	10·29	97·5	78·5	90·2	78·5	62·1	73·9	16·3	82·2	72·2	·214
February, 1919	6·75	92·5	82·0	90·0	72·5	62·8	68·4	21·3	80·5	87·0	·186
March, 1919	1·92	94·8	76·5	91·5	76·0	64·5	70·1	21·4	83·8	75·8	·191
April, 1919	9·52	88·5	80·0	84·5	71·0	44·5	68·4	16·1	75·2	87·3	·170
May, 1919	5·84	83·5	71·0	79·1	67·0	43·0	57·9	21·2	69·3	88·9	·145
June, 1919	1·56	83·0	70·1	76·1	69·0	42·0	57·0	19·1	67·4	79·5	·193
July, 1919	·59	83·0	67·0	74·6	58·0	37·0	47·0	27·6	65·9	61·5	·243
August, 1919	·15	84·1	71·5	77·6	60·2	37·0	47·8	29·8	68·6	58·6	·261
Total	40·66										

Lowest temperatures on the grass, July, 1919—4th 31·3°, 5th 32·5°, 9th 30·0°, 10th 31·5°, 16th 32·2°, 28th 33°, 29th 31°.

Lowest temperatures on the grass, August, 1919—1st 33·8°, 2nd 32·1°, 3rd 32·0°, 4th 31°.

Low grass temperatures also occurred in September; on the 9th the thermometer registered 31°.

The temperature readings are also of importance from the manner in which they are shown. Hilgard ("Soils," page 289) points out that it is the extremes of temperature that are most important, and that the annual mean temperature is not a good critieron, since one and the same figures may result equally from the averaging of two widely divergent data and from such as are close together. Thus an average of 60 degrees Fahr. might result equally from the averaging of 65 and 55 degrees, or from taking the mean of 15 and 105 degrees, yet the respective cultural adaptations would be widely different.

This section of the report includes the following :—

A.—Comparative field and analytical tests of 15 of the best New Guinea canes selected from Wells's Collection.

B.—Tests to determine the action of fertilisers on plant crops and their effect on the succeeding ratoon crops.

C.—Tests to determine the value of subsoiling ratoon crops.

D.—Subsoiling *versus* ordinary cultivation.

E.—Analyses of miscellaneous canes.

A.—COMPARATIVE FIELD AND ANALYTICAL TESTS OF FIFTEEN OF THE BEST NEW GUINEA CANES SELECTED FROM WELLS'S COLLECTION.

Full details of all the canes brought from New Guinea by Mr. Wells in 1912 appear in the Annual Reports for 1913-1918. Last year, on the completion of the trials of these canes, which had not so far developed disease, a selection of 15 of the best croppers and sugar-producers was made. These were carefully planted out under uniform conditions in specially prepared land in August, 1918. Very cold weather was experienced after planting, which was succeeded by dry conditions. The canes, however, did fairly well, and in July of this year the usual preliminary progressive analyses took place. The results appear in the tables hereunder :—

FIRST PRELIMINARY EXAMINATION OF FIFTEEN SELECTED PAPUAN CANES (WELLS'S COLLECTION)—PLANT CROP—JULY, 1919.

Variety of Cane.	Date of Analysis.	Age of Cane.	Total Solids (Brix).	% Sucrose in Juice.	% Glucose in Juice.	C.C.S. in Cane.	Purity of Juice.
N.G. 81	4-7-19	11 months	15·0	9·79	2·13	5·9	65·3
N.G. 83	4-7-19	do.	16·0	12·59	2·58	8·97	78·7
N.G. 87	4-7-19	do.	15·6	11·46	2·85	7·73	73·4
N.G. 88	7-7-19	do.	15·8	13·07	2·55	10·20	82·7
N.G. 89	7-7-19	do.	14·7	11·13	1·54	8·5	75·0
N.G. 94	7-7-19	do.	13·6	8·03	4·0	4·8	59·0
N.G. 102	7-7-19	do.	16·9	14·09	1·63	10·5	83·3
N.G. 103	7-7-19	do.	15·6	9·12	2·27	4·8	58·5
N.G. 123	7-7-19	do.	15·5	9·50	2·58	5·3	61·3
N.G. 130	7-7-19	do.	16·8	11·74	1·56	7·6	69·8
N.G. 141	7-7-19	do.	14·8	8·50	3·02	4·4	57·4
N.G. 147	7-7-19	do.	16·6	13·42	2·10	9·7	80·9
N.G. 161	7-7-19	do.	15·6	9·34	2·38	5·1	59·8
N.G. 164	7-7-19	do.	16·0	9·21	2·60	4·7	57·6
N.F. 165	7-7-19	do.	14·5	8·65	2·41	4·7	59·6

SECOND PROGRESSIVE EXAMINATION OF FIFTEEN SELECTED PAPUAN CANES (WELLS'S COLLECTION)—PLANT CROP—AUGUST, 1919.

Variety of Cane.	Date of Analysis.	Age of Cane.	Total Solids (Brix).	% Sucrose in Juice.	% Glucose in Juice.	C.C.S. in Cane.	Purity of Juice.
N.G. 81	5-8-19	12 months	15·4	11·71	2·03	8·1	76·0
N.G. 83	5-8-19	do.	15·6	12·18	2·05	8·6	78·0
N.G. 87	5-8-19	do.	17·5	14·54	1·85	10·8	83·0
N.G. 88	5-8-19	do.	17·3	14·38	2·03	10·7	83·0
N.G. 89	5-8-19	do.	17·6	14·48	1·88	10·7	82·0
N.G. 94	5-8-19	do.	15·7	10·71	3·33	6·7	68·2
N.G. 102	5-8-19	do.	18·1	15·38	1·17	11·6	84·9
N.G. 103	5-8-19	do	18·1	15·43	1·92	11·7	85·2
N.G. 123	5-8-19	do.	17·2	14·38	1·66	10·7	83·6
N.G. 130	5-8-19	do.	17·8	15·89	1·11	12·4	89·2
N.G. 141	5-8-19	do.	17·4	15·02	1·16	11·4	86·3
N.G. 147	5-8-19	do.	17·6	14·65	1·66	10·9	83·2
N.G. 161	5-8-19	do.	17·5	14·57	1·31	10·8	82·2
N.G. 164	5-8-19	do	17·1	14·11	1·29	10·9	82·5
N.G. 165	5-8-19	do	15·6	11·27	2·28	7·5	72·2

The final analysis of the plant crop was carried out in September, and it will be seen from the C.C.S. column that the sugar contents are all low. These canes have proved a most disappointing lot, there being nothing to equal Badila or any of the Gorus. The analyses, however, at Bundaberg are somewhat higher. The table set out below shows the analytical data secured at Mackay :—

FINAL EXAMINATION OF FIFTEEN SELECTED PAPUAN CANES (WELLS'S COLLECTION)—PLANT CROP—AUGUST, 1919.

