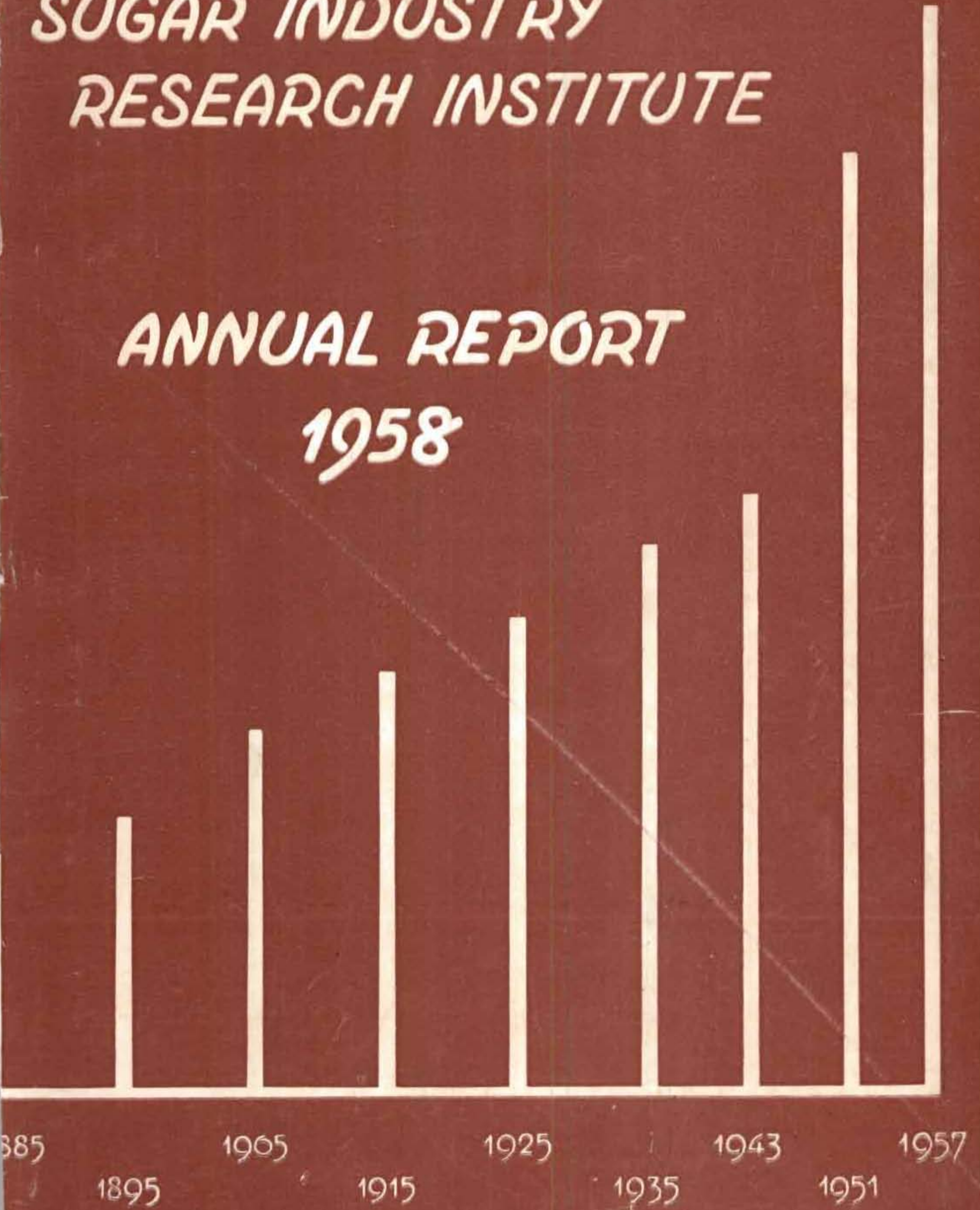
MAURITIUS SUGAR INDUSTRY RESEARCH INSTITUTE

ANNUAL REPORT 1958



MAURITIUS SUGAR INDUSTRY RESEARCH INSTITUTE

ANNUAL REPORT 1958

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CORRIGENDA

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Page 27, Title of Occasional Paper No. 2, *read* Williams, J. R. Studies on the nematode soil fauna of sugar cane fields in Mauritius. (2) Belondiridae.

,, 33, Second column, 24th line (a), *read* A delay in the opening of spikelets *instead of* A delay in the opening of male and female spikelets.

,, 35, Table 4, Heading of 6th column, *read* Approximate size of sample for an accuracy in mean and S.D. of *instead of* Approximate size of for an accuracy in mean and S.D. of.

,, 52, Second column, 13th line *read* 0.08 *instead of* 0.88

,, 61, The legends for figures 24 & 25 have been inverted.

,, 72, *read* table 26 *instead of* table (a)

,, 73, *read* tables 27 and 28 *instead of* tables (b) and (c)

,, 76, *read* table 29 *instead of* table (d)

,, 77, Table 29, 2nd column *read* 37.4 *instead of* 57.4

,, 87, Table 35, *read* 20* *instead of* 200*

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The diagram on the cover shows the sugar production of Mauritius from 1825 to date. The area under sugar cane in 1835, 1870 and 1958 is shown in white on the maps. Yield of commercial sugar per arpent is indicated in fig. 13.

MEMBERS EXECUTIVE BOARD

Mr. Raymond Hein, Q.C., *Chairman, representing the Chamber of Agriculture*

Mr. M. N. Lucie-Smith, *representing Government*

Mr. L. H. Garthwaite,
Mr. P. de L. d'Arifat, *representing factory owners*
Mr. J. A. Harel,

Mr. Georges Rouillard, *representing large planters*

Mr. M. Kisnah,
Mr. M. Ramdin, *representing small planters*

MEMBERS RESEARCH ADVISORY COMMITTEE

Dr. P. O. Wiehe, C.B.E., *Chairman*

Mr. M. N. Lucie-Smith, *representing the Department of Agriculture*

Mr. A. d'Emmerez de Charmoy, M.B.E., *representing the Extension Service of the Department of Agriculture*

Mr. G. P. Langlois, *representing the Chamber of Agriculture*

Mr. P. de L. d'Arifat,
Mr. A. Wiehe, *representing the Société de Technologie Agricole et Sucrière*

and the senior staff of the Research Institute

STAFF LIST

Director	P. O. Wiehe, C.B.E., D.Sc., A.R.C.S., F.L.S
Agronomist	Pierre Halaïs, Dip.Agr.(Maur.)
Botanist	E. Rochecouste, B.Sc., Dip.Agr. (Maur.)
Chemist	D. H. Parish, B.Sc., M.Agr. (Q.U.B.), A.R.I.C.
Senior Asst. Chemist ...	S. M. Feillafé, Dip.Agr. (Maur.)
Plant Breeder ...	A. de Sornay, B.Sc., D.I.A.C., Dip.Agr.(Maur.)
Geneticist	E. F. George, B.Sc., A.R.C.S.
Asst. Plant Breeder ...	G. Harvais, B.Sc.,(Aberd.)
Plant Pathologist ...	R. Antoine, B.Sc., A.R.C.S., Dip.Agr.Sc.(Cantab.), Dip.Agr.(Maur.)
Sugar Technologist ...	J. D. de R. de Saint Antoine, B.S., Dip.Agr.(Maur.)
Associate Sugar Technologist	J. P. Lamusse, B.S.
Associate Chemist (S.T.)	Vacant
Asst. Chemist (S.T.) ...	Vacant
Asst. Sugar Technologist	R. H. de Froberville, Dip.Agr.(Maur.)
Asst. Sugar Technologist	Vacant
Entomologist ...	J. R. Williams, M.Sc., D.I.C.
Chief Agriculturist ...	Guy Rouillard, Dip.Agr.(Maur.)
Senior Field Officer ...	G. Mazery, Dip.Agr.(Maur).
Field Officers:	
Headquarters ...	P. R. Hermelin, Dip.Agr.(Maur.) *i/c Réduit Experiment Station*
...	R. Béchet, Dip.Agr.(Maur.)
...	A. Lagesse, Dip.Agr.(Maur.)
North ...	M. Hardy, Dip Agr.(Maur). *i/c Pamplemousses Experiment Station*
South ...	F. Mayer, Dip.Agr.(Maur.) *i/c Union Park Experiment Station*
Centre ...	L. P. Noël, Dip.Agr.(Maur.) *i/c Belle Rive Experiment Station*
Laboratory Assistants:	
Botany ...	C. Mongelard
Chemistry ...	L. C. Figon
Soils ...	L. Ross, Dip.Agr.(Maur.)
Entomology ...	M. A. Rajabalee
Foliar Diagnosis	Mrs. G. Caine
Pathology ...	C. Ricaud, B.Sc.
Sugar Technology	F. Le Guen, B.Sc.
...	M. Randabel, Dip.Agr.(Maur).
Secretary-Accountant ...	P. G. de C. Du Mée
Asst. Secretary-Accountant	M. M. d'Unienville
Draughtsman-Photographer	L. de Réland
Clerks	Mrs. A. d'Espagnac
	Mrs. A. Baissac
	Miss L. Kingdon
	Miss F. Rey

REPORT OF THE CHAIRMAN

EXECUTIVE BOARD 1958

THE high distinction conferred on Dr. P. O. Wiehe in recognition of his valuable services to the colony deserves first place in this Report. The news of his nomination to the rank of Commander of the Most Excellent Order of the British Empire has been received with pride and satisfaction by every member of the Staff and of the Board. I wish to congratulate Dr. Wiehe on this well deserved distinction.

Apart from the replacement by Mr. A. North Coombes O.B.E. of Mr. M. N. Lucie-Smith during the latter's absence on leave from January to August, the composition of the Board was identical to that of 1957.

The Board held 15 meetings during the year and visited the four Experiment Stations of the Institute.

ESTABLISHMENT

Consequent upon Dr. Kerr's report on his visit to Mauritius, the Board decided that the Sugar Technology division of the Institute should be expanded and gradually built up to a strength of 10 research workers and assistants. As part fulfilment of this programme Mr. R. H. de Froberville, Dip.Agr. and Mr. M. Randabel, Dip.Agr. were appointed Assistant Sugar Technologist and Laboratory Assistant respectively to assume duty in January 1959. The Board also appointed two consulting Sugar Technologists, Messrs. A. Wiehe and M. Paturea, to act in an advisory capacity on matters relating to sugar manufacture.

A new post of Field Officer was also created during the year, Mr. A. Lagesse, Dip.Agr., being appointed. In view of the importance of soil studies, and the difficulties in obtaining a candidate on secondment from Government, a post of soil Analyst was created and Mr. L. Ross, Dip.Agr. nominated for these duties. Both Messrs. Lagesse and Ross assumed duty in May.

The following officers were granted overseas leave during the year: J. D. de R. de Saint Antoine, P. Noël, M. Hardy and R. Antoine. On his return journey to Mauritius Mr. Parish, who was on leave in U.K., spent 5 weeks in the Hawaiian islands, while Mr. de St. Antoine attended the 12th meeting of the I.C.U.M.S.A. which met at Washington in June. Mr Antoine spent a considerable part of his leave visiting plant pathology research laboratories in the U.K., France, Belgium, Holland and Switzerland.

Mr. E. Rochecouste represented the Institute at the 1st African Weed Control Conference held in Southern Rhodesia in July.

Under the auspices of the «Comité de Collaboration Agricole Maurice — Réunion — Madagascar» Messrs. Antoine and Béchet spent two weeks in Madagascar in February to study the Fiji disease situation, while Messrs. Antoine and Ricaud went to Réunion in early December in connection with an outbreak of gumming disease in that island.

I wish to congratulate Messrs. C. Ricaud and F. Le Guen on obtainning their B.Sc. (General) of London University, Le Guen with First Class Honours.

BUILDINGS

The various branches of the Institute, hitherto accomodated at the Department of Agriculture, occupied the new Biology wing in April. I should like to take this apportunity of expressing my gratitude to the Director of Agriculture for granting us accommodation facilities during the last few years. It is also gratifying to record that the Medical Department vacated the former Bacteriological Laboratories in September. The Chemistry and Sugar Technology divisions were transferred to these buildings and work started immediately on the extension of the former Chemistry buildings in order to provide the extra laboratory space necessitated by the expansion of the Sugar Technology division.

FINANCE

The Board has decided that, as from 1959, its financial year should coincide with the calendar year. To implement this decision it was decided to have a short financial period from 1st July to 31st December 1958. This report therefore covers two financial periods, the year ended 30th June 1958 and the half year ended 31st December 1958.

Accumulated funds at 31st December 1958 stood at Rs. 1,484,275.11 having been increased by Rs. 87,642.16 for the year ended 30th June 1958 and Rs. 454,178.55 for the half year ended 31st December 1958. The Board has now embarked on the last phase of its major capital expenditure programme which, it is hoped, should be completed by the end of 1959.

Special Funds shown on our Balance Sheet comprise the accounts of the Palmyre Overhead Irrigation Experiment and Ground Water Research, which are financed by Funds created by Government and the Sugar Industry Reserve Fund and are administered by the Institute.

It may be of interest to note that expenditure for the period 1st July 1957 to 31st December 1958 was approximately 26% Capital and 74% Current. Current expenditure is divided between the three sections of the Institute approximately as follows: Administration 28% Field 59% Factory 13%.

It is once again a pleasure for me to commend every member of the staff for the good work done by the Institute during the past year.

Increased development has called for increased activity and stimulated no doubt by the high example set by the Director, all members have responded splendidly.

Raymond Hein

Chairman.

31st December 1958.

REVENUE & EXPENDITURE ACCOUNT

YEAR ENDED 30th JUNE 1958

Running and Administrative Expenses ...	1,109,085.60	Cess on Sugar exported	1,345,840.90
Interest on Loan	37,000.45	Miscellaneous receipts	93,797.44
Leave and Mission Fund	60,000.00		
Depreciation	145,910.13		
	1,351,996.18		
Excess of Revenue over Expenditure for the period carried to Accumulated Funds	87,642.16		
Rs.	1,439,638.34	Rs.	1,439,638.34

AS AT 30th JUNE 1958

Accumulated Funds		1,030,096.56	Fixed Assets (at cost less depreciation & amounts written off)		
Revenue Funds		32,408.89	Land and Buildings ...	1,289,859.34	
Special Funds:-			Equipment & Furniture—laboratories, houses and offices	92,641.01	
Palmyre Overhead Irrigation Experiment ...	21,449.87		Agricultural Machinery & Vehicles ...	20,000.00	
Ground Water Research	13,609.40				1,402,500.35
Special Studies Fund...	14,215.33		**Current Assets:-**		
		49,324.60	Sundry Debtors ...	43,933.08	
Loan from Anglo-Mauritius Assurance Society Ltd.		644,509.00	Cash on Fixed Deposit	425,000.00	
Interest due on Loan		2,685.45	Cash at Banks (Special Funds Account) ...	49,324.60	
Government of Mauritius (Purchase of Buildings)		217,123.15	Cash at Bank (Revenue Funds Account) ...	32,408.89	
Retention Money on Buildings		14,200.00	Cash at Banks and on hand	37,180.73	
					587,847.30
Rs.		1,990,347.65	Rs.		1,990,347.65

Auditors' Report

We have examined the books and accounts of the Institute for the year ended 30th June 1958, and have obtained all the information and explanations we have required. In our opinion, proper books of account have been kept by the Institute so far as appears from our examination of those books, and the foregoing Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Institute's affairs as at 30th June 1958, according to the best of our information and the explanations given to us and as shown by the books and accounts of the Institute.

(sd) M. N. LUCIE-SMITH
(sd) RAYMOND HEIN } *Board Members*

(sd) P. O. WIEHE *Director*

Port Louis,
Mauritius,
6th September, 1958

(sd) P. R. C. du MÉE
C.A.(S.A.), A.S.A.A.
p. p. de CHAZAL, DU MÉE & Co.
Chartered Accountants.

REVENUE & EXPENDITURE ACCOUNT

HALF YEAR ENDED 31st DECEMBER 1958

Running and Administrative Expenses ...	670,140.06	Cess on Sugar exported	1,282,589.63
Interest on Loan	15,993.05	Miscellaneous receipts	51,778.77
Leave and Mission Fund	60,000.00		
Depreciation	134,056.74		
	880,189.85		
Excess of Revenue over Expenditure for the period carried to Accumulated Funds ...	454,178.55		
Rs	1,334,368.40	Rs.	1,334,368.40

BALANCE SHEET

AS AT 31st DECEMBER 1958

Accumulated Funds		1,484,275.11	**Fixed Assets** (at cost less depreciation and amounts written off		
Revenue Funds		85,382.15	Land and Buildings ...	1,257,428.03	
Special Funds:-			Equipment & Furniture—laboratories, houses and offices	71,263.52	
Palmyre Overhead Irrigation Experiment ...	8,669.37		Agricultural Machinery & Vehicles	15,300.00	
Ground Water Research	41,257.76				1,343,991.55
Special Studies Fund	21,715.33		**Current Assets**:-		
		71,642.46	Sundry Debtors ...	263,317.08	
Loan from Anglo-Mauritius Assurance Society Ltd....		615,719.00	Cash on Fixed Deposit	625,000.00	
Interest Due on Loan		2,565.50	Cash at Banks (Special Funds Accounts) ...	71,642.46	
Government of Mauritius (Purchase of Buildings)		204,351.20	Cash at Bank (Revenue Funds Account) ...	85,382.15	
Retention Money on Buildings		7,100.00	Cash at Banks and on hand	81,702.18	
					1,127,043.87
Rs.		2,471,035.42	Rs.		2,471,035.42

Auditors' Report

We have examined the books and accounts of the Institute for the ½ year ended 31st December 1958, and have obtained all the information and explanations we have required. In our opinion, proper books of account have been kept by the Institute so far as appears from our examination of those books, and the foregoing Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Institute's affairs as at 31st December 1958, according to the best of our information and the explanations given to us as shown by the books and accounts of the Institute.

(sd) RAYMOND HEIN
(sd) M. N. LUCIE-SMITH } *Board Members*

(sd) P. O. WIEHE *Director*

Port Louis,
Mauritius,
31st January, 1959

(sd) P. R. C. du MÉE
C. A. (S.A.), A.S.A.A.
p. p. de CHAZAL, DU MÉE & Co.
Chartered Accountants.

INTRODUCTION

THE activities of the Sugar Industry Research Institute in 1958 are briefly reviewed in the usual way in this introduction to the Annual Report.

Special mention should be made first of all to several changes in the establishment, the most important of which, following Dr. H. W. Kerr's recommendations in 1957, was the decision to intensify research in Sugar Technology. As a consequence the Board agreed to increase the staff of the Sugar Technology section to 10 officers, two of whom were appointed at the end of 1958 to assume duty early in 1959. In addition, Messrs. Adrien Wiehe and Maurice Paturau were appointed Consulting Sugar Technologists to the Institute.

A seventh post of Field Officer was created in order that a better picture of the occurrence and severity of cane diseases and pests should be available at all times. Henceforth the duties of one of the Field Officers will be the routine inspection of cane fields to assess the relative importance of pests and diseases in various areas. This officer will also visit Madagascar at regular intervals in connection with Fiji disease studies.

It was also decided that a Soil Analyst should be appointed on a permanent basis.

Candidates chosen for the four permanent posts mentioned above are all holders of the Diploma of the College of Agriculture, an institution which thus continues to supply the Institute with a large number of recruits. The permanent staff at the end of 1958 totalled 35.

A definite step forward was made during the year concerning accommodation. The Biology wing was occupied in April while the Medical Department handed over the former Bacteriological Laboratories early in September. In view of the expansion of the Sugar Technology division, plans had to be prepared for increased laboratory space. The Sugar Technology and Chemistry sections were therefore moved temporarily to the laboratories vacated by the Medical authorities in order that the necessary alterations should be carried out to the building assigned to these divisions. The building and conversion programme will not be completed before the end of 1959, when the following approximate floor space will be available; administration including library and conference room: 5.000 sq. ft., field services (excluding out-stations) : 1,000 sq. ft., biology: 4,000 sq. ft., chemistry and sugar technology: 8,000 sq. ft.

A new glasshouse provided with electrical strip-heaters and thermostatic control was erected at Réduit for work on cane breeding. In an attempt to increase fertility, part of the breeding programme in 1959 will be carried out indoors at higher temperatures.

Irrigation of seedlings and first selection trials at Réduit Experiment Station will henceforth be made with a self-propelled spraying machine manufactured in Southern Rhodesia, the «Selpromat» which is driven by an 8.25 HP motor travelling along specially constructed concrete channels. The machine irrigates one acre in two hours at a rate of between 0.5" and 0.9" of water.

By arrangement with the Director of the Observatory, the experiment station at Pamplemousses will be equipped with a greater range of meteorological instruments, including a Dines anemometer purchased by the Institute but which will be under the control of the Meteorological Department.

Cane production amounted to 1635 tons at the four stations (Réduit 310 tons, Pamplemousses 645 tons, Belle Rive 507 tons, Union Park 173 tons).

THE 1958 SUGAR CROP

Until the occurrence of a cyclone in March it was generally agreed that the island had one of the heaviest cane crops in the making. Growth conditions had been extremely satisfactory as a result of well distributed rainfall. The fact that an almost normal crop was realised reflects in some measure the large weight of standing cane before the occurrence of mild cyclones in March and April.

The area under cane cultivation in 1958 was approximately 184,000 arpents, of which 94.6% (174,040) were reaped, producing 24.9 tons of cane per arpent. The total weight of cane harvested was 4,329,000 tons. Sugar yields were below normal, averaging 12.14% commercial cane sugar manufactured % cane* and bringing final production to 525,600 metric tons at 98.5 pol.

Cane yields per arpent, as estimated at the end of June according to rainfall deficits (6.4" instead of the normal 15") during the growing period, was 27.6 tons. However, the actual yield was 24.9 tons. It appears therefore that a reduction of approximately 10% on the standing crop was caused by the March and April cyclones. Sucrose content and recovery of commercial sugar were also adversely affected by both rainfall excesses in July and August (4.0" instead

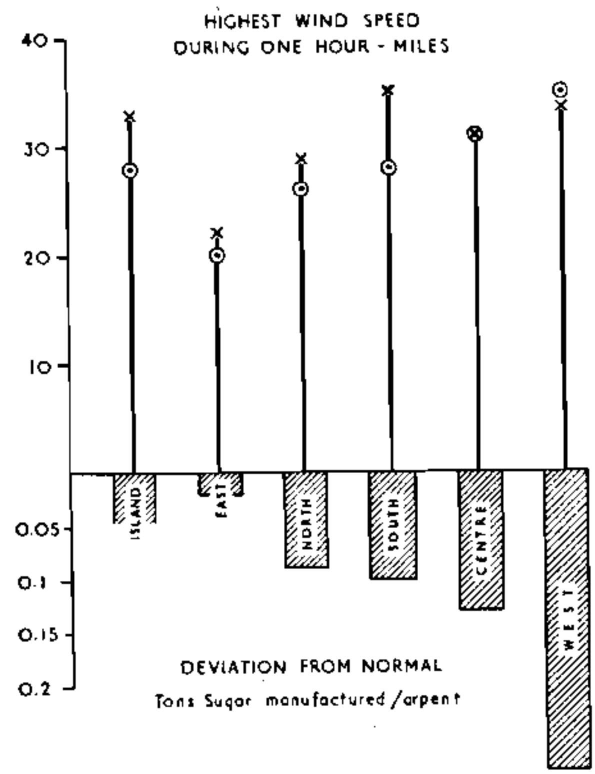

Fig. 1. Deviations from normal of sugar yields in different sectors in relation to highest wind speed during one hour. Crosses: March cyclone: circles: April cyclone.

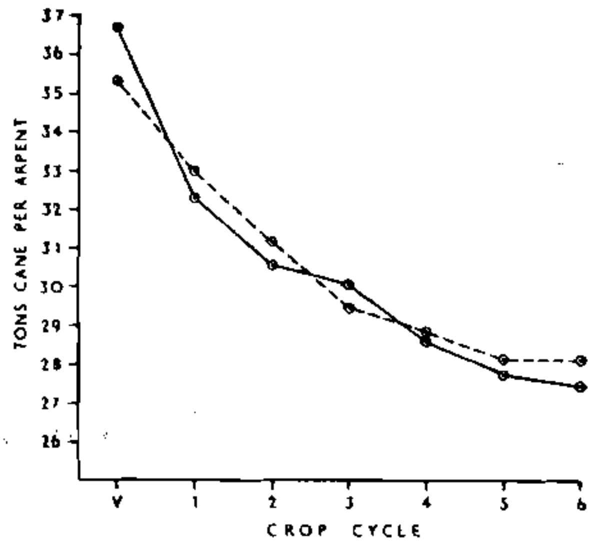

Fig. 2. Yield of cane per arpent (estates) in virgins and succeeding ratoons.
Plain line: 1958; broken line: average 1947 - 1958.

of a normal of 2.5") and poor juice quality resulting from canes which had lodged or had been damaged by wind. Cane yields on estates were more affected than those on planters' land, probably because of greater damage caused to taller canes.

The decrease in yield of commercial sugar per arpent on estates in relation to highest wind speed, varied from sector to sector and is shown in fig. 1, from which it may be seen that highest losses coincided, as might be expected, with highest wind speeds recorded during one hour. The West and Centre were the most affected regions.

The final results of the 1958 season, however, were very close to a normal crop, departure from the mean being as follows:

tons cane per arpent:	nil,
commercial sugar manufactured % cane:	—0.19,
tons sugar manufactured per arpent:	—0.05.

These data are also illustrated in fig. 2 which shows the similarity between normal yields and those obtained in 1958 in virgins and successive ratoons, while fig. 3 indicates the generally inferior conditions which prevailed for maturation of the cane.

Previous investigations relating climatic

* *Equivalent to 8.2 tons of cane per ton of sugar.*

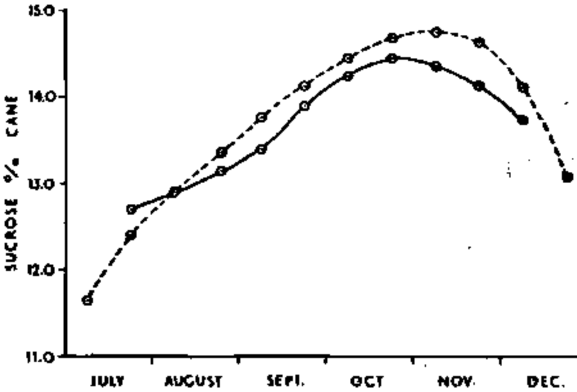

Fig. 3. Maturation curves.
Plain line: 1958; broken line: 1947 - 1958.

factors with cane and sugar yields have shown the overriding influence of rainfall. Further studies published elsewhere in this report indicate the dominating influence which trade winds exercise on sugar content of the cane during the maturation period. Indeed this factor governs cloudiness, incidence of rainfall and daily range of temperature, all of which have an effect on sucrose content.

Twenty-five factories operated during the year, the canes from Trianon being crushed at Réunion S.E. and Highlands S.E. The crushing season began on 30th June and ended on 27th December. The average number of crushing days was 108. The steady increase in the capacity of factories is clearly seen in fig. 4, which shows the hourly crushing rate of Mauritius factories from 1947 (48.5 tons cane/hour) to 1958 (82.5 tons cane/hour). During the same period, the average daily output of sugar per factory has passed from 108 tons in 1947 to 195 tons in 1958, the lowest and highest rates of daily sugar production per factory in 1958 being 77 and 468 tons. The amount of commercial sugar entering and leaving each factory of the island during the year is shown in fig. 5. A full analysis of factory data and performance during the year is published in the sugar manufacture section of this Report.

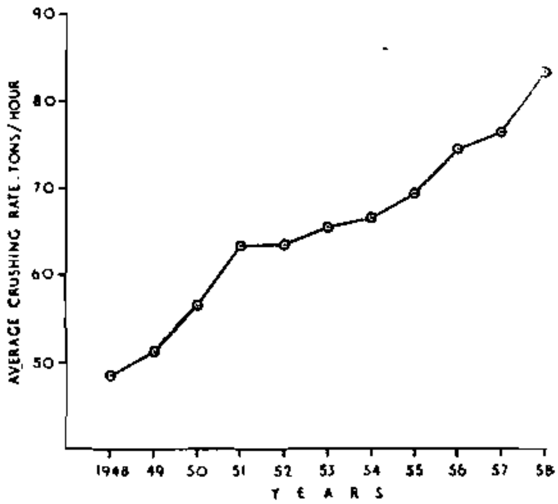

Fig .4. Average crushing rate of factories 1948 to 1958.

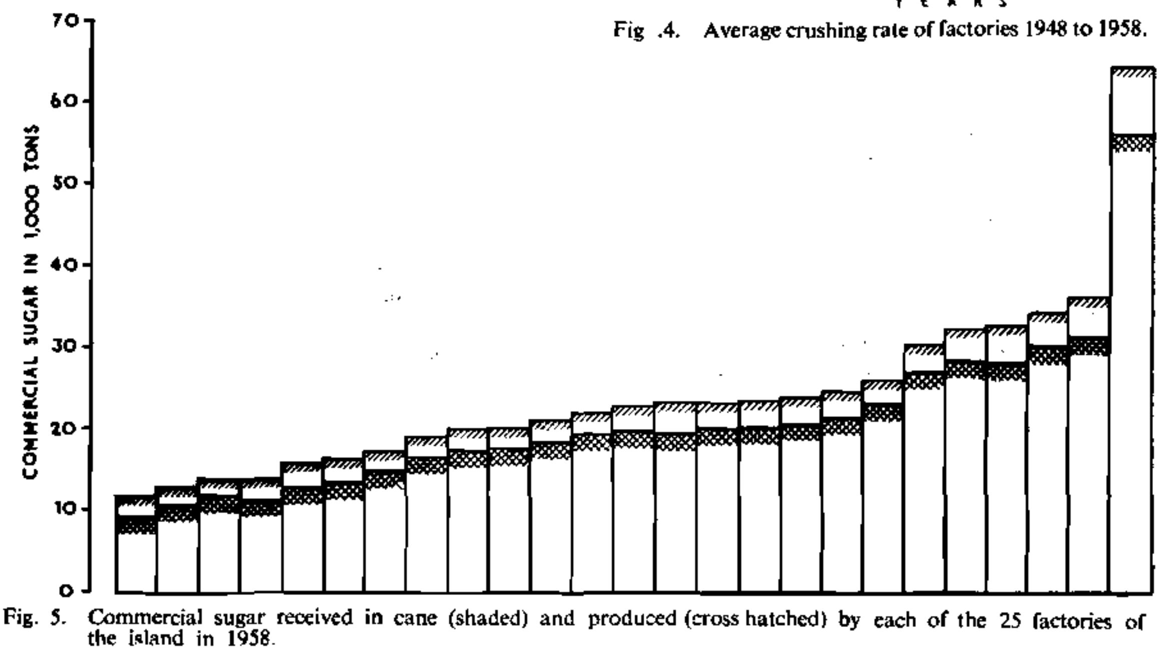

Fig. 5. Commercial sugar received in cane (shaded) and produced (cross hatched) by each of the 25 factories of the island in 1958.

CANE VARIETIES

It has been customary for some years to include standard diagrams illustrating the varietal composition of the crop under review and the trend in varieties. Figs. 6 & 7 should therefore be compared to corresponding diagrams in previous reports in order to gauge the changing pattern of cane varieties grown in the island.

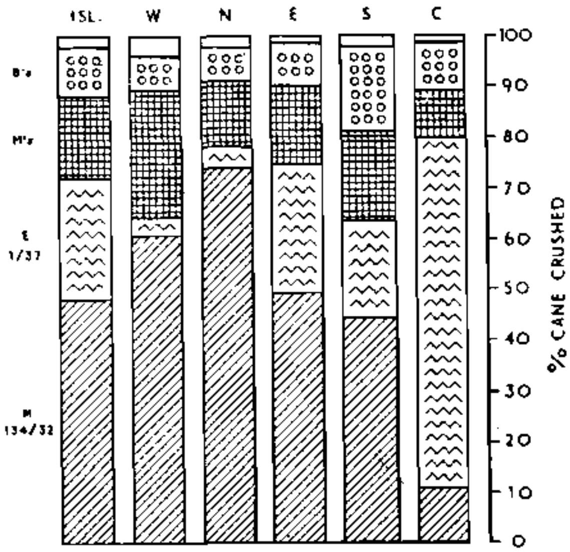

Fig. 6. Varietal composition of 1958 crop in different sectors (estate grown cane).

For the first time in 12 years the proportion of M.134/32 produced on estates fell below 50% of the total cane weight. Ebène 1/37 increased by 4% to 25% of the total, while other M. seedlings (chiefly M.147/44) accounted for nearly 15%, and Barbados varieties 13%, of the total (fig.6). The composition of 1958 plantations on estates (fig.7) shows that the three most popular varieties at present are: Ebène 1/37 (29%) in the East, South and Centre, M.147/44 (29%) uniformly distributed in all sectors and B.37172 (20%) which has been propagated intensively mainly in the North and the coastal regions of the East and South. The remainder of plantations consisted chiefly of M.31/45 (8%), B.3337 (5%) and B.34104 (3%). Other varieties including M.134/32 accounted for only 3% of the total.

In the light of observations made in 1958, further notes are given on the merits and defects of commercial cane varieties approved for large scale cultivation.

Ebène 1/37, which is typically a variety suited for super-humid and humid localities, has shown a large measure of susceptibility to cyclones, while ratoon stunting resistance trials have indicated that this variety is more suscep-

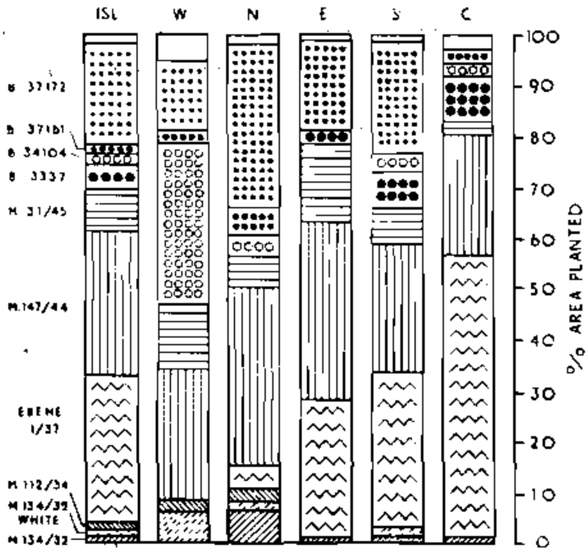

Fig. 7. Varietal composition of plantations made in 1958 on estates.

tible to the disease than it was originally believed. It is also highly susceptible to chlorotic streak and may suffer considerably from stalk borer. In spite of such weaknesses, counterbalanced to an appreciable extent by hot water treatment, Ebène 1/37 has outyielded all other varieties in the super-humid zone, where it must remain the dominant variety until a better substitute is found. In order to offset some of the defects of Ebène 1/37 it is recommended that excess N fertilization should be avoided.

B.37172 proved to be resistant to wind. There were few broken stalks and little leaf shredding during the cyclones of March and April. Yields from experimental plots and under field conditions have confirmed that this variety is excellent for regions receiving less than 80" of rain per annum. It is resistant to drought and moderately susceptible to ratoon stunting disease. Sucrose content is slightly below that of Ebène 1/37 in localities where both varieties grow well.

B.3337. There is little to add to our knowledge of this variety which is characterised by its vigorous habit of growth and poor juice quality. It is highly resistant to cyclonic winds, but it produced most disappointing results on one estate late in the season, becoming extremely pithy. It is rated susceptible to ratoon stunting disease and its cultivation should be confined to poor lands of wetter regions. Its usefulness as a windbreak for interplanting with Ebène 1/37 has been suggested, provided that such mixed planting should be made from cuttings free from ratoon stunting disease.

B.34104 has shown moderate resistance to cyclones. This variety has performed well in humid and irrigated areas where it has been extended. It is susceptible to ratoon stunting disease.

B.37161. It is not believed from the results of post-release trials and field performance that this variety will ever occupy an important role

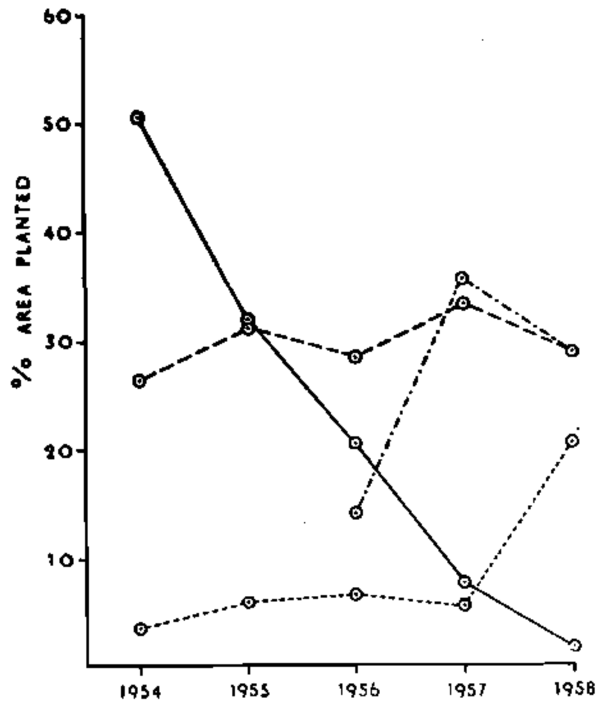

Fig. 8. Variety trend 1954 - 1958. M.134/32: plain line; Ebène 1/37: broken line; B.37172: dots; M.147/44: dots and dashes.

in commercial plantations. It is susceptible to cyclones and to ratoon stunting disease.

M.147/44. The main defects of this variety are clinging trash and a tendency to lodge. As a result and because of its high vigour, cultivation operations are difficult and expensive. Although variety trials have shown that the sucrose content of M.144/47 was nearly equal to that of M.134/32, there have been several unfavourable reports from factories. This may be due to the poor maturation conditions in 1958. The yields of commercial cane sugar per acre on the other hand are such that its cultivation is being rapidly extended in sub-humid and humid zones and to a smaller extent in high rainfall areas. In pre-release variety trials reaped during the period 1951 - 1958, the yield of CCS per arpent of M.147/44 has exceeded that of M.134/32 by 0.81 tons in sub-humid localities, 1.87 tons under irrigation and 1.16 tons in the humid zone. In humid regions M.147/44 produced 0.99 tons of commercial sugar per arpent more than Ebène 1/37. The average CCS of M.147/44 in eight post-release trials reaped in virgins in 1958 was 0.74 below Ebène 1/37 and 0.59 below B.37172. Yield of canes was superior by 6.0 and 4.2 tons per arpent, respectively. It is resistant to cyclones and moderately susceptible to ratoon stunting disease.

M.31/45. A variety with an erratic performance, which appears to yield best in humid localities. It is very susceptible to stalk borers particularly in the high rainfall areas where low yields were encountered. M.31/45 has on the other hand produced exceptionally high yields with good sucrose content on the coastal zone of the South, East and North. Its performance in terms of tons CCS per arpent in pre-release variety trials reaped from 1951 to 1958 has proved comparable to Ebène 1/37 in super-humid regions and was superior to M.134/32 by 0.53 tons in sub-humid localities, 1.95 tons under irrigation and 1.26 tons under humid conditions. It shows moderate resistance to cyclones and moderate susceptibility to ratoon stunting disease.

Varieties under experimentation. As mentioned in earlier reports, one of the urgent problems of this Institute is to produce cane varieties which are well adapted to the super-humid localities of the island where only two cane varieties Ebène 1/37 and B. 3337 are available at present. The efforts of the Plant Breeding Division are therefore orientated towards finding out the best crosses which should be made for such environments and increasing the range of selection in super-humid localities. Concerning the first objective a preliminary study by the Geneticist has revealed many interesting facts concerning the variation of seedling populations derived from five different crosses when planted under different rainfall and soil conditions. As to the second factor selection procedure has been organised in such a way that at least 60% of the seedlings produced will be tested at the high rainfall stations of the Institute, while all promising varieties selected at any of the experimental stations will be studied further under conditions of high rainfall, either on the Institute's land or by arrangement with estates.

The number of cane varieties at various stages in the selection work in 1958 is summarized below:

No. of seedlings obtained ...	15,397
1957 seedlings for selection in 1959 ...	35,153
1956 seedlings selected in 1958 and planted in propagation plots	339
Varieties in first selection trials ...	358
Varieties in pre-release trials on estates	129
„ (foreign) in propagation plots	20
„ „ „ quarantine ...	6

Promising varieties which have been included in pre-release trials in representative climatic zones are M.202/46, M.93/48, M.253/48 and M.305/49.

The following were imported in 1958 from Australia: Q.61, *Miscanthus floridulus* (clone 51 N.G. 24), and *Erianthus* sp. (clone Mindiano); from South Africa: B.45151, C.P.29 - 116, H.38-2915, H.39 - 7028, NCo. 293 and NCo. 334.

The second generation of the varieties imported in October 1957 namely B.39246, C.L.41 - 70 and C.P.1, is being grown in the quarantine greenhouse.

Of the varieties introduced in 1956, 30M.Q.985 was destroyed in the quarantine greenhouse as it shown abnormal growth. The others* have been propagated and it is expected that there will be sufficient planting material of the promising varieties for trials in 1959.

CANE PHYSIOLOGY

Nitrogen. Improved knowledge, resulting from an extended series of field trials, indicates the necessity of altering the nitrogen fertilizer pattern used on estates. Present practice, derived mainly from field experimentation with M.134/32, is to apply the approximate amount of nitrogen in terms of kg. per arpent, as there is expected cane yield in tons plus an additional amount of nitrogen varying from 10 to 20 kg. per arpent. Newer trials show that exceptions to this rule are more frequent than previously thought. Thus it was found that in individual fields, sugar response to nitrogen may be low in certain areas and high in others, while different varieties may require different doses mainly on account of their quality characteristics. In other words differential nitrogen fertilization should be resorted to as a result of correct interpretation of foliar diagnosis. The new rules to follow for arriving at nitrogen fertilizer needs on a quantitative basis for two of the recommended varieties B.37172 and Ebène 1/37 are given elsewhere in this report. A similar key of interpretation for M.147/44 will be made available in about two years' time. Proper leaf sampling must henceforth be organized for nitrogen in the same way as already carried out for P & K during the last twelve years.

The trials laid down to compare the efficacy of the nitrogen in ammonium sulphate and urea in supplying the plant needs have shown that ammonium sulphate remains unchallenged as an efficient source of nitrogen.

Phosphorus. Foliar diagnosis results show that this element has been neglected in the past and that the phosphate situation on many esta-

* *39 M.Q.832, 39 M.Q.841, 36 M.Q.217, 47 R 277, 47 R.4056, 4 OS. N.5819, Eros, Korpi, Oramboo, Ragnar, Vesta, Q.50, Q 56, Q.58, 51 N.G.142, B 4744, CB 38-22, N Co. 376 P.T.42-52.*

tes is now a significant factor in limiting their yields. Studies have therefore been aimed at finding the best and cheapest way of overcoming phosphate deficiency as quickly as possible. Results from many field experiments have shown that the soluble forms of phosphate, namely ammonium phosphate and triple superphosphate, are well utilized by the plant and that in spite of their higher price they are economically as practical as guano phosphate, the soluble forms giving yield increments up to 50% better than this cheaper material. This work has also shown that the principal loss in yield of cane grown on deficient land occurs in the virgin crop.

From these results the recommendations for phosphate fertilization are that the largest possible amount of guano should be spread on the open furrows before planting; in addition on very deficient land, 50 to 100 kg. of soluble phosphate should be banded alongside the cuttings. Thereafter if phosphate deficiency is indicated by foliar analysis, 25 to 50 kg. of soluble phosphate should be applied on the ratoon crops.

The best method of placement is still the subject for research, but evidence shows that soluble phosphates applied directly on the cane row are well utilized.

The Hawaiian Sugar Producers' Association method (modified Troug) of determining soil phosphorus has been used on soils from experimental plots in phosphate trials. The results show a good correlation between soil phosphate and response to phosphate application.

Soil analyses should therefore prove useful on lands being brought under cultivation for the first time or where results of foliar diagnosis are not available; in addition they should also be helpful in cases where land is changing ownership.

Potassium. No soil work has been carried out recently on potassium but foliar analyses show a slight improvement as regards this element.

Molasses taken from all the factories of Mauritius show an average figure of 5% K_2O, the highest levels come from dry districts and the lowest from the wet districts.

Biochemistry. The work on the alcohol soluble nitrogen and fatty acids of cane juice has been prepared for publication. Results show that the dominant factor affecting the levels of soluble nitrogen is site; after that, the level of nitrogen fertilization is important, varietal effects being of minor significance.

Chromatographic techniques have shown that aconitic acid, despite the low levels occurring, is the principal non-nitrogenous acid of local cane juice.

An early means of detecting ratoon stunting disease applicable to all varieties still remains a problem and therefore studies on this subject were reopened. In this connection preliminary estimations of the nucleic acids of cane have been made.

Growth substances. An experiment was carried out again this year with a view to investigating the effect of foliar spray of sodium 2,4-D on sucrose content. Three rates of application were used: 50, 100 and 150 p.p.m. at weekly intervals on the variety B. 37172 in an area where sucrose content is normally low. No significant increase in sucrose content was observed.

SOIL SURVEY

In order that a soil survey should be of real value, it is essential that the field work be supported by a laboratory capable of carrying out a wide range of soil analyses. Government undertook to supply a suitable candidate for the post of analyst in the soil survey laboratory when work was started on this project in January 1957. Eventually it fell to this Institute to appoint its own analyst, which was done in May 1958. This means that almost eighteen months of valuable time was lost, and, although good headway is now being made, the original estimate of three years for the production of a reasonably complete soil map remains. A soil survey however is never finished. Newer techniques and discoveries in the fields of soil/plant relationship and soil genesis will enable modifications or reassessment of previous classifications to be made.

Soil science is in a phase of rapid development and therefore any soil survey must be continuous and cannot be completed within a given period.

This is well illustrated by taking Hawaiian experience. The original soil survey of Hawaii was started in 1933 and finished in 1939. However since that time a team of soil scientists has been continually engaged on revising and improving the original survey.

A good local example also is that any soil survey carried out before 1954 would have classified the Plaine des Roches as unusable for extensive agriculture; but now, with the advent of heavy mechanical equipment, a large surface of this extremely rocky plain is being converted into cane lands.

So far the work carried out on soil survey has included a reconnaissance of the cane lands of the island and a start has also been made on the detailed mapping of certain regions. Thus the area from North to South, between Plaine des Roches and Montagne Blanche, and from East to West between Argy and Rich Fund — Bel Etang, has received considerable attention. This sector was chosen because it has fairly complex geological and topographical features and is representative of the various agricultural soils of Mauritius. Both the early and late lava occur and have given rise to a wide range of soils particularly in the latter case. Soils developed on these lava range from deep and highly weathered mature soils, to shallow rocky soils and finally almost unweathered material. The topography is such that, apart from the usual climatological sequence, it has given rise to alluvial materials and also to hydromorphism and erosion of varying intensity. More than thirty pits have been dug, the soil profiles described and samples of the various horizons taken for analyses. This work has given a clear indication of the details which must be included in a map in order to show all those features affecting land utilization and soil properties.

Work has also been carried out on the dark-magnesium clays of the leeward coastal areas, soils which present particular difficulties in cultivation. The results of these studies will be published in the future and should lead to a better appreciation of the correct methods for the agricultural exploitation of such soils. Most of these soils have developed from colluvium, and drainage waters from the surrounding hills have enriched them with magnesium and thus given rise to a high content of montmorillonite. Because of the chemical nature of this clay, the soils are very plastic when wet; on drying they shrink and become extremely hard. Before normal cane growth can be established it is essential that fields should be thoroughly drained, thus preventing water logging and also allowing aeration of the rooting zone. Any treatment which will improve the physical structure will be reflected by better cane growth and of all the soils in Mauritius the dark-magnesium clays should respond better to applications of bagasse, trash or other organic material. Despite their dark colour these soils do not rank high in organic matter content. The poor structure of the dark-magnesium clays is the overriding limiting factor for plant growth, as chemically these soils are quite fertile. They occur in the subhumid zone and provided the physical conditions are improved and irrigation practiced, very good yields of cane will be obtained. The effect of growing cane will be to ameliorate the structure owing to the organic matter returned into the soil and planters on this type of land may expect results improving continuously.

In October the Institute gave facilities for the setting up of a soil mechanics laboratory which will be used for obtaining basic information about the physical properties of local soils from the point of view of road construction. This laboratory is under the joint control of the Consulting Engineers and the P.W.D. but as no one is yet available to direct and supervise the work of the staff, the Chemistry division has been giving the necessary guidance. With the knowledge and experience already acquired on soils, the help given by the Institute has enabled the laboratory to be brought into operation far quicker than would otherwise have been possible, with, it is hoped, consequent benefit to the community at large. The physical properties of soils vary considerably even within one soil family and therefore information on these properties can be of great help in a soil classification. The results coming from the Public Works laboratory will thus facilitate the work of the soil survey.

CANE DISEASES

Attention was again focussed this year on the two major pathological problems, ratoon stunting and chlorotic streak, and experimental work was concentrated mainly on these diseases.

No major epidemic prevailed although red rot (*Physalospora tucumanensis* Speg.) once more came into the picture and, in a few cases, severe yet local attacks were observed on M.134/32 and M.112/34. Eye spot (*Helminthosporium sacchari* Butler) was conspicuous during the cooler months particularly on B.37172 but in spite of heavy leaf striping no top rot ensued.

Following the abnormally wet weather early in the year, stunted stools of B.37172 were seen in patches heavily attacked by *Marasmius sacchari* Wakker. or *Sclerotium rolfsii* Sacc. The fructifications of the basidiomycete were common on the basal portions of the stalks and, in the case of the latter fungus, the presence of masses of sclerotia associated with rotting of the leaf sheaths is a first record in the island.

Another new addition to the list of diseases is *Pahala* blight, or manganese deficiency, observed on M.147/44 growing in calcareous sandy soil the pH of which was found to be above 8.0.

An isolated outbreak of *Sclerophthora* disease, first recorded in the island in 1953, was seen this year on M.147/44. Such local attacks are recorded from time to time and it is doubtful whether the disease will ever be of any importance.

Leaf burn, an injury to the foliage resulting from excessive transpiration caused by hot winds during a spell of dry weather at a time when the plant is making rapid growth, was again observed in a few localities early this year. Although leaf burn may cause some alarm to planters, it should be mentioned that the conducive conditions usually prevail for a short period, seldom affecting more than two to three leaves of the shoot, and that complete recovery follows.

Weather conditions were favourable to gummosis (*Xanthomonas vasculorum* Dowson) this year, but all commercial varieties in cultivation in the island are highly resistant or immune to the disease. D.109, a susceptible variety grown in experimental plots, and the grass *Thysanolaena maxima* («bambou balai») were severely affected and so was 55/1182, the standard variety in the gumming trial. Three new varieties in resistance trials showed high susceptibility and were rejected.

Ratoon Stunting Disease. Ratoon stunting was again severe particularly on M.134/32 in the super-humid zone.

Results obtained in trials established in dry and wet areas have shown that the nine commercial varieties are susceptible to the disease to varying degrees. In the sub-humid zone reduction in yield, in virgin cane, ranged from 4.7% to 26.0% and in the super-humid zone from 2.4% to 45.0%. The most susceptible variety is M.134/32 with a reduction in virgins of 1.2 tons of sugar per arpent (25%) in diseased plots. M.147/44 seems to be resistant, whereas Ebène 1/37, a variety believed to be resistant until recently, has shown susceptibility in both trials. Another conclusion from the experiments is that M.134/32, in spite of the heat treatment, is still inferior to Ebène 1/37, B.37172, M.147/44 and M.31/45. Investigations on growth failures of Co. 419 have shown that this variety is susceptible to the ratoon stunting virus. Reductions in yield of 6% were obtained in virgins and 21% in 1st ratoons.

In view of the susceptibility of all cane varieties grown commercially in Mauritius at present, it is considered imperative that all plantations should be derived from nurseries established with heat treated cuttings. It is hoped that this objective may be attained in 1960.

The time /temperature relationship of 50°C for 2 hours was maintained, since evidence was obtained that the above combination gave adequate control of the disease in such a highly susceptible variety as D.109. It should be pointed out, however, that the two hours duration of treatment must apply from the moment that the temperature equilibrium of 50°C has been reached in the hot water bath.

Investigations were pursued on the tetrazolium test for detecting the presence of the virus. It appears that under the conditions of the test, only three varieties D.109, M.134/32 and M.147/44 give a positive response. Further work is being carried out in order to determine the conditions under which different varieties should be tested.

Chlorotic Streak. Chlorotic streak is still the important disease of the super-humid zone. It would in fact be difficult to conceive cane cultivation in that area, without the heat treatment of cuttings particularly of the susceptible Ebène 1/37. A few isolated cases of severe germination failures on M.147/44 have brought to light the importance of giving that variety the short hot water treatment in areas where the disease prevails. Although chlorotic streak was known to occur locally on heavy ill-drained soils of the sub-humid area of the western sector, the disease is now spreading to the red irrigated soils («Richelieu» series).

Experimentation on chlorotic streak disease has shown that symptomless canes in a dry locality do not harbour the pathogen in the stalks. Furthermore, infected setts when planted in an apparently disease-free area, give rise to stools with typical leaf striping. Such symptoms are no longer seen after some time and are correlated to a disappearance of the virus from the shoots. There is, however, the possibility that the virus may still be harboured in the root system.

Results obtained in an experiment carried out in containers, in the super-humid area, have shown that transmission of the disease apparently takes place in the soil and not in the air and that leachates from infected soils may transmit chlorotic streak.

No positive results have been obtained in experiments conducted on experimental transmission of chlorotic streak. Attempts to transmit the disease by means of *Cuscuta chinensis* and through moisture transfer between the intertwined root systems of cane plants growing in sterilized soil, are being continued.

FIJI DISEASE IN MADAGASCAR

The campaign against Fiji disease in Madagascar is reported more fully elsewhere in this report. Attention is however drawn once more to the efforts which are being made by the authorities in Madagascar in the district of Brickaville as well as in the whole province of Tamatave in spite of the inevitable set backs.

Considering the high initial level of infection (127,500 diseased stools were dug out during the first year of the campaign in 1955) and the conditions under which the sugar cane is cultivated on the East Coast of Madagascar, long and sustained efforts will be required until the stage of complete eradication is reached. It appears therefore that the presence of the virus in that area, in other words the potential menace to the sugar industry of Mauritius, may last for some considerable time.

A knowledge of the reaction to the disease of varieties commercially grown in Mauritius would lead to the establishemnt of a local stock of resistant canes, a vital requirement for the protection of the sugar industry. With that end in view, regular visits are paid by technicians of the Institute to the infected zone in Madagascar. The reactions of several varieties have already been assessed in commercial plantations and observations will be made, early in 1959, in the resistance trial. Agreement has been reached with the French authorities for the inclusion in resistance trials of varieties which are promising in Mauritius.

Strict measures are in force in Madagascar and in Mauritius for the protection of the island against the introduction of the disease by sea or air. Two attempted introductions of cane cuttings into Mauritius have been stopped at the port of entry by the Customs authorities.

A few varieties known to be resistant to Fiji disease have been released from the local quarantine greenhouse and planted in observation plots at Réduit E.S. Their performance in the field will be assessed.

Previous studies, by the Entomologist, of the potential insect vectors of Fiji disease in Mauritius, have shown that these are already subjected to a high degree of parasitism. In an effort to obtain additional control, an egg predator of *Perkinsiella saccharicida* has been established in the island and the area colonised by this insect is extending.

GUMMING DISEASE IN REUNION

Information was obtained during the year from the neighbouring island of Réunion that there had been a severe outbreak of gumming disease. The leading variety in the island, R.397, as well as R.336, R.386, R.460 and B.34104, showed susceptibility to the disease. The greatest cause for alarm, however, was that M.147/44, one of the leading commercial varieties in Mauritius, was highly susceptible.

A comparison of the reactions of the varieties present in the two islands shows that M.147/44, B.34104 and R.397 and the progeny derived from Co.281 are resistant in Mauritius but susceptible in Réunion. Furthermore some of the affected varieties show severe white chlorosis of the leaves in Réunion, a symptom seldom observed in Mauritius.

Although environmental conditions might have been conducive to the appearance of the acute phase of the disease, the susceptibility in Réunion of varieties tested and classified as resistant in Mauritius seem to point to the existence of a different strain of the gumming disease organism in Réunion.

The Pathologist, accompanied by his laboratory assistant, went to the neighbouring island in December to investigate the problem. The bacterium was isolated from cane and from *Thysanolaena maxima* and after successful pathogenicity tests was forwarded to Dr. W. J. Dowson of the Botany School, Cambridge University, for comparison with the strain of *Xanthomonas vasculorum* present in Mauritius.

CANE PESTS

The activities of the Entomological Division were concentrated on studies of stalk borers, nematode fauna of cane soils and insecticidal treatment in the control of *Clemora smithi.* At least two insects which had not hitherto been recorded as pests of sugar cane in Mauritius were studied. A start was also made to build up a reference collection of local insects with emphasis on those attacking sugar cane.

Moth Borers. Severe attacks of moth borers occurred during the year throughout the cane area. The stalk or spotted borer (*Proceras sacchariphagus*) has in recent years been of increasing importance in the super-humid zone and this may be correlated with the extended cultivation of Ebène 1/37, a soft thick cane, and the disappearance of the more resistant M.134/32. The varietal position in the super-humid region with regard to stalk borers undoubtedly leaves much to be desired. Ebène 1/37 is distinctly inferior to M.134/32 in its ability to withstand stalk borers, a fact which is accentuated by the debilitating effect of chlorotic streak upon the variety. It is also to be noted that the ill effects of high wind velocity on Ebène 1/37 were considerably aggravated by borer attacks. Otherwise the varieties most suitable for the super-humid region are M.31/45 and B.3337. Unfortunately the attributes of the former are compromised by its liability to develop high stalk borer populations while the high fibre and low sucrose content of the resistant B.3337 limit its use to marginal lands. On the other hand M.147/44 and B.37172 behave satisfactorily under stalk borer attack.

Attacks of pink and white borers (*Sesamia calamistis* and *Argyroploce schistaceana*) were also heavy in some cases while a most unusual attack on germinating virgin cane by the borer *Crambus malacellus* occurred at Mon Desert-Alma. *C. malacellus* has long been known in Mauritius and its larvae, which spend most of their time in the soil, sometimes bore stems of young maize and rice although wild grasses are probably their main food. Its attack on cane, the first to be recorded in Mauritius, is considered to be the result of unusual ecological factors and it is not anticipated that the insect will develop into a new cane pest.

Arrangements were concluded with the Commonwealth Institute of Biological Control for the initiation of a project to introduce parasites of cane moth borers from India. The sub-station of the Commonwealth Institute at Bangalore is to collect or breed selected parasite species for dispatch to Mauritius. Several trial consignments of parasites, to devise suitable methods of packing and to minimize mortality in transit, were received and small numbers of two parasite species were released during the latter part of the year.

Nematodes. Progress was made with a faunistic study of soil-inhabiting nematodes occurring about cane roots and three papers upon free-living species belonging to the families of Trilobidae, Belondiridae and Dorylamidae, were prepared for publication as Occasional Papers of the Institute. Root endoparasites are also being studied. Preliminary experiments on soil fumigation with ethylene dibromide have shown that a remarkable increase of early growth may result. Experimentation is being continued on different soil types to assess the precise effect of fumigants on nematode activity, subsequent cane growth and yields.

White Grubs. High populations of *Clemora smithi* seem to be now restricted to localities in the high rainfall area of the island. Experimentation with the insecticides aldrin and chlordane were continued and the greater amount of data now available tends to confirm that the use of these insecticides will prove of value in certain regions but also shows that more work is required to determine correct dosage levels and methods of application.

The propagation of *Eupatorium pallescens* and the protection of the plants against herbicides is strongly recommended to attract the parasites of Clemora.

Leafhoppers. Field observations have shown that the natural enemy of *Perkinsiella*, *Tytthus mundulus*, which was introduced from Hawaii, is now firmly established in the Flacq district and the colonised area is gradually enlarging. Two power dusters were purchased during the year as a precautionary measure for the treatment of cane fields against leafhoppers should Fiji disease be detected in the island.

HEAT TREATMENT OF CUTTINGS

A major step forward was made in the campaign against ratoon stunting disease when the central hot water treatment plant at Belle Rive Experiment Station started to function. It may be recalled that this plant is entirely financed by the Sugar Producers' Association and is administered by a Committee on which the Institute is represented. One tank treating just over one ton of cuttings per cycle, went into operation on the 23rd of June. The second tank was completed on the 11th of December and the treatment plant started to work at full capacity on that date.

Treatments were also carried out in the experimental tank of the Institute at Réduit, with a capacity of half a ton of cuttings per cycle.

Seven of the commercial varieties, M.134/32, Ebène 1/37, B.3337, B.34104, B.37172, M.147/44 and M.31/45 were treated and nurseries established in the various localities of the island.

The weight of cuttings treated amounted to 650 tons at Belle Rive and 566 tons at Réduit, a total of 1216 tons. In the Réduit tank planting material was also treated for experimental purposes and for distribution to large and small planters. The cuttings treated for small planters were established in nurseries run by the Sugar Planters' Rehabilitation Fund.

The area of nurseries created during the year for the Mauritius Sugar Producers' Association was 350 arpents. Of these, 282 arpents were maintained. The failures obtained in the remaining 68 arpents can be attributed mainly to adverse weather conditions which prevailed at planting time in areas where irrigation cannot be practised. Other contributing factors were poor quality of cuttings and greater tolerance of some varieties to the heat treatment. Several planters believed that local overheating of cuttings might be the cause of erratic germination observed in some cases; overheating is unlikely in view of the rigid control of temperature in the tanks.

The amount of cuttings treated for recruiting reached 16% of the total. Observations made during the year revealed that M.147/44, M.31/35, B.3337 and B.37172 are the most resistant varieties to the long hot water treatment while Ebène 1/37 and M.134/32 are fairly susceptible. Concerning tolerance to hot water treatment, the type of cuttings to be selected is of importance: the stalks should not be less than 10 months old, the tops and butts being discarded.

Studies were conducted in the laboratory on the effect of adding various anti-oxidants to the water bath on the germination of treated setts as encouraging results have been obtained.

Treatment of cuttings with gibberellic acid, using various methods of application, did not improve germination of setts whether heat treated or not, nor did it improve the rate of growth and final stand. Some distortion was observed in a few of the young shoots derived from setts treated with gibberellic acid.

No positive evidence was obtained on the induction of flowering by the heat treatment on shy arrowers. A large nursery was established under treated B.H.10/12 in the sub-humid area, and not a single cane arrowed. The same observations was made in resistance trials.

WEED CONTROL

Substituted Ureas. Experimental work on CMU and DCMU was continued this year. Of the five trials in progress two could not be harvested because of cyclone damage. In the other three trials the substituted ureas did not affect cane yield and sucrose content. With regard to the control of weeds, DCMU gave a better weed kill than CMU more particularly at the higher rates of application.

Control of «Chiendent» (*Cynodon dactylon*) and **«Herbe Mackaye»** (*Phalaris arundinacea*). The control of these grasses was further experimented this year. TCA, Dowpon, Amizol, sodium chlorate were used alone and in mixed formulations in single and double applications at different seasons of the year. From results obtained it was found that TCA at 100-200 lb per arpent gave a good control of «Chiendent» and that for «Herbe Mackaye» a mixture of TCA (100 lb) and sodium chlorate (100 lb) per arpent proved superior. Indications were obtained that there are different varieties of «Chiendent» and investigations on varietal differences in susceptibility to these herbicides are in progress.

Comparative effectiveness of MCPA and 2,4-D derivatives. Experimental work on the comparison of 2,4-D and MCPA derivatives in pre-emergence control of weeds was carried out in different localities of the island differing in soil type and rainfall. From results obtained it was found that sodium and potassium salts of MCPA were the most effective treatments and the amines and low volatile esters of 2,4-D proved superior to the volatile esters.

«Herbe Sifflette» (*Paspalidum geminatum*). Further experiments on the control of this grass have been laid down during the year. Dalapon, CMU, Simazin, Amizol and sodium chlorate have been used in various combinations and applied at different seasons of the year. No conclusions can be drawn at this stage.

Weed Flora. Work was continued on a weed flora of Mauritius. Descriptions and plates of the following species were prepared: *Oxalis debilis*, *O. latifolia*, *O. corniculata*, *Argemone mexicana*, *Artemisia vulgaris*, *Ambrosia arthemisiifolia*, *Cassia occidentalis*, *Bidens pilosa*, *Hydrocotyle bonariensis*.

It is hoped that publication of these pamphlets will begin early in 1959.

OVERHEAD IRRIGATION

Overhead irrigation is gradually gaining favour in Mauritius and there are now nine units used in cane plantations. Apart from the significant water saving, other advantages of spray irrigation are to give greater flexibility in the execution of a planting programme, and to maintain soil moisture in recently harvested fields so that young ratoon canes may tide over the dry spell which usually prevails during the last months of the crop. Overhead irrigation will also undoubtedly prove of great value in conjunction with the establishment of nurseries planted with cuttings heat treated against ratoon stunting disease.

Experimental work at the irrigation centre of Palmyre started in March. I should like to take this opportunity to acknowledge the valuable assistance received in this connection from the Manager of Médine S.E. As mentioned in the last Annual Report the main object of this experiment is to compare the economics of overhead and surface irrigation on two soil types. The lay-out of the experiment is described elsewhere in this Report and brief notes are also given on the results obtained to date in relation to water consumption and cost of irrigation. Comparative cane and sucrose yields will not be available until the 1959 crop as standing canes in the paired plots were of different ages when the experiment was started. Growth measurements, however, were made at weekly intervals and did not reveal major differences between fields irrigated by surface and overhead. Frequency of irrigations were determined according to soil moisture as indicated by plaster of Paris cells.

The amount of water used monthly for irrigation during the period April to December in the two systems studied and on the two soil types of the experimental site were as follows:

Acre inch of water/month

	Gravelly soil	Free soil
Overhead Irrigation	3.3	3.0
Surface ,,	27.0	8.0

It is clear from these preliminary data that overhead irrigation results in a considerable saving of water, particularly on gravelly soils, which, as is well known, are the most difficult to irrigate economically by surface.

It was also possible to assess approximately the relative cost of spray irrigation using a mobile equipment and a semi-permanent installation. These data are given hereunder:

Cost per acre inch Rs.

	Semi-permanent Installation	Mobile Equipment
Fuel	2.30	2.30
Labour ...	1.45	2.30
Depreciation ...	1.00	1.50
Total ...	4.75	6.10

Assuming that 50" of spray irrigation are required for satisfactory cane yields in the dry regions of the island, the relative cost of irrigation per annum excluding the cost of water would amount to Rs. 237 per arpent with a permanent installation and Rs. 305 with a mobile unit. It is to be noted that fuel is the largest single item in cost. Cheap electric power would no doubt be of great value in reducing the cost of overhead irrigation by a wide margin.

GROUND WATER RESOURCES

As mentioned in the Annual Report for 1958 of the Mauritius Chamber of Agriculture, the Research Institute assumed the supervision of the geophysical survey entrusted to the *Compagnie Générale de Géophysique* of Paris. The object of this survey is to estimate the magnitude of the ground water reservoir and to pin-point the most suitable sites for future pumping.

The initial stage of the survey includes an area of approximately 125 sq. kms west of a line extending from Montagne Longue to Cap Malheureux (fig. 9). Mr. R. Sentenac, Engineer in charge of this mission, and an assistant, arrived in August and established their headquarters at Pamplemousses Experiment Station. Resistivity maps are being prepared from data obtained by the Schlumberger* electrical resistance method, whereby dry, aquiferous and saline geological layers may be distinguished by their characteristic resistivity curves. Measurements are made for depths varying from 5 to 10 metres near the coast, depending on the depth at which salt water is reached, to 500 metres further inland.

The presence of a large number of wells used in former days in the area surveyed has been of much assistance in the interpretation of the electrical data obtained. Whenever possible the volume of water available for pumping and its chemical composition are being determined.

From the preliminary results obtained it appears that deep aquiferous layers are present in the northern plain of Pamplemousses. Sea

* *cf. BREUSSE, J. J. (1958). Revue de l'Institut Français du Pétrole, XIII, 149-158.*

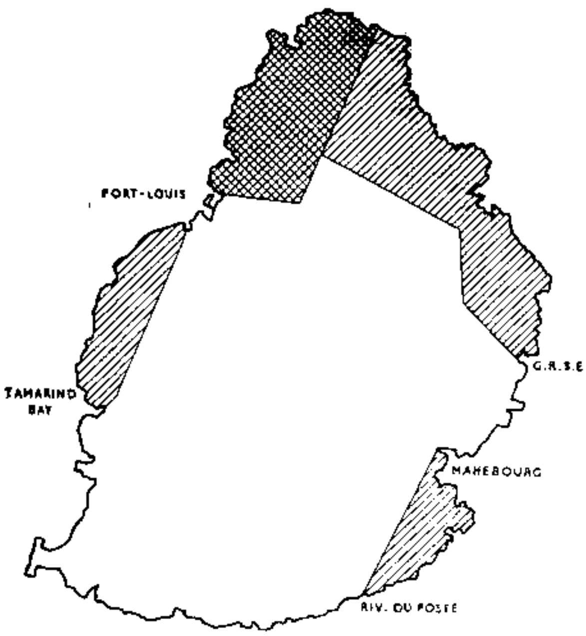

Fig. 9. Map of Mauritius showing areas surveyed for ground water resources (cross hatched) and those which it is proposed to survey (shaded).

water penetrates appreciably inland in the rocky regions surveyed, but penetration is less along the north-western coast of the island where red soils extend almost to the sea.