Variety of Cane.	Date of Analysis.	Age of Cane.	Total Solids (Brix).	% Sucrose in Juice.	% Glucose in Juice.	C.C.S. in Cane.	Purity of Juice.	Fibre in Cane.
N.G. 81	2-9-19	13 months	17·82	15·01	1·39	11·13	84·2	11·9
N.G. 83	2-9-19	do.	18·62	16·28	1·41	12·65	87·4	10·0
N.G. 87	2-9-19	do.	16·82	13·69	2·15	9·86	81·4	12·3
N.G. 88	2-9-19	do.	18·55	16·39	1·18	12·54	88·3	11·9
N.G. 89	2-9-19	do.	20·35	18·50	·96	14·80	90·9	9·6
N.G. 94	2-9-19	do.	15·47	10·42	2·70	6·35	67·3	12·5
N.G. 102	2-9-19	do.	17·1	14·35	1·96	10·97	83·8	9·1
N.G. 103	2-9-19	do.	18·4	15·43	1·82	11·57	83·8	10·7
N.G. 123	2-9-19	do.	18·2	15·39	1·72	11·38	84·5	12·3
N.G. 130	2-9-19	do.	18·8	16·58	1·92	12·65	88·2	12·0
N.G. 141	2-9-19	do.	18·9	16·23	1·55	12·23	85·9	11·6
N.G. 147	2-9-19	do.	19·2	16·56	1·54	12·62	86·2	10·9
N.G. 161	2-9-19	do.	18·9	16·82	1·21	12·89	89·0	12·7
N.G. 164	2-9-19	do.	19·7	17·83	·96	13·79	90·5	12·2
N.G. 165	2-9-19	do.	17·9	16·01	1·15	12·71	89·4	9·4

In September the crop was cut and sent to Racecourse Sugar Mill, and from the weights and the analytical data the following table of crop results has been compiled :—

CROP RESULTS OF SELECTED PAPUAN CANES (WELLS'S COLLECTION) IN FINAL COMPETITIVE TEST—PLANT CROP—1919.

Name or Number of Variety.	Age of Cane.	Weight of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
N.G. 81	13 months	44·9	5·1
N.G. 83	do.	41·4	5·2
N.G. 87	do.	33·0	3·2
N.G. 88	do.	42·2	5·3
N.G. 89	do.	23·5	3·5
N.G. 94	do.	27·8	1·7
N.G. 102	do.	47·0	5·1
N.G. 103	do.	50·7	5·9
N.G. 123	do.	34·8	4·0
N.G. 130	do.	50·0	6·3
N.G. 141	do.	34·2	4·2
N.G. 147	do.	33·4	4·2
N.G. 161	do.	17·5	2·2
N.G. 164	do.	14·6	2·0
N.G. 165	do.	38·8	4·9

Although many of the yields are good, as shown above, unless these varieties improve in sugar content they are not likely to be much sought after by farmers in these days when the commercial cane sugar in cane is such a vital factor. It is intended to carry them on through two more crops which, with the data that will be available from Bundaberg, should give some indication as to whether any of them will prove of value to the industry.

The following are the descriptions of the above 15 canes :—

N.G. 81.—Stout brown-coloured cane with white wax, joints 2 to 5 inches in length, barrel-shaped and inclined to crack, eyes medium full and slightly acute, grooved, stool good, habit erect, foliage medium bright and heavy, trashes easily, germination good ; very similar to N.G. 26, but a heavier cropper.

N.G. 83.—Light-green-coloured cane of medium thickness, joints 2 to 5 inches in length, inclining to barrel, eyes full and acute, no groove, foliage medium bright and heavy, stool good, inclining to lodge, trashes easily, germination good.

N.G. 87.—Stout green-coloured cane with pink to red blush, parallel sided joints 3 to 5 inches long, eyes flat and acute, lying in deep grove, stool good and growth erect, foliage broad and heavy, trashes easily, germination good.

N.G. 88.—Light-green-coloured cane of medium stoutness with pale somewhat indistinct red stripe, heavily waxed with white wax, joints 3 to 5 inches in length, barrel-shaped and zigzag, eyes medium full and slightly acute, no groove, foliage medium, stool good, inclining to lodge, trashes easily, germination good.

N.G. 89.—Stout red cane with green stripe, joints 2 to 4 inches in length, slightly barrel and zigzag, eyes small, full and round, no groove, foliage medium and striped on sheath and midrib, stool fair and habit erect, trashes easily, and germination good.

N.G. 94.—Light-green-coloured cane of fair thickness, semi-erect habit, joints 4 to 6 inches, telescopic at nodes, eyes flat, acute, and running in deep grove, foliage broad and heavy, stool and germination good.

N.G. 102.—Light green to yellow coloured cane of fair stoutness, black waxed, semi-erect habit, joints 5 to 7 inches, parallel sided, bulging at nodes, eyes large, full, and acute, running in groove, foliage broad and heavy, stool and germination good.

N.G. 103.—Dirty olive-green-coloured cane with light red to brown coloured stripe, medium stoutness, heavily waxed, erect habit, joints 3 to 5 inches, barrel-shaped, eyes medium, full, and acute, foliage medium, germination and stool very good.

N.G. 123.—Stout yellow-coloured cane with bright-green stripe, joints 4 to 5 inches in length, parallel sided and bulging at nodes, eyes medium, full, and acute, deeply grooved, foliage broad and heavy showing white stripe on sheath and midrib, stool good and semi-erect in habit, trashes easily, and germination good.

N.G. 130.—Olive-green-coloured cane with light-red stripe, medium thickness, erect habit, joints 3 to 5 inches, staggered, eyes large, full, and acute, foliage medium, germination good, stool fair.

N.G. 141.—Light-green to yellow-coloured cane with broad pink stripe, medium stoutness, semi-erect habit, joints 3 to 6 inches, parallel sides, eyes round and full, foliage medium with striped leaf, germination and stool good.

N.G. 147.—Yellow cane with green stripe and slight pink blush, medium stoutness, semi-erect habit, joints 4 to 6 inches, parallel sided, eyes medium, full, and acute, foliage medium, germination and stool good.

N.G. 161.—Stout olive-green-coloured cane, eyes are flat and acute, running in groove, joints are also slightly staggered.

N.G. 164.—Green-coloured cane, heavily waxed with black wax, medium stoutness, semi-erect habit, joints 4 to 6 inches, parallel sided, eyes medium, full, acute, foliage medium, germination and stool good.

N.G. 165.—Same cane as original New Guinea 40.

B.—Tests to Determine the Action of Fertilisers on Plant Crops of Cane and their Effect on Succeeding Ratoon Crops.

During the course of a number of manurial experiments at this station, the fact has frequently been noted that where the land has been treated with lime and green manure the subsequent application of fertilisers to plant crops has not increased the yield notably. When the cost of the manures is taken into consideration, the fact cannot be overlooked that the fertilising of a plant crop may not be a payable proposition as far as the plant crop is concerned.

There is, however, another aspect of the question, which is that extremely payable results are obtained in the succeeding ratoon crops, where results often show an increase of 15 tons per acre due to the use of manures on this class of crop. The question arises : Is the action of the manure alone responsible for this increase ? ; or does the application of fertiliser to plant cane result in a more vigorous stooling, and, in consequence, being of higher vitality, causes it to throw a stronger and more robust ratoon ? In order to arrive at this point, two plots were planted out with cane known as New Guinea 24B, which have been treated as follows :—

Plot 1.—Not fertilised in the plant crop, but all succeeding ratoon crops will be manured.