The survey of the area mentioned above will be completed early in 1959. There is every prospect that additional funds will be made available to continue the survey so as to cover a coastal area extending from Tamarin Bay in Black River, Rivière du Rempart and Flacq, to the estuary of Rivière du Poste in Grand Port, thus covering most of the drier belt of the island.

It should be clearly stated that the survey outlined above is only the first step in the study of potential ground water resources. Borings will have to be made at a later stage in the investigations before final conclusions may be reached about the volume of water available and the economics of its utilisation for irrigation purposes.

FIELD EXPERIMENTATION

The programme of field experiments carried out in 1958 included 147 trials harvested, 35 new trials laid down and a large number of other field experiments such as selection trials, germination and nutritional studies, weed control, insecticidal treatments, disease observation plots and other experiments which were not harvested.

The number of trials standing for harvest in 1959 is given below:

1st selection trials	9
Variety trials (1 date of harvest)	24
„ „ (3 dates of harvest) ...	31
Ratooning capacity	6
Post release variety and fertilizer trials (3 dates of harvest) ...	14
Fertilization and amendments :	
(i) Urea and sulphate of ammonia ...	8
(ii) Levels, forms and placement of phosphate ...	26
(iii) High and low fertilization (demonstration) ...	2
(iv) Balanced and unbalanced fertilization ...	2
(v) Basalt on highly leached soils ...	2
(vi) Gypsum	2
(vii) Bagasse on hydromorphic soils ...	2
(viii) Trace elements	2
(ix) Organic matter	10
Ratoon stunting disease	13
Chlorotic streak	5
Other diseases	7
Control of Clemora by insecticides ...	15
Weed control	5
Effect of fumigants on nematodes ...	7

EXTENSION AND ADVISORY WORK

The staff of the Institute paid 1661 visits to estates and planters during the year either for experimental work or for advisory service. The minimum number of visits made was 29 per estate and the maximum 160. I should like to emphasize the need for closer cooperation between the staff of sugar estates at all levels and officers of the Institute. In this connection it may be opportune to reiterate the views expressed at a meeting of the Sugar Conference in June, namely, that great benefit would be derived on large plantations by employing a qualified agronomist in addition to the existing staff structure.

It is clear that with the complexity of technical problems on the one hand and the ever growing administrative duties of estates personnel on the other, it is difficult to achieve the most of the available potential on such questions as: best suited variety for given sections of an estate, optimum nutritional levels for commercial varieties, disease, insect and weed control, cultivation and irrigation problems. While officers of the Institute endeavour to keep in close contact with estates and planters, much benefit would no doubt derive if another link was established in the opposite direction.

Another question of importance is extension work for small planters. Close cooperation was maintained between the Senior Agricultural officer of the Department of Agriculture and the staff of the Institute. Although the cane yields of small planters have improved during the last years there is still much that could be done in order to bring production to a level commensurate with the potential of their lands. Cane yields of planters and estates are compared in fig. 10.

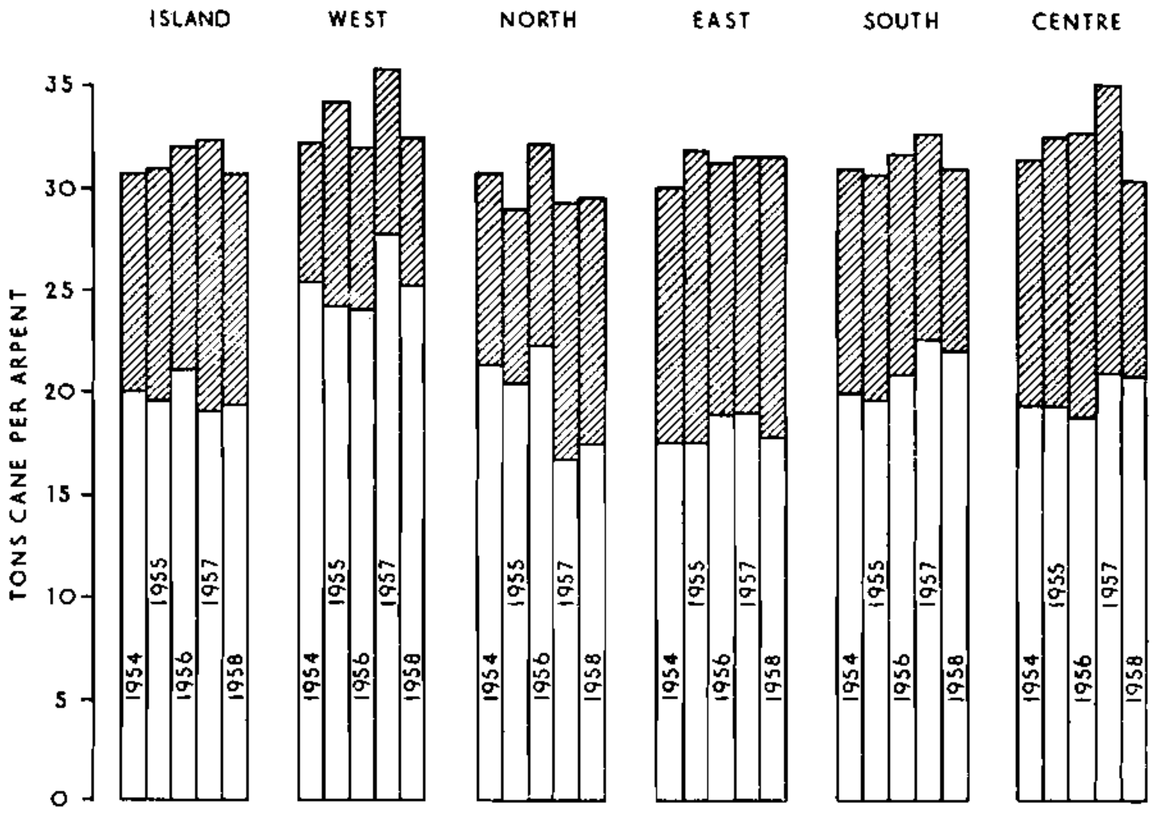

Fig. 10. Comparative cane yields on estates (shaded) and on planters' land in different sectors.

SUGAR MANUFACTURE

The main activities of the Sugar Technology Division are reported below in summarized form. Very useful help was obtained during part of the intercrop period from the chemists of the Sugar Syndicate and of five factories who spent several weeks in the laboratories of the Institute, and without whose collaboration it would not have been possible to carry out several lines of investigations. It is hoped that the help of a limited number of chemists during the intercrop period will become a regular feature as such a practice is beneficial to all concerned.

Routine. In addition to the compilation and circulation, at weekly intervals, of chemical control figures during the crop, a synopsis of chemical laboratory reports has been prepared (see Table XVII of Appendix) for the 1958 crop and is commented upon in the Sugar Technology section of this report. Routine work also included the analysis of about 3000 cane samples from the experimental plots of the Institute; analysis of 104 raw sugar samples consigned to countries requiring special certificates; the analysis of 396 cane samples for reducing sugars in experimental plots devoted to irrigation studies; the standardization of 84 hydrometers; the dilution and distribution of hydrochloric acid to sugar house laboratories, the setting of five thermoregulators and the checking of two pH meters.

Advisory. The amount of advisory work has also been on the upward trend this year, the advice or collaboration of the Sugar Technology division having been requested on a large number of occasions. Amongst the problems studied the following may be mentioned:

(a) At the request of the Sugar Syndicate a study was made on the economics of low pol. sugar manufacture. This study revealed that it is not advantageous to manufacture low pol. sugar at present, due mainly to the high price of final molasses on the export market.

(b) During his stay in Natal, the Sugar Technologist obtained information on the various processes favoured there for the manufacture of white and of refined sugar, and submitted his views to the technical sub-committee appointed by the Chamber of Agriculture to study the process best suited to our conditions for the manufacture of refined sugar.

(c) Report on the possibility of furfural production in Mauritius.

(d) Report on Escher Wyss continuous centrifugals.

(e) Calculation of mill settings.

Advice to sugar factory chemists included abnormal Boiling House Efficiency, calculation of glucose balance, blower-type bagasse dryer and bagasse disintegrator, stock taking report and new forms of laboratory report.

Research. A brief account of the main research projects undertaken in 1958 is given below.

(a) Exhaustibility of final molasses was determined during the intercrop and purity compared with the so-called Douwes-Dekker purity. The results were published in technical circular No. 10. A similar study will be made on the molasses samples gathered during this crop with the object of recalculating the constants of Douwes-Dekker's formula so as to bring them in line with the conditions prevailing in Mauritius.

(b) The relationship between Brix and dry matter in final molasses was studied and is reported upon in the Sugar Technology section of this report. It was found that the Sijlamns' formula which relates Brix (1/9 wt—wt) to dry matter does not apply to Mauritius and a new formula is proposed.

(c) Filtrability of raw sugars. Twenty-five average crop samples of raw sugar were analysed and found to have high contents of starch. The effect of cane variety was studied and it was shown that Ebène 1/37 and B.3337 have a higher starch content than M.134/32. This study is not yet complete but it is intended to issue a Technical Progress Report on the subject in the near future.

(d) The use of krilium as an aid to clarification was investigated in three factories but the results obtained were not very encouraging.

(e) Experiments were started to study the effect of reheating massecuite on molasses exhaustion. Laboratory experiments on 20 samples of C massecuites, which had been kept in crystallizers from the previous grinding season and on 10 massecuite samples from the 1958 crop, showed an increase in molasses purity varying from 3.3 to 0.8 degrees when these massecuites were reheated to 50°C. Factory scale experiments on reheating in Blanchard crystallizers and in the mixing troughs of centrifugals were less conclusive and were affected by severe experimental difficulties. In one factory, however, an average increase in molasses purity of 1.4

degrees was observed when C massecuite was reheated to 40°C in Blanchard crystallizers and a further increase of 1.6 degrees when the massecuite was brought to 50°C in the centrifugal mixer. These preliminary experiments show that reheating C massecuites in factories should be closely controlled. Massecuites should be reheated only to the minimum temperature at which the centrifugal capacity of the factory is sufficient to cope with the massecuite production. It is probable that the molasses exhaustion which could be obtained by centrifugalling colder C massecuites would justify the necessary increase in centrifugal capacity in many factories.

(f) A study of the heat transfer coefficients of evaporators has also started and will be continued in 1959.

HERBARIUM

The plant collection of the Mauritius Institute, which is probably one of the most representative of the Mascarene region, was transferred to this Institute and is now preserved in metal cabinets in a special room of the Biology wing. By arrangement with the Department of Agriculture, about 1000 herbarium specimens were also transferred to our custody. The identity of these two collections has been retained by suitable labelling and they remain the property of the Institutions concerned, but have been amalgamated with the S.I.R.I. Herbarium, which is representative mostly of the weed flora of the island. A central regional herbarium has thus been constituted and will no doubt prove of great value to students of the Mascarene flora and for reference purposes.

Once the collections have been finally classified and indexed, the Herbarium will be accessible to all *bona fide* workers. The Botanist of the Institute will act as «keeper» and will be responsible for the administration of regulations governing the use of the Herbarium.

As a supplement to the plant collections the Department of Agriculture has also kindly transferred, on loan to the Institute, a useful collection of botanical works of importance in floristic and taxonomic studies.

It is my pleasure once more to acknowledge the invaluable help received from Dr. R. E. Vaughan O.B.E., who has for many years made the Mauritius Institute Herbarium his special care, and who has spared no efforts in the rearrangement and classification of the combined plant collections referred to above.

GENERAL

Visit of Professor Van Hook. In October the Institute had the pleasure of welcoming Dr. Andrew van Hook, Professor of Physical Chemistry at the Holy Cross College, Massachusetts. Dr. van Hook spent nearly a fortnight in the island as the guest of the Institute and had an opportunity of visiting several factories. His valuable advice on problems of sugar crystallization was sought on many occasions by the Sugar Technologists of the island. Joint meetings were arranged with the «Société de Technologie» at which Dr. van Hook spoke on sugar crystallization.

10th Congress I.S.S.C.T. Several meetings of the regional section of the I.S.S.C.T. were held during the year to discuss various questions relative to the 10th meeting of the Society to be held in Hawaii in May, 1959.

The official Mauritius delegation to the Congress will be composed of Dr. P. O. Wiehe, Messrs. C. Noël and E. Bouvet, representing the Industry. Messrs. P. Halais, R. Antoine and J. P. Lamusse will be delegates of the Research Institute. There will be in addition many other members attending the Congress on their own behalf or representing their Companies.

Eight papers prepared by several members of the staff have been submitted to the Programme Committee of the Congress.

Sugar Conference. A technical sugar conference was organised by the «Société de Technologie» with the collaboration of the Institute and was held at Réduit from 16th to 21st June. Overseas delegates included

Messrs. P. N. Boyes, N. Sargent, A. van Hengel, P. C. Brett and G. M. Thomson from Natal, H. Barat from Madagascar, E. Hugot, M. Rivière, C. A. Barau and M. Hoareau from Réunion. The Proceedings of this Conference have recently been published in the *Revue Agricole et Sucrière de l'Ile Maurice.*

Meetings and excursions were well attended and an exhibition of agricultural machinery and equipment attracted much interest. The staff of the Institute presented seven papers at the conference.

The value of such meetings in establishing closer ties between research and industry cannot be overemphasised.

Meetings. The Research Advisory Committee met in May and December when various projects of the research programme were discussed.

In view of the sugar conference referred to above only one regional meeting was organised. It was held in March when Mr. J. R. Williams, Entomologist, lectured on «Clemora smithi and its Control».

At a meeting of the *Société Royale des Arts et des Sciences* held on 24th September Mr. J. R. Williams lectured on «Free living and plant parasitic nematodes».

The Institute organized two meetings jointly with the *Société de Technologie Agricole et Sucrière* on the 21st and 25th September at the College of Agriculture, when Professor Andrew van Hook lectured on «Sugar Crystallization».

The **Comité de Collaboration Agricole Maurice - Réunion - Madagascar** met in Mauritius from 17th to 24th October. In collaboration with the Director of Agriculture, who is Chairman of the Committee, a programme of visits was prepared which included the participation of the Sugar Research Institute. At the Annual conference, discussions on problems of common interest to the sugar industries of the three countries took place, in particular the control of Fiji disease, stalk borers and incidence of gummosis in Réunion.

PUBLICATIONS, REPORTS AND CIRCULARS

Annual Report for 1957. An abridged French version was also issued.

Bulletins. No. 9 Antoine, R., 1958. La Production des boutures saines dans la lutte contre la maladie du rabougrissement des repousses de la canne à sucre à l'Ile Maurice. (Extracted from *Rev. Agric.* Maurice. 37(1) pp. 8-13).

No. 10 Rochecouste, E., 1958. Observations on Chemical Weed Control in Mauritius.

Occasional Papers. No.1 Williams, J. R. Studies on the nematode soil fauna of sugar cane fields in Mauritius. (1) The genus *Mononchus.*

No.2 Williams, J. R., The genus *Mononchus.* (2) *Belondiridae*

Private Circulation Reports. No. 10. Antoine, R., The Campaign against Fiji disease in Madagascar, 1958. Mimeo., 36 pp. 2 figs. Sept. 1958.

No. 11. Parish, D. H., Report on a visit to Agricultural Research Centres in U.K. and Hawaii. Mimeo., 97 pp. 11 figs, 6 phots., 1 Map, Nov. 1958.

No. 12. Rochecouste, E., Report on the African Weed Control Conference, Southern Rhodesia. Mimeo., 19 pp., Nov. 1958.

No. 13. Saint Antoine, J. D. de R. de Report on the 12th Session of ICUMSA and miscellaneous visits in Natal, Louisiana and U.K. Mimeo., 28pp., Nov. 1958.

Technical Circulars. No. 10. Halais, P. Foliar Diagnosis, 1958. Mimeo., 5 pp.

No. 10. Lamusse, J. P., Applying the Douwes-Dekker formula for molasses exhaustibility to the molasses of the 1957 crop. Mimeo., 11 pp. May 1958.

Articles in " Revue Agricole et Sucriere de l'Ile Maurice. "

Halais, P., Besoins quantitatifs de la canne en azote, d'après le Diagnostic Foliaire. 37, 202-206.

Parish, D. H. & Feillafé, S. M., A review of phosphatic fertilization in Mauritius. 37, 207-211.

Rochecouste, E., Observations on the Chemical Control of «Chiendent» and «Herbe Mackaye». 37, 259-264.

Rouillard, G. Experimentation aux Champs à l'Institut de Recherches. 37, 252-258.

Sornay, A. de. Resistance of Sugarcane varieties to cyclones. 37, 241-251.

Wiehe, P. O., Le problème des variétés de cannes 37, 194-201.

Williams J. R., A Summary of Entomological and related problems of sugarcane in Mauritius. 37, 229-234.

Miscellaneous.

Rochecouste, E., Comparison of 2,4-D and MCPA for pre-emergent weed control in sugar cane. (Proceedings African Weed Control Conference, Southern Rhodesia, July, 1958).

Williams, J. R., A list of Hymenoptera (excluding Formicidae) recorded from Mauritius. *Maur. Inst. Bull.* V. (4), 108-128.

STAFF MOVEMENTS

Mr. J. Dupont de R. de Saint Antoine, Sugar Technologist, and Messrs L.P. Noël and M. Hardy, Field Officers, went on overseas leave from January to June. Messrs. Hardy and Noël visited several agricultural centres in U.K. and France. Mr. de Saint Antoine attended the 12th Session of ICUMSA in Washington as representative of Mauritius and also visited sugar factories and research centres in Natal, U.K. and Louisiana.

Messrs. R. Antoine, Pathologist, and R. Béchet, Field Officer, went on a mission to Madagascar in February to study the progress of the campaign against Fiji disease there.

In May Mr. Antoine left the island on overseas leave. He returned in November after having paid visits to agricultural research centres in U.K., France, Belgium, Holland and Switzerland.

During the same month Mr. D. H. Parish, Chemist, returned from overseas leave. He spent approximately two months at the Agricultural Chemistry Department of Queen's University, Belfast and several other research laboratories in the United Kingdom. Mr. Parish returned via Hawaii, where he stayed 5 weeks studying sugar research problems of interest to Mauritius.

In December Messrs. R. Antoine and C. Ricaud went to Réunion to study an outbreak of gumming disease on that island.

I should like to express my gratitude to all the authorities concerned for the assistance extended to the staff of the Institute while on mission abroad.

It is once more my pleasant duty to place on record my appreciation of the loyal cooperation which I received from all members of the staff during the year.

Director.

15th January, 1959.

Fig. 11. Biology wing opened in April 1958.

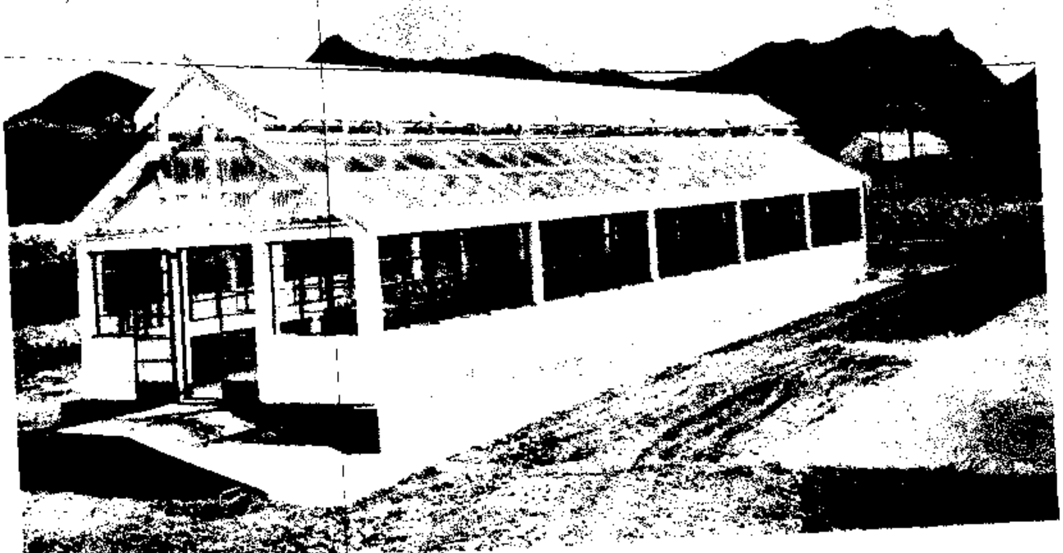

Fig. 12. Cane breeding glasshouse.

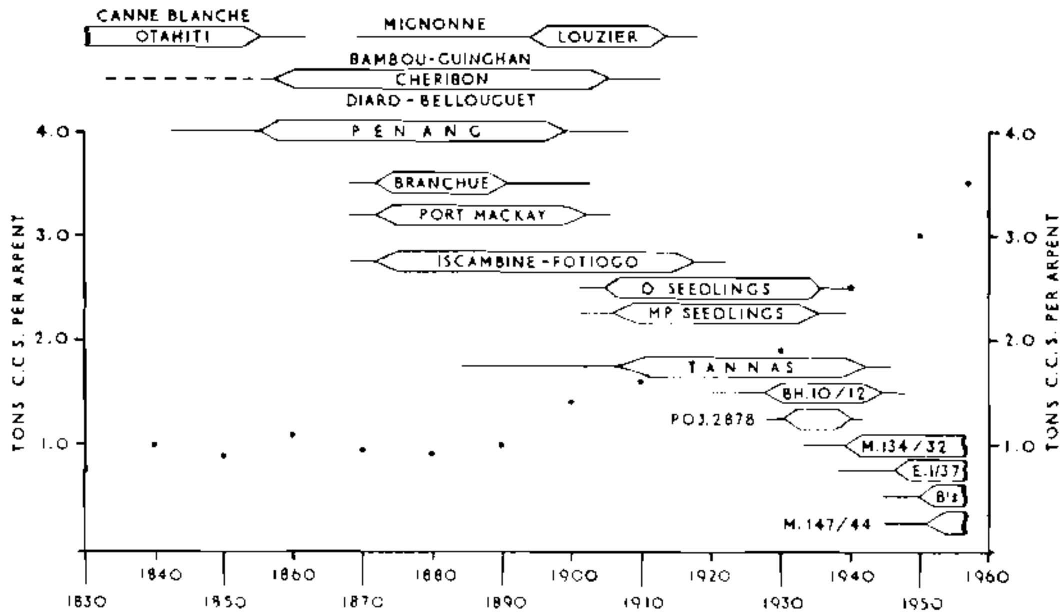

Fig. 13. Succession of commercial cane varieties in Mauritius since 1825. Dots indicate the yield of commercial sugar per arpent.

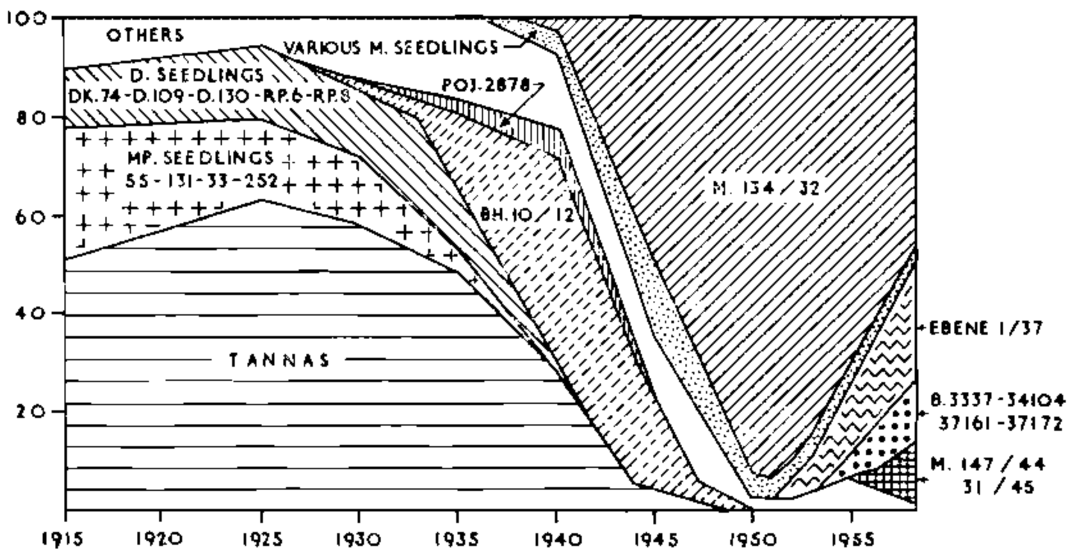

Fig. 14. Percentage area cultivated in different commercial cane varieties since 1915.

CANE BREEDING

A. de SORNAY & E. F. GEORGE *

1. ARROWING

(i) Conditions in 1958.

THERE has again been good response to the questionnaire sent to estates to obtain data of arrowing in the five sectors of the island. Some of the newer varieties having gained in impetus in certain sectors, it has been found necessary to investigate their arrowing potential on a larger scale than in previous years. The figures in table 1 give therefore a better picture of arrowing patterns than when M.134/32 and Ebène 1/37 only were studied.

Table 1. Arrowing in 1958.

Variety		Arrows %					
		North	South	East	West	Centre	Average
M.134/32	...	5.3	5.6	9.4	4.9	1.7	5.4
Ebène1/37	...	—	5.3	6.5	—	7.2	6.1
M.147/44	...	0.0	3.6	6.7	4.3	—	4.6
M.31/45	...	—	0.5	0.0	—	—	0.4
B.3337	...	—	0.8	0.2	—	—	0.7
B.37161	...	—	1.7	1.4	0.0	—	1.5
B.37172	...	0.0	2.6	0.4	—	—	0.2

In order not to make table 1 unwieldy, it has been found convenient to give the average arrowing percentage only. The weighted averages in the last column are nearly entirely those for ratoons, since much greater bias is given to these as compared to plant cane.

It emerges from the above figures that the cane flowered little on the average in 1958, the percentages for M. 134/32 and Ebène 1/37 being about half those recorded in 1957, which was itself a poor arrowing year. M.31/45 and the Barbados varieties were, as usual, shy arrowers.

No generalisation can be made respecting the effect of altitude on arrowing due to the low flowering intensity, but in conformity with the preceding years' data, ratoons flowered more than virgins, and border rows more than inside rows, although the differences in arrowing percentage are of a low order of magnitude.

Data of the effect of age of ratoons on arrow incidence confirm that, for the period August - November, arrowing percentage is directly proportional to the age of the ratoon canes. The combined data for the years 1956, 1957 and 1958 give straight lines which are illustrated in fig. 15. It will be remarked that the percentage figure for December, which could not be given hitherto owing to insufficiency of data, also falls on the regression line for M.134/32. When this line is produced, it cuts the x-axis at a point equivalent temporally to the middle of December, a period at which

* *Sections written by A. de Sornay: 1(i), 1(iv), 2(i), 4, 5, 6.*
Sections written by E. F. George: 2(ii), 3(i), 3(ii), 3(iii), 7.
Sections written jointly: 1(ii), 1(iii), 3(iv).

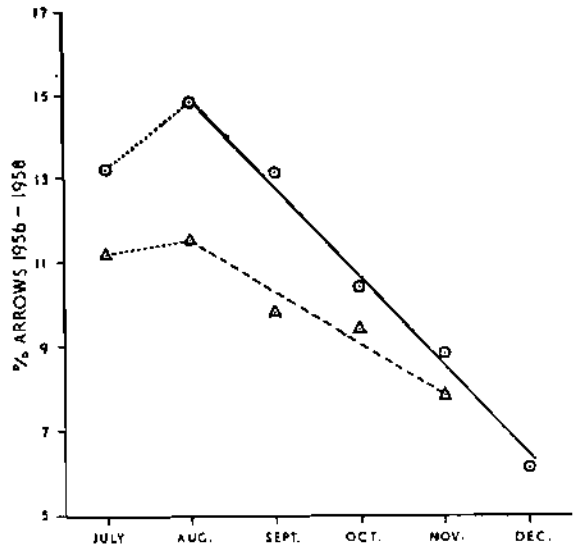

Fig. 15. Relationship between arrowing in ratoons and date of reaping. Plain line: M.134/32; broken line: Ebène 1/37.

ratoons would probably still produce about 5% arrows the following year. No extrapolation is safe in the case of Ebène 1/37 as not enough data for December reapings are available.

It is a very curious fact that, for three consecutive years, a lower arrowing percentage has been recorded in both M.134/32 and Ebène 1/37 for canes reaped in July the previous year. No hypothesis is put forward to explain this phenomenon at present. The part of the graphs between the months of July and August is, therefore, indicated by dots.

(ii) **Flower initiation.**

Investigations were carried out with C.P. 36-13 and M.241/40, two freely flowering varieties, to determine the effect of defoliation on the formation of flower primordia. The treatments were as follows: (a) control, (b) spindle only left, (c) spindle severed and leaves left, (d) spindle severed, three young leaves left, (e) spindle severed, three old leaves left.

Five canes of each treatment in both varieties were labelled at weekly intervals as from January 21st, 1958. The leaves were cut out with a pair of scissors at the point of attachment with the blade, and the spindle was severed at the level of the topmost dewlap. Soon after the experiment had commenced, it was found that the cut spindles were growing so rapidly that they had to be removed every morning and afternoon.

The usefulness of the experiment was unfortunately partially offset by the March and April cyclones, some of the labels having been blown off by the wind. Arrow counts were made in June, notes being also made on early or late emergence in the treated and control canes. The following preliminary conclusions may be drawn from the results obtained:

(a) young unexpanded leaves forming the spindle are capable of inducing flowering in the cane,

(b) fully developed leaves which are young at the time of induction have also the capacity to induce flowering in the absence of the spindle,

(c) old leaves are non-functional,

(d) the effective induction period in the variety C.P. 36-13 was apparently the last two weeks of February, that is, between one and two weeks before the first change in the growing point was noticed microscopically, and about two and a half months before actual arrow emergence.

Five tops each of C.P. 36-13, M.241/40 and a dozen other varieties were cut at weekly intervals at Réduit as from the middle of January, vertical sections of the growing point made with a bench microtome and examined under the low power of the microscope. The interval was reduced to one to three days at the critical period as soon as the first signs of floral bud formation were visible. The development of the embryonic inflorescences was followed up in certain varieties. The following points emerge from these studies:

(a) The first signs of arrow formation were seen at the beginning of March, 1958. An increase in size of the growing point is the first recognisable sign of differentiation, and is followed by the appearance of bulges on the sides of the growing point some four to seven days later.

(b) Arrow initiation in different varieties appears to take place within a fifteen-day period, and not simultaneously.

(c) Varieties showing early initiation tend to arrow more freely than those showing late initiation.

Up to 1957, canes of several varieties had been cut at weekly intervals as from February, longitudinal sections of the growing point made with a sharp scalpel, mounted on a slide and examined with a lens in the field. Rudimentary arrows were seen at varying intervals in March.

(iii) **Experimental induction of arrowing.**

Several methods were used during 1958 to try to induce flowering by chemical methods. All of them were unsuccessful. The experiments carried out were as follows:

(a) **Use of Gibberellic acid.** Treatments consisted of the injection of 2 ccs. of gibberellic acid in an aqueous solution of 50 p.p.m. around the spindle of the treated canes, so that the solution was retained between the youngest leaves. Tall mature canes of the varieties B.H.10/12 and R.P.8 were given weekly doses of the growth substance between the 29th January and the 28th of February, while with other canes these weekly treatments were commenced on the 7th, 14th, 21st and 28th of February respectively.

Treated canes showed slightly greater stem elongation than untreated canes while applications of the acid continued, but did not flower. No rudimentary inflorescences were found by section cutting in treated canes broken by the March and April cyclones. These results tend to confirm what has been found in other countries, namely, that gibberellic acid is incapable of inducing flowering in sugar cane. By being capable of accelerating stem growth, it may however find use in the crossing programme by hastening arrow protrusion in late flowering varieties.

(b) **2,4-D and trace elements.** The experiment consisted of weekly foliage sprays which started on the 20th January and terminated on 3rd March 1958. Different canes were treated at each application, all being of the variety B.H. 10/12. There were three treatments:

(i) The sodium salt of 2,4-dichlorophenoxyacetic acid at a strength of 100 p.p.m.

(ii) A solution of trace elements.

(iii) 50% trace elements solution and 50% 2,4-D solution.

2,4-D is found to stimulate flowering in certain crop plants and, in common with other plant hormones, is thought to change the permeability of the plant cell wall. The passage of certain metallic ions is probably related to this effect (Wolley, 1957). Thus if the non-flowering of the varieties in question was due to mineral salt deficiency, the combination of the treatments should have been a corrective.

None of the treated canes flowered, which is in accordance with the results of a similar experiment conducted in 1955.

(c) **The application of glucose.** The initiation of flowering is associated with a change in the carbohydrate metabolism of the plant. Short day plants have been stimulated to flower by the administration of sugar substrates (Liverman, 1955).

The variety used in this experiment was B.H.10/12 at Pamplemousses. Ten ccs. of 1% glucose solution were run down into the spindle of the treated canes from a hypodermic syringe. Excess solution ran out from between the leaves, and so this was not always the effective dose. The sugar solution was administered at weekly intervals from the 1st Frebuary to the 1st March 1958. The first application was so arranged that some canes received five consecutive weekly treatments while others received 4, 3, 2 or one treatment.

No flowers developed in any of the treated or untreated canes.

(iv) **Effect of long H.W.T. on arrowing.**

Following observations made recently in Barbados that the long H.W.T. resulted in a marked increase in arrowing in the varieties B.37161 and B.41211, arrow counts have been made in six trials conducted by the Pathology Division of the Institute.

In one experiment with Co.419 in first ratoons, the difference of 12.5% in arrowing between the means of the treated and control plots was significant, and it must be mentioned that in all pairs of plots, the treated plots have flowered systematically more than the untreated plots.

There was no significant difference between the percentage of arrowing in the treated and untreated plots of two trials containing M.134/32 in first ratoons, and in another trial with the same variety in plant cane.

M.134/32 in first ratoons and in plant cane in the fourth and fifth trials, respectively, had not flowered at all.

On an irrigated estate of the West, the treatment had no effect in inducing arrowing in B.H.10/12 which is a very shy arrower. Untreated canes of this variety tasseled on another estate in the North in 1956 and 1957.

To summarize, the results of only one trial give positive odds that the long H.W.T. has resulted in increased arrowing in Co.419, but these results are largely offset by the negative results of the five other trials. Therefore, in the present state of the knowledge acquired locally, no definite conclusions can be drawn with regard to the effect of this treatment in either increasing arrow incidence in normally freely arrowing varieties, or in inducing flower formation in a shy arrower.

A logical follow-up of the trial including Co.419 in ratoons will be to ascertain if cuttings from the treated plots give rise to cane having a greater tendency to arrow than those from the control plots and, of course, to pursue the trial in second ratoons.

2. CROSSING

(i) **Crossing programme.**

From the hybridization standpoint, the year under review was probably the worst on record since 1930. In 1958, seedlings per cross averaged nearly 45 at both Réduit and Pamplemousses, as against the general mean of about 225.

The poor results obtained in 1958 are ascribed to the very unfavourable temperature conditions that prevailed during the crossing season. Both the mean monthly maximum and the mean monthly minimum were markedly below normal in May, June and July. The absolute minimum temperatures recorded were as follows: Réduit 9.0°C; Belle Rive 8.5°C; Union Park 10.2°C; Curepipe 7.2°C; Vacoas 8.7°C and Pamplemousses 10.1°C.

Earlier work has shown that there is a strong negative correlation between the percentage of open anthers in M.63/39 and altitude. As temperature falls nearly linearly with altitude over the earth's surface, the effect of decreasing temperature on male fertility in this variety and other male varieties was clearly brought forward, and it was calculated that the percentage of open red anthers decreased by 7.8% per 100 ft. increase in altitude in M.63/39 in 1954.

Routine anther tests of many parental varieties made during the crossing season revealed male sterility in many cases. An interesting case of sex inversion was that of M. 213/40, which had been a strong pollen producer up to 1957, and gave little pollen at Pamplemousses and nearly 100% yellow anthers at Réduit in 1958. M. 147/44 also displayed reduced male fertility, being entirely female at the higher altitudes. The largest proportion of the seedlings bred in 1958 was derived from crosses involving that variety.

In order that breeding may no longer be dependent on weather vagaries, steps will be taken next year to institute indoor crossing to supplement field crosses. Even male arrows intended for use in crossing in glass lanterns will be marcotted and kept in the greenhouse some time before being used, to try to induce higher pollen fertility.

Crosses made at Réduit and Pamplemousses totalled 189 and 152, respectively. Solution crosses were attempted in the open, both the male and female arrows being kept in SO_2 — H_3PO_4 mixture. The results were poor in general.

Large linen lanterns of the Australian type were used with little success.

Due to the scarcity of arrows in the ratoon seedling plots, few of the sib-crosses planned out could be effected. The six crosses carried out produced 81 seedlings. The cross M.147/44 x M.202/46 and its reciprocal were made for the first time and gave a total of 57 seedlings. Both varieties have the same genealogy.

Sib-crossing involving proven parents would perhaps be productive of better varieties than that comprising as parents seedlings of which little is known of their potentialities at the time of hybridization. But there must be a limit to this method imposed by the comparatively fewer number of parental varieties available for sibbing.

About 1,444 seedlings were obtained from the fuzz obtained in 1957 and stored at low temperatures for 6 to 8 months. These are poor results compared to those obtained with fuzz from 1955 crosses stored for seven months. The seedlings have been planted in two batches at Union Park in July and October, 1958. Both planting months proved suitable for transplanting seedlings.

Field transplanting of the 1958 seedlings could not take place before December because of the very dry conditions in November. Progeny tests including two control varieties derived from single-eyed cuttings, and seedlings from six crosses in replicated randomized blocks, have been made. Similar tests were carried out in the past using several designs, those with one-seedling plots giving unsatisfactory results owing to interaction between adjacent seedlings.

A summary of the breeding work in 1958 is given in table 2, and crosses made at Réduit and Pamplemouesss are listed in Table XIII of the Appendix.

(ii) **Experiments on the male and female fertility of flowers.**

(a) Effect of Hot Water. Treatment of flowers in hot water is used in the breeding of many cereals and grasses to impair male fertility [see for example Mackay & Dunn, (1957) and Doggett (1957).] The treatment forms a quick and reliable method of emasculation and is especially useful where physical removal of the anthers is impossible due to their small size and the multiplicity of individual spikelets.

In species which are naturally self-fertilizing, emasculation is almost an essential prerequisite to cross pollination. In sugarcane, which in Mauritius is found to be partially self-sterile, the use of emasculation would only be desirable in crosses where it is particularly important to know that no selfing has occurred. Such a situation might arise where, for example, a set of diallel crosses is intended.

The effect of hot water on cane flowers was investigated in the following experiment. Whole canes were cut just as the inflorescence began to protrude from the sheath and before opening of the first spikelets. The sheath was cut away and the delicate inflorescence supported with a thin bamboo stem. Complete arrows fully exposed in this way were immersed in a hot water bath for various time/temperature treatments. The temperatures used were between 35 and 55°C. It was found that varieties differ markedly in their resistance to heat on the flower, but in each case various combinations of time and temperature could be found where the anthers did not turn red and dehisce.

The progressive damage to sugar cane flowers caused by increasing heat treatment may be summarised as follows:

(a) A delay in the opening of ~~male and female~~ spikelets.

(b) Anthers when mature are yellow and do not open. There is a progressive change from % pink anthers found to % yellow (table 3) with increasing temperature treatment.

(c) Anthers protrude less.

(d) Stigmas which until this stage appear to be normal anatomically, become reduced in size.

(e) Only reduced stigmas emerge from the spikelets.

(f) No protrusion of either anthers or stigmas. Arrow remains intact.

(g) Arrow killed and quickly falls apart.

Table 2. Summary of breeding work in 1958.

Experiment Stations	No. of crosses made	No. of seedlings obtained	No. of seedlings transplanted
Réduit	189	8,713	3,065
Pamplemousses ...	152	6,684	3,513
Belle Rive ...	—	—	3,883
Union Park ...	—	—	2,798
Total	341	15,397	13,259

Table 3. The effect of increasing heat treatment on the anthers of M.147/44.

Treatment			% anthers		
			Open	Unopen	
				Yellow	Other Colours
Control	20°C.	60 mins. ...	50.7	25.0	24.3
	50°C.	6 mins. ...	15.7	29.3	55.0
	50°C.	8 mins. ...	0	50.0	50.0

Emasculation was considered successful at stage (c) and fig. 16 shows the large varietal differences in susceptibility to heat.

Treated canes were kept in a standard solution of sulphur dioxide and phosphoric acid and crosses were made with selected arrows. No seedlings were obtained from any of the crosses including controls of untreated arrows which indicated that the crossing technique was at fault. No information was gained therefore on the effect of heat on female fertility.

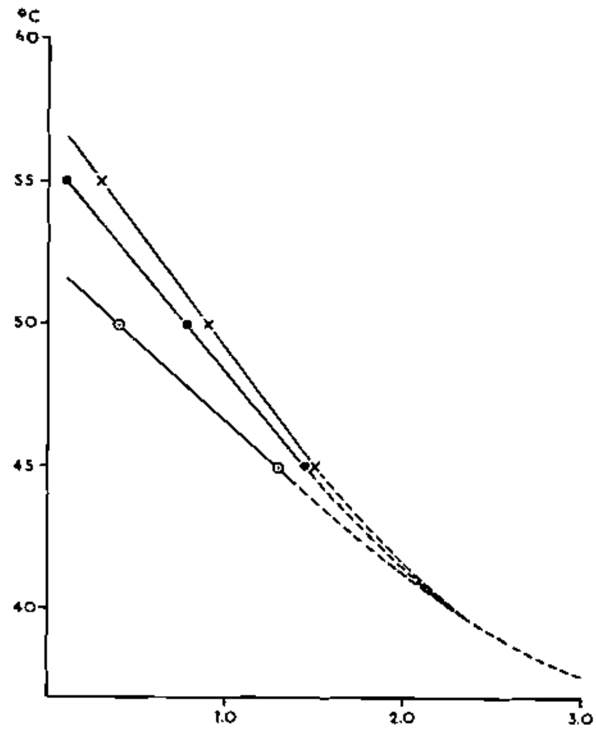

Fig. 16. Susceptibility of cane lowers to heat. Time/temperature combination giving a stage of optimum emasculation for M.147/44 (crosses), M.112/34 (squares) and Ebène 1/37 (circles).

Inside non-dehiscing yellow anthers, a proportion of mature pollen grains was found which stained with either acetocarmine or iodine and by this criterion at least could be considered still viable. Successful emasculation would appear to depend on the non-dehiscence of the anthers alone.

(b) Effect of Hormone Sprays on Arrows. In an attempt to induce parthenocarpy, arrows of two female varieties, the canes of which had been cut and placed in standard solution, were sprayed with solutions of 3-indolyl-acetic acid, 100 p.p.m., and of gibberellic acid, 10 p.p.m. No seedlings were obtained from these arrows.

A small experiment was carried out to determine whether 2,4-D sprays at 6 p.p.m., would improve viable seed formation in sugar cane. It is the author's own experience that 2,4-D solution at a strength of 6 p.p.m. can cause unfertilised ovaries of wheat to expand although parthenocarpy does not occur. It has also been shown by Dionne (1958) that in crossing widely separated *Solanum* species, the pollen often germinates but fertilised ovaries fail to develop; they are stimulated to do so, however, when treated with 2,4-D solution.

Slightly more seedlings were in fact obtained from selfings of D.109 and M.147/44 after this treatment, but the result cannot be regarded as significant in view of the low fuzz fertility.

3. STUDIES ON SEEDLING POPULATIONS

(i) Minimum size of population for studies on frequency distributions.

In order to gain reliable knowledge of the variation of important characters within current seedling populations, measurements were made at Pamplemousses on the first ratoons of over 500 singly planted seedlings of each of the crosses P.O.J.2878 × M.147/44 and M.241/40 ×

M.147/44, and on 200 clonal stools of M.134/32 planted as a standard. The stools of the standard had been derived from single eyed cuttings. The characters: number of canes, number of arrows, average length of stem, average diameter of stem, brix and weight of millable cane, were recorded for each stool.

The number of stools (N) taken at random which must be measured to give a figure for the mean or standard deviation which is within x % of the mean or standard deviation of the true hypothetical population from which the sample is drawn is :

$$\sqrt{N} = \frac{t \times V \times \sqrt{2}}{x}$$

where V is the coefficient of variability of the hypothetical population.

characters number of canes and weight of cane are measured to a probable accuracy of 10% and average height of stool to 5% in the case of average diameter and Brix.

It is interesting to note that the mean weight of cane from the cross P.O.J. 2878 × M.147/44 is almost as great as that from the standard stools of M134/32. As measurements were made on many seedlings of poor quality in this cross, it may be realized that many other stools were of very high weight. To show that selection cannot be made on yield alone, the characteristics of the top 14% of all the stools by weight, are given in fig. 17 in which selected seedlings are also indicated. It may be seen from the above diagram that of all seedlings weighing more than 15 kg., 5 only were finally selected, showing that selection for yield

Table 4. Statistics of the three populations with necessary sample size for estimation of the mean or standard deviation.

Character	Statistic	P.O.J.2878 × M.147/44	M.241/40 × M.147/44	Standard M.134/32	Approximate size of sample for an accuracy in mean and S.D. of:		
Number of Canes	S.D.	4.38	4.56	4.56	10%	—	110
	$\bar{x}$	10.34	12.39	8.65	5%	—	625
	C.V.	42.38	36.80	34.58			
Average Height of Stool	S.D.	38.98	28.03	16.08	10%	—	35
	$\bar{x}$	186.60	175.41	190.53	5%	—	195
	C.V.	20.89	15.98	8.44			
Average Diameter	S.D.	0.25	0.27	0.21	10%	—	8
	$\bar{x}$	2.72	2.28	3.05	5%	—	45
	C.V.	9.19	11.67	6.79			
Weight of Cane	S.D.	5.52	4.56	4.56	10%	—	135
	$\bar{x}$	11.32	10.23	11.66	5%	—	770
	C.V.	48.79	44.53	38.21			
Brix	S.D.	1.13	1.14	1.21	5%	—	18
	$\bar{x}$	21.12	20.84	20.89	1%	—	650
	C.V.	5.32	5.45	5.78			

The statistics of the populations examined are given in table 4 and, taking a figure which puts the variability of the true hypothetical populations at a maximum, the sample sizes necessary for estimation of the mean and standard deviation with an accuracy of 10% and 5% are given.

Measurements on 200 seedlings will ensure that the mean and standard deviation of the alone is comparatively easy. Characters such as growth habit and disease susceptibility, not shown in the diagram, have precluded the selection of otherwise satisfactory seedlings.

The high standard deviation of the Brix distribution of the standard M.134/32 confirms the well known fact that too much emphasis should not be placed on selection for Brix in early stages.

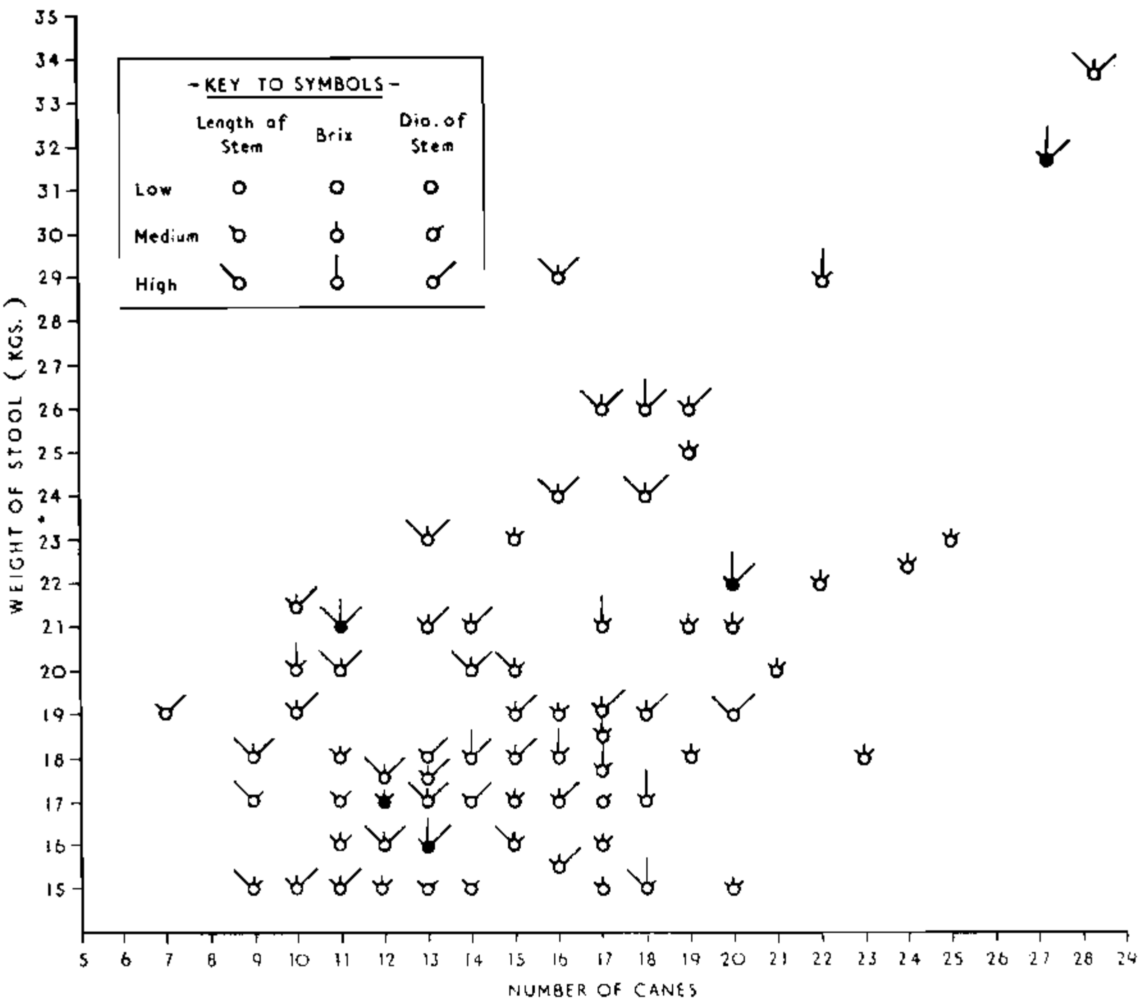

Fig. 17. Pictorialised scatter diagram showing the association of the five characters measured in the highest yielding 14% of the sample population. Selected seedlings are indicated by black circles.

(ii) **Effect of Environment on Yield Components.**

Seedlings of five crosses made in the course of the normal breeding programme were planted at each of the four experiment stations of the Institute in November, 1957. During 1958 these crosses were examined at similar times at each of the four places and characters affecting yield were measured. Distribution curves prepared for these characters indicate the selection potential of each cross.

On a population basis the relationship between mean length aud mean yield was shown to depend on environment, while between mean tiller number and mean yield a linear relationship was found within each cross, and indicatep that it is mainly the efficiency of the environment in producing tillers which determines the suitability of any cross to a particular place. These results are discussed fully in a paper to be presented to the 1958 Congress of the I.S.S.C.T. in Hawaii.

(iii) **Brix of Reciprocal Crosses.**

The cross Ebène 1/37 × B.37172 and its reciprocal were situated adjacently in the 1956 first ratoon seedlings. The Brix of one hundred seedlings from each of the crosses at Pamplemoussess Experiment Station was examined in the first week of July. The distribution curves are found to be very similar, as is shown in fig. 18, and their means and standard deviations are not significantly different. There was thus no indication of cytoplasmic inheritance of high brix as found by Raghavan (1955) in crosses involving parents of high brix and low vigour, and high vigour and low brix.

The frequency curve for 100 standard stools of M.134/32 is also shown, as well as the curve for the cross B.37172 × Ebène 1/37 at Réduit Experiment Station. The latter curve shows the effect of differing environments on Brix distribution.

Although the Brix distributions of each of the reciprocal crosses at Pamplemousses are

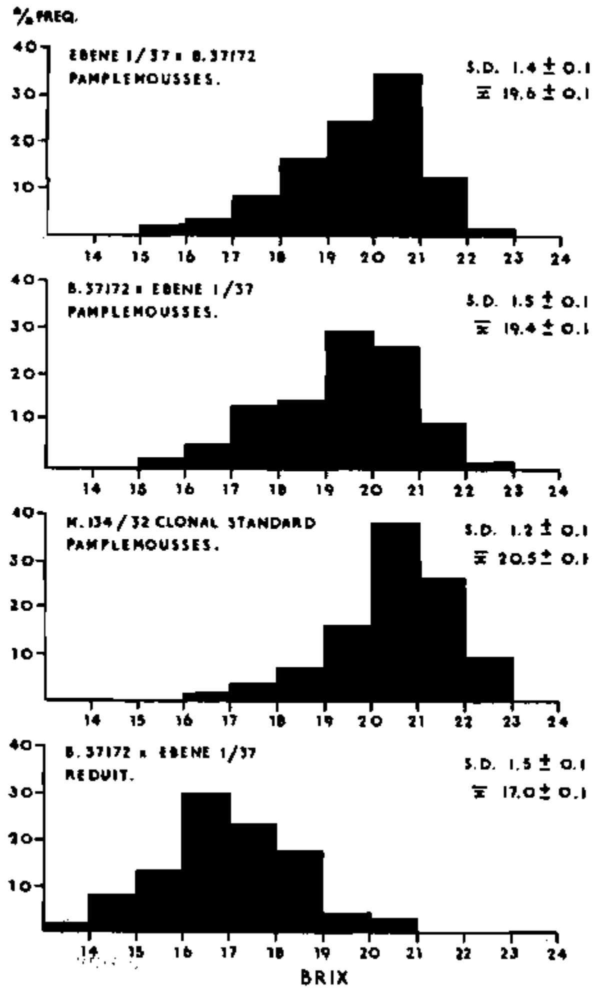

Fig. 18. Frequency distributions for Brix of a reciprocal cross and of the standard variety at Pamplemousses E. S. The curve for one of these crosses at Réduit illustrates the effect of environment.

nearly the same, the association of this factor with other useful characteristics appears to be different in each of the two crosses. The percentage of selections made from the cross B.37172 × Ebène 1/37 has been higher than from the cross Ebène 1/37 × B.37172.

(iv) **Bunch Planting Experiment.**

The theory behind bunch planting of seedlings is that, by extreme competition, only the very vigorous seedlings survive, and thus it is possible to sieve through many more seedlings in the early stages of selection while utilising minimum space for planting. It has been shown by Skinner (1957) that selection from within bunch planted seedlings is effective under Queensland conditions, but a comparison has never been made between the efficiency of selection from bunch planted seedlings and that from single planting.

An experiment was laid down in 1956 with seedlings of the same cross, B.34104 × M.63/39, to compare two methods of bunch planting with ordinary space planting. These two methods were (a) one seedling per pot and 7 to 10 of these pots per hole in the field, (b) 7 to 10 seedlings per pot and one such pot per hole in the field. These two methods may be expected to give a differential amount of selection by competition at an early stage.

Selections were made during the last week in August from this original trial, and a new five-replicate trial was planted with these selections in which the 25 best stools from the singly planted seedlings will be compared to selections from the two kinds of bunch planting. The comparison will be made between the best, the worst and canes of average quality selected from the bunch planting. Since many more seedlings from the same cross went into the original bunch planted plots, the best selections from these treatments should provide more varieties of better quality than the best selections from the single planting, if bunch planting is to prove its worth.

Germination in the new experiment was good and has shown, as might be expected, that the best selections from the bunch planting have germinated better than the worst selections, but not better than the selected canes from single planting. Germination of selected material from bunch planting under method (a) above was consistently better than germination of material derived from planting under method (b). It will be interesting to see if future results confirm a difference in selection due to the type of bunch planting adopted.

4. FIRST SELECTION TRIALS

One hundred and fourteen varieties of the M/55 series have been selected from propagation plots laid down in 1957, and planted in first-selection trials. Table 5 gives the percentage of selection at the four experimental stations:

Table 5. Percentage Selection in Propagation Plots.

Station	Number of varieties in propagation plots	Number of varieties selected	%
Réduit	917	32	27.3
Pamplemousses ...	117	41	35.0
Belle Rive ...	116	21	12.6
Union Park ...	28	20	71.4
TOTAL ...	428	114	26.6

The mean percentage of selection was about 27%, and is of the same order as that for previous years. Selection in 1958 was based mainly on Brix, general appearance and yield of cane. Under the present breeding policy, it is considered necessary to determine the weight of the individual varieties, as yield must of necessity be a better criterion than visual assessment, and as spectacular differences in the yield of the new varieties are improbable.

The low percentage of selection at Belle Rive is due to the fact that few varieties in the propagation plot approached Ebène 1/37, the control variety, in Brix values.

The lay-out of the first-selection trials was the same at all stations. There are three randomized blocks, the plot size being two rows of 15 ft. The number of varieties per trial has been doubled or trebled compared to previous years. The general working rule postulated by Finney (1955), that the number of plots of the control variety per block should be the square root of the number of varieties under trial, has been followed as far as possible.

The standard varieties used in the trials are as follows: Réduit: Ebène 1/37 and M.147/44; Pamplemousses: M.147/44 and B.37172; Belle Rive and Union Park: Ebène 1/37. It will be remarked that M.134/32 is no longer being used as control variety, in the drier stations, as it is declining and is gradually being ousted by M.147/44 and B. 37172.

Five trials have been reaped in 1958, those in ratoons only, being weighed and analysed. As there were no trials in second ratoon, no selections have been made for further trials.

5. PRE-RELEASE VARIETY TRIALS

It should be made clear at the outset that pre-release variety trials can really be divided into two groups:

(a) **Variety trials** which are routine sorting tests containing new varieties of which comparatively little is known except their performance in first-selection trials in ratoons. These trials generally include five varieties plus a standard arranged in four randomized blocks, generally all reaped at the same time. Plot size is 4 rows of 30 feet.

(b) **Pre-release trials proper** containing promising varieties selected from variety trials and worthwhile testing under a diversity of environmental conditions. They include three to four varieties and one or two control varieties per block. There are six blocks, two of which are harvested at each of the three maturation periods. Plot size is also 4 rows of 30 feet.

Eleven trials have been planted on estates during the year. The varieties included in these trials are mainly those of the 1951, 1952 and 1953 M. series, the Ebène varieties 50/47 and 3/48 and the foreign varieties B.41227, B.4362, H.37-1933, N.Co.310 and R.397.

The distribution of pre-release trials containing varieties, some of which may have commercial prospects, is given in table 6.

White and Striped Sports of M.134/32. The productive figures of 19 ratoon tests for the white sport and of 9 tests for the striped variety in the humid, sub-humid and irrigated zones show that the differences in yield of cane and sugar from the control red variety are small and non-significant. As reported earlier, the striped sport is unstable and has a tendency to mutate back to the white type. Arrow counts made in variety trials reveal no real differences in the rate of flowering in the three varieties.

Table 6. Distribution of Promising Varieties in 1958.

Varieties	Number of Trials — Climatic Zones			
	Super-humid	Humid	Sub-Humid	Irrigated
M.202/46	2	2	2	3
M.93/48	2	1	1	1
M.253/48	1	1	2	2
M.305/49	0	1	1	1
Ebène1/44	1	1	1	1
B.41227	1	3	2	2
N:Co.310	1	1	1	0
R.397	0	2	1	0

N:Co.310 is being tested in the main agro-ecological zones in view of its good performance in several countries and its very high sugar content. It looked fairly good in the propagation plot at Réduit in which, unfortunately, it arrowed to the extent of nearly 100%, even when very young.

Thirty-eight trials have been harvested in 1958. The results of those including the varieties M.147/44 and M.31/45 are given in tables 7 & 8 and confirm those obtained the previous years. The former variety was found resistant to cyclones: the percentage of broken stalks was low and the leaves have been slightly damaged. Lodging is a natural characteristic of this variety, but it was accentuated by the wind.

M.31/45 was rated as moderately resistant to cyclones. Its wider leaves have been more lacerated than those of M.147/44, and stalk snapping occurred to a greater extent than in the latter variety. Lodging was bad in some localities.

Bearing in mind that M.134/32 is declining in all sectors, it is considered that the planting of the white and striped sports should not be extended.

The other varieties mentioned in the previous report as showing promise and worthy of further trial are considered below. Naturally, their agricultural characteristics are given with the necessary margin of reserve due to insufficiency of data.

M.202/46. Its yield of cane and sugar were on a par with those of Ebène 1/37 in a trial of the superhumid zone harvested up to the fifth ratoon stage. It was better than M.134/32 in the North under dry and irrigated conditions. Its performance in high rainfall areas cannot as yet be assessed. It germinates and grows remarkably well and has a good canopy. Its stalks are thicker than those of M.147/44, a sister variety.

M.93/48. In an experiment under superhumid conditions, it has outyielded B.3337 by quite a considerable margin. Its sugar content is high, and it appears suited to high rainfall but not to dry conditions.

M.253/48. This variety has responded well to irrigation at Black River where it has yielded 20% more cane and sugar than M.134/32. The C.C.S. is somewhat lower than that of the control variety. It is a thick cane which seldom arrows.

M.305/49. Yielded more sugar per arpent than Ebène 1/37 in a trial located in the humid zone. Its sugar content was well above that of the standard, so that it is also worth while testing in several trials.

Ebène 1/44. It is a rich cane but was inferoir to Ebène 1/37 in sugar output in the superhumid and humid zones. Compared to M.134/32, it produced more sugar per arpent in virtue of its higher C.C.S.

B.41227. It was inferior to Ebène 1/37 in the superhumid zone and was nearly equal to M.134/32 under dry and humid conditions.

R.397. Gave good results compared to M.134/32 under humid and sub-humid conditions. It has a good sugar content, and is probably early maturing. It arrows heavily, a defect which might militate against its cultivation on a large scale. It is now in the gumming trial at Réduit and has, so far, shown resistance; it is reported susceptible in Réunion Island.

Table 7. Summarized Performance of M. 147/44 and M. 31/45 in Ratoons in Variety Trials.

	Tons cane/arpent				C.C.S. % cane				C.C.S. per arpent			
Varieties	Sub Humid	Humid	Super Humid	Irrigated	Sub Humid	Humid	Super Humid	Irrigated	Sub Humid	Humid	Super Humid	Irrigated
M.147/44	32.8	39.7	—	39.2	15.4	15.9	—	15.5	5.06	6.34	—	6.12
M.134/32	27.4	32.5	—	27.3	15.5	15.9	—	15.5	4.25	5.18	—	4.25
(1950 - 1958)												
M.147/44	—	43.8	—	—	—	15.5	—	—	—	6.83	—	—
Ebène1/37	—	36.6	—	—	—	15.9	—	—	—	5.84	—	—
(1955 - 1958)												
M.31/45	31.1	38.4	—	33.6	15.3	15.6	—	15.2	4.76	5.98	—	5.13
M.134/32	27.8	31.6	—	27.3	15.4	15.3	—	15.5	4.29	4.86	—	4.26
(1953 - 1958)												
M.31/45	—	—	32.8	—	—	—	13.5	—	—	—	4.44	—
Ebène1/37	—	—	30.7	—	—	—	14.5	—	—	—	4.47	—
(1951 - 1958)												

Table 8. Maturity Behaviour of M.147/44 and M.31/45 in ratoon as compared to M.134/32 (1954 - 1958).

	July-August		Sep.-Oct.		Nov.-Dec.	
Variety	No. of Harvests	C.C.S.	No. of Harvests	C.C.S.	No. of Harvests	C.C.S.
M.147/44 ...	40	+0.6	53	—0.3	34	—0.2
M.31/45 ...	53	—0.1	74	+0.2	39	0.0

6. SAMPLING METHODS

The sampling experiments described in the Annual Report for 1957 have been continued this year.

(i) **Stool versus random sampling.**

Ten stalks were taken from a random stool per plot of two lines of 30 feet as in the previous experiments. Thirty canes were then taken at random per plot and reduced to a sample equivalent to 10 stalks, consisting of 10 tops, 10 middles and 10 bottoms, each top, middle or bottom being derived from a seperate stalk. Both types of sampling were repeated ten times, the samples being collected from ten different plots distributed over an area equivalent to that of an ordinary variety trial. The samples were analysed in the laboratory with the following results (table 9).

Table 9. Analysis figures of samples from whole stools and random stalks.

Variety	Date of analysis	Sampling Method	Brix Mean	Brix C.V.	C.C.S. Mean	C.C.S. C.V.
M.134/32	20.10.58.	Whole stools	20.45	2.5	16.72	3.1
		Random stalks	20.50	3.0	17.08	1.0
		Significant difference	0.52		0.37	
Ebène1/37	13.10.58.	Whole stools	20.34	4.3	17.21	4.7
		Random stalks	20.43	2.3	17.52	3.6
		Significant difference	0.63		0.67	

These results are quite in line with those collected up to now: there is no significant difference between the mean Brix and mean C.C.S. of whole stool and random stalk samples. The coefficient of variation (C.V.) is, as before, lower for the random stalk samples.

(ii) **Dividing stalks into tops, middles and bottoms.**

The process of dividing the stalks into three portions of about the same length was the same as the one adopted before. Four new standard varieties have been investigated, and analyses of M.147/44 and Ebène1/37 were repeated. The experiments made so far comprise therefore eight different varieties analysed at different periods of the crushing season. The mean ratios

$$\frac{\text{Brix of entire cane}}{\text{Brix of middle portion}} \text{ and } \frac{\text{C.C.S. of entire cane}}{\text{C.C.S. of middle portion}}$$

are given in table 10.

Table 10. Ratio of mean Brix and mean C.C.S. of entire canes to Brix and C.C.S. of middle portions

Variety		Date of analysis	Ratio Brix	Ratio Fibre	Ratio C.C.S.
M.134/32	...	10.7.57	0.96	1.00	0.91
M.112/34	...	4.12.57	0.96	1.04	0.93
M.147/44	...	4.12.56	0.90	1.08	0.85
M.147/44	...	12.8.58	0.95	1.03	0.93
M.31/45	...	8.9.58	0.89	1.03	0.85
Ebène1/37	...	11.11.57	0.96	1.03	0.94
Ebène1/37	...	14.7.58	0.97	1.05	0.96
Ebène1/37	...	6.10.58	0.96	1.02	0.95
B.3337	...	29.9.58	0.94	1.05	0.94
B.37161	...	22.9.58	0.96	1.07	0.94
B.37172	...	15.9.58	0.95	0.95	0.94
Mean	...		0.94	1.03	0.92

Except for M.147/44 (4.12.56) and M.31/45, the Brix and C.C.S. ratios hold up consistently, irrespective of the date of analysis. It is therefore considered that the method of analysis based on middle stalk portions can be applied to first-selection and variety trials. A sample of 40 middle thirds of stalks, equivalent to about 13 entire canes for shredding, but to 40 canes from the analysis standpoint, could be taken per three plots of first-selection trials and per plot of variety trials. The error would be reduced theoretically in the proportion 1: $\sqrt{3}$ in comparison with samples consisting of 10 entire stalks.

The absolute value of the Brix and C.C.S. ratios is of no importance, but it should be fixed in different varieties, so that the analysis results may be comparable. The values obtained so far vary within so narrow limits as to warrant an application of the method to the sampling of trials, but the experiments must, needless to emphasize, be persued with other varieties so that the constancy of the relationship may be definitely established.

The value of the ratios is independent of whether the Brix or C.C.S. of the middle portions is intermediate between those of the top and bottom portions, or whether it is greater than that of the bottom portions.

The aberrant figures obtained in the case of M.147/44 (4.12.56)) and M.31/45 should in no way invalidate the results of trilas based on the analysis of many cane samples, which are usually taken prior to releasing varieties.

Since the mean Brix and C.C.S. ratios are 0.94 and 0.92 respectively, the true mean Brix and C.C.S. of samples can be obtained by multiplying the actual Brix and C.C.S. found for middle portions by the appropriate factor to bring the analysis figures more in line with those of ordinary samples. But this is not really necessary, as it is the relative sugar content of the different varieties under test which is needed for experimental purposes.

If T be the mean Brix or C.C.S. of top portions,
M „ „ „ „ middle portions,
B „ „ „ „ bottom portions,
m „ „ „ „ entire stalks

it is found that (M-m) is systematically positive and $\frac{(T+B)}{2}-m$ systematically negative, the mean value of the first expression being somewhat higher than that of the second. In ordinary parlance, the Brix and C.C.S. of the top and bottom portions taken together are nearer to the Brix and C.C.S. of entire stalks than those of the middle portions. But, from a practical standpoint, it is better to sample middle portions only for analysis instead of top and bottoms.

7. CYTOLOGICAL INVESTIGATIONS

The Chromosome numbers of commercial varieties.

Chromosome numbers have been counted in some of the varieties which are at present commercial canes in Mauritius and are shown in table 11.

Table 11. Approximate chromosome numbers encountered in commercial varieties. The number which has been most commonly found in each variety is printed in bold figures.

Variety	Somatic tissues 2n.	P.M.C. n.
M.147/44 ...	54, **108**, 125.	**61^{II}** + 1^{I}, 60^{II} + 2^{I}.
Ebène1/37 ...	84, **124**, 144.	42, 61^{I} + **2^{II}**, 72.
M.31/45 ...	34, **102 - 108**, 134.	—
M.134/32 ...	**97**	—
M.112/34 ...	53, **106**, 120.	—

As the chromosomes of sugarcane are very small and very numerous, considerable difficulty has been experienced in fixing the above numbers which have been arrived at by counts on many cells.

The number of chromosomes in somatic cells of plants and animals is known to often vary slightly from cell to cell, but large differences in number such as indicated above would normally indicate chimaeral tissues. As the irregular numbers indicated above have been widely found in both leaf and root tissues, and sometimes in adjacent cells, it is more probable that either irregular mitotic divisions are of frequent occurrence in the polyploid tissues of these complex hybrids or that reduction in number occurs by the process of *somatic reduction* observed by Huskins (1948 and subsequently) in roots of *Allium cepa*, giving rise to a mosaic of chimaeral tissue. Elimination of chromosomes during mitosis in somatic tissue of *Saccharum* hybrids has been observed previously (Raghavan and Govindaswamy 1956).