Plot 2.—Has received manure in both plant and ratoons.

The experiment, unfortunately, met disaster in the shape of the cyclone and the tremendously abnormal rainfall in January and early in February, 1918. The results of that year showed little difference between the two plots, and this year the same result has occurred. It was stated last year that it had been thought better to include the results of 1918, as they might have some bearing on this year's figures. It is apparent that they have, the amount of cane destroyed by the cyclone evidently influencing this year's crop. As a matter of interest the figures will be included for the three crops, but it is intended to repeat the experiment.

Yields to Date in the Above Manurial Experiments—Plant, First, and Second Ratoon Crops; N.G. 24B—1917, 1918, and 1919.

Plot.	Treatment.	Plant Crop, 1917.			First Ratoon Crop, 1918.			Second Ratoon Crop, 1919.			Total Yield, Three Years.	
		Age of Cane.	Weight of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.	Age of Cane.	Weight of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.	Age of Cane.	Weight of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.	Weight of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
1	No Fertiliser applied to Plant Crop, but succeeding Ratoon Crops fertilised	13 mths.	48·2	7·0	11 mths.	21·1	3·2	11 mths.	22·2	3·3	91·5	13·5
2	Plant Crop treated with Mixed Fertilisers, and Ratoon Crops also fertilised	do.	48·6	6·7	do.	21·7	3·3	do.	20·7	3·2	91·0	13·2

It will be seen that the yield of the three crops from Plots 1 and 2 are practically identical. Until the experiment is repeated, however, it would be unwise to draw conclusions as to whether the use of manures on a plant crop does cause it to produce stronger and more robust ratoons.

C.—Tests to Determine the Value of Subsoiling Ratoon Crops.

The method of ratooning cane in vogue at this station may be briefly described as follows :—Centres of drills are split with a swing plough and subsoiled, the stools are then cut away from and also subsoiled, manure is applied to the stools, and the centres immediately worked down with a scuffler. As this method is somewhat slow, and the cost of cultivation has now to be seriously studied, in some cases where the cane is not under experiment, such as that for propagation and distribution purposes, the ratooning has been confined to simply loosening the soil. In some cases the only treatment received has been a deep double cultivation with the riding spring-tooth cultivator. In watching the results, the latter method has often compared favourably with the former, and it may be that a well-fertilised cane stool growing on ground which has been previously deeply cultivated before planting may possess sufficient vitality to produce a flourishing ratoon crop without further treatment other than a loosening of the surface hard pan.

In the preparation of land for planting it has been noticed that where land has previously been subsoiled, the subsoil, even after a lapse of as long as four years, is of a considerably more friable and porous nature than where no subsoiling has been given. This is borne out when rain falls, as during harvesting great trouble is often experienced through teams bogging on such land. On subsoiled ground, apparently, the only setting of the land occurs in the first nine inches of soil, whilst below this depth the soil is in a comparatively loose condition. As the point is of considerable value in lowering the cost of production, it fully justifies experiment. To this end plots have been treated as follows :—

Plot 1.—Plant and ratoon crops subsoiled.

Plot 2.—Plant crop subsoiled, but ratooning has been carried out with the spring-tooth cultivator only.

The analytical data and the crop results appear hereunder :—

Experiments to Determine the Value of Subsoiling Ratoon Crops—N.G. 24B, Second Ratoon Crop—1919.

Plot.	Treatment.	Date of Analysis.	Age of Cane.	Total Solids (Brix).	% Sucrose in Juice.	% Glucose in Juice.	C.C.S. in Cane.	Purity of Juice.	Fibre in Cane.
3	Plant and Ratoon Crops both Subsoiled	4-9-19	11 months	21·2	20·05	·62	16·0	94·6	11·75
4	Plant Crop Subsoiled, but succeeding crops Ratooned with Spring-toothed Cultivator only	4-9-19	do.	21·0	19·87	·59	15·86	94·6	11·75

Crop Results of Experiments to Determine the Value of Subsoiling Ratoon Crops—N.G. 24B, Second Ratoon Crop—1919.

Plot.	Treatment.	Age of Cane.	Yield of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
3	Plant and Ratoon Crops both Subsoiled..	11 months	21·2	3·4
4	Plant Crop Subsoiled, but succeeding crops Ratooned with Spring-toothed Cultivator only	do.	23·9	3·8

Following is a table showing the total crop results for the first and second ratoon crops, from which it appears that the results are decidedly in favour of spring-tooth cultivation for ratoons as opposed to subsoiling.

Crop Results to Date of Experiments to Determine the Value of Subsoiling Ratoon Crops—N.G. 24B; Plant, First, and Second Ratoon Crops—1917, 1918, and 1919.

Plot.	Treatment.	First Ratoon Crop, 1918.			Second Ratoon Crop, 1919.			Total Yield Two Years.	
		Age of Cane.	Yield of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.	Age of Cane.	Yield of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.	Yield of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
3	Plant and Ratoon Crops both Subsoiled	11 months	21·5	3·9	11 months	21·2	3·4	42·7	7·3
4	Plant Crop Subsoiled, but succeeding crops Ratooned with Spring-toothed Cultivator only	do.	24·8	3·9	do.	23·9	3·8	48·7	7·7

D.—Subsoiling versus Ordinary Cultivation.

At the request of many farmers in the Mackay district for a repetition of experiments as to the value of subsoiling as compared with ordinary farmers' cultivation, an experiment of this nature was laid down last year. The previous test was made in 1902, when the results were as follows :—

Treatment.	Yield of Cane per Acre.	Yield of Sugar per Acre.
Deep subsoiling (21 inches) supplemented by thorough cultivation	49·6	6·7
Ordinary farmers' treatment	29·6	3·7

The cane grown by the deep subsoil and thorough cultivation had a higher sucrose, higher purity, lower glucose, and a notably less content of fibre, thus resulting in a higher total amount of commercial cane sugar than in the cane grown by "ordinary cultivation."

In 1918 when the results of the plant crop came to hand it was found, due to the cyclone, that the results were very low. It was estimated that more than 50 per cent. of this cane was destroyed, the wind striking the cane at right angles to the rows. This year the crop recovered a great deal, and the analytical and crop results will be found in the succeeding tables.

Further Experiments on the Value of Subsoiling—N.G. 24a, First Ratoon Crop—1919.

Plot.	Treatment.	Date of Analysis.	Age of Cane.	Total Solids (Brix).	% Sucrose in Juice.	% Glucose in Juice.	C.C.S. in Cane.	Purity of Juice.	Fibre in Cane.
1	Plant Crop Subsoiled, and succeeding Ratoon Crops also Subsoiled	4-9-19	11 months	21·4	20·31	·58	16·21	94·9	11·92
2	Plant Crop not Subsoiled, and succeeding crops Ratooned by Ploughing 10 inches deep	4-9-19	do.	21·4	20·18	·70	16·04	94·3	11·92

Crop Results on the Value of Subsoiling—N.G. 24a, First Ratoon Crop—1919.