Pretreament of material. All the counts made on somatic tissues were of metaphase plates after pretreatment of the original material with colchicine. Methods used were :

(a) a leaf squash method (Price 1956), in which shoots germinated at 35°C are kept in 0.2% colchicine in the cold for 2 hours before fixation.

(b) A root squash method which has been recently tried and promises to be very useful. Germinated single eyed cuttings with vigorously growing roots about one inch long are placed in aerated 0.025% colchicine at 30-35°C for several hours. The roots are then cut off and placed directly in fixative. Dividing cells are arrested at metaphase by this treatment (see Evans *et al.* 1958.)

Staining technique. A successful staining method has also been recently found which seems to give equally good squash preparations of either root or leaf tissue. It is based on that of Zielinga (1956), q.v.

Materials.(a) 2% orcein in 45% acetic acid which has the addition of 2N - HCl in the proportion 9 parts stain to 1 part acid. (b) 2% orcein in 45% acetic acid.

1. Place fixed material on a clean slide.

2. Cover with a drop of orcein stain/HCl. mixture and leave for one minute.

3. Heat once over a spirit flame until the drop of orcein stain contracts.

4. Leave slide 10 minutes or so, during which time as the stain dries, staining and hydrolysis go on.

5. Remove material to one end of the slide and clean off the old stain.

6. Put a drop of ordinary 2% orcein stain on the material and macerate thoroughly with a glass rod.

7. Place a cover glass coated with adhesive over the material and spread the cells by gently tapping the cover glass with a matchstick.

8. Seal the preparation with a paraffin — mastic mixture.

Making squash preparations permanent. Some temporary squash preparations have been made permanent by the method of Conger and Fairchild (1953), but as dry ice was not available, the slides were first frozen by placing them in a deep freeze for one hour. This slower freezing does not appear to harm the cells.

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NUTRITION AND SOILS

1. CHEMICAL FERTILIZATION

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Nitrogen

VARIETY selection in Mauritius in the past was based on the assumption that canes growing well under the poorer conditions in the island, would prove to be the best when planted on good land. This approach has given us the present Mauritius varieties, none of which respond really well to high fertility conditions.

The key of fertility in the tropics is nitrogen, and therefore the aim of all estates should be to eliminate deficiencies of phosphate and potash and concentrate on the more critical nitrogen requirement of the cane, as variety selection is now aimed at obtaining varieties which are efficient converters of applied nitrogen into sucrose yield.

The whole of modern agriculture has swung towards high performances, with the consequent demand for high levels of technique. With sugar-cane, high performances will be associated with the level of nitrogen which can be utilized by the plant. The fertilizer programmes will eventually therefore be concerned mainly with nitrogen and the individual demands of variety and field for this expensive nutrient. In other words, Mauritius will enter a period of intensive cane growing in which the skill used in rationalizing the nitrogen fertilizer programme will determine the yield level and profit.

In view of this key position of nitrogen in the fertilizer programme, it is essential to have a full knowledge of the performance of the various nitrogenous fertilizers available commercially.

Sulphate of ammonia has been the principal source of agricultural nitrogen for many years for the reason that it was efficient and cheap. Recently, particularly in the United States, ammonia liquor has replaced the crystalline nitrogenous fertilizers because the price per unit of nitrogen is only about one-third the price of its nearest competitor. This material requires considerable capital in the form of tankers and trailers and injection equipment, before it can be used, but nevertheless in view of the large amount of nitrogen used and the low price, it has ousted sulphate of ammonia in Hawaii.

One other important competitor for sulphate of ammonia has also been developed, namely urea. The big attraction of this material is the high nitrogen content (45%), and as a result, the lower freight and handling charges involved in applying the material to the field. In Hawaii, where on non-irrigated estates nitrogen must be applied by air, urea is the form of nitrogen used because of payload considerations.

In view of the importance of nitrogen fertilizers to the prosperity of Mauritius, critical studies of the various forms of nitrogen and their effect on the cane have, and will continue to receive considerable attention and some interesting results will be forthcoming in the near future.

Many field trials have been laid down in different areas of the island, planted with different varieties and several pot experiments have been completed or are in progress. The comparison of two different forms of nitrogen is not a simple matter as the rate of application, time and the actual placement of the fertilizer should be studied as well as toxicity and supplementary nutritional effects.

Work so far has been concentrated on comparisons between urea and ammonium sulphate and studies on the possible toxicity of urea.

As indicated in a previous report of this Institute it is well known that biuret, a constituent of all commercial urea, is toxic to certain plants, particularly the pineapple. Rotini (1956) has also shown that on soils of low biological activity, urea may be transformed into ammonium cyanate, a far more phyto-toxic material than biuret. Normally urea applied to the soil is converted into ammonium carbonate by urease, an enzyme present in most soils. Conceivably however, conditions could arise where the production of ammonium cyanate is possible and a potential danger to a growing crop created.

Preliminary pot experiments carried out in 1957 and 1958 have shown that on normal soils biuret is not particularly toxic to cane plants and that on an agricultural scale this material is probably unimportant owing to the low levels occurring in the types of fertilizer urea used locally. In the case of sterilized soils it has been found that urea has a distinct depressive effect on cane growth. Whether this finding has any agricultural significance or not remains to be seen, but the results are of sufficient interest to warrant an extension of these studies.

Results from field experiments carried out in other countries in which commercial urea and ammonium sulphate have been compared show some differences. Thus in Australia, Vallance (1957) has found no difference between the two materials. Cooke (1957) however, in some preliminary results from England has shown that urea can cause growth losses, this loss being attributed to the biuret which was high, 4%, as against 1% in most local samples. Results so far obtained in Mauritius show that ammonium sulphate remains unbeaten as a cheap and efficient nitrogen source when cost and performance are considered, and there is no reason to suppose that it will not remain the standard nitrogenous fertilizer used locally, for some time to come.

Phosphorus

Since the establishment of the Institute, a considerable amount of work has been carried out on this nutrient element because foliar diagnosis results have shown that over large areas of Mauritius the low phosphate status of the soils is an important factor in reducing cane yields. The recommendations made as a result of these studies have been readily put into practice by most estates and large planters and consequent amelioration of the position can be expected.

During the year many more experimental results became available and in addition a better appreciation of Hawaiian agricultural practices was obtained, thus permitting a reappraisal of the best method of phosphate fertilization.

Results from the 1958 experiments showed that:

(a) Soluble phosphates are well utilized over a wide range of soil conditions; once again disproving the widely held belief that with the ferruginous lateritic soils high fixation will prevent assimilation of the soluble forms of phosphate fertilizer.

(b) The soluble forms are more efficient suppliers of phosphate to the cane than the insoluble guano phosphate, a conclusion which is in agreement with experience in other parts of the world.

(c) The guano phosphate or the other insoluble phosphates are well utilized even in soil of the higher pHs (6.0 - 6.5). This finding is important as it has long been assumed that only very acid soils responded well to insoluble phosphate application.

(d) The principal loss in yield from phosphate deficiency occurs in the virgin crop. Whilst ratoon yields are depressed, the greater feeding power of a ratoon makes the actual losses smaller although of course the number of ratoon crops multiplies this loss.

(e) Surface applied soluble phosphate is assimilated by the ratoon crop and increases in yield can thus be obtained.

These facts were obtained locally, but they are obviously applicable to any area with low humic and humic ferruginous latosols.

Before extending these findings to actual practice, it is essential to have a sound philosophy of phosphate fertilization which must be based on the aims of the cane grower and sound economics. Of all the nutrients, phosphate alone when applied to the soil is never lost, provided of course that there is no erosion. This being the case, the phosphate status of soils can be built up to the point when yield response to phosphate fertilization no longer occurs. This has happened in many areas of Mauritius, particularly on land near the factories which have received massive dressings of scums.

In the absence of a phosphate problem, time and money can be profitably devoted to potash and nitrogen, the more expensive items of the fertilizer budget.

Bearing these facts in mind, then it would seem that the wisest course for a plantation would be to build up the phosphate reserves of the soil by applying the largest possible dressing of cheap phosphate during the ploughing out and to use smaller dressings of soluble phosphate in the furrow at planting, and in the rooting zone in ratoons where deficiencies continue to exist.

The actual quantities to be applied will of course be subject to variations but one point should be borne in mind, and that is that there is no reason to spend up to fifteen times the amount of money on nitrogenous fertilizers than on phosphate and that if the amount of money available for fertilizers is fixed, then transfer of some money spent on nitrogen to the purchase of phosphate will be sound practice especially in those areas where Ebène 1/37 is grown.

Taking local and Hawaiian experience it is reasonable to suppose that the amount of phosphate imported to Mauritius should be more of the order of 5,000 tons of P_2O_5 as against the 1,000 tons of P_2O_5, annual average during the years 1950 - 1954.

The bulk of these imports should be as guano phosphate, this material being produced by local capital, but a considerable amount of triple super and ammonium phosphate should also be imported. The prices paid in Hawaii for the various types of phosphatic fertilizers are similar to those paid in Mauritius, although the cost of ammonium phosphate locally is rather higher.

In areas known to be deficient in phosphate, dressings of one ton per acre of guano at planting should be supplemented by dressings applied in the furrow of one of the soluble phosphates at a rate of 50 to 100 kilos P_2O_5/arpent, and if deficiencies occur in ratoon crops 25 to 50 kilos of soluble P_2O_5 should be applied.

On land which has been de-rocked or subsoiled and on eroded slopes, dressings of the order of two tons of guano phosphate should be used, again with supplementary soluble phosphate in the furrow.

These dressings appear to be heavy compared with former practices, but they offer the quickest and best way of removing phosphate from the list of factors limiting growth.

The standard used locally for assessing the phosphate status of soils is foliar diagnosis. Soil analyses have recently proved of considerable value in Hawaii and Fiji and therefore the opportunity afforded by the various phosphate experiments in progress was taken to obtain soil samples for phosphate analyses.

The results showed that with ratoon crops 10 p.p.m. P (modified Truog extractant) was the critical level.

Fair correlation between expected increase in yield and soil phophorus was obtained, $r = -0.52$ being significant at the $P = 0.05$ level. The correlation foliar diagnosis and soil analyses for phosphorus is highly significant. Soil sampling is difficult and expensive and compares unfavourably with foliar diagnosis technique in this respect, however soil analyses should prove useful on newly cultivated land or land which has been subsoiled or derocked and on which, therefore, previous foliar diagnosis histories will be of little value due to the dilution of fertile top-soil with sterile sub-soil.

Potassium

The importance of this element to the sound nutrition of the cane is widely appreciated and consequently the status of local soils in this element is generally good, deficiencies occurring principally amongst the small planters.

The source of potash for the field are the potash salts and molasses. The latter is used as a fertilizer when its commercial value is low, but is sold for export should the price be considered satisfactory.

The evaluation of the molasses is frequently made by assessing its value in terms of the cost of an equivalent amount of potash and nitrogen salts. This being the case, then it is essential to know the average composition of the molasses being sold. Monthly weighted samples were therefore obtained from each factory and analyses of the nitrogen, phosphate and potash contents were made. The results are summarized in Table 12.

Table 12. Analyses of molasses for factories situated in the three rainfall zones.

	Sub-humid Zone			Humid Zone			Super-humid Zone		
Nutrient %	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
Lowest ...	.69	.15	4.62	.45	.08	3.76	.58	.13	3.90
Highest ...	.83	.23	6.23	.68	.26	6.70	.82	,29	5.07
Average ...	.76	.19	5.77	.60	.20	5.05	.72	.23	4.58
General Average:				.67%	.21%	5.03%			

The principal point of interest in this table is the marked effect of rainfall on the potash content of the molasses, in other words, cane grown in the super-humid zone has a lower potash content, although it may not be suffering from potash starvation. This lower content is almost certainly due to the lower soil levels of the element in high rainfall districts.

The Hawaiians have made detailed studies on the leaching of potassium from the soil and have shown that losses of the element in drainage water can be very high. As a result, fertilizer recommendations in the case of potash in that country are that no dressings higher than about 100 kilos of potash per acre should be applied at any one time in order to reduce leaching losses. This work has an important bearing on local practice as in the case of molasses, the dressings vary from 4 to 8 tons per acre which on the average works out to applications of between 200 and 400 kilos of K_2O/acre.

There is every reason to suppose that Hawaiian findings are applicable locally in view of the climatic and pedological similarities, and therefore applications of potash at such high levels is unsound, the more so as the molasses are applied at least two weeks before planting and consequently several weeks must pass before the cane begins to absorb appreciable quantities of this nutrient. Moreover the amount applied is far in excess of what will be absorbed by the crop. Leaching losses during heavy rains must therefore be high and much of the value of the application will be lost.

Two further points from Hawaiian practice which should receive consideration in Mauritius are that potash is not generally applied in the furrow at planting, as, when cane is selected for seed, should foliar diagnosis for potash be low in these fields then potash is applied a few weeks before cutting. This ensures that theie is an adequate level of potassium in the setts for good initial growth, the potash fertilization being applied with the nitrogen after a few weeks.

The beneficial effects of molasses applied to the soil are due principally to its high potash content. In addition, however, the nitrogen present as low molecular weight organic compounds, can act as a source of nutrient to the cane though apparently less efficiently than an equivalent amount of sulphate of ammonia. The addition of large amounts of readily decomposable organic matter to the soil is also known to effect improvement in the structure and also to bring about considerable changes in the fauna and flora of the rhizosphere; whether these changes have any effect on cane yields is being studied in a series of field trials, but experimental results already obtained locally have shown no significant increase in yield attributable to these factors after molasses application.

Taking into account the foregoing then the evaluation of molasses could be made in terms of cost of equivalent amounts of plant nutrients, but as has already been pointed out, it is unwise to apply dressings of K_2O at a rate of more than 100 kilos/acre in order to reduce leaching losses, and therefore direct equation of the value of molasses with its contents of potash or even nitrogen and phosphate is not correct.

With the high prices being paid for molasses in Europe as an agricultural feed there is no reason why the whole of the local production should not be exported, the potash lost being returned to the soil as salts, a far easier and more reliable way of correcting potash deficiencies in those fields short of this nutrient.

To conclude, it would seem that, taking local and Hawaiian experience, the best method of potash fertilization would be to limit single applications of the nutrient to a maximum of 100 k/arpent, to feed seed cane particularly well and to avoid furrow application of the element.

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2. A SUMMARY OF FOLIAR DIAGNOSIS DATA FOR PHOSPHORUS AND POTASSIUM; 1947 - 1958.

PIERRE HALAIS

Organised cane leaf punch sampling on sugar estates, large and small planters' lands, followed by P & K analysis in a central laboratory from 1947 to 1953 and later on at the M. S. I. R. I. has been going on for 12 years. Separate samples totalling 61386 were collected during that period: 52176 from sugar estates, 8045 from large planters' and 1165 from small planters' fields, this last figure for the period 1954 - 1957 alone. Determinations of P and K numbered 122,772.

In addition, well over 10000 leaf samples were collected since 1936 on individual plots, from practically all fertilizer trials conducted with sugar cane on the island. Most of these samples were analysed for the three major nutrients N.P and K. The green leaf weight was also recorded as a comparative index of vegetative behaviour obtainable well before harvest, while the canes were still exhibiting full growth.

The advisory work was confined to P and K because these nutrients show a much larger variability from field to field than does nitrogen and also because the optimum levels for the first two could be more easily assessed without disturbing influences arising from cane quality at harvest time.

It is interesting to note in this connection that similar results have been obtained in Jamaica, British Guiana and Natal where the third leaf punch (or mid-laminae) method of foliar diagnosis, originated in Mauritius in 1937, is correlated with response in yield of cane and sugar. Thus for fertilizer advisory purposes in these countries, optimum levels are considered to be 0.50 P_2O_5 % d.m. and 1.50 K_2O% d.m. at the grand period of growth. A further stage has been reached locally where slightly different optima are ascribed to the different cane varieties cultivated.

More detailed investigations carried out since 1954 at the M.S.I.R.I. are now leading to to the extension of the advisory work to nitrogenous fertilization. Starting with proper leaf punch sampling, three years moving averages of the nitrogen contents can henceforth be used with confidence for assessing, on a quantitative basis, the nitrogenous fertilizer requirements of cane crops grown on sugar sectors or large fields. For the recommended varieties B.37172 and Ebène 1/37, the optimum levels found experimentally of 1.95 and 1.75 N % d.m. respectively should be attained by means of adequate fertilization.

The percentage of F.D. cases lower than the accepted leaf punch ranges from optimum P and K nutrition are given in Tables 13 and 14, in which the three different systems of cane cultivation practised in Mauritius are compared.

Comparisons made twenty years ago by Craig and Halais at the S.R.S. had pointed out similar disproportions in the P and K levels of nutrition between the systems of cane cultivation in local use.

The general trends for phosphorus and potassium found on estates for each of the five sugar sectors of the island are given in tables 15 & 16.

The percentage of cases showing phosphorus deficiency is almost everywhere on the increase. This undesirable situation is a major concern of

Table 13. Percentage cases of Phosphorus deficiency

Period	No. of Analysis	Estates	Large Planters	Small Planters
	1947—58	1947—58	1947—58	1954—57
West Sector ...	3674	17%	26%	77%
North ,, ...	21867	13	3[illegible]	51
East ,, ...	8926	20	39	63
South ,, ...	23086	22	27	67
Central ,, ...	3833	18	35	51
Mauritius ...		18	30	61
No. of analyses	61386	52176	8045	1165

Table 14. Percentage cases of Potassium deficiency

Period	No of Analyses	Estates	Large Planters	Small Planters
	1947—58	1947—58	1947—58	1954—57
West Sector	3674	21%	8%	41%
North ,, ...	21867	17	21	38
East ,, ...	8926	15	15	38
South ,, ...	23086	11	16	39
Central ,, ...	3833	20	4	27
Mauritius		13	17	36
No. of analyses ...	61386	52176	8045	1165

The first conclusion to be derived from the large number of data available, is that the system of cane cultivation exercises a dominating influence on the levels of P and K nutrition of sugar cane crops in Mauritius.

These data naturally reflect the importance given in the past to balanced fertilization: estates leading with only 18% of deficient F.D. cases for phosphorus and 13% for potassium; large planters coming next with 30% for P and 17% for K and small planters well behind with 61% for P and 36% for K.

the M.S.I.R.I. and steps are being actively taken, by the Agronomy Division, to ensure that the pertinent recommendations made for individual sectors or large fields, as a result of foliar diagnosis carried out repeatedly, are being actually implemented by the estates and larger planters concerned.

The Extension Service of the Department of Agriculture is also making an effort in this connection as regards small planters.

Such advice has unfortunately been too often ignored in the past as a consequence of established routine.

The increased occurrence of P deficiency is due chiefly to the extension of cane cultivation, from 1947 to 1958, to new lands where soil phosphorus reserves had not been built up in the past through adequate fertilization or regular return of factory residues. A further aggravation of the phosphorus situation can also be ascribed to a reduction in the P_2O_5 fertilizer imports per ton of sugar produced, as well as to the longer ratooning practised nowadays.

The Chemistry Division also initiated, several years ago, a comprehensive programme of field experiments to determine the quantity, best form and mode of application of phosphatic fertilizers, with a view to attaining optimum nutritional level at the least cost and as rapidly as possible.

The present policy recommended by the Chemistry Division of the Institute, is to spread as much phosphatic guano as is needed and practicable on the exposed furrow before or at planting, supplemented at the same time, by smaller banded applications of a water soluble phosphate to act as a booster during early growth. In cases of persistent phosphorus deficiency revealed by leaf analysis on ratoon canes derived from virgins fertilized in this manner, the use of water soluble phosphate is advocated.

Table 15. Trend in Percentage cases of Phosphorus deficiency.

Period	Analyses	West	North	East	South	Centre	Mauritius
1947—53	25260	9%	11%	16%	17%	17 %	14%
1953—55	17861	12	10	19	20	14	17
1954—56	16884	14	11	20	22	16	18
1955—57	15624	19	18	22	27	22	23
1956—58	14861	27	21	25	28	21	26
Averages		17	13	20	22	18	18
No. of Analyses		2252	16231	8152	21977	3564	52176

Table 16. Trend in percentage cases of Potassium deficiency.

Period	No. of Analyses	West	North	East	South	Centre	Mauritius
1957—53	25260	24%	18%	18%	14%	39%	18%
1953—55	17861	21	14	13	3	16	12
1954—56	16884	25	13	13	9	3	11
1955—57	15624	19	16	10	9	7	11
1956—58	14861	18	17	13	9	17	12
Averages		21	17	15	11	20	13
No. of Analyses		2252	16231	8152	21977	3564	52176

3. EXTENSION OF FOLIAR ANALYSIS FOR DETERMINING N REQUIREMENTS.

PIERRE HALAIS

The results of six post release trials (variety/levels of nitrogen) planted in 1954 and reaped as 1st, 2nd and 3rd ratoons in 1956, 1957 and 1958, have shown that two varieties B.37172 and Ebène 1/37 should be recommended for the following environmental conditions (table 17).

Table 17.

Variety	Suitable Locations	Altitude	Annual Rainfall	Soil Series
B.37172	Beau Vallon Bon Espoir The Mount & Fuel	50—600 feet	60—80 inches	Plaisance Réduit
Ebène 1/37	The Mount & Fuel Eau Bleue & Bonne Veine	300— 1,500 feet	70—130 inches	Réduit Rose Belle (Sans Souci)

Three levels of nitrogen were tried; low: 20 kg. N/arpent, medium: 40 kg. and high: 60 kg. in the form of sulphate of ammonia as annual dressings made early in the season.

Each trial was sub-divided for early, middle and late reaping of ratoons at the age of 12 months.

The basic phosphate and potash treatments were kept within the desired limits by proper fertilization, checked by leaf analysis. The optimum range for leaf punch P_2O_5 being 0.42 to 0.52% d.m. for B.37172 and 0.41 to 0.51 for Ebène 1/37 corresponding values for K_2O are 1.30 to 1.60% d.m. for B.37172 and 1.35 to 1.65 for Ebène 1/37.

The aim of the trials was to devise, as rapidly as possible, the proper key of interpretation for leaf punch nitrogen so as to have a practical guide for profitable nitrogenous fertilization of the newly recommended varieties according to the various field conditions met within their selected locations.

Leaf samples were collected twice on each plot when the ratoon canes reached four and six months. Similar sampling was repeated for three successive years 1956, 1957 and 1958.

The basic data used for final interpretation were derived from the following number of units, (table 18).

Table 18.

	Plot Replication	Sampling 4 & 6 m.	Years	Total Repetitions
Leaf punch nitrogen	2	2	2	12
Tons cane/arpent at harvest ...	2	—	3	6
C.C.S. % cane at harvest	2	—	3	6

For each variety B.37172 and Ebène 1/37, 24 pairs of data were available corresponding to the standard additional dose of 20 kg. N/arpent thus:

(i) Locations 4

(ii) 20 to 40 kg. N/arpent 1 } 40 to 60 „ „ 1 } ... 2

(iii) Harvesting date 3

Total 4 × 2 × 3 = 24

The C.C.S. % cane values obtained in the laboratory were reduced by 20% in order to give more realistic crop returns. Net sugar response to the standard additional dose of 20kg. N/arpent was calculated by subtracting, from the gross response expressed in tons of C.C.S/arpent, the price equivalent to the standard dose amounting to 0.08 tons C.C.S/arpent.

Eight regression equations are given in table 19 for n = 24. FD_0 corresponds to an initial leaf punch N and FD_{20} to that resulting from the standard additional dose of 20 kg. N/arpent.

Fig. 19 has been prepared for B.37172 and Ebène 1/37, using the appropriate equations 1 and 4 given above. The diagram shows that the addition of a standard dose of 20 kg. N/arpent is not followed by any detectable rise in leaf punch nitrogen content, when the initial leaf level is already at 2.05 N % d.m. for B.37172 and at 2.20 for Ebène 1/37. On the other hand, the same additional treatment does not result in any net sugar response at harvest, when the initial leaf punch nitrogen content is already at 1.94 for B.37172 and at 1.74 for Ebène 1/37. Actual losses are observed as soon

Table 19. Relationship between leaf punch nitrogen and leaf and sugar responses following fertilization with 20 kg. N/arpent.

		B.37172	t values		Ebène 1/37	t values
Equations 1						
Increase in Leaf punch	N	$= 0.965—0.471\ FD_0$	5.06**	=	$0.478—0.217\ FD_0$	2.33*
Equations 2						
Final punch Leaf	N	$= 0.965+0.529\ FD_0$	5.06**	=	$0.478+0.783\ FD_0$	2.33*
Equations 3						
Initial Leaf punch	N	$= 1.8903\ FD_{20}—1.8241$	5.06**	=	$1.2771\ FD_{20}—0.61045$	2.33*
Equations 4						
Net Sugar Response						
Tons CCS/Arp.		$= 2.9925—1.54FD_0$	3.22**	=	$1.897—1.09\ FD_0$	2.96**

* Regression coef. significant to 0.05 level.
** ,, ,, ,, ,, 0.01 ,,

as those optimal contents are exceeded. In other words the danger of over fertilization with nitrogen in reaching the full nutrient effect, as shown by leaf punch nitrogen content, is smaller with B.37172 than with Ebène 1/37. With the former variety this danger zone is comparatively narrow, as it starts above the optimum of 1.94 to reach the maximum of 2.05 N % d.m. With Ebène 1/37 this zone is much wider: between 1.74 and 2.20.

Those findings prove how careful one must be in the use of nitrogenous fertilizers for specific cane varieties. Foliar diagnosis, when properly run and interpreted, thus constitutes a major help in avoiding potential losses in sugar production through insufficient fertilization and instigated losses through over fertilization.

Fig.20 shows the amount of nitrogenous fertilizer required to reach the optimum N nutrition for any initial leaf punch nitrogen value. The curves are drawn, starting from the optimum 1.94 N % d.m. for B.37172 and 1.74 for Ebène 1/37, using the appropriate equations (2 of Table 19) step by step for leaf contents

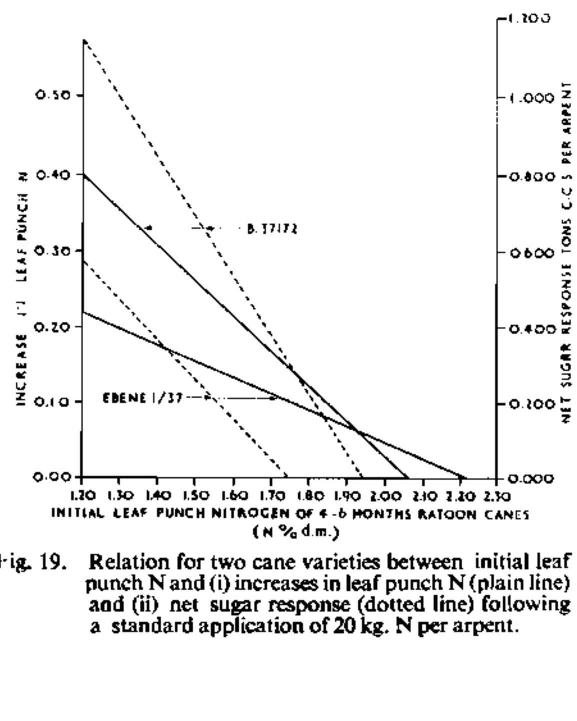

Fig. 19. Relation for two cane varieties between initial leaf punch N and (i) increases in leaf punch N (plain line) and (ii) net sugar response (dotted line) following a standard application of 20 kg. N per arpent.

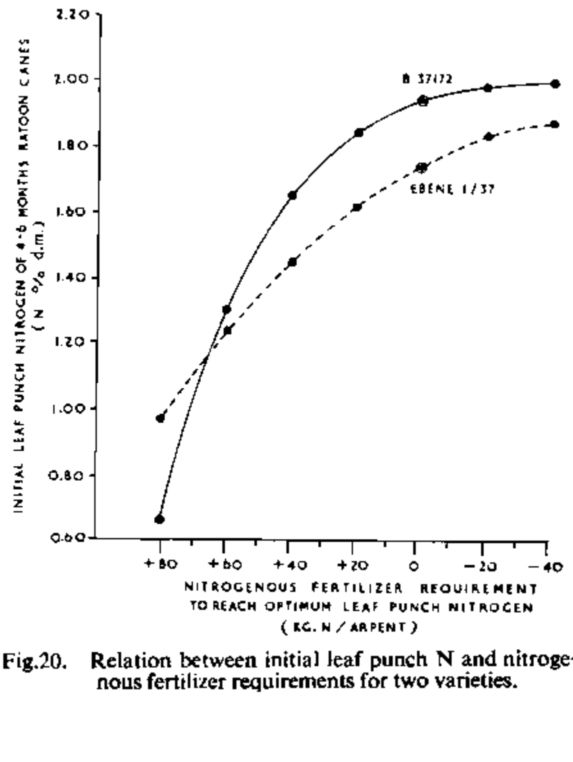

Fig.20. Relation between initial leaf punch N and nitrogenous fertilizer requirements for two varieties.

below the optimum. For values above, associated with negative fertilizer requirements, equations 3 are used.

It is interesting to give, as example, the nitrogenous fertilizer requirements found for the post-release variety-nitrogen trials already mentioned. The initial leaf punch N has been obtained through extrapolation of the lowest level tested which consists of a dose of 20 kg. N/arpent (table 20).

A second series of post-release variety fertilizer trials planted in 1957 will enable the proper key of interpretation to be derived for the newly released variety M.147/44.

Table 20. Nitrogenous fertilizer requirements of B.37172 and Ebène 1/37 at four suitable locations for each variety.

Locations	B.37172 Opt. N.1.94		Ebène 1/37 Opt. N. 1.74	
	Initial leaf punch N. % d.m.	Nitrogen fertilizer requirement Kg. N/arp	Initial leaf punch N. % d.m.	Nitrogen fertilizer requirement Kg. N/arp
The Mount ...	1.33	59	1.30	56
Beau Vallon ...	1.54	48		
Bon Espoir ...	1.58	46		
Fuel ...	1.79	27	1.60	22
Eau Bleue ...			1.68	12
Bonne Veine ...			1.78	0(—6)
Averages ...	**1.56**	**45**	**1.59**	**22**

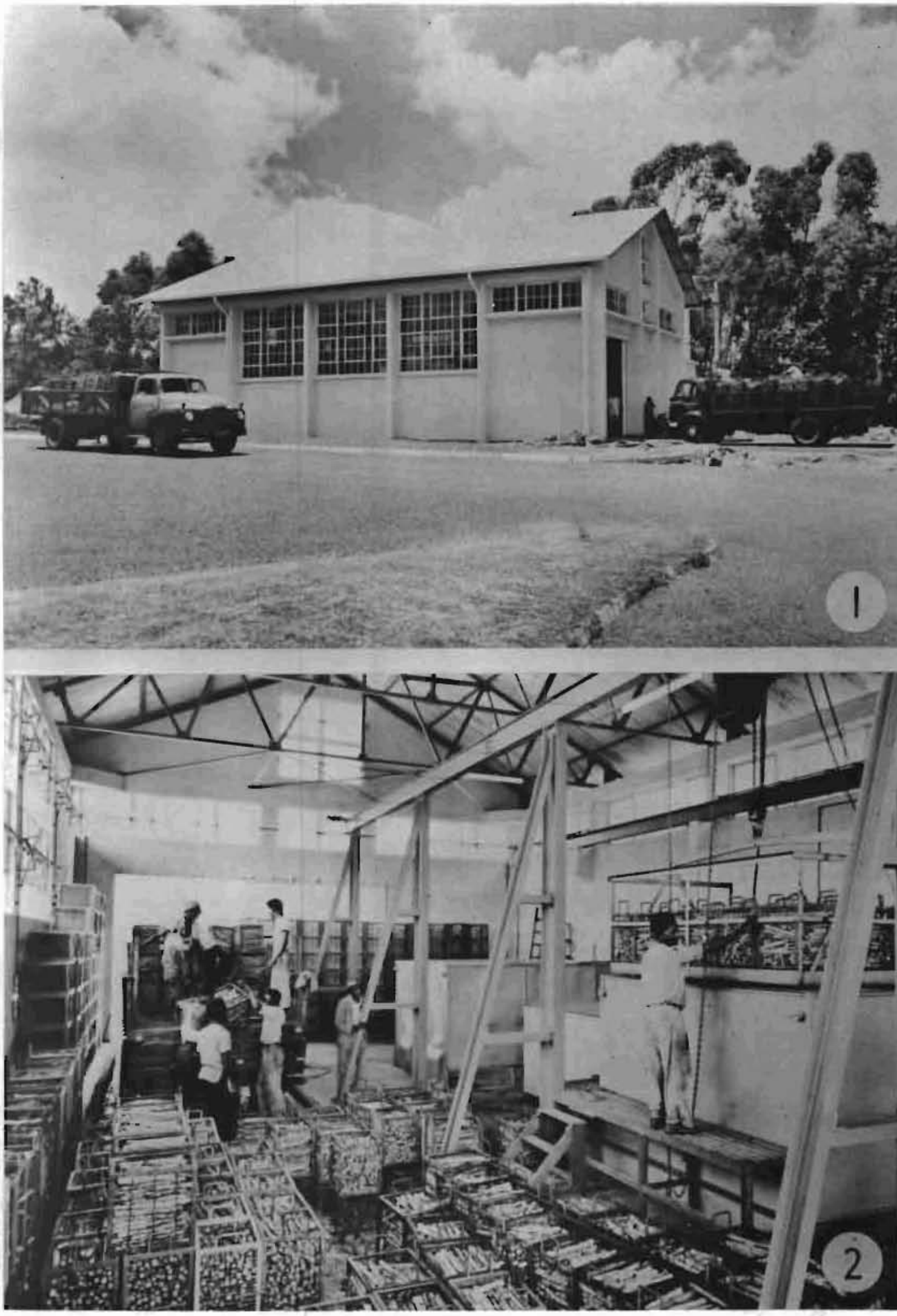

Fig. 21. Central hot water treatment plant of the M.S.P.A. at Belle Rive Experiment Station. (1) Exterior view of the building, (2) interior view showing baskets of cuttings and a cage being lowered in one of the two tanks; the fungicide tank is seen at the right centre.

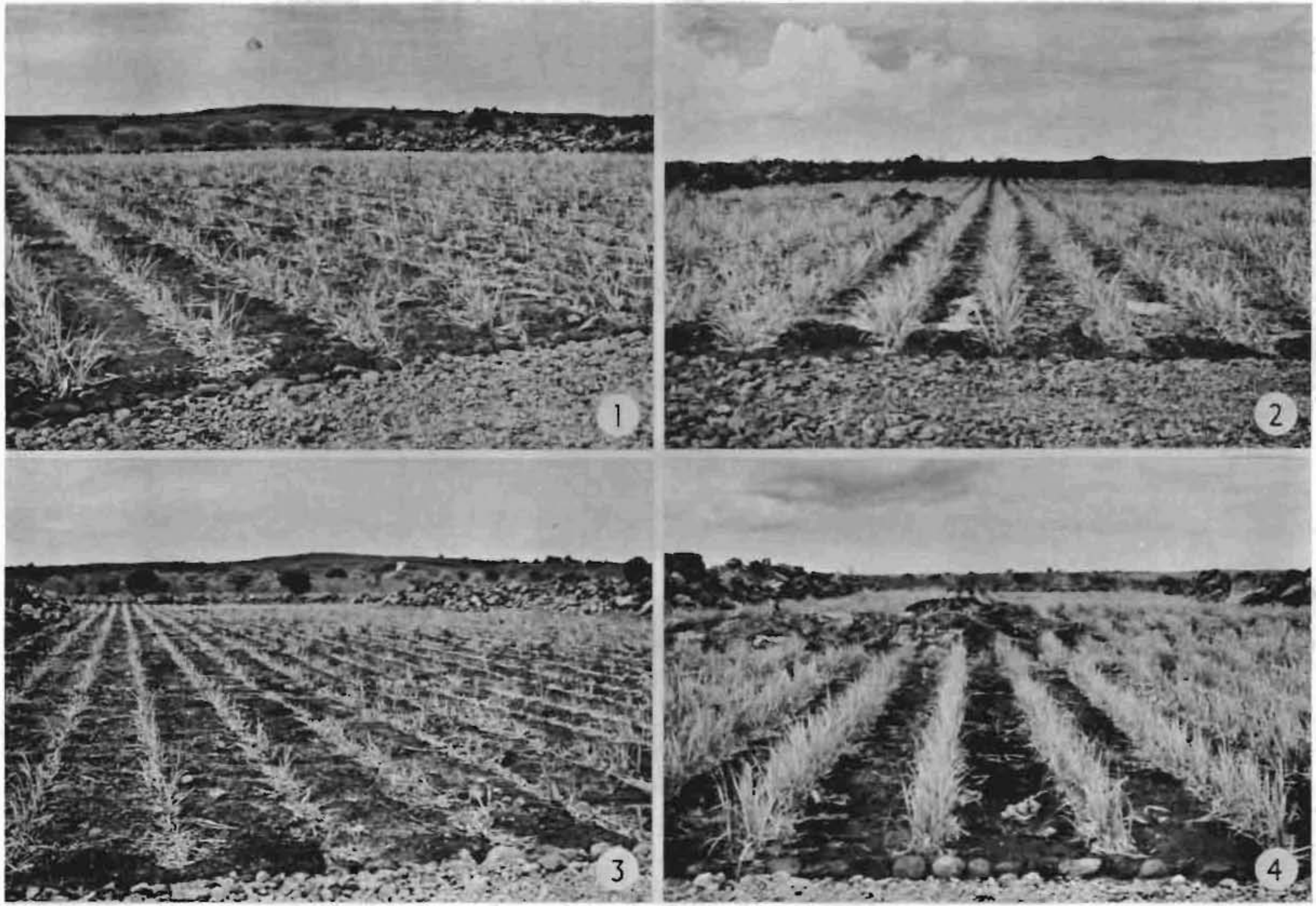

Fig. 22. Young cane plantations derived from heat treated cuttings (1) B. 3337, (2) M. 147/44, (3) Ebene 1/37 and (4) B. 37172. These nurseries have been established at Point aux Sables by the Planters' Rehabilitation Fund for distribution to small planters.

CANE DISEASES

R. ANTOINE

1. CHLOROTIC STREAK

CHLOROTIC streak can be considered the most enigmatic amongst major diseases of the sugar cane. In spite of the large amount of research work carried out in sugar producing countries, the inter-relationship pathogen-environment-host is still fairly obscure.

Broadly speaking it can be said that, in Mauritius, chlorotic streak sets an important pathological problem in the humid to super-humid areas. All varieties grown commercially in the island are susceptible to the disease, varietal reaction having been assessed as follows:

Highly susceptible	Ebène 1/37
	M.112/34
	M.147/44
	B.37172
Susceptible	M.134/32
	B.3337
Moderately susceptible ...	M.31/45
	B.34104
	B.37161

Attention is drawn to the reaction of M.147/44, a variety which is being propagated on a large scale, and which has shown as high a degree of susceptibility as Ebène 1/37. In spite of the changing varietal pattern, the short hot water treatment (52°C for 20 minutes) of all planting material, derived from localities in which the disease prevails, has to remain in general use until resistant varieties are bred. Furthermore, it is a mistake to believe that cuttings derived from an infected area can be planted, without heat treatment if such plantings are to be carried out in a dry, apparently disease-free, part of an estate.

M.112/34 adapted to the irrigated low humic latosols was considered, until recently, as resistant to chlorotic streak. The variety, when included in a ratoon stunting trial in the super-humid zone, contracted chlorotic streak and reacted as highly susceptible to the disease.

In the irrigated leeward coastal plain, the disease is commonly encountered on the poorly drained dark magnesium clays but was believed absent from the low humic latosols. There is now the perturbing evidence that chlorotic streak is spreading to the latter type of soil.

It was therefore important to investigate the effect of environment on the disease and to determine the mode of transmission. Results of experimental work carried out on those lines have been submitted for publication elsewhere. A preliminary assessment will be made however on their bearing on some aspects of cane cultivation in Mauritius.

The island can now be roughly divided into an infected and a disease-free zone, with chlorotic streak prevailing in areas receiving more than 50 inches of rain per annum. The hot water treatment must be given to planting material obtained in infected areas. Experimentation having shown that the virus is not harboured, in a latent form, in stalks growing in a dry zone, these could be used as a direct source of cuttings to supplement the heat-treated material at peak periods in the planting season. In other words, cuttings could be taken from the dry part of an estate for planting in the humid, diseased part, without the heat treatment.

Experimental results having indicated that the disease is transmitted in the soil and that leachate from contaminated soil is infective, it would appear that the spread of the disease could be effected by irrigation water. A survey is being started in the coastal leeward area in order to assess the incidence and spread of the disease under different soil conditions.

A point which should be stressed and which answers a question frequently asked, is that, although stools derived from heat-treated cuttings, planted in a diseased locality, will contract infection sooner or later according to the time of planting, it is imperative to give the heat treatment for the following reasons:

1. The hot water treatment of planting material derived from an infected locality reduces subsequent recruiting to a minimum.

2. The beneficial effect of the short heat treatment itself on early growth and establishment.

3. The reduced incidence of the disease in the virgin crop and early ratoons.

4. The improved ratooning of highly susceptible varieties.

Furthermore, the establishment of plantations during the cooler months of the year, in the super-humid region, reduces the rate of re-infection of stools derived from treated setts.

A fact which cannot be stated too often is that, with the range of susceptibility of varieties adapted at present to conditions prevailing in the super-humid zone, it is impossible to conceive cultivation of the sugar cane in that area without the short hot water treatment of all planting material.

Experiments are being pursued on the transmission of chlorotic streak from diseased to healthy plants by means of *Cuscuta chinensis*. A second series of experiments is under way in order to study the possible transfer of the disease organism between the intertwined root systems of cane plants growing in sterilized soil.

2. RATOON STUNTING DISEASE

(a) **Reactions of commercial varieties.**

Two trials were established one in a dry and the other in a wet locality, the object being to study the effect of the disease on commercial varieties. In order to eliminate the adverse effect of the heat treatment on the germination of cuttings and the early establishment of stools in the healthy plots, cuttings were derived from nurseries free from ratoon stunting disease. Setts planted in the diseased plots were taken from infected stool and pressure inoculated with contaminated juice. Each plot consisted of 4 rows, with 24 stools per row. There were three replications.

Table 21. Effect of ratoon stunting disease on yield of cane and sugar in a sub-humid locality.

Variety		Reduction in Yield Cane/acre (Tons)	%	Sugar/acre (Tons)
M.134/32	...	5.4	22.3	1.19
M.112/34	...	1.2	4.7	0.25
M.147/44	...	4.4	13.0	0.87
M.31/45	...	5.8	16.9	0.96
Ebène 1/37	...	2.6	10.8	0.84
B.3337	...	4.0	13.4	0.74
B.34104	...	2.6	9.3	0.51
B.37161	...	6.0	26.0	1.15
B.37172	...	3.5	11.0	0.60

The trial in the dry area was irrigated for early establishment but afterwards no water was given in order to intensify the effects of the disease. Results for 12 months old virgins are given in table 21.

The trial in the super-humid area was harvested after 12 months. The canes were still immature. No sugar determination was carried out. Experimental results are shown in table 22.

Table 22. Effect of ratoon stunting disease on yield of cane in a super-humid locality.

Variety		Reduction in Yield Cane/acre (Tons)	%
M.134/32...	...	2.3	45.0
M.112/34	...	2.3	36.5
M.147/44	...	0.4	2.4
M.31/45	...	1.0	13.7
Ebène 1/37	...	6.8	39.3
B.3337	...	4.9	34.0
B.34104	...	4.6	41.4
B.37172	...	3.7	25.9

B. 37161 is not included on account of erratic growth in all plots.

It will be observed that all commercial varieties are susceptible to the disease, M.134/32 as expected, being the most affected with the exceedingly high reduction, in virgins, of 1.2 tons of sugar per acre. It will be noted that Ebène 1/37, a variety believed to be resistant, has reacted as a susceptible cane in both trials. On the other hand, M.147/44 has shown moderate susceptibility only, particularly in the high rainfall area. Another interesting finding is that the once popular M.134/32, in spite of the heat treatment, is still inferior to B.37172, M.147/44 and M.31/45 in the sub-humid area.

In order to study in more detail the part played by ratoon stunting in the inferior performance of M.134/32 in all sectors, three trials have been established in the super-humid, humid and sub-humid zones. The experimental plots were planted with cuttings originating from nurseries, heat-treated cuttings, and cuttings inoculated with the virus.

Results will be obtained in two of the trials next year. In the experiment planted in the sub-humid zone, heat-treated, 12 months old virgins, yielded 11% more than diseased and 3% more than apparently healthy cane.

Investigations on poor growth of Co.419 have shown that the variety is susceptible to the ratoon stunting virus, reductions of 6% in virgins and 21% in first ratoons being recorded.

(b) **Tetrazolium test.**

Experimentation was pursued on the diagnosis of ratoon stunting by means of the tetrazollium test described in the report for 1957. D.109, a variety which shows well the pink internal discolouration of diseased stalks, gave consistently a positive reaction to the test. M.134/32 and M.147/44 also responded to the tetrazolium reaction. The other seven varieties tested reacted indifferently or gave a negative response. Juice samples obtained from several varieties tested have been inoculated into D.109 for further study. Experimentation is being continued in order to determine the conditions under which different varieties should be tested.

3. HEAT TREATMENT OF CUTTINGS.

In view of the widespread occurrence of ratoon stunting and the susceptibility of canes grown commercially in the island, the policy of the Institute aims at the eradication of the disease.

Following studies on heat treatment of cuttings, an experimental hot water treatment plant was installed at Réduit in 1956. The object was to obtain precise information on the treatment of cuttings on a commercial basis. The results being convincing, it was decided to go ahead with the large scale treatment of all planting material.

The recommendations of the Institute were that a central hot water treatment plant should be installed by the Mauritius Sugar Producers' Association at Belle Rive. Two hot water tanks would operate at the station and the target should be fixed around 6,500 tons annually. That amount of treated material would suffice to establish an area of nurseries, large enough to provide healthy cuttings for all plantings made by millers the following year.

The M.S.P.A. accepted the recommendations and the station was installed during the year. The treatment plant is entirely financed and administered by the Association, the Institute acting in an advisory capacity.

The first hot water tank went into operation in June and the second was completed early in December when the treatment plant, described in the report for 1957, began to function at full capacity. The amount of cuttings treated per cycle was lower than the original estimate: 1.1 ton per tank instead of 1.5 ton.

Cuttings were also treated in the small tank of the Institute at Réduit, with a capacity of half a ton of cuttings per cycle, to supplement the Belle Rive plant. In addition, treatments were carried out for experimental work and for large and small planters.

All canes grown in experimental plots at the various stations and on estates will henceforth be derived from nurseries established to provide healthy stock.

The weight of cuttings treated amounted to 650 tons at Belle Rive and 566 tons at Réduit, a total of 1,216 tons. Seven of the commercial varieties, M.134/32, M.147/44, M.31/45, Ebène 1/37, B.3337, B.34104 and B.37172 were heat-treated and nurseries established in the various localities of the island. In addition, healthy planting material is being obtained from cane derived from stock treated in the tank of the Institute in 1957.

The area of nurseries established by the Sugar Producers' Association during 1958 was 350 acres. Of these, 281 acres were maintained and recruited, recruiting figure amounting to 16%. The failures in the remaining 69 acres (19%) can be attributed mainly to the following factors:

(a) adverse weather conditions at planting time, in localities where irrigation cannot be practised,

(b) poor condition of cuttings sent to the treatment plant,

(c) different varietal tolerance of the heat treatment, M.134/32 and Ebène 1/37 being the the most susceptible.

It is therefore once more emphasized that nurseries should, wherever possible, be established on an irrigated part of an estate. A rigorous selection of cuttings should be effected before their dispatch to the treatment plant. In one case of severe germination failure, the poor quality of the planting material had been observed before treatment and the following assessment made, broken eyes: 8%; sprouted eyes: 15%; cuttings attacked by borers and red rot 11%; cuttings with roots developed: 38%; immature cuttings with sheaths: 19%. Although it should be mentioned that a very creditable effort is being made by the majority of planters in connection with the selection of cuttings, it is on the other hand disheartening on occasions to see the poor quality of setts sent to the treatment plant.

Results obtained in the establishment of nurseries for the Sugar Producers' Association with heat-treated material are shown in table 23.

A start was made during the year in the establishment of nurseries for small planters as well. Cuttings were treated in the tank of the Institute at Réduit and a nursery was created by the Sugar Planters' Rehabilitation Fund Committee in a sub-humid, irrigated locality. Mention should be made here of the highly creditable results obtained by the officer in charge in the establishment of nurseries for small planters. The good quality of cuttings sent to the treatment plant, and the proper attention in the care and maintenance of the nursery, account in a large measure for the success obtained (Fig. 22).

The target for 1959 has been set at 4,600 tons for the Sugar Producers' Association, to be treated at Belle Rive; and, 700 tons, to be treated at Réduit, for the Cane Growers' Association, an organisation responsible for planters, other than millers, cultivating more than 100 arpents under cane. In addition, the treatment programme for small planters will be continued at Réduit.

Studies were conducted in the laboratory in order to investigate the possibility of increasing the germination of heat-treated setts at the recommended time-temperature combination of 50°C for 2 hours. It should be mentioned in that connection that the actual treatment time varies according to different factors such as the cuttings themselves, the load and ambient

Table 23. Nurseries established in 1958.

Variety	Area planted (acres)	Area maintained (acres)	% Recruiting	Area abandonned Acres	%
M.134/32 ...	13	8	23	5	38
Ebène 1/37 ...	90	61	22	29	32
B.3337 ...	20	16	5	4	20
B.34104 ...	9	9	30	0	0
B.37172 ...	113	104	11	9	8
M.147/44 ...	85	70	18	15	18
M.31/45 ...	20	13	4	7	35
TOTAL	350	281	16	69	19

conditions. The treatment time of 2 hours is reckoned from the time temperature equilibrium is reached in the water bath. In practice it means that the total immersion time varies between 140 and 155 minutes.

Results obtained with a susceptible variety such as D.109 do not warrant an increase in the duration of the treatment. The design and operation of the tanks are such that the most rigid temperature control is obtained. Temperature fluctuations rarely exceed 0.2°C.

In the attempts to improve the germination of cuttings the effects of various anti-oxidants, when added to the water bath, were investigated. Cornuet* has suggested that temperatures of the order of 50 to 52°C represent a threshold at which the balance between oxidase and dehydrogenase systems is upset, resulting in the oxidation of phenolic compounds with production of quinones toxic to living cell constituents. Cornuet's experiment was repeated with the following anti-oxidants: urea, potassium cyanide and sodium sulphite. Other substances used for purposes of comparison were the mercurial fungicide Agallol and hydroquinone. The number of three-eyed cuttings per treatment numbered 100. The results are expressed in table 24.

Considering the promising results obtained with urea, experimentation is being pursued at higher temperatures and for longer treatment periods.

The effects of gibberellic acid on the germination and establishment of cuttings treated in hot water at 50°C for two hours and 52°C for 20 minutes, was also investigated. The acid was applied at two concentrations: 10 and 100 p.p.m.

The methods of application were the following:

(a) pressure inoculation,

(b) immersion of ends of cuttings for 6 and 24 hours,

(c) soaking of buds for 6 and 24 hours.

The results obtained were that gibberellic acid did not improve germination of setts, heat-treated or not. Furthermore, it had no effect on rate of growth and final stand, but caused some distortion of young shoots.

Table 24. Effect of anti-oxidants and other chemicals on the germination of treated setts.

Substance and Concentration	No. of germinated cuttings	No. of germinated eyes	Increase in germination over heat-treated setts %
Urea 0.25%	69	133	+56
Sodium sulphite 0.10%	58	88	+ 4
Potassium cyanide 0.020%	61	97	+14
Potassium cyanide 0.015%	44	72	—15
Potassium cyanide 0.010%	39	62	—27
Potassium cyanide 0.005%	51	76	—11
Hydroquinone 0.05%	60	98	+15
Agallol 1.0%	47	67	—21
Control (heat-treated)	56	85	—
Control (untreated)	84	160	+86

* *Cornuet, M. Amélioration du rendement de la thermothérapie de la canne à sucre. C. R. Acad. Agri. Fr. 18: 1957. p. 925.*

4. FIJI DISEASE IN MADAGASCAR.

The outbreak of Fiji disease on the East Coast of Madagascar in 1954, a malady hitherto restricted to the South West Pacific area, constitutes a potential menace to the sugar industry of Mauritius. The presence of the disease in the neighbouring island has therefore been for the last four years a major concern of the Institute.

Regular visits are paid to the affected zone, shown in fig. 23, by technicians from the M.S.I.R.I. and the vigorous campaign conducted by the authorities in Madagascar aiming at an eradication of the disease under the able technical supervision of the Senior Pathologist, Mr. H. Barat, has been followed with keen interest.

The sugar cane is cultivated on the East Coast of Madagascar in the province of Tamatave. It is essential to divide the sugar cane

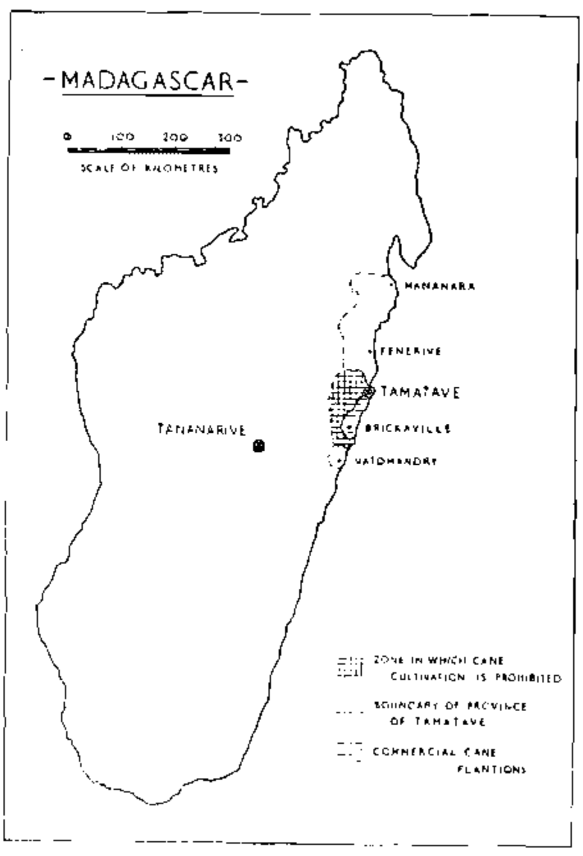

Fig. 23. Map of Madagascar showing zone where Fiji disease occurs.

area into two zones in order to obtain a picture of the difficult conditions under which the campaign against Fiji disease is being conducted:

(a) The zone of commercial cultivation with only one sugar factory, situated mainly in the district of Brickaville, with a few scattered plantations in the district of Tamatave.

(b) The zone outside the above area in which sugar cane is grown in innumerable small plantations. These range down to only a few stools growing in the jungle, for the production of fermented cane juice known as «betsa-betsa», for the production of alcohol and for chewing purposes. There is thus in the province an extensive scattering of small plantations mainly along river banks. Inspection and rogueing work is thus rendered a very difficult task.

Fiji disease was first discovered in the district of Brickaville and it was thought at the time that if early and drastic measures were adopted, eradication of the disease could be obtained. Unfortunately, intensive surveys carried out under difficult conditions brought to light that the disease was present in the whole province. Such a sudden and widespread outbreak is due to the early contamination in nurseries of a highly susceptible variety, namely M.134/32, which was being extensively propagated in the area to replace the old standing varieties susceptible to mosaic and leaf scald.

It should be said to the credit of the responsible authorities in Madagascar that they immediately set up a control organisation and launched an eradication campaign upon sound lines. The rigorous and sustained efforts that have been maintained all along have yielded the results illustrated in fig. 24. It appears that a regression has been obtained in the area of Brickaville as well as in the other districts. Fig. 25 shows that the initial level of infection was exceedingly high; 127,500 diseased stools were dug out during the first year of the campaign as against 6,600 in Queensland. The vigorous efforts made by the «Fiji section» are realised when it is considered that for the three years, 1955 to 1957, eighteen thousand

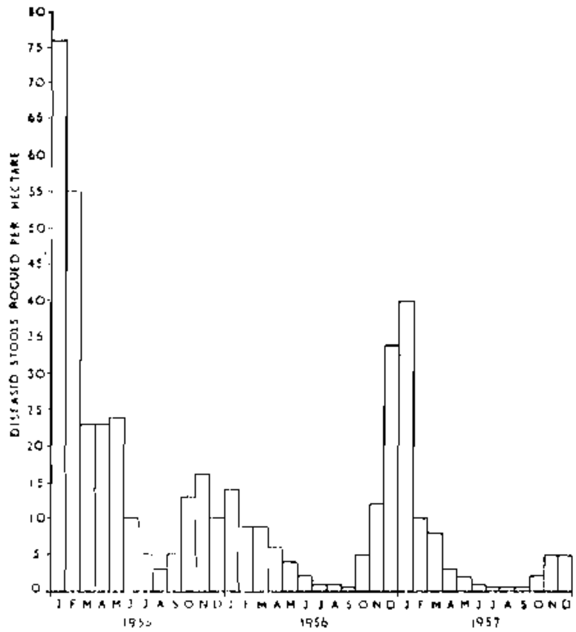

Fig. 24. Total number of cane stools infected with Fiji disease rogued on the East Coast of Madagascar between 1955 and 1957.

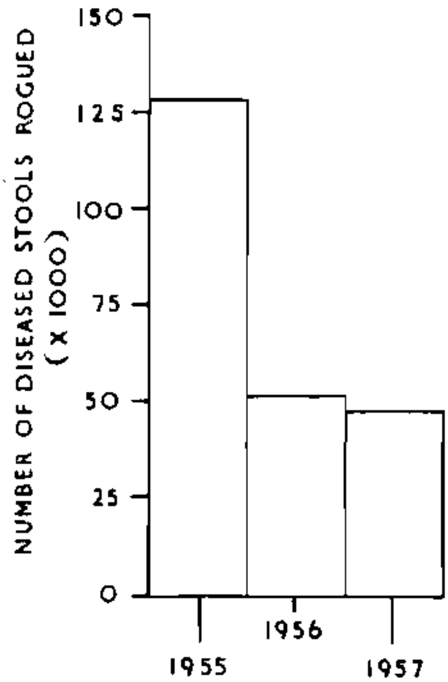

Fig. 25. Number of diseased stools per hectare rogued at monthly intervals 1956 to 1957.

hectares* were surveyed, 227,214 diseased stools were rogued and 50 tons of insecticide were dusted over nine thousand hectares.

In order to carry out the eradication programme it was essential to establish nurseries with cane known to be resistant to Fiji disease and to assess their performance in the area. The reactions to the disease were as follows:

Highly susceptible	...	M.134/32
		Ebène 1/37
		M.76/39
		M.63/39
Susceptible ...	...	B.34104
		B.37161
		B.37172
		B.37193
		Co.419
Tolerant ...	...	N:Co.310
Highly resistant	...	H.37-1933
		Pindar

H.37-1933 having shown high susceptibility to the strain of the leaf scald organism present on the East Coast of Madagascar, Pindar, a good yielder in the area, is now the only variety which is being propagated on a large scale for the replacement of the susceptible varieties.

Considering the high initial level of infection and the odds against which the eradication campaign has to be carried out, it appears that a long time will elapse before complete recovery is reached. Fiji disease will remain a serious threat to the sugar industry of Mauritius so long as a single cane stool harbours the virus in the province of Tamatave. The first line of defence must be in Madagascar. In this connection, trials are being run in the province of Tamatave in order to test the reactions of sugar cane varieties to Fiji disease. Agreement has been reached with the French authorities on the introduction into Madagascar of sugar cane varieties showing promise as commercial canes in Mauritius, for their inclusion in the resistance trials. The ultimate object, once varietal reactions are known, is the establishment of a stock of resistant commercial cane in the colony.

In the meantime, the strict measures adopted both in Madagascar and locally in order to

* *1 hectare = 2.471 acres.*

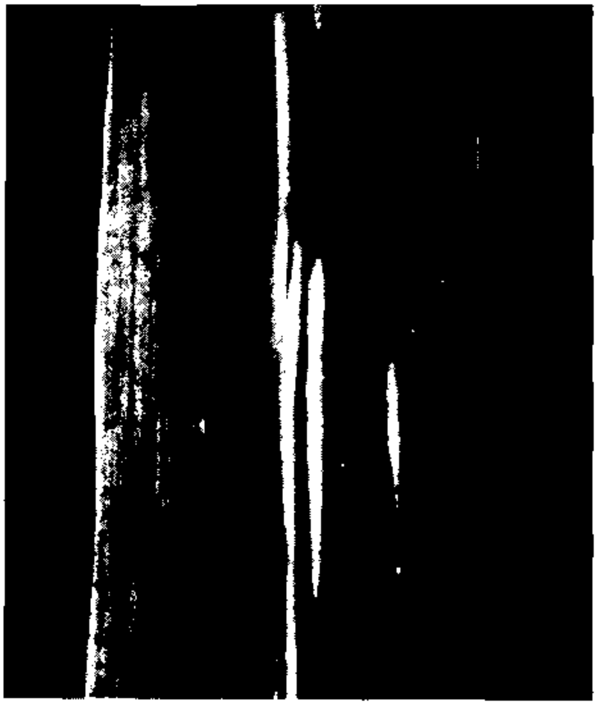

Fig. 26. Galls caused by Fiji disease on leaves of M.134/32, Brickaville, Madagascar.

protect the Mauritian sugar industry must be maintained. Measures, taken by the French authorities either directly or indirectly to prevent the entry of the disease into Mauritius, which were in force until the end of 1958 are:

(1) The prohibition from growing sugar cane in the Arivonimamo canton, in the province of Tananarive, where long distance planes take off for other countries including Mauritius.

(2) The inclusion of the port of Tamatave and surroundings in a zone in which cane cultivation is prohibited, thus ensuring the complete absence of sugar cane stools throughout the town.

(3) The prohibition of the sale of the sugar cane in the town of Tamatave (that applies to other towns and villages in the whole province) ensures that passengers leaving the town cannot obtain any part of the sugar cane plant.

(4) The interdiction to ship sugar cane parts by boat or plane throughout the province and the compulsion on all sea and air passengers to sign a declaration form stating that they do not carry any part of the sugar cane plant with them.

(5) The disinsectization of all planes leaving Tamatave airport.

(6) The prohibition from growing sugar cane within a radius of 3 kilometres around the Tamatave airport.

(7) The establishment of phytosanitary control posts at the port and airport of Tamatave.

(8) Agreement on the early importation of varieties, showing promise in Mauritius, for inclusion in resistance trials.

Measures adopted by the local authorities are the following:

(1) Widespread publicity has been given to the danger of introducing cane cuttings or any part of the sugar cane plant into Mauritius.

(2) Local technicians are in constant touch with the Agricultural Authorities in Madagascar and follow the progress in the fight against the disease.

(3) The Customs Authorities carry out a thorough examination of the luggage of passengers coming from Madagascar and Réunion.

(4) A special paragraph has been included in the Customs declaration form which passen-

Fig. 27. Stool of M.134/32 infected with Fiji disease, Brickaville, Madagascar.

gers have to sign on landing, to the effect that they have no part of the sugar cane and generally no living plant part of any kind in their luggage.

(5) A double disinsectization of aircrafts is being carried out.

(6) Importation of varieties known to be resistant to Fiji disease.

(7) Assessment of reactions of sugar cane varieties in commercial plantations and in resistance trials on the East Coast of Madagascar.

(8) Detailed study of the insect vector of Fiji disease.

(9) Importation and establishment of egg predators of the vector in Mauritius.

(10) Acquisition of power dusters for eventual insecticidal treatment of diseased foci should they appear.

It is evident that in order to put into force the measures serving for the protection of the sugar industry of Mauritius, full co-operation was needed from the authorities in Madagascar. It is gratifying to record the understanding and assistance received at all times from the Administrative and Agricultural quarters in Madagascar and the «Comité de Collaboration Agricole Maurice-Réunion-Madagascar».

5. GUMMING DISEASE IN REUNION.

The alarming discovery of what appears to be a new strain of the gumming disease organism (*Xanthomonas vasculorum* Dowson) was made in the neighbouring island of Réunion during the year.

Information was received during July that there had been a severe outbreak of gummosis in Réunion and that one of the leading varieties in Mauritius, M.147/44, had showed itself susceptible. In subsequent correspondence it was learned that, amongst other varieties, B.34104 and R.397, the leading variety in Réunion were susceptible and so was apparently the progeny derived from Co. 281.

A comparison of reactions of cane varieties in the two islands shows M.147/44, B.34104 and

R.397 as resistant in Mauritius and susceptible in Réunion. M.147/44 and B.34104 have both been tested in gumming trials at Réduit E. S. and a survey carried out in Mauritius did not reveal a single case of gumming on M. 147/44. Furthermore, at one of the out-stations of the Institute, M.147/44 growing in close proximity to the susceptible D.109, showed no sign of gumming although the latter variety was highly infected. R.397 is now in a gumming resistance trial, and although gumming disease incidence has been very high this year in Mauritius, the variety has shown resistance so far. It should also be noted that 13 varieties derived from Co.281 tested in Mauritius between 1932 and 1957 have all been found resistant.

Gumming disease has been responsible for severe losses in the past and for the disappearance from cultivation of several commercial varieties.

the cultivation of varieties resistant to the disease. In the breeding and selection programme, all seedlings coming out of the first selection trial are included in a gumming resistance trial and all varieties showing susceptibility to the disease are rejected whatever their other agricultural characteristics may be. Imported cane coming out of quarantine are also included in a resistance trial and here again, if they show promise as commercial canes, only those which are highly resistant or immune to gummosis are released.

It is evident that all along, with such an established policy, a selection has been made for commercial planting of varieties resistant to that strain of *Xanthomonas vasculorum* present in Mauritius and that a mutation in that strain or the accidental introduction of another one would mean the complete collapse of the vigilant work carried out over so many years.

Fig. 28. Stools of R. 460 infected with gumming disease, showing stunting and severe chlorosis. La Bretagne, Réunion Island.

In view of the widespread occurrence of the pathogen in a number of alternate hosts, the eradication of the malady cannot be contemplated. The only line of defence is therefore

Apart from the difference in varietal reaction in the two islands, some of the affected varieties show severe white chlorosis of the leaves in Réunion, a symptom seldom observed in Mauritius, and similar to that reported in 1957 on N.Co:310 in Natal (fig. 28).

The possibility that environmental conditions in Réunion, affected by two cyclones and a severe drought in 1958, may have been conducive to the appearance of the acute phase of the disease cannot be ruled out. Yet, the perturbing evidence, pointing to the possible existence of a different strain of the disease organism in Réunion, more than a difference in leaf symptons, is the susceptibility in that island of varieties classified as resistant in Mauritius.

The writer accompanied by his laboratory assistant visited Réunion island in December. The pathogen was isolated from cane and *Thysanolaena maxima*, this being the first record of an alternate host in Réunion, and after successful pathogenicity tests, cultures were forwarded to Dr. Dowson of the Botany School, Cambridge University, for comparison with the pathogen from Mauritius and South Africa. Cuttings of M.147/44, a variety resistant in Mauritius and susceptible in Réunion, and of D.109, a variety susceptible in Mauritius, were also forwarded to Dr. Dowson for inoculation purposes.

CANE PESTS

J. R. WILLIAMS

1. CANE MOTH BORERS

A. The stalk Borer, *Proceras sacchariphagus*

A project to import parasites against the stalk, or spotted, moth borer was initiated during the year. The aid of the Commonwealth Institute of Biological Control has been enlisted and its substation at Bangalore is to send selected species of Indian moth borer parasites to Mauritius for trial. The project as now envisaged will probably last for a period of two or three years depending upon the facility with which the desired parasites can be obtained. Several small consignments of various species were received by air during the latter months of the year to devise methods of packing which will minimise mortality in transit. Sufficient material of two species, *Elasmus zehntneri* Ferr. and *Rhaconotus scirpophagae* Ashm., were received to enable the release of small numbers.

The cane variety position has changed considerably since 1951 when about 90% of the cane growing area was under M.134/32 and it is of interest to briefly consider stalk borer attacks in relation to the several locally bred and imported canes which are now of major commercial importance.

Stalk borer attacks result from, or are influenced by, various environmental factors which may be grouped as follows:

(1) Cane variety—the fixed hereditary characters of a cane variety which influence borer abundance and the ultimate damage done by the insect.

(2) Environmental factors affecting cane growth—the incidence of other pests and of diseases, soil fertility, climate, etc., which by affecting the vigour of growth increase or decrease the significance of borer attack.

(3) Environmental factors other than (1) affecting the insect, such as parasites, predators, and weather.

Susceptibility or resistance of a variety to borer relate only to the hereditary characters of the variety which in some way affect the abundance of the insect and the loss consequent upon its attack. The influence of these characters, however, is often subordinate to the influence of environmental factors mentioned under (2) and (3). The importance of the stalk borer in a field of cane is thus dependent upon a complex of factors of which cane variety is but one and it is no easy matter to determine the susceptibility or resistance of a variety from field observations. Unfortunately, field observations have to be relied upon to a large extent when judging the relative resistance of a variety to borer for resistance cannot be inferred from botanical characters and data from small plot replicated variety trials are compromised by the fact that uniform stands of a single variety in commercial plantings present a different set of conditions.

It is convenient to use the terms resistant, moderately resistant, moderately susceptible, and susceptible to compare different varieties in relation to the stalk borer. The terms are relative and to some extent arbitrary but for present purposes M.134/32 is rated as moderately resistant and may be used as a standard or basis for comparison. The following is an appreciation of the relative degrees of resistance shown by the present main cane varieties.