Plot.	Treatment.	Date of Analysis.	Age of Cane.	Yield of Cane per Acre in English Tons.	Yield of Commercial Cane Sugar per Acre in English Tons.
1	Plant Crop Subsoiled, and succeeding Ratoon Crops also Subsoiled	4-9-19	11 months	31·9	5·2
2	Plant Crop not Subsoiled, and succeeding crops Ratooned by ploughing 10 inches deep	4-9-19	do.	28·8	4·6

Crop Results to Date of Experiments to Test the Value of Subsoiling—N.G. 24a.

Plot.	Treatment.	Plant Crop, 1918.			First Ratoon Crop, 1919.		
		Age of Cane.	Yield of Cane per Acre in English Tons.	Yield of Sugar per Acre in English Tons.	Age of Cane.	Yield of Cane per Acre in English Tons.	Yield of Sugar per Acre in English Tons.
1	Plant Crop Subsoiled and succeeding Ratoon Crops also Subsoiled	13 months	14·2	2·2	11 months	31·9	5·2
2	Plant Crop not Subsoiled and succeeding crops Ratooned by Ploughing 12 inches deep	do.	11·5	1·8	do.	28·8	4·6

Crop results to date are given above. It will be noted that there is a difference in favour of subsoiling both in plant and ratoon crops.

Note.—This experiment differs from the preceding one, inasmuch as one plot only was subsoiled. In No. 4 both plant crops were subsoiled, but one plot of the ratoons was not subsoiled. In the present experiment the test is a straightout one between subsoiling and non-subsoiling. This experiment is also being repeated.

E.—Analyses of Miscellaneous Canes.

The following analyses of a number of new canes will prove interesting :—

Analyses of Miscellaneous Canes—Plant Crop.

Variety of Cane.	Date of Analysis.	Age of Cane.	Total Solids (Brix).	% Sucrose in Juice.	C.G.S.	Purity.
Q. 813	4-9-19	13 months	21·2	20·25	16·38	95·3
Q. 970	4-9-19	do.	21·3	20·01	16·02	93·7
Q. 1098	4-9-19	do.	20·3	17·98	13·91	88·4
Q. 1121	4-9-19	do.	18·3	16·61	13·05	90·6
H.Q. 458	4-9-19	do.	19·3	17·21	13·36	88·9
Mowbray Seedling	4-9-19	do.	20·33	18·72	14·84	92·1
D. 1457	4-9-19	do.	20·6	19·43	15·61	94·1
West Indies No. 1	4-9-19	do.	18·3	15·87	12·13	86·7
West Indies No. 2	4-9-19	do.	19·7	18·81	15·23	95·5
Wesr Indies No. 3	4-9-19	do.	18·2	15·23	11·36	83·7
West Indies No. 4	4-9-19	do.	19·65	19·03	15·53	96·8
Gingor	4-9-19	do.	21·2	19·99	16·07	94·3
Gingraya	4-9-19	do.	19·8	17·70	13·78	89·4
8R 431	4-9-19	do.	21·5	20·03	15·99	93·1
7R 428	4-9-19	do.	19·7	17·30	13·33	87·8
Unknown	4-9-19	do.	18·7	16·23	12·41	86·8

The Mowbray Seedling is very like Badila and comes from Mossman. 8R 431 and 7R 428 are seedlings raised by the Colonial Sugar Refining Company in Fiji. Gingor and Gingraya are crosses raised by Mr. Crofton, of Ayr. The West Indian canes are seedlings that have been imported from the West Indies, and Nos. 2 and 4 appear promising.

Arrowing of Canes on Mackay Station.

1919—20th May—Malagache, M. 87, Q. 1133, N.G. 94, 146, 185.

26th May—Reintroduced D. 1135.

7th June—N.G. 16, N.G. 89, 158, Q. 1092.

21st June—N.G. 164, Q. 855.

Distribution of Cane Varieties at Mackay.

The usual distribution of canes to farmers took place and was a great success, no less than 121 farmers putting in an appearance for cane. In addition to this a large number of packages of varieties were sent to outside growers, and a number of crates were also despatched to the new station at Innisfail.

New Experiments.

New experiments this year will include :—

1. Subsoiling trials ;

2. Trials of new canes from a chemical and commercial standpoint. The following varieties have been planted out to provide seed for this purpose :—

Mowbray Seedling, West Indian Nos. 1, 2, 3, and 4.

Gingor, Gingraya, 7R 428, 8R 431, D. 1457.

Brisbane Seedling, Unknown, and H.Q. 458.

7.—WORK OF THE NORTHERN SUGAR EXPERIMENT STATION AT SOUTH JOHNSTONE, INNISFAIL.

The piece of land to be used as a site for the Northern Sugar Experiment Station was selected owing to its being Crown land. It is situated at the foot of the Basilisk Range, upon the opposite side of the river from the South Johnstone Mill. The land is of fair average quality, low in available phosphoric acid and lime, and, like most of the soils in the neighbourhood, containing a larger percentage of magnesia than lime.

During the past year the necessary buildings have been completed. These comprise a laboratory, chemist's residence, foreman's residence, men's quarters, and stables,

The land after a great number of stumps had been removed was put under the plough, and by September a large portion had been cross ploughed four times. Planting was then taken in hand. Varieties of cane were sent up from Mackay and Bundaberg and were planted out in a nursery. These comprise :—

From Mackay.—Q. 1133, 1098, 1092, 855, 812A, 1121, 970, 903, 813, N.G. 24, 24A, 24B, Badila Seedling, Hybrid No. 1, Petite Senneville, Q. 695, M. 87, M. 89, N.G. 16, H.Q. 426, 428, 7R 428, and 8R 431.

From Bundaberg.—Hawaii, 109, 227, 146. Java, E.K. 1, E.K. 2, E.K. 28, 100 Bont. 247, H.Q. 77. Mauritius, 168[04]. South Africa, Yuba or Uba.

Canes were also sent down from the Kairi State Farm, near Atherton, where they had been sent in 1913. During the interval they have been grown on the Tableland in the hope that they would throw off disease and become sound healthy canes. The varieties which came down to Innisfail were :—Rose Bamboo or Rappoe, Meera, Striped Singapore, Goru, and Badila.

In addition to the planting out of these canes, experiment plots of Badila were also laid out. It is hoped to conduct fertiliser trials upon these during the coming season, but owing to the shortage of stocks it is feared that these will not be so complete as hoped for. It is particularly difficult to obtain fertilisers at the time of writing, and, when obtained, to get them shipped.

A well-appointed laboratory has been installed, so that Northern farmers will be able to get soils, waters, limestones, fertilisers, and sugar-canes tested free of charge.

The position of Chemist in Charge is filled by Mr. P. H. McWalters, a returned soldier. Mr. McWalters has considerable chemical experience along the lines of both sugar and agriculture. He is assisted in the field by Mr. E. McCulloch.

The originally planned idea of three Experiment Stations has now been fulfilled by the addition of Southern and Northern institutions to the original Central Station.

8.—SUGAR-CANES, SEEDLINGS, CANE FROM KAIRI, ETC.

Several of the New Papuan varieties were sent to Mr. James Mackersie's farm at Ayr in 1918. During the present year they were analysed when they were 11½ months old. It will be seen that the gerenal results were low, N.G. 89 being the best of the lot, as it also was at Mackay.