B.3337. Resistant. A hardy, vigourous cane with a high fibre content. It withstands borer attack well although there is little to indicate that its fibrous nature diminishes borer abundance.

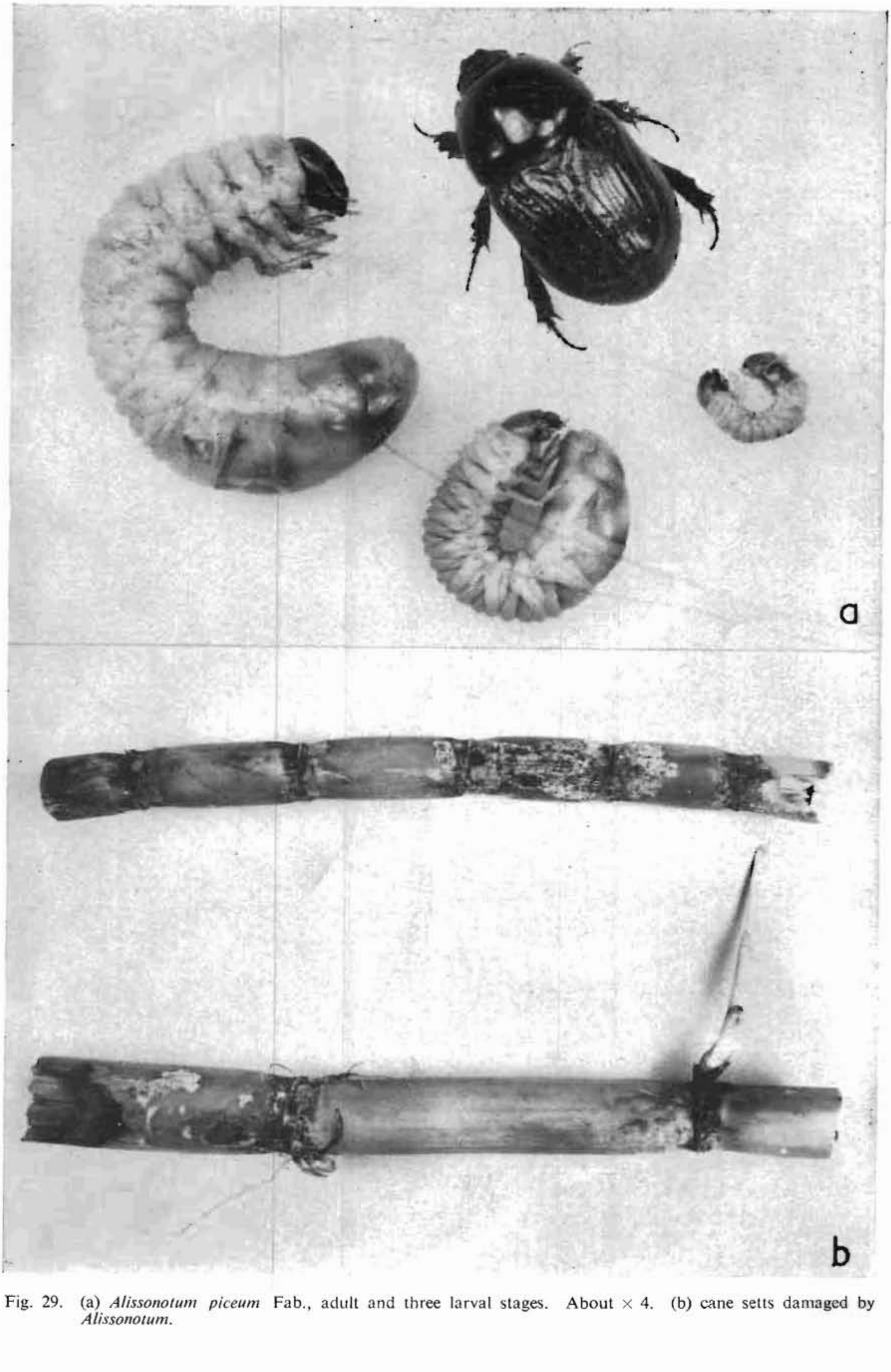

Fig. 29. (a) *Alissonotum piceum* Fab., adult and three larval stages. About × 4. (b) cane setts damaged by *Alissonotum*.

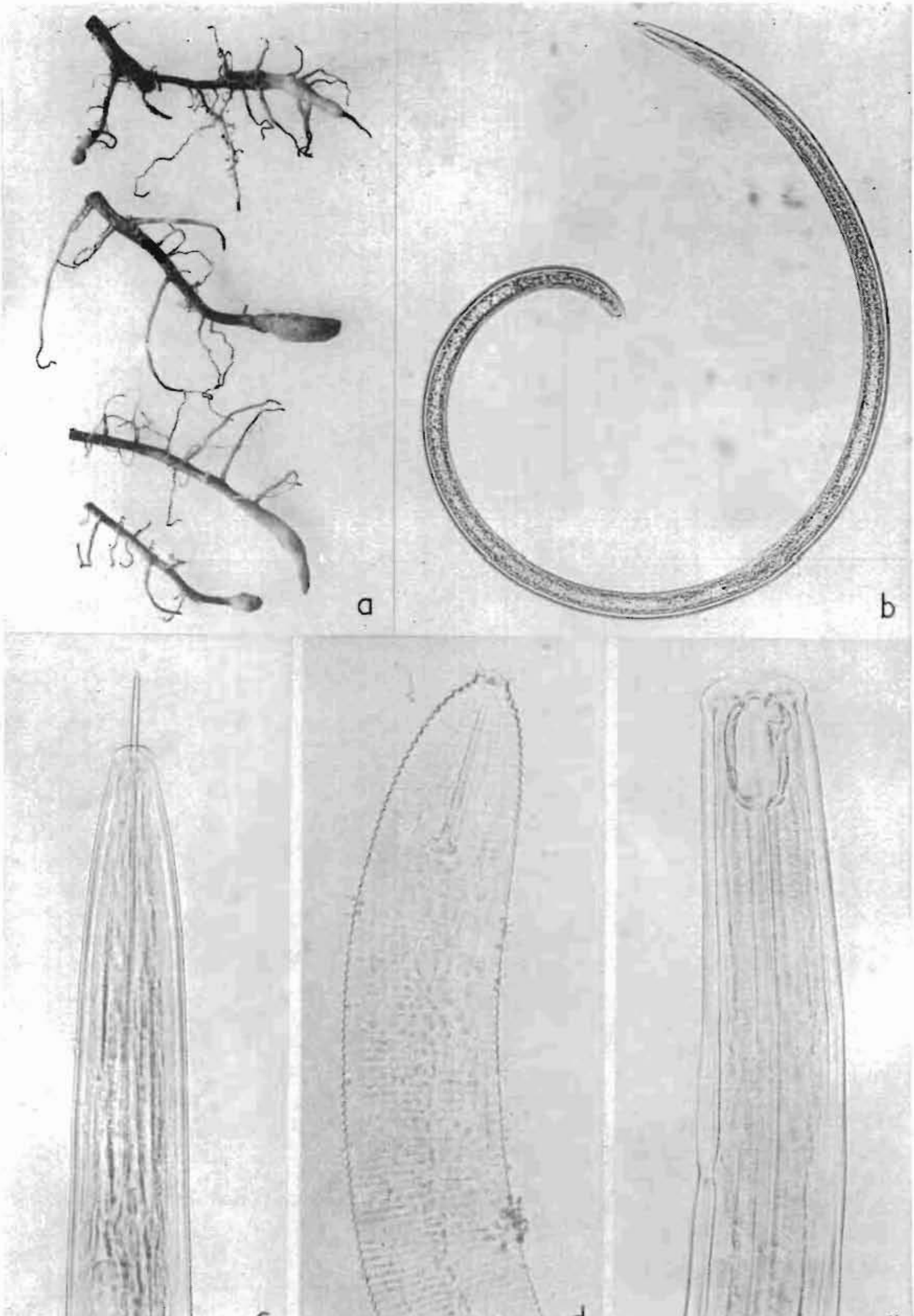

Fig. 30. Nematodes. (a) Roots of var. B.37172 infested with the root-knot nematode, *Meloidogyne* sp. (b) *Longidorus* sp., a free-living nematode which feeds externally upon cane roots; actual length about 2.3mm. (c), (d), (e), the head end of *Xiphinema* sp. (about × 550), *Criconema* sp., (about × 650), and *Mononchus* sp., (about × 500), respectively; the two former feed externally on roots while the latter is predacious on other nematodes.

M.134/32, M.147/44, M.112/34, B.37172. Moderately resistant. These varieties behave satisfactorily under borer attack and apparently possess no botanical characters which favour borer abundance or accentuate loss following injury. M.147/44, a variety which will probably continue to gain popularity, seems quite comparable if not superior to M.134/32 in this respect.

B.37161. Moderately susceptible. Few observations have been made on this variety and its rating is given chiefly upon reports from the West Indies that it is susceptible to the borer *Diatraea saccharalis.*

E·1/37, M.31/45. Susceptible E.1/37 is classed as a susceptible variety mainly because the thick, top-heavy stalks are very liable to be broken by wind when injured by borer. This weakness of the variety was well illustrated during the cyclones of March and April. The tops of the stalks also seem to be killed more easily by borer tunnelling than in other varieties. In variety trials, the percentage stalk and joint infestation tends to be comparatively high.

M.31/45 is not a physically weak cane and tolerates a higher degree of attack than E.1/37. There is, however, a distinct tendency for the borer population to build up in the variety and intense attacks may occur. It is believed that the dense cover afforded by the variety during early growth provides a favourable habitat for the insect.

In dry coastal regions the stalk borer is a familiar pest but in recent years it has become more evident in the higher rainfall areas where some severe attacks have occurred. It is in these latter areas that the varietal position has changed most rapidly, the change being primarily from M.134/32 to E.1/37 and the greater prominence of the borer is probably a consequence of this succession of varieties. Unfortunately, E.1/37 is also highly susceptible to Chlorotic Streak disease and the debilitating effect of the disease in ratoon cane accentuates the damage caused by borer. As M.31/45, considered in general to be the best alternative variety to E.1/37 for high rainfall areas, is also susceptible to borer and B.3337 is not recommended for wide cultivation, the present varietal position in higher rainfall areas is unsatisfactory from the narrow viewpoint of stalk borer control. It seems likely, however, that M.147/44, although not suited to regions of very high rainfall, will prove the equal or superior of E.1/37 in some areas where the latter now predominates.

In the subhumid and humid zones the varietal position with regard to borer is much more satisfactory. M.134/32 still occupies a large area and the borer resistance of varieties which are replacing it, M.147/44 and B.37172, seems in no way inferior.

B. A New Moth Borer, *Crambus malacellus* Dup.

Fields of germinating virgin cane at Mon Desert-Alma were attacked in June-July by larvae of the moth *Crambus malacellus* Dup. (Fig. 31), an insect previously known in Mauritius as an occasional pest of young maize and rice. The only record of the insect as a cane pest in other countries is from Queensland (Mungomery, 1929).

The larva of *C.malacellus* is dark grey with black spots and superficially resembles a young larva of the stalk borer, *Proceras sacchariphagus.* Its method of attacking cane is quite distinctive and unlike that of other borers which cause similar damage. A young shoot is bored usually a little below soil level and a gallery made from silk and soil particles is attached to the shoot over the hole. When it is not feeding, the larva retires to its gallery outside the shoot. The internal damage to the shoot kills the growing point and a "deadheart" eventually results.

The attacks observed were not severe although in part of one field over 50% of the young shoots were killed. *C. malacellus* has been known in Mauritius for many years and the recent attack on cane is of interest because of its unusual nature. The insect probably feeds mostly on wild grasses and it is noteworthy that the attacks were confined to young cane on newly reclaimed land with wild vegetation immediately adjacent.

2. NEMATODE INVESTIGATIONS

Work to assess the prevalence and economic importance of free-living and endoparasitic soil nematodes in cane fields was continued. The investigations have so far been concerned chiefly with the collection, identification, and preservation of the free-living species occurring about cane roots but a start has also been made with a study of root endoparasites. Three papers dealing with free-living nematodes belonging to the families Trilobidae, Belondiridae, and Dorylaimidae, respectively, were prepared for publication*. Only cursory observations on the abundance and possible importance of the various species encountered have yet been made. In June, however, a field of unhealthy M.147/44 on sandy coastal soil was found after careful examination of the roots, to be badly infested with root-knot nematode and the stunted growth, poor colour, and droughty appearance of the cane seemed attributable to the infestation. The species of root-knot nematode concerned is believed to be *Meloidogyne incognita* var. *acrita* Chitwood.

Preliminary experiments to observe the effect upon cane growth of soil fumigation with ethylene dibromide before planting were made in several localities. A remarkable increase in the rate of early growth resulted from the treatment in some of these experiments. On sandy soil the number of tillers in the treated plots six months after planting was double that in the untreated plots while shoot size was also greater. A similar response was obtained on other soil types. It is not known if the growth difference shown by the young cane in the treated and untreated plots will persist until harvest. Much of the increased rate of growth in the fumigated plots is undoubtedly due to the increased soil fertility which is a well known result of partial soil sterilization and very careful assessment of the fauna of such treated soil is required before conclusions are drawn upon the relation of the treatment to nematode activity and cane growth. Observations are being continued and more critical experiments of a similar nature are to be made.

3. INSECTICIDE EXPERIMENTS AGAINST WHITE GRUBS.

Investigations on the use of aldrin and chlordane to control infestations of the white grub *Clemora smithi* were continued. Data from a total of 17 randomised block trials, of which 13 are still current, became available for analysis. The trials are located in different regions and have plots of five cane rows by forty feet with chlordane and aldrin applied at 2 to 8 and 2 to 4 lb active ingredient per arpent, respectively. Emulsions and insecticide-fertilizer mixtures were applied to the furrows before planting in four and three trials, respectively, while emulsions were applied along the rows of germinated virgin cane and harvested ratoon cane in four and five trials, respectively. One trial combined furrow and row application to virgin cane. The dates of application varied widely, except that ratoon cane was treated in Sept.-Nov., following harvest.

With the exception of one early trial in ratoon cane, infestation in the trials has been light to moderate (not more than about 50,000 grubs estimated per arpent) and was so low in four that no counts were made.

Grub infestation in the trials, estimated by counting the larvae found by uprooting of 10ft of cane row in each plot in June-July, is shown in Table 25 which comprises all such data obtained to date, some of it having been included in the Annual Report for 1957. The extent to which the different treatments prevented infestation is indicated in each instance as a figure representing percentage control obtained, taking the grub population in the untreated plots to represent 100% infestation. All figures except those indicated are significant at either the 5% or the 1% level. The data in the table may be generalised as follows:

(a) At equivalent dosage rates, aldrin appears to be more efficacious than chlordane.

(b) Chlordane at the concentrations used has a residual action which may extend over three grub seasons while aldrin, though none of

* *See publications of the Institute on page 65*

the trials in which it has been used have been running for three years, seems comparable and its action may definitely extend over two grub seasons.

(c) Averaging the relevent figures in the table, 4 lb chlordane as emulsion to the furrow reduced infestation by 84% and 59% in the first and second grub seasons (first and second years after applications), respectively, while the corresponding figures for 2 lb aldrin are 79% and 43%. The same formulations and doses applied along rows of ratoon cane after harvest resulted in 54% and 28% control with chlordane in the first and second years, respectively, and similarly 72% and 64% with aldrin.

(d) Application of insecticide dust-fertilizer mixtures to the furrows before planting gave a high degree of control in the single trial of this type where infestation occurred.

Shoot counts and measurements taken in four trials 2 to 4 months after planting revealed no reduced or retarded germination following application of emulsions or insecticide-fertilizer mixtures to the furrows even at the high dosage

Table 25. Effect of insecticide treatments on grub infestation. Figures indicate percentage control obtained.

Method of application	Expt No.	Year after treatment	Infestation (grubs/arp) untreated plots	Chlordane lbs/arp.					Aldrin lbs/arp.	
				2	3	4	6	8	2	4
Emulsion to furrows before planting	1.	1st	6,000		75		92			
		2nd	23,500		57		81			
		3rd	26,000		52		61			
	2.	1st	14,500			90		96	83	96
		2nd	2,400			58*		92	58*	67
	3.	1st	7,000	97		87			97	99
		2nd	7,300	53		33			29	36
	4.	1st	3,600			69		92	56	83
	5.	1st	12,000			91				
		2nd	42,000			87				
		3rd	17,300			66				
Dust-fertilizer mixture to furrows before planting	1.	1st	5,300			75		91	81	81
Emulsion along rows virgin cane after germination	1.	1st	39,000			68	83	87		
		2nd	13,600			78*	80*	88*		
	2.	1st	6,200			39*		84	79	81
	3.	1st	12,000			75				
		2nd	42,000			74				
		3rd	17,300			52				
Emulsion along rows ratoon cane after cropping	1.	1st	90,000		40		59			
	2.	1st	59,000	59		63			71	83
		2nd	27,800	52		46			72	79
	3.	1st	20,500	56		56			68	68
		2nd	6,500	31*		11*			57*	75
	4.	1st	11,500			67		80	89	83
	5.	1st	37,600			18*		36	52	52
	6.	1st	18,300			68		82	82	79

* not significant at 5% level

rates. Yield of cane was unaffected except that the high dose of 4 lb aldrin applied in the fertilizer significantly reduced yield of virgin cane in one trial and consistently, but non-significantly, lowered yields in others whether applied to the furrows with fertilizer or as an emulsion. In one trial, 4 lb chlordane dust-fertilizer mixture in the furrows before planting significantly increased yield in the absence of grub infestation but this result was not repeated in other trials.

With application of emulsions to cane after germination, 8 lb chlordane significantly reduced yield of virgin cane in one trial but did not affect yield in others. When emulsions were applied to ratoon cane yield was significantly depressed in the subsequent crop on one occasion by 4 and 8 lb chlordane, by 2 lb aldrin, and on two occasions by 4 lb aldrin, one of the latter being in the second crop after application.

The interpretation of the more extensive experimental data now available presents some difficulty and it is evident that much work remains to be done upon rates and methods of application of the insecticides. There are critical dosage levels, which may be influenced by soil type, method of application, and possibly by local climatic conditions, which cannot be safely exceeded and which are within the dosage ranges employed in the trials. Thus, the high doses used, 4 lb aldrin and 8 lb chlordane, are excessive. The available data also surprisingly tends to show that furrow application during planting offers greater latitude with regard to dosage rate than application after establishment of the cane. There is no evidence to show that chlordane may increase yield in the absence of recognised pests as is reported from India and Louisiana.

Fig. 31. *Crambus malacellus* Dup., adult.

Field use of these insecticides, on the basis of the above results, should be on an exploratory basis and at present restricted to furrow application of 1 lb actual aldrin or 2 lb actual chlordane at planting, using either emulsion or dust.

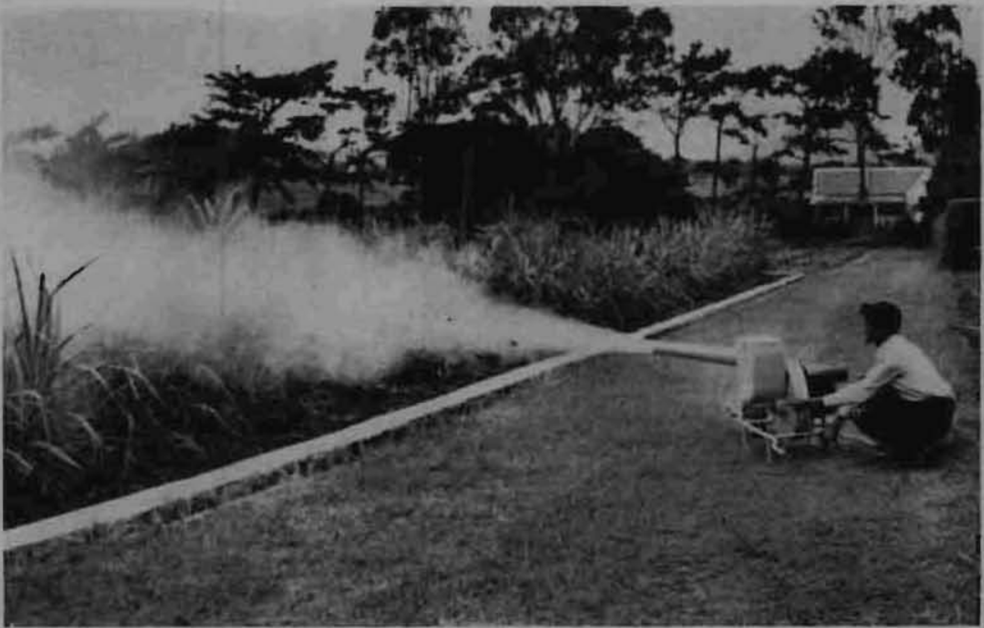

Fig. 32. Power driven duster for experimental insecticidal treatment of cane fields.

WEED CONTROL

E. ROCHECOUSTE

1. INVESTIGATIONS ON THE SUBSTITUTED UREAS.

EXPERIMENTAL work on the substituted ureas CMU-N-(4-chlorophenyl)- N^I, N^I-dimethyl urea and DCMU-N-(3,4-dichlorophenyl)- N^I, N^I-dimethyl urea was continued this year. Of the five trials in progress those at Rose Belle and Valetta could not be harvested owing to severe cane damage caused by cyclonic disturbances experienced early in the year. These experiments, as previously reported (M.S.I.R.I. Ann. Reports 1956-1957) were initiated in 1956. The treatments consisted of CMU and DCMU applied at rates 2,3,4,5,6,8, and 10 lb per arpent, rates of application 4, 6 and 8 consisting of two series: one in single application and the other in which half of these rates were used in two applications at two months' intervals.

A weed survey was carried out about 10 weeks after herbicide application. The second weed survey could not be made, as planned out originally, owing to the fact that at the time observations had to be made on the weed population, canes had completely closed the interlines.

(a) **Effects on Weeds.** In general it may be said that DCMU proved more effective than CMU. From table (a) it will be observed that differences in efficacy with regard to rates of application are inconsistent in CMU treatments. In DCMU treatments on the other hand control of weeds has been more effective at the higher concentrations. In the Bénares and Solitude trials no great differences was observed between the effectiveness of the two herbicides.

Cyperus rotundus occurred again this year in all trials irrespective of rates of application indicating that this perennial is not affected by these chemicals at such concentrations. Other weed species of common occurrence in the experimental plots were the following:

(i) Rose Belle. *Digitaria timorensis, Colocasia antiquorum, Oxalis latifolia, Kyllinga monocephala, Cynodon dactylon.*

(ii) Valetta. *Digitaria timorensis, Colocasia antiquorum, Oxalis latifolia, Oxalis debilis, Sonchus asper, Setaria pallide-fusca.*

(iii) Bénares. *Cynodon dactylon.*

(iv) Magenta. *Euphorbia hirta, Cynodon dactylon.*

(v) Solitude. *Amaranthus spinosus.*

Table 26. Effects of CMU and DCMU on weed growth. Weed infestation in % of control 2 months after spraying.

Locality	Mean Ann. R/fall inches	CMU lb. per arpent 2	3	4	5	6	8	10	DCMU lb. per arpent 2	3	4	5	6	8	10
Rose Belle ...	150	47	29	47	41	27	29	41	44	32	44	21	29	18	12
Valetta ...	125	60	58	31	44	44	35	46	42	65	65	50	54	52	38
Benares ...	77	18	18	18	14	18	23	24	18	21	28	21	29	18	10
Magenta ...	56	46	60	51	43	51	51	57	53	68	55	58	53	50	40
Solitude ...	38	38	33	33	25	33	25	25	47	42	35	23	28	26	16

4. MISCELLANEOUS

A. The Leafhopper, *Perkinsiella saccharicida* Kirk.

In the Annual Report for 1957, the introduction of the Mirid *Tytthus mundulus* (Bredd.), a predator of *Perkinsiella saccharicida* and other leafhoppers, was described and it was stated that the insect appeared to be established at a locality in Flacq. Observations made during the year under review have confirmed that the insect is established in that locality and specimens collected several miles away from the original liberation site show that the colonised area is expanding. Its gradual dispersion over the island from the colonised area now seems assurred.

Two other Miridae, *Tytthus parviceps* (Reuter) and *Cyrtorhinus lividipennis* Reuter, were collected on cane while searching for *T. mundulus*. These may also be leafhopper predators but there has been no opportunity to study their biology.

B. The White Grub, *Alissonotum piceum* Fab.

A localised white grub infestation in young virgin cane was reported at Calebasses in December and upon investigation the species concerned proved to be *Alissonotum piceum* Fab., an indigenous Dynastid beetle. Larvae of all stages as well as adults were found in the furrows and the cane setts and sometimes the shoot bases were eaten by the former (Fig. 29). The cane injury was neither serious nor extensive but there appears to be no definite record of cane damage by this beetle although its occurrence in cane fields has been observed in the past.

C. Dispatch of Borer Parasites to Madagascar.

At the request of the French authorities, two consignments of the moth borer parasite *Xanthopimpla stemmator* Thunb. were sent to Madagascar in May. Students of the College of Agriculture helped in the collection of the parasites.

Effects on yield and sucrose content.

The effect of these herbicides on cane and sugar yields was assessed in virgin and first ratoon canes. The results obtained are shown in tables (b) and (c) from which it may be seen that neither cane weight nor sucrose content were adversely affected by CMU and DCMU at the concentrations used.

With reference to tables (b) and (c) it will be found that no effects on yield and sucrose content were obtained in plant canes and first ratoon crops. It would appear then that under conditions prevailing in Mauritius there is so far no correlated effect of these herbicides at concentrations used.

Table 27. Effects of CMU and DCMU on cane yield expressed in tons per arpent.

Herbicide in lb. per arpent	CMU Plant Canes					CMU First Ratoons		DCMU Plant Canes					DCMU First Ratoons	
	Rose-Belle	Valetta	Benares	Magenta	Solitude	Magenta	Solitude	Rose-Belle	Valetta	Benares	Magenta	Solitude	Magenta	Solitude
2	31.7	35.8	32.9	29.0	28.8	17.0	28.6	26.3	35.7	33.6	32.8	29.4	23.5	36.2
2/2	29.0	37.2	36.0	27.8	25.7	24.2	31.0	29.7	38.1	38.2	30.7	28.5	25.3	33.2
3	30.2	38.3	34.4	30.5	25.9	22.7	38.0	32.7	37.7	41.1	35.6	31.5	25.2	33.5
4	29.0	38.7	34.0	29.2	26.2	24.9	34.4	31.8	37.0	36.7	30.2	27.6	24.0	33.5
4/4	29.5	37.3	35.3	26.2	32.8	21.9	36.9	29.9	37.1	36.2	26.1	25.7	21.0	29.6
5	27.3	35.6	35.0	28.8	27.8	24.8	34.7	29.3	36.8	37.1	30.0	25.4	24.8	29.6
6	27.7	32.7	33.1	30.5	27.3	25.7	29.2	27.0	38.5	36.5	33.6	28.1	25.1	31.4
8	27.0	36.2	40.5	37.2	32.7	25.1	33.9	26.7	36.1	35.9	40.1 *	27.0	25.6	34.9
10	27.3	34.6	37.5	25.3	36.5	24.3	32.5	27.3	35.9	36.0	34.3	31.5	25.0	28.4
Control	26.7	34.9	32.6	30.3	31.0	22.5	35.9	33.0	36.6	35.6	28.7	24.4	26.2	29.5

Table 28. Effects of CMU and DCMU on Sucrose Content expressed in terms of CCS % Cane.

Herbicide in lb. per arpent	CMU Plant Canes					CMU First Ratoons		DCMU Plant Canes					DCMU First Ratoons	
	Rose-Belle	Valetta	Benares	Magenta	Solitude	Magenta	Solitude	Rose-Belle	Valetta	Benares	Magenta	Solitude	Magenta	Solitude
2	17.86	15.50	13.18	16.30	15.11	14.79	14.92	18.24	15.39	12.37	15.45	15.27	14.42	13.71
2/2	17.77	15.74	11.94	15.63	14.72	13.97	14.93	18.41	14.93	12.06	14.35	15.16	14.59	14.05
3	17.90	15.34	12.07	15.30	15.68	15.10	13.52	18.08	15.42	13.22	16.07	14.82	14.42	14.73
4	17.57	15.08	12.93	16.00	15.14	14.18	15.27	18.16	15.38	12.01	16.53	14.87	14.60	14.77
4/4	18.20	15.29	12.34	16.16	15.77	14.20	13.62	18.16	15.50	11.40	15.42	15.82	14.80	14.66
5	17.97	15.85	13.27	15.99	14.28	14.92	15.11	18.38	15.27	12.96	16.34	15.45	14.25	14.78
6	17.56	15.35	12.62	16.05	16.12*	15.13	13.85	18.02	14.78	11.86	15.42	16.26	14.90	14.66
8	17.84	15.56	11.79	15.70	13.88	14.37	13.02	18.15	15.58	13.36	17.01	14.58	15.08	14.86
10	17.52	14.74	12.99	15.98	13.98	15.28	14.57	18.04	14.80	12.63	14.40	13.79	14.76	14.78
Control	18.17	15.84	11.84	16.13	13.99	14.18	15.10	17.62	15.65	11.92	15.50	15.04	14.86	14.34

* *Significant at 5% level.*

2. OBSERVATIONS ON THE CONTROL OF «CHIENDENT» (*Cynodon dactylon*) AND «HERBE MACKAYE» (*Phalaris arundinacea*).

These two grasses are troublesome weeds of the agricultural lands of Mauritius. «Chiendent» is particularly tenacious in the humid and sub-humid localities and «Herbe Mackaye» is more troublesome in the super-humid regions. These grasses have an extensive system of rhizomes which may penetrate the soil to a depth varying from one to two feet. Owing to unsatisfactory control of these grasses by TCA and sodium chlorate more particularly at certain seasons of the year a new series of experiments was initiated. The object was to obtain further information on the best time of appliyng the herbicides and on the effects of repeating the same treatment at two months' intervals on the growth behaviour of these perennials. Regrowth incidence was recorded at monthly intervals.

In these trials TCA was used alone and in various combinations with sodium chlorate (100 lb) dalapon (20 and 40 lb) and amizol (20 and 40 lb).

Two series of trials were established thus:

(a) **Single application treatment.** Series of plots were sprayed at different times of the year and no plot received the treatment more than

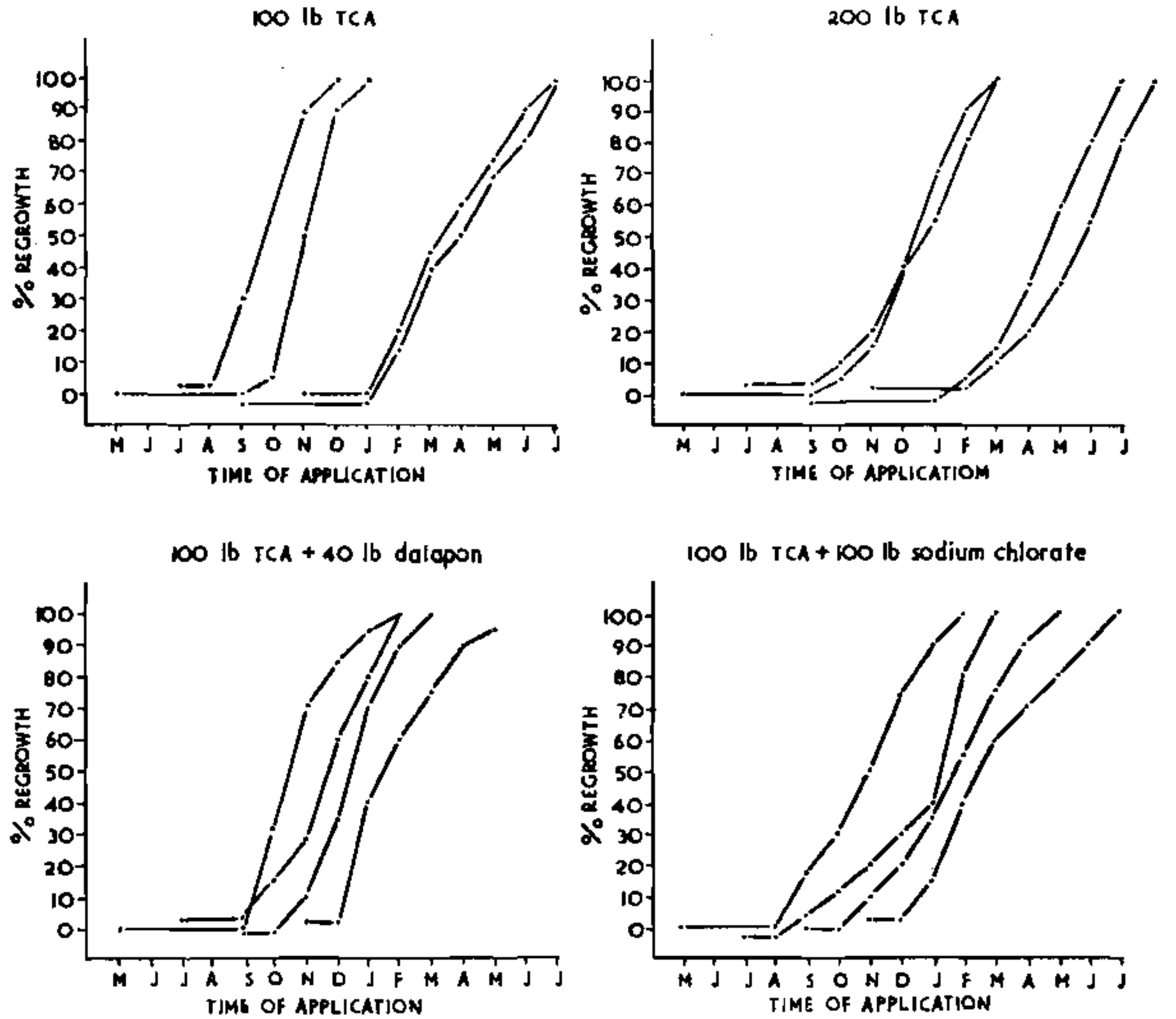

Fig. 33. Effects of TCA, Dalapon and sodium chlorate on *Cynodon dactylon*, in relation to time of application.

once. The first series of plots were sprayed in May and the others were subsequently treated in July, September, November, 1957 and January 1958.

The best spraying time was found to be May, September and November, but no treatment killed the grasses in one application. Time of application was also found to have an important bearing on the efficacy of the treatment. With reference to the best treatments in relation to time of application the following observations can be made, (figs. 33 34.)

Chiendent: TCA at 100, 150 and 200 lb. gave comparatively similar results to the combination 100 lb. TCA plus dalapon at both concentrations and no great difference was obtained between the treatments 100 lb. TCA plus dalapon at 20 or 40 lb. Further, the treatment 100 lb TCA plus 100 lb. sodium chlorate was less effective, the grass resuming its activity one month earlier in that treatment than in the others.

Herbe Mackaye: 100 lb. TCA plus 100 lb. sodium chlorate stood out as being the best treatment, more particularly when application was made in September. Other treatments that gave satisfactory results were 100, 150 and 200 lb. TCA and the combination 100 lb. TCA plus 40 lb. dalapon.