ANALYTICAL RESULTS OF CANE FROM MR. MACKERSIE'S EXPERIMENTAL PLOT.

Variety.	Age of Cane.	% Fibre assumed.	% Brix.	% C.S.	Quot.	C.C.S.
N.G. 123	11½ months	11	15·10	11·40	75·50	7·90
N.G. 130	do.	11	18·40	14·80	80·40	10·70
N.G. 103	do.	11	16·50	13·60	82·40	10·00
N.G. 89	do.	11	22·40	19·60	87·50	15·10
N.G. 164	do.	11	20·40	17·40	85·30	13·15
N.G. 161	do.	11	16·10	12·90	80·10	9·25
N.G. 147	do.	11	17·10	14·10	82·50	10·35
N.G. 88	do.	11	17·10	13·40	78·40	9·60
N.G. 94	do.	11	17·10	12·90	75·40	8·85
N.G. 83	do.	11	15·10	11·70	77·50	8·20
N.G. 81	do.	11	16·80	13·70	81·50	10·05
N.G. 102	do.	11	16·70	13·40	80·20	9·75
N.G. 87	do.	11	18·90	15·80	83·60	11·80
N.G. 165	do.	11	19·20	16·90	88·00	13·05
N.G. 141	do.	11	15·20	11·80	77·60	8·30
Q. 903	12 months	11	19·60	17·40	88·80	13·45

NOTES ON CANES.

The Manager of Qunaba Plantation, near Bundaberg, reported that Q. 813 had done very well, and on the 30th July, 1919, was showing five to six feet of cane. The Fairymead Sugar Company have planted out about 20 acres of this variety, which is doing well in many parts of Queensland.

H.Q. 285 continues to do well about Nambour. It is spoken of as having a high sugar content and being a good ratooner.

As showing the appreciation of farmers for the work being carried out by the Sugar Experiment Stations, the following paragraph appeared in a Bundaberg paper :—

"The day has gone by for growing sugar-cane varieties that give bulk weight, irrespective of commercial cane sugar results. Farmers realise the benefits to be derived from selecting cane plants of high density, that are in other respects adaptable to this district.

"Therefore, information regarding such is eagerly sought and closely scrutinised. The Experiment Station has rendered much assistance to growers, and the information and advice

thereby obtained has been greatly appreciated. Individual growers, from time to time, through the volumes of the 'Mail,' have made public the result of their experience, and such is invariably sought for by farmers and is invariably accepted as most useful.

"Mr. J. Kincaid, of Marrington, Ashfield, Woongarra, was yesterday good enough to show us the official analysis of three samples of cane supplied to the Experiment Station for the purpose of ascertaining the true value. Sample No. 1 is H.Q. 285, a new variety just newly tried in this district. As indicated it is a Hambledon Seedling. Mr. Kincaid has a half-acre plot, and finds it both frost and drought resisting, and he strongly recommends it to district farmers. It is cane easy to work, a self-trasher, and stands erect. At 11 months old, unmanured, and receiving no special attention, Mr. Kincaid estimates the crop at 15 tons to the acre despite the severe season that it has had to endure. He will not cut the crop for the mill, having resolved to retain it for plant purposes, and he will gladly permit anyone interested to examine it whilst growing."

Seedlings.

With reference to the raising of seedlings it is hoped to do some work along this line of investigation at the new Experiment Station at South Johnstone. The following remarks by Professor J. B. Harrison, of British Guiana, who has had a long experience in the raising of seedling canes, is worthy of note. The extract is taken from Professor Harrison's Presidential Address to the Royal Agricultural and Commercial Society of British Guiana, and is as follows :—

"In 1897 investigators generally were of the opinion that once a new variety of sugar-cane was produced, that after its first period of excessive vegetative vigour has passed, its characteristics were fixed for all time. Soon after the cultivation of the new varieties had been extended over large areas, it became painfully evident to the majority of planters that their characteristics are not fixed, and that, in many instances, characteristics which in the earlier years promised to make a variety of sugar-cane of high value both in field and factory, were the first to fail. This tendency towards senile degeneration renders it necessary to raise new varieties of seedling canes year after year, in the hope of having fairly good varieties available to replace others which may gradually fail.

"Experience has proved to us that it is very easy indeed to raise new varieties of sugar-canes which are of high promise as plant canes. It has further proved to us that it is relatively difficult to obtain sugar-canes capable of producing good crops as plant canes and as first ratoons ; and that it is exceedingly difficult to produce varieties which can be relied on to give satisfactory crops of plant canes, first, second, and third ratoons. Few indeed of the enormous numbers of new varieties which are now raised each year in various parts of the tropics will do this.

"We have been advised time after time to give up our proven methods and to confine our efforts towards raising canes by cross-fertilisation. If we had in this colony sugar-canes of single parentage showing fixed characters and, through their purity of origin, having little or no tendency to mutation or sporting, that advice would be excellent. In India, and to a less extent in Java, sugar-cane varieties of high purity of strain exist ; and with these it is possible that by the application of Mendelian principles in raising seedlings, new varieties of high value may be obtained. Up to the present, however, this has not taken place.

"At the inception of the sugar-cane breeding work here, Jenman was enthusiastic over the possibilities of raising new varieties of high promise by controlled methods of cross-fertilisation ; but in 1892-93 our hopes in that direction received a severe shock. Using a variety of sugar-cane, the Kara-kara-wa cane, which our experience in three preceding years had shown to produce seedling canes having usually somewhat close resemblance to the parent variety, and placing it under conditions by which it was impossible for its arrow or flowering shoot to be either cross-fertilised by any other variety, or fertilised by any other flower-shoot of its own kind, we got seedling canes from the one arrow of 267 different sorts. The parent cane in its own seedling stage was hence possibly derived from 14 diverse ancestral strains.

"Supposing, for example, that we take two kinds of sugar-cane—one X, having as ancestral kinds the varieties A, B, C, D, E, and F, and the other Y, derived from its ancestors A, B, G, H, I, and J—it is evident that 406 different combinations can arise from the interbreeding of the two kinds, instead of a single blend or cross X by Y.

"By Mendelian segregation, the inheritable properties of this diverse progeny will fall into three groups. We do not know which properties are inherited ; but assuming that the general characteristics as a whole are heritable, the segregation of the seedlings from the cross X and Y may give rise in the first generation to 1,218 groups of varieties.

"Now either X or Y, by interbreeding with its own kind, could produce only 15 by 3 groups or forty-five general strains of sugar-canes. The complexity introduced by the cross-fertilisation of existent complex hybrids is well illustrated by this example.

"Up to 1902 we had not made any systematic attempt at raising canes of controlled parentage. We now do it as a matter of regular routine—not with any idea of getting seedlings having definite and desired characteristics, but as a means of greatly widening the range of their variation. We have complete proof of the success of the method in this line. Unfortunately, there is no chance in British Guiana of controlled cross-fertilisation of the sugar-cane proving a short and certain way to success in the production of new varieties of high saccharine value.

"Probably a more disappointing investigation has never been pursued than has been the search for improved varieties of sugar-cane. There are now many stations at work at it in the tropics and sub-tropics. Their results appear to be very similar ; in the earlier years, working with natural varieties of sugar-cane, several kinds of high promise are almost invariably obtained ; in later years, when the mass of material for parental purposes has rapidly and enormously increased, the production of really good varieties appears to become increasingly difficult, and results satisfactory to both investigator and planter tend to be few and far between."

Varieties at Kairi.—Some years ago a number of the older kinds of cane were sent up to the Kairi State Farm, near Atherton. These were Rose Bamboo or Rappoe, Striped Singapore or Mauritius Gingham, Meerah, Goru, and Badila. The first three varieties were long the standard canes of the State, but in recent years they developed disease. Badila was also reported to be deteriorating in some districts. It was thought that if they were taken to a high elevation and colder climate, and allowed to remain there for some years, they might ultimately become rejuvenated and again become useful canes. These varieties have now been at Kairi for six years, and, while they have met with drawbacks in the shape of cyclones and drought, they have never shown any traces of disease. They have now been brought down to the Innisfail Experi-

ment Station, and will from there be distributed to other places. The Tableland Badila should be particularly useful in North Queensland. The Bureau is much indebted to Mr. C. E. Olive, the manager of the farm, for his care of the plants and his anxiety to do everything possible to ensure the success of the experiment.

9.—WORK OF THE LABORATORIES.

The large amount of chemical data collected in this report is a comparatively small part of the analytical work carried out by the laboratories at Bundaberg and Mackay. Now that the commercial cane sugar in cane is paid for by a scale under the awards of the Cane Prices Boards, farmers are taking a much keener interest in ascertaining the value of their canes than they did a few years ago. As a consequence the Bundaberg laboratory is kept very busy analysing farmers' canes during the season, and the Mackay laboratory has also received many more growers' samples than hitherto. Part of the staff of the Sugar Experiment Station is located in Brisbane, the chemical work being carried out in the laboratory of the Department of Agriculture, under the supervision of Mr. J. C. Brünnich, who is hereby thanked for the large number of soil and other analyses carried out for the Bureau, and the quickness with which results are obtained :—

CANE AND JUICE ANALYSES CARRIED OUT AT THE SUGAR EXPERIMENT STATION, BUNDABERG, SEASON 1919.

Materials.	Number of Analyses.
Sugar Cane and Juices for Growers	278
Sugar-canes for the Horticultural Society, Bundaberg	67
Sugar-canes for the Agricultural Show, Gin Gin	43
Sugar Canes and Juices for Experiment Station	20
Sugar-cane Fibres for Experiment Station	6
Total	414

DETAILED REPORT OF ANALYTICAL WORK PERFORMED BY THE LABORATORY OF THE SUGAR EXPERIMENT STATION, MACKAY, FOR THE SEASON 1918-19.

Materials.	Number of Analyses.
Sugar-canes for Farmers	178
Sugar-cane Juices—Station	67
Sugar-cane Fibres	18
Limestones	7
Waters	2
Rock Deposits	2
Soils	4
Total	278

ANALYSES CARRIED OUT FOR THE BUREAU OF SUGAR EXPERIMENT STATIONS AT THE AGRICULTURAL LABORATORY, BRISBANE.

Materials.	Number of Analyses.
Soils	42
Waters	18
Limestones and Lime Earths	23
Fertilisers	3
Sugars and Molasses	10
Total	96

10.—WORK OF THE DIVISION OF ENTOMOLOGY.

The work of the entomological branch of the Sugar Bureau is so important and so much hangs on the investigation now being undertaken in relation to the grub pest that the keenest interest is taken by growers and millers alike in the work now proceeding at Gordonvale, which is in the hands of Dr. J. F. Illingworth, who has associated with him Mr. Edmund Jarvis. By means of monthly reports the Entomologist has kept the subject of his researches before the canegrowers, and valuable information and assistance to them is therein given. Dr. Illingworth has written the following for the Annual Report :—

"After two years of investigation of control measures for white grubs affecting the roots of sugar-cane, I am more and more impressed with the tremendous importance of the problem.

Investigation of control measures for white grubs injurious to field crops is as old as economic entomology—more than 30 years ago we find that these pests were a serious menace in Europe. When the cockchafer appeared in Denmark in 1887 the Government got behind a movement for collecting the beetles by hand, which was carried out so persistently and economically by the people that the country was apparently quickly rid of the pest. Naturally similar methods have formerly been advocated for Queensland, and, in some localities, vast quantities of beetles were collected, at great expense to the growers, but with little apparent result. The only explanation that suggests itself is that areas collected were comparatively small, and the price demanded for collecting would bankrupt a State if all the beetles were collected. These insects are indigenous on the wild grassland, which is very extensive in North Queensland—much more so than the narrow belts of cleared agricultural lands.

It appears to me something like a proposition of picking up all the insects on a square foot in the middle of a large field, then expecting that this small area would be freed of the pest for succeeding crops. We get the same result—the beetles swarm over it again from the surrounding infested lands, so that no noticeable benefit appears.

Damage Done by Grubs.

"An estimation of the vast economic importance of this pest in North Queensland is difficult to formulate. First of all, we should consider the immense areas that have gone out of cultivation, solely because of the grubs. On the friable red-volcanic soils, which are of high fertility, this is particularly true. Even much of the land that is now planted to cane will soon go out, unless some relief is furnished. The most distressing part of the situation is that the grubs wait until all the work of planting, chipping, and cultivation is finished, and the cane is laid by—all the expense has been put into it—when the grubs begin their devastation. It is heart-rending to view the ruin on an estate like Greenhills, in the Cairns district, where hundreds of acres of beautiful, perfect cane goes down to destruction within a few weeks, during March. Once the roots are eaten off the slightest wind pushes the stool over in that loose soil; then deterioration quickly sets in.

"In 1911, a conservative estimate* of the annual loss in the Cairns district, through grubs, was 25 to 30 thousand tons; and this loss continued year after year in spite of all efforts to combat the pest. In one year the Cairns growers collected 22 tons of beetles and 9 tons of grubs, at an expense of over £3,000, with no apparent diminution in the pest. On this point the following interesting figures† will help one to understand what a ton of beetles represents:—1 lb. of beetles equals 250; in 1 ton there are 560,000 beetles, 60 per cent. females equals 336,000, each laying eggs which produce 25 fully grown grubs, equals 8,400,000. Since it is estimated that 16,000 are sufficient to destroy 1 acre of cane, 1 ton of beetles, therefore, could destroy about 500 acres of cane.

"From data at hand, it is easy to see that in all the canegrowing districts of Queensland the losses from the grub pest alone undoubtedly runs into hundreds of thousands of pounds.

Combating the Pest.

"I must admit that the problem seemed hopeless at first, but I am beginning to see light. In fact, I am more and more encouraged as the investigation proceeds.

"Control measures have been developed along several lines, the most important of which are: (1) stimulating vigour in the plant, (2) egg destruction by cultivation, (3) application of poisons, and (4) removal of feeding trees.

"There are numerous factors which bring about increased vigour, and all of them should be considered as valuable aids in combating the pest, for if the cane is in a thrifty growing condition it will resist the grubs to a considerable degree. Among these factors, I would suggest the application of lime and fertilisers, supplying humus, and thorough cultivation.