(b) **Double application treatment.** Series of plots were sprayed at different times of the year and the same treatment was repeated at

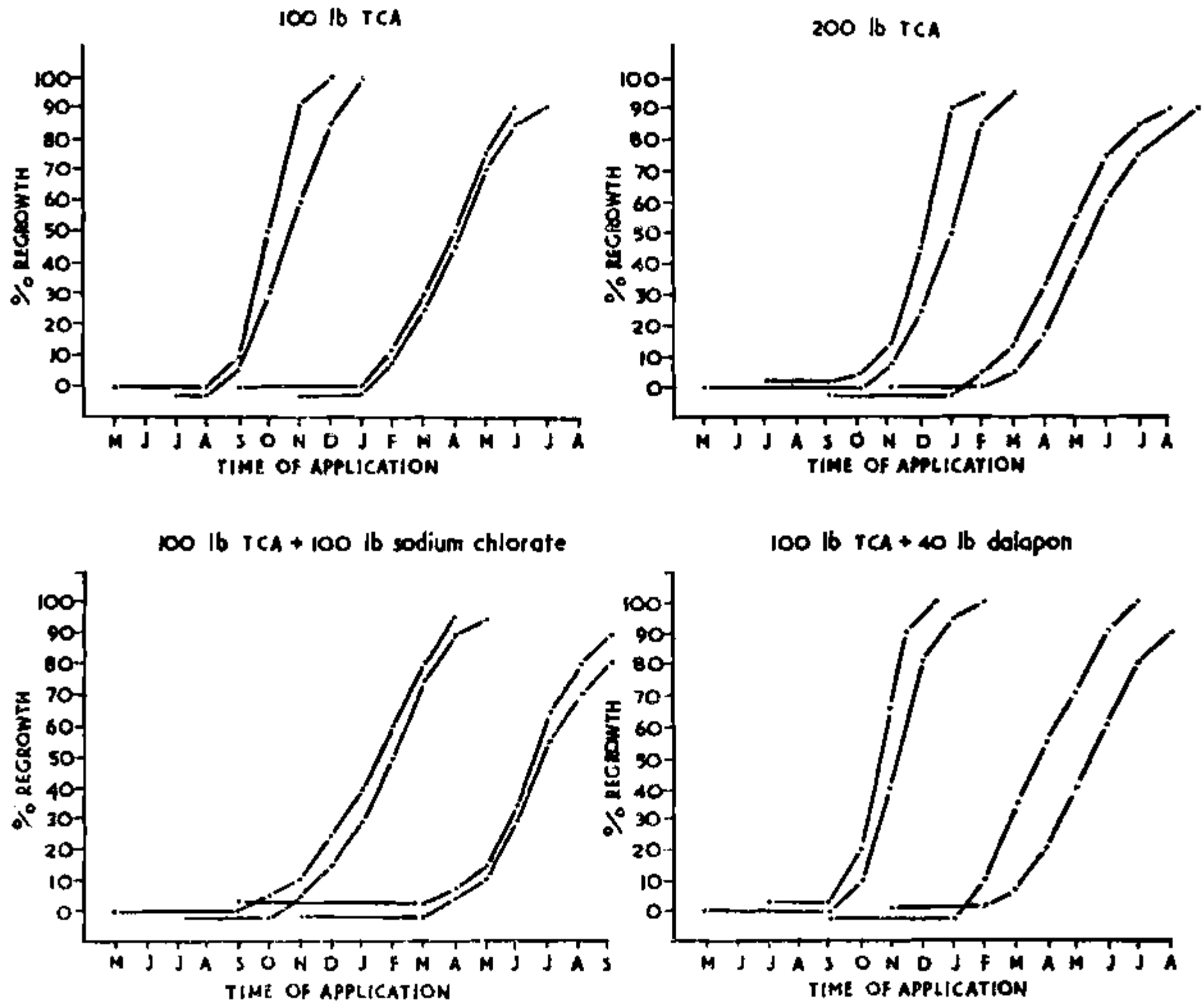

Fig. 34. Effects of TCA, Dalapon and sodium chlorate on *Phalaris arundinacea* in relation to time of application.

two months' intervals. Briefly, different series of plots were sprayed in May, July, September, November 1957 and January 1958, and received a second application in July, September, November 1957 January and March 1958 respectively.

When second applications were made, the state of the plots with respect to the grass was recorded in the following way: no regrowth; regrowth just started and regrowth well established. The efficacy of the treatment was to some extent related to the degree of regrowth at the time spraying was made. When there was *no regrowth* a second application of the herbicide did not improve the efficacy of the treatment since the grasses resumed their activity in these plots at approximately the same rate as in those that had received only a single application. When *regrowth had just started* the effect of a second application gave satisfactory results. On the other hand when *regrowth was fairly well established* a second application did not improve the efficacy of the treatment.

The results obtained from these experiments indicate that the herbicidal control of «Chiendent» and «Herbe Mackaye» is a complex problem involving a set of factors of which the most important are:

(i) time of application,

(ii) depth of penetration of rhizomes,

(iii) soil type.

There are also indications that more than one variety of «Chiendent» exist in Mauritius and a preliminary survey has so far differentiated three types. Of these the form occurring at Constance fig. 35 has proved more resistant to the toxic action of TCA than that common at Bel Ombre. fig. 36.

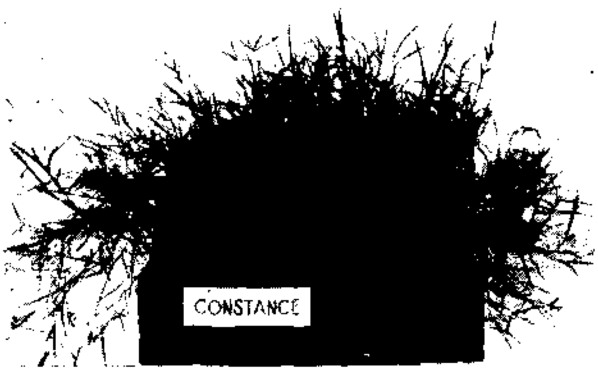

Fig. 35. *Cynodon dactylon*, variety common at Constance S.E.

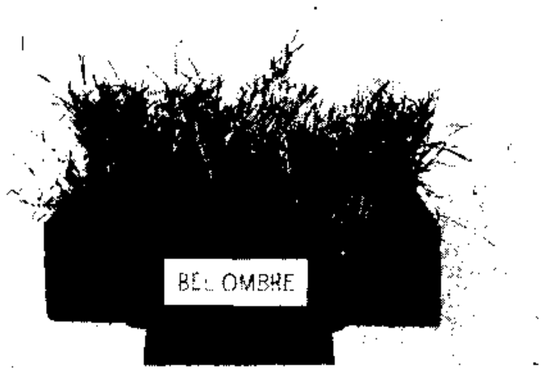

Fig. 36. *Cynoudon dactylon*, variety common at Bel Ombre S.E.

3. COMPARISON OF 2,4-D AND MCPA DERIVATIVES IN PRE-EMERGENCE CONTROL OF WEEDS *

Fourteen trials were established with a view to evaluating the efficacy of 2,4-D and MCPA derivatives under the different climatic conditions prevailing in the island. These experiments consisted of two series: one in which herbicide application was made in plant canes about three to four months old, and the other, in which the treatment was applied in ratoon crops about a fortnight after harvest. In all trials the plots were hoed a day or two before herbicidal treatment. All treatments were randomized with fourfold replications. The frequency-abundance method was used for weed assessment. The rate of 4 lb a.e. was adopted for the metallic and amine derivatives but for the esters lower rates of application had to be used on account of their adverse effects on cane growth.

The data obtained from these experiments are presented in table 23 from which the following observations may be drawn:

(i) The MCPA derivatives proved to be the best treatments in all trials. Differences in

* *Summary of a paper presented at the African Weed Control Conference held in Rhodesia, July 1958.*

the efficacy of the two MCPA derivatives occur in individual trials, but even up when average figures are compared.

(ii) Sodium 2,4-D was found to be the second best treatment.

(iii) The amine derivatives were found more effective than the volatile esters and of the two amine forms the dimethyl one gave better results than the tri-ethalnolamine.

(iv) The butoxyethanol ester gave a better weed kill than the volatile esters isopropyl and ethyl and was comparable in its effects to the tri-ethanol amine derivative.

Other information that was obtained from these trials was:

(1) Perennial grasses were in general not affected.

(2) Esters of 2,4-D were found to affect some perennial broad leaved weeds when their underground buds were shallow seated and consequently easily reached by the toxic material.

(3) Some annuals were found to be fairly resistant to all MCPA and 2,4-D derivatives at rates used in these trials.

Table 29. Weed infestation in % control.

Herbicide	Rate in lb. a.e. per arpent	Averages for trials in plant canes		Averages for trials in ratoons		General Averages	
		Annuals	Total	Annuals	Total	Annuals	Total
MCPA Sodium salt	4	37.4	43.3	31.1	37.5	34.3	40.6
MCPA Potassium salt	4	31.7	37.8	38.4	44.5	35.0	41.3
2,4-D Sodium salt	4	46.3	50.3	40.1	45.9	43.2	48.1
2,4-D Dimethyl amine	4	36.6	41.3	50.8	57.8	48.1	50.6
2,4-D Triethanol amine	4	63.7	67.6	37.9	45.3	52.7	58.0
2,4-D Butoxyethanol	1½	59.6	62.3	49.4	56.0	54.5	59.1
2,4-D Isopropyl	1½	63.1	65.9	55.4	61.9	59.3	63.9
2,4-D Ethyl Ester	1	63.8	72.3	62.5	71.1	65.6	71.7

CULTIVATION, IRRIGATION, CLIMATE

1. A REVIEW OF ORGANIC AND INORGANIC AMENDMENTS USED IN CANE CULTIVATION IN MAURITIUS*.

A. Farmyard manure, molasses and scums.

WHETHER farmyard manure, factory scums or molasses applied in normal amounts to sugar cane fields produce profitable sugar responses additional to the effect of nitrogen, phosphorus and potassium contents, has been and is still the subject of much discussion in Mauritius. Many cane growers are of opinion that such is the case, but most agricultural chemists do not admit this contention, at least with the high yielding cane varieties now cultivated. This note aims at the elucidation of this controversy.

Results obtained from 32 field trials located in the various regions of the island form the basis of the present discussion. These trials were conducted from 1947 to 1953 by Guy Rouillard (26 trials), and from 1954 to date by the M.S.I.R.I. (6 trials). The experiments comprise a number of properly chosen treatments carrying separately farmyard manure and the factory by-products, scums and molasses. In addition, and for the first time in experimentation in Mauritius, the actual nutrition of the canes on each plot was followed for a number of years by means of foliar diagnosis.

All the plots have received the normal annual dressing of 30 to 40 kg. N/arpent in the form of sulphate of ammonia in order to rule out complications in the interpretation of sugar responses arising from the small, but significant, amount of nitrogen contained in farmyard manure, factory scums and molasses. As usual, all those bulky materials, rich in organic substance, were applied in the cane furrow before or at planting time.

Foliar diagnosis, run for at least three years on the ratoon canes, has allowed the grouping of the trials into two contrasting series:

(a) The first series, *not deficient*, on which the canes of the control plots, i.e. those not receiving any organic material to be studied, showed optimum phosphorus or potassium levels in the leaves.

(b) The second series, *deficient* in phosphorus or potassium. The chosen levels for the first series — not deficient — were as follows: P_2O_5 at or above 0.50% d.m. of the leaf punch for M.134/32, and 0.54 for Ebène 1/37 and B.3337, and K_2O at or above 1.50 for M.134/32 and Ebène 1/37, and 1.40 for B.3337. The second series — deficient — with foliar diagnosis levels lower than the above limits.

If a sugar response is obtained with the first — not deficient series — it may be attributed to other properties or constituents of the three organic materials tested outside their nitrogen, phosphorus or potassium contents.

Table 30 gives the necessary answer to the problem involved.

The conclusions to be drawn from this extensive experimentation are briefly summarized :

Farmyard manure, when used at a normal rate of 10 tons per arpent at planting time, shows no sugar response whatsoever outside the nitrogen, phosphorus and potassium effects. These can be brought about much more economically by means of properly selected commercial fertilizers. Consequently there is no room nowadays for the regular use of farmyard manure on cane fields. This valuable material can find better utilization with other crops.

Factory scums owe their fertilizing value to their phosphate content. On soils well provided with available phosphorus reserves, they apparently show a slight positive effect on the virgin

* *Section A prepared by Guy Rouillard & P. Halais ; sections B, C, D by D. H. Parish and S. M. Feillafé.*

B. Bagasse.

With increasing factory efficiency, increasing yields and the higher fibre contents of present day varieties, bagasse production has outstripped its consumption. This surplus material, for which no industrial outlet is so far available in Mauritius, must be disposed of, and it is therefore either burned or returned to the fields.

Burning the surplus bagasse is the cheapest way of disposal, but there is a reticence to do this as the feeling is that in doing so organic matter which could be returned to the soil is being lost. The reasons for wanting to return organic matter to the soil are based principally on traditional attitudes.

There are, however, more specific reasons such as the application of bagasse on the surface as a mulch, or its use in heavy clay soils where it is easily proved that applications above 20 tons per acre have a distinctly beneficial effect on cane growth.

The known beneficial effects of organic matter applications to soils are attributed to the production of stable soil aggregates by water-soluble high molecular weight materials formed from the organic matter by the soil micro-organisms. This increased aggregation improves the soil, air and moisture conditions. The degree of improvement in soil structure following additions of organic matter will depend on the initial state of aggregation of the soil and the amount of organic matter added. Well aggregated soils will not benefit and the poorly aggregated soils will improve as the rate of application increases, as it is well known that only large amounts of organic matter have any effect.

The nature of the organic matter is important; readily decomposable materials give an immediate improvement declining slowly, until after one year, the effects have disappeared. Inert materials like bagasse apparently give no effect until up to two years have elapsed following the application, and the beneficial effects then last for several years.

The growth of various crops in the soil affects aggregation; grasses in particular have a very beneficial effect on the soil structure which is attributed to the amount of root residues left in the soil, its good distribution throughout the soil mass and the action of the root system in breaking up the soil into small structural units, (Martin et al., 1955). Sugar cane returns a considerable quantity of organic matter to the soil each year in terms of roots and trash, and consequently, cane can be grown in monoculture, the structure of the soil tending if anything to improve with time under this crop.

Only those soils which are known to have marked structural deficiencies will respond economically to bagasse application. Local soils known to be of this type are the dark magnesium clays of Yemen and Magenta and small scattered areas of grey hydromorphic soils. The first cultivation requirements of these soils is thorough drainage, as, unless surplus water can drain off, root growth will be restricted to the surface layers. During this deep and thorough cultivation, bagasse or any other organic residue can be worked in with consequent benefit at a later date, increases in yields of up to one ton of sugar per acre having been obtained on analogous soils in Hawaii, (H.S.P.A. 1953).

It is well known that phosphate fertilization of cane encourages root growth and penetration, and many areas in which root growth was poor were possibly suffering from phosphate deficiency rather than actual poor soil physical conditions.

Generally, any failings in the physical conditions of our latosolic soils could be corrected by cultivation, although the incorporation of organic material during this operation should prove beneficial, if only by encouraging more thorough working of the soil.

The benefits, if any, of the addition of organic matter in the furrow at planting, are only temporary as experiments with farmyard manure loc. cit. have shown no response in terms of yield to this material.

To summarize, then, the limited information available shows that yield increases from organic matter applications, such as raw or composted bagasse, can be expected on certain types of soil provided the material is well worked into the soil and in massive dressings, whilst the value of furrow applications, taking local experience with farmyard manure, is negligible when nutrient effects are discounted.

Table 30. Sugar response to farmyard manure, scums and molasses.

No. of trials	F.D. of Control Plots	Response to 10 tons FYM/arpent in tons sugar/arpent	
		Virgins	1st Ratoons
10	*Not deficient* in P and K	— 0.008	+ 0.031
11	*deficient* in P and/or K	+ 0.621*	+ 0.132
		Response to 8 tons Factory Scums/arpent in tons sugar/arpent	
		Virgins	1st Ratoons
12	*Not deficient* in P	+ 0.230	+ 0.006
9	*deficient* in P	+ 0.769*	+ 0.432*
		Response to 5 tons molasses/arpent in tons sugar/arpent	
		Virgins	1st Ratoons
9	*Not deficient* in K	+ 0.366*	— 0.135
7	*deficient* in K	+ 1.047	+ 0.224

* Significant to 5% level.

crop which is not statistically significant however and does not even extend to the first ratoons and, by deduction, to any ratoons. In soils deficient in phosphate, factory scums produce sugar responses which are quite comparable to those obtained with commercial phosphatic fertilizers properly applied.

It follows that all scums made available at the factory should normally be returned to the cane fields at planting but supplementary applications of phosphatic fertilizers must be resorted to for fields or sectors known to be still deficient in phosphorus.

Molasses applied to soils already provided with enough potassium give rise to a small but positive and statistically significant sugar response which, however, does not last beyond the virgin crop. Interline applications of 5 tons of molasses per arpent to ratoons already provided with enough potassium in their leaves do not show any sugar response (—0.030 tons sugar/arpent in the first year of application and —0.050 in the second) according to results obtained in four field trials.

In soils deficient in potassium, molasses which contain from 3 to 7% K_2O compare well with commercial potassic fertilizers as far as sugar production is concerned. However, the application of molasses to cane fields is not an economic proposition in a world where this factory residue, rich in sugars and other valuable constituents, is finding many remunerative industrial uses.

The general conclusion is that sufficient proof has been given to allow for the statement that farmyard manure, factory scums, and molasses produce no profitable sugar responses outside those attributed to their nitrogen, phosphorus and potassium contents.

The whole problem of cane fertilization therefore remains in the proper use of commercial fertilizers with a view to reaching the optimum nutritional levels in the cane, as revealed by foliar diagnosis. The higher yields contributed by improved cane varieties when adequately fertilized produce sufficient organic residues in the field at harvest to maintain the humus content of the soil at the proper level.

C. Basalt Dust

The free soils of the super-humid zone of Mauritius have been formed as a result of intensive weathering of basalt. These soils fall into the humic ferruginous latosol group which is characterized by low nutrient status. As less weathered basalt derived soils are fertile, d'Hotman (1947) suggested that the application of massive dressings of crushed basalt to the mature soils would rejuvenate them and increase their fertility. Previous experimental results were available from Germany which showed that crushed basalt was beneficial to plant growth and d'Hotman assumed the effect to be nutritional.

Experiments were therefore laid down in which cane grown on plots receiving 36 tons of basalt powder per acre in the furrow at planting was compared with the control. The results showed that increases in cane yields obtained by the basalt treatment were of the order of 12% and that the improvement was almost permanent.

Foliar analyses showed that only calcium and silica uptake were increased by the basalt treatment, although it was still felt that the effects of the basalt were nutritional.

After these experiments a trial was laid down by the Sugar Research Station (1952), in which plots receiving 0, 90 and 180 tons of basalt per acre were compared. The plots were well supplied with phosphate, potash and nitrogen and therefore major fertility effects were eliminated. The results showed that the 90 ton treatment gave 10% yield increase whilst the 180 ton treatment gave almost a 20% increase and again it was shown that the improvement was long lasting.

Foliar analyses, as was to be expected showed no major nutritional effect and moreover the original observations on calcium uptake were not confirmed.

In 1955 a trial was laid down by the S.I.R.I at Rose Belle. Heavy fertilizer treatment was given to all plots and basalt was applied at the rates of 0, 45, 90 and 180 tons per acre. The results are given in table 31.

Table 31. Rose Belle (Cascade) Trial.
(Tons of cane/arpent).

Tons of crushed basalt applied at planting	0	45	90	180
Virgins	15.5	23.1	27.9	31.1
1st Ratoon	39.2	44.8	47.1	49.6
2nd Ratoon	32.7	36.9	37.9	36.5
Increase in 3 crops		+17.4	+25.5	+29.8

Foliar analyses again showed no difference in the uptake of major nutrients, and in addition, trace elements trials carried out on the same soil have given no response. The weight of the third leaf also remained unchanged, thus showing that the increase in yield was not due to better growth of individual canes, and therefore the number of canes, in other words the degree of tillering, must account for the difference in yields. Shoots counts confirmed that the heavy dressings of basalt give 10% more shoots than the control plots.

From the data obtained therefore, it is reasonable to suppose that the effect of basalt is of a physical nature allowing probably a better aeration of the roots and optimum conditions for the development of the stool.

It is somewhat ironical that the only yield increase due to a non-nutrient soil treatment on record in Mauritius should be with an inert inorganic material.

The conclusions made imply that the physical conditions of some of our latosotls are not optimal for cane growth and the best method for correcting this fault must be considered.

Deep cultivation with the addition of heavy dressings of phosphate to counteract the subsoil dilution effect will almost certainly prove beneficial, in that the cultivation will provide the necessary soil conditions for optimum growth. Massive dressings of organic materials worked into the soil at the same time should help to stabilize the structure if this is inherently weak.

D. Lime and Sand.

The practice of applying large dressings, 5 tons or more per acre, of lime and sand on cane land has long since disappeared, nevertheless in view of the importance of calcium and magnesium as plant nutrients and the known effects of lime on structure, pH and on the availability of various heavy metal nutrients, studies on these materials continue.

The only positive effect on yield following lime application so far described locally, comes from the work of Feillafé (1954) in which a large yield response to small applications on the gravelly soils of the superhumid zone was obtained.

As has already been pointed out the effects of lime treatment are manifold and the reason for this response has not yet been elucidated.

Current practice of applying one ton of guano phosphate at planting is equivalent in terms of calcium to a lime application of half a ton, and it is unlikely therefore that calcium as a nutrient will ever be a limiting factor to cane growth in Mauritius, and moreover those soils which may have been low in calcium will now be amply supplied. In view of the low pHs of some of the soils of the super-humid zone and the continual use of sulphate of ammonia, small dressings of one to two tons of lime could reasonably be applied. The value of sand depends upon its fineness of grinding, and as local samples are coarse, it would be preferable to use lime rather than this material.

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2. DESCRIPT.ON OF THE PALMYRE IRRIGATION EXPERIMENT.

G. MAZERY.

The object of this experiment is to compare under dry conditions, spray irrigation with surface irrigation on gravelly and free soils from the agronomic and economic standpoints and to determine the relative merits of the 100% portable and semipermanent spraying systems.

Layout. The experiment comprises approximately 56 arpents of gravelly soil («*Mapou*» series) and 65 arpents of free soils, («*Richelieu*» series). In each case half the area is irrigated by spray and half along the furrow by the surface method, as practiced in Mauritius. The layout of experimental fields is shown in fig. 38. For each method of irrigation comparable fields were selected concerning cane varieties and crop cycle. The experiment as originally planned will last for three years.

Fig. 37. Ground water survey in the Pamplemousses area by Schlumberger electrical resistance method.

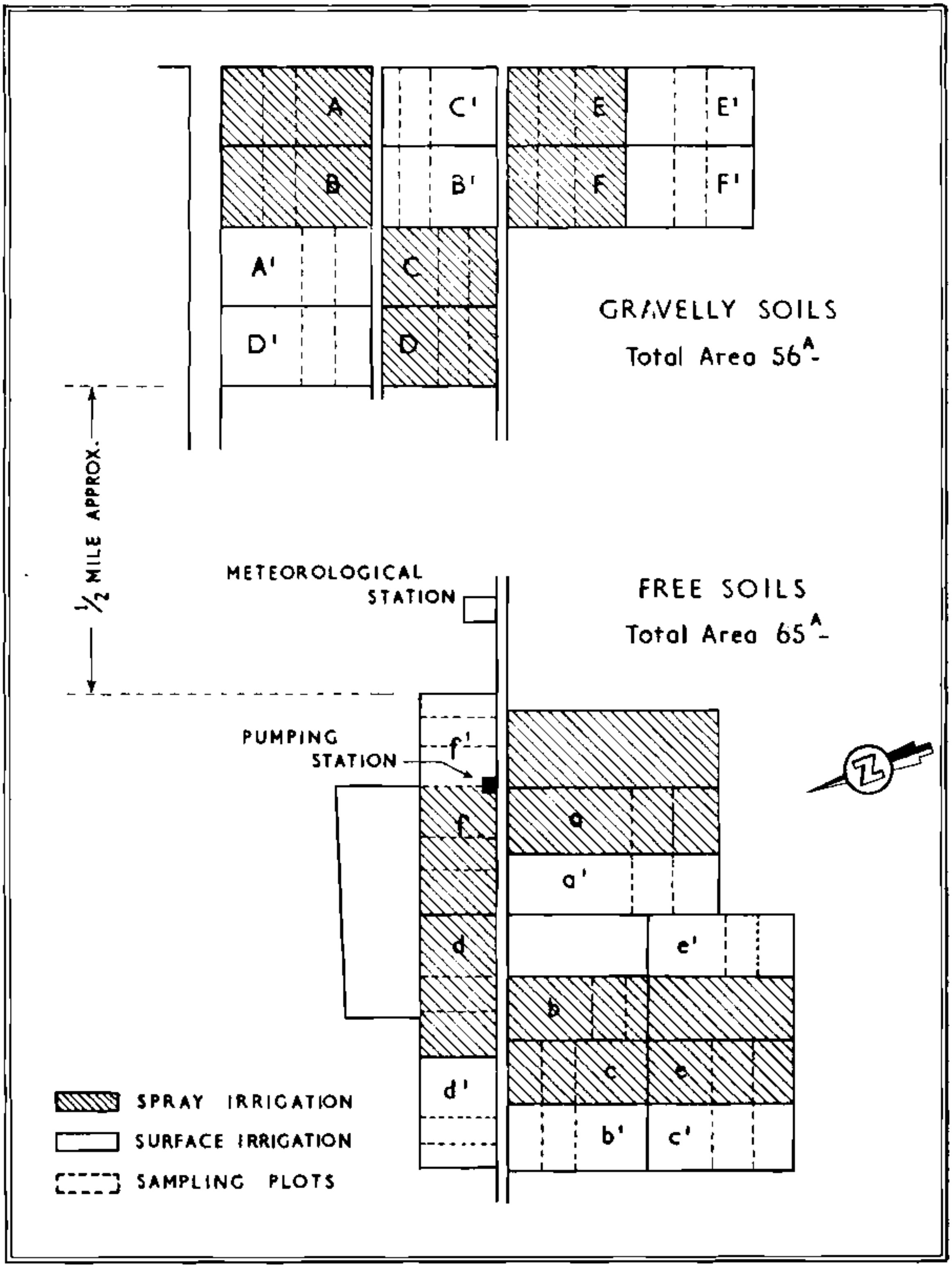

Fig. 38. Plan of irrigation experiment at Palmyre.

Equipment. A 100% portable equipment is used on the gravelly soils and a semi-permanent installation on the free soils.

The mobile equipment includes a 60 H.P. Diesel pumping unit of 500 g.p.m. capacity (1.33 cu. ft. p. sec.), 2700 ft quick coupling aluminium piping 6" and 4" diameter with fittings and ten «Rainspray» sprinklers of 125 g.p.m. capacity (0.33 cu. ft. p. sec.).

The semi-permanent installation includes, in addition to the sprinklers and part of the piping indicated above, one 100 H.P. Diesel pumping unit of 750 g.p.m. capacity (2 cu. ft. p. sec.) and about 3600 ft. of underground asbestos cement piping.

Both pumping units are mobile and can be used for either scheme if necessary.

A tractor and a specially constructed trailer are used for the displacement of the mobile equipment from one block to another.

A pressure recorder and a number of pressure gauges are used for the control of the water distribution.

Soil moisture in the sprayed plots is determined by plaster cells of a model already described*, and Bouyoucos moisture meter.

A small meteorological station provides data on local climatic factors which influence plant growth. Instruments include: recording rain gauge, evaporimeters (standard American and standard British types) maximum and minimum thermometers recording thermohygrograph and sunshine recorder.

Operation. Surface irrigation is carried out along standard estate practice prevailing in the district i.e. one irrigation approximately every 23 days corresponding to 6" for free soils and 22" for gravelly soils.

Frequency of spray irrigation and volume of water used in the sprayed fields are determined according to the level of soil moisture as indicated by plaster cells. Normal precipitations correspond to 3" per irrigation on both types of soil, water being delivered at a maximum rate of 0.7" per hour.

Experimental data. An area of approximately half an acre is clearly marked out in each field for sampling and growth measurements. Weight of cane produced and sucrose content of each experimental field will be recorded at harvest as from the 1959 season. Meanwhile, the following data are recorded at weekly intervals on 20 cane stalks taken at random in each of the 24 sampling plots:

(a) *Elongation* from ground level to first visible dewlap.

(b) *Weight and moisture* of leaf sheaths from leaves Nos 3,4,5,6, punches from corresponding leaf blades being kept for N content determinations.

(c) *Reducing sugars* and moisture are determined on 8th to 10th internodes.

In addition the rate of decomposition of trash is studied at intervals of two to three months in random samples 20' long by 5' wide in the experimental fields.

A log book kept by the overseer in charge gives all details relevent to frequency of irrigation and amount of water used.

It is hoped that the data obtained over a sufficiently long period of time will enable a full analysis to be made of the evolution of growth and maturity under different irrigation conditions. This coupled with yield of sugar per acre will enable results to be translated in economic terms.

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* *Bull. 18, Mauritius Sugar Industry Research Institute (1957) p. 234.*

3. SUGAR YIELDS IN RELATION TO VARIOUS CLIMATIC FACTORS.

PIERRE HALAIS

Ten years systematic collection of meteorological data, from 1949 to 1958, by the Government Meteorological Service now allow for their interpretation to be attempted in terms of sugar production.

The rainfall data are regularly collected at 18 key stations fully representative of the five sugar sectors of the island. Temperature and wind recordings are made at three main Stations: Pamplemousses Observatory representing the North, Vacoas Meteorological Head quarters the Centre, and Plaisance Air Field the South.

Two new anemometers have been functioning since 1957 through funds made available by the M.S.I.R.I. and are being run by the Sugar Estates under the general supervision of the Observatory Department at Médine S.E. representing the West and FUEL the East.

The wind data used in the following interpretation are averages of the highest hourly speed recorded in one hour during the maturation period of four months, July, August, September and October. The sum of monthly rainfall excesses E and the sum of monthly rainfall deficits D have been calculated in the usual way as can be seen in table VII of the Appendix.

Sugar Manufactured % Cane. The ten year period 1949 - 1958 under review may be subdivided into two contrasting five years groups for the maturation period from July to October, (table 32).

Out of a series of all possible correlation coefficients «r» between the six different variables the most pertinent are reproduced below for the sugar plantations of the island as a whole, (table 33).

Table 32.

	Sugar manuf. % cane	Excess rainfall inches	Max. wind speed miles/hr.	Min. temp. °C	Max. temp. °C	Daily range temp. °C
Five favourable years ...	12.63	0.43	17.4	16.3	24.4	8.1
Ten year averages ...	12.05	2.56	18.6	16.6	24.3	7.7
Five unfavourable years	11.47	4.70	19.8	16.7	24.1	7.4
Extremes	12.95	0.00	15	16.2	25.0	8.6
	11.03	6.25	22	17.3	23.6	6.9

Table 33. Maturation period: July - October 1949 - 1958.

	Sugar manufactured % Cane	Excess rainfall E	Max. wind speed
Sugar manufactured % cane		— 0.894**	— 0.862**
Excess rainfall E ...	— 0.894**		0.632*
Max. wind speed ...	— 0.862**	0.632*	
Daily range temp. ...	0.772**	— 0.663*	— 0.743*
Min. temp.	— 0.660*	0.601	0.411
Max. temp.	0.542	0.438	— 0.684*

* "r" significant to 0.05 level
** " " 0.01 "

As proved previously the highest correlation observed is with excess rainfall E which thus accounts for 80% of the annual fluctuation in average sugar manufactured % cane. It is also clearly shown that high trade wind velocity encountered during the July-October maturation period exercises a dominating influence on sugar content of the harvested canes as such winds bring clouds which eventually fall as rain, resulting in high night minimum temperatures low day maximum temperatures and consequently low daily temperature ranges. Probably the best expression of temperature concerning cane maturation is integrated in daily range.

Tons of cane per arpent. The meteorological data and cane yields for the sugar plantations of the island pertain to a nine year period 1949 - 1957, the figures for 1958 having been discarded on account of the disturbing influence of two mild cylones which occurred as usual during the vegetation period.

The five favourable years, nine year averages, four unfavourable years and the extremes of the five variables are given below: (table 34.)

Once again the overhelming influence of rainfall deficits D during the vegetation period is being proved, accounting for 70% of the annual fluctuations in cane production per unit area.

It appears from the above correlation coefficient that under climatic conditions prevailing in Mauritius the differences in temperature from year to year for the period November-June are not sufficiently large to bring about marked changes in cane yields at harvest, although variations during short periods undoubtedly influence cane growth in a transitory way.

Conclusions. For explaining the year-to-year fluctuations in sugar production, rainfall excesses and deficits respectively for the maturation (July - October) and vegetation (November - June) periods constitute the best meteorological information to be used when no cyclonic winds have caused damage to cane growth.

Daily range of temperature may provide

Table 34.

	Tons cane/arp.	Deficit rainfall D	Min. temp. °C	Max. temp. °C	Daily range temp. °C
Five favourable years ...	26.5	10.1	20.0	27.5	7.5
Nine year averages ...	25.6	11.4	20.1	27.5	7.5
Four unfavourable years	24.4	13.2	20.2	27.6	7.4
Extremes	27.8	8.4	19.5	27.1	7.0
	23.3	17.2	20.6	27.8	8.2

A selection of correlation coefficients calculated for the five variables from data obtained during the vegetation period November to June 1949 - 1957 is as follows :

Vegetation Period; November - June 1949 to 1957.

	Tons cane/arp.	Rain Deficit
Tons cane/arp ...		— 0.834**
Rain deficits	— 0.843**	
Min. temp.	— 0.192	— 0.007
Max. temp.	— 0.031	0.213
Daily range temp.	— 0.390	0.134

* "r" significant to 00.1 level.

useful data in addition to the sum of monthly rainfall excesses during the maturation period.

Knowledge of maximum wind speed recorded during one hour is valuable during the the passage of cyclones, but the general interpretation in terms of sugar production is very complex as the rainfall conditions prior to and following a cyclone may alter the magnitude of the damage to a considerable extent. At its best, information on wind speed may serve a valuable purpose as an index of comparative damage for the sugar sectors or estates in connection with the same cylcone as rainfall conditions are highly correlated for the different sectors except for sheltered western regions.

It should be pointed out that the relationships obtained so far between climatic factors and sugar yields refer exclusively to year-to-year fluctuations observed in the same location. More knowledge is now needed on the influence exercised by the different climatic factors in specific regions of the island.

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4. RESISTANCE OF CANE VARIETIES TO CYCLONES

A. de SORNAY & P. HALAIS

After a lull of twelve years, Mauritius was struck by two cyclones in March and April 1958. These cyclones were fortunately of short duration