"Lime, as every grower knows, improves the physical condition of clay soils, and assists in the rapid change of plant refuse into humus. It improves the health of soil bacteria and fungi, in other words, which are all-important in the growing of crops. It is well recognised, too, that a leguminous green crop does very poorly in land without lime, which is essential to the bacteria forming the nitrifying nodules on the roots.

"The use of fertilisers is important in the growing of any crop, but this is particularly true with sugar-cane, for experiments have demonstrated that a 30-ton crop removes from the soil 102 lb. of nitrogen, 65 lb. of potash, and 45 lb. of phosphate. Land poor in these elements naturally produces cane of inferior quality, which easily succumbs to grub injury. Experience has shown that, for the best results, small experimental plots should be developed in each locality or class of soil. In Hawaii this diversified testing is done by the Planters' Experiment Station, with such efficiency that they have found that under certain conditions it pays to apply 1,200 lb. of mixed fertilisers, containing 11 per cent. of nitrogen, and, on top of this, to add as much

* "Australian Sugar Journal," vol. 3, p. 199. † "Australian Sugar Journal," vol. 2, p. 443.

as 500 lb. of sulphate of ammonia or nitrate of soda. That is to say, the idea is to apply as much fertiliser as will produce a profit. They also use lime very freely. It is by such methods that the output of these small islands has been increased from 75,000 to over 600,000 tons of sugar in the history of the station.

" Comparatively speaking, little fertiliser is used in Queensland ; many of the newer farms get none at all. Consequently I wish to emphasise not only the value of manures as a factor in grub control, but further to say that under scientific application they will pay a handsome profit on most soils.

" Speaking generally, grubby soils are lacking in humus. This is true of all of those that I have tested. Experiments have demonstrated that the grubs prefer partly decayed organic matter to living roots. As a matter of fact, they live happily, and develop well in rich soil alone, even when all roots, trash, &c., are removed. Moreover, it is a well-known fact that their bodies are always full of earth during the feeding period, and from this they derive their principal supply of nutriment, by extracting the humus, if present.

" Where soils are poor in humus, and all organic matter is removed by the destructive methods of farming now in vogue in Queensland, the grubs are compelled to feed upon the living roots or starve. Furthermore, we know that humus has a remarkable affinity for arsenic, which may be made use of, as I shall point out later.

" What is needed is a method of conserving all trash and waste from the crop, together with a regular rotation of green crops. Sooner or later all farms must come under this practice, if the productivity of the land is to be maintained. In line with this advice, I wish to call attention to the large areas at Goondi—the Mundoo section, which produced splendid crops of cane for a few years, but now is said to be so worn out that it will not pay to work. Apparently many other cane areas are fast approaching this condition, even though only a few crops have been taken off.

" I have emphasised surface cultivation mainly because of its value for increasing the vigour of the crop, and in this way making the plants more resistant to attack. However, as I shall indicate later, I have found that it often has a more direct action in the destruction of the pest.

" Undoubtedly the value of cultivation is recognised, but on many farms it is not carried out. Climatic conditions bring about great difficulties, in this regard, particularly with the late planted crop. Many soils cannot be worked properly when either too wet or too dry, and as a consequence the cane is left to suffer. However, it is common experience that the man who cultivates well is the man who reaps the reward.

" I have found by extensive experiments at Greenhills, during the past season, that both the eggs and the young grubs are considerably injured by even shallow cultivation, for they are located near the surface in December. The common cultivators, reaching to a depth of about six inches, are satisfactory for this work, though I got somewhat better results by using a pony plough, which got in closer to the roots.

" In order to be effective this work must start at the time the beetles begin to emerge, and be continued, going over the ground every fortnight while they are on the wing. Normally, this would mean about four cultivations, though this would not be extra work in the case of late cane. I have advocated September-October planting on grubby soils, where they are well drained, so as to facilitate this cultivation during the flight of the beetles ; the plants are then small enough so that the implements can get well under them.

" We have had encouraging results in the use of arsenic for the destruction of the grubs. I found that by using arsenious acid (white arsenic) with Greenhills soil in pots, that full-grown grubs were quickly destroyed by ingesting it—all of them dying in one to four days. The quantity used was approximately what would amount to about 20 lb. per acre. I should state that only sifted soil and arsenic were placed in the pots, so that it was demonstrated that the grubs were destroyed by feeding on the poisoned humus of the soil.

"Arsenic was used on our experimental plots at Meringa, in variyng proportions and combinations, the best results apparently being from the use of the poison placed in the drill with the plants. In this case 20 lb. was mixed with 5 cwt. of meatworks manure per acre. The cane came along splendidly, with no sign of grub injury, while several of the other plots showed more or less infestation.

"Again, as is shown in my recent monthly reports, the use of arsenic for the destruction of grubs has evidently been beneficial in other districts where it has been applied.

"Apparently the most satisfactory and far-reaching remedy, however, is the removal of all feeding trees, within a radius of about half-a-mile of infested cane areas. Investigation has demonstrated that once this is done the land becomes immune. This fact is particularly noticeable in the older districts, like the Herbert River and Goondi, where all the land was once more or less infested. Now that the clearing has been far extended, all of the older fields are immune, the only infestation being on the lands lying near the feeding trees. Hence, we might justly conclude that, by concerted efforts, many of the infested lands could be freed of this pest for ever."

11.—VARIETY PLOTS.

These plots have been established for the purpose of growing canes for distribution in the different districts. The work has suffered this year due to the long-extended shipping strike, preventing the forwarding of new varieties. Those at present established are upon the farms of the following :—Mr. N. Jacobsen, Yerra ; Messrs. H. Ruge and Sons, Proserpine ; Messrs. Black Bros., Kalamia ; and Mr. Jas. Mackersie, Ayr.

12.—LIME, GREEN MANURES, AND FERTILISERS.

Cheap lime is of the utmost importance to the industry, and it appears as if the problem is about to be solved as far as Cairns and Innisfail are concerned. Many tons of a lime earth containing from 60 to 90 per cent. of carbonate of lime are now being put on trucks at Chillagoe at reasonable rates. It is also proposed to supply pulverised limestone at cheap rates, and arrangements are now being made to that end. There is an impression abroad that the Bureau does not favour the use of pulverised limestone. This is an error, as the extension of the use of lime in any form that will correct acidity in our cane soils would be welcomed.

Green manure seed is at times very difficult to procure and is a relatively high price, when it can be got. Very little Mauritius bean has been seen for a long time past, and growers have had to rely on cowpea. It is hoped that arrangements will be made for growing both these necessary articles in the future.

Fertilisers have also been, and still are, very difficult to obtain. Nitrate of soda and sulphate of potash have been unprocurable. Supplies of the former, however, are promised for the end of the year. There does not seem much prospect of our obtaining sulphate of potash for a time, but it is understood that chloride or muriate of potash is coming here in some quantities. This form of potash is not to be recommended for cane, as it is stated to affect the juice prejudicially. The following extract from the June "Victorian Agricultural Journal" deals with the subject of muriate as against sulphate of potash :—

Potash Manures—Sulphate or Muriate ?

By F. de Castella, Government Viticulturist.

The superiority of sulphate of potash over the chloride, or, as it is still often termed, muriate, is generally admitted, a contention which received forcible support from a recent article by Professor Degrully, of Montpellier (France), criticising the form in which Alsatian potash is being made available for French agriculturists. He points out the inferiority of kainit and chloride of potash, as compared with nitrate, carbonate, or sulphate, stating that it is under either of the last three forms that potash gives the best results in the majority of soils.

He quotes an article by M. Lagatu, which appeared in "Progres Agricole" in 1901, in which attention was very forcibly drawn to the inferiority of the chloride. Professor Lagatu, indeed, goes so far as to assert that in certain cases potash chloride, as well as kainit (in which potash sulphate is mixed with a large proportion of various chlorides) can even be positively injurious. It is largely a question of rainfall.

"In free limy soil, potash chloride, which is as good as the other potassic manures in the case of medium or heavy rainfall, is harmful if little or no rain should fall. . . . Chlorides react on the lime contained in the soil, forming calcium chloride, a salt injurious to plant life, and especially so to nitrifying bacteria. Being soluble, heavy rain removes this salt from friable, well-drained land. . . . . but if the rainfall be deficient it remains in the soil to the detriment of the plant."

In the case of stiffer limy soil, he is even more emphatic. "Chloride by hindering nitrification, which is usually unsatisfactory in a stiff soil, should be altogether avoided. In all stiff soils it is not a manure, but a poison. Potash sulphate presents no danger. It even favours nitrification." He further points out that in very free soils, where, owing to its great solubility, the calcium chloride is readily removed by the easy circulation of rain water, no injurious chloride remains, but, should drought supervene, it will again cause damage.

Professor Degrully also quotes from a letter by M. Octave Audebert, President of the Agricultural Society of Gironde, to the French Minister of Agriculture, protesting against potash salts recently made available, and emphasising the point hitherto insufficiently recognised, but confirmed by his long experience with agricultural manures :—

"That, of the two potash salts furnished by the Rhine mines, the sulphate alone should be supplied to agriculture, the chloride being reserved for industrial purposes, more especially for the manufacture of potassium nitrate." He admits that "Germany has in the past mainly supplied us with chloride, reserving the sulphate for her own crops." He expresses his conviction that "the more general use of potash in the soils of our country is capable of bringing about an enormous increase in the yield of all crops, but on the express condition that it be supplied in the form of sulphate, the one to which all plants accommodate themselves best ; this is particularly so in the case of the vine."

Professor Degrully points out that neither Alsace nor Strassfurth supply pure potash sulphate—it must be manufactured from kainite or chloride ; from the latter by treatment with sulphuric acid, or by the reaction of sodium sulphate on potash chloride. In conclusion, he points out that the value of potassium manures has often been questioned by practical men—no doubt, in some soils, naturally rich in potash, the addition of this element may not materially affect the yield—but, as he pertinently asks, "May not many failures be due to the injurious action of the chloride ?"

To use potash chloride in a soil over rich in salt (sodium chloride), thereby still further increasing the already excessive chlorine content, is, to say the least, illogical ; under such conditions the superiority of the sulphate over the cholride form of potash is likely to make itself strongly felt.

13.—ECONOMICS.

It was remarked in last year's report that it was unfortunate that climatic conditions should play so large a part in the variation of yields of sugar. This is largely due to the tremendous length of coastline embracing the industry. Droughts are practically unknown in

North Queensland above Townsville, and fair to good crops can always be relied on in the absence of cyclones, which are few and far between. But the Southern districts below Rockhampton are frequently subject to droughty periods which affect the total yield of cane. The rich red soils of Woongarra and Childers, if they were irrigated, would produce much larger crops than they do at present, and would largely reduce the present yearly variations in the Queensland sugar crops, and reduce the need for importations. The price of sugar in other countries is now very high, and Australia will probably be obliged to pay considerably more for imported sugars for some time to come.

Taking last year's figures, for which this Bureau is indebted to the Government Statistician, it will be found that the conditions for the growth of sugar were extremely unfavourable.

The severe cyclonic blow experienced at Mackay, Babinda, and Innisfail not only caused immense damage to the cane crops in those centres but the neighbouring cane areas were also to some extent affected. Floods and frosts also added to the generally unfavourable nature of the season, and in every district it was ultimately found that the cane had cut out much lighter than was anticipated. Even in those areas that escaped the disturbances mentioned above, the early setting in of cold weather retarded the progress of the cane and caused a decrease in the yield. The last six months of the year were exceedingly dry, and this has had a prejudicial effect also on the 1918 crop.

The total acreage under cane in 1918 was estimated by the Government Statistician to be 160,534 acres, a decrease of 15,228 acres, compared with the previous year. Of this area cane from 111,572 acres was crushed, leaving a balance of 48,962 acres, which included standover cane, cane cut for plants, and cane planted for 1919. The yield of cane per acre was only 15·01 tons, the previous year (1917) giving a yield of 24·88 tons. The tonnage of sugar per acre in 1918 was 1·70 as against 2·83 in 1917. A figure of much interest is the tons of cane taken to make 1 ton of sugar. This, in 1918, amounted to 8·82, a trifle more than in the previous year, which showed 8·79.

The yield for 1918 only amounted to 189,978 tons of sugar, or 117,736 tons less than were manufactured in the preceding record year of 1917. This yield fell very far short of Australia's consumption, but the surplus for 1917 helped to make up the deficiency.

New South Wales last year produced 19,875 tons of sugar. The yield of sugar from the Beet Factory at Maffra, Victoria, has not been ascertained.

The number of sugar plantations is returned as 4,148, the average being given as 39 acres to each planter.

The return of molasses made is as under :—

	Gallons.
Sold to distilleries and others	1,662,454
Burnt	2,110,775
Used or sold for feed	1,602,962
In stock	923,307
Used for manure	109,000
Run to waste	1,390,893
Total	7,799,391

The price of sugar has remained at £21 per ton for raws. This price will continue till the end of this season by agreement between the Commonwealth and State Governments.

14.—GENERAL.

The last few years have seen the closing up of a number of small sugar-mills that are unable to continue under present conditions, due to their small capacity and low efficiency. The following mills have gone out of sugar-production recently :—Goodwood, Miara, Waterloo, Baffle Creek, and Nerang. The Invicta Mill, which operated near Bundaberg, is now being removed to the Haughton River, in the Lower Burdekin district. It is anticipated to be re-erected and ready for the 1920 cane season.

Motor tractors still continue to increase in numbers, particularly in the Northern areas. New types are being introduced, and some of these are doing very good work.

The thanks of the Bureau are due to the various Canefarmers' Associations, their presidents and secretaries ; also to the managers and officers of the various sugar-mills, for their courtesy and attention and for their willingness to assist the work of the Bureau in every way possible.

The metropolitan and country Press are of great service to the Bureau in the dissemination of general information and reports, while the "Australian Sugar Journal" most kindly gives a great deal of space to reporting, and in many instances specially illustrating, the activities of the Sugar Experiment Stations.

The Bureau is also indebted to the Government Printer for the care taken in printing technical bulletins and reports.

HARRY T. EASTERBY,
General Superintendent.

Brisbane, 1st November, 1919.

Price, 1s.]

By Authority: ANTHONY JAMES CUMMING, Government Printer, Brisbane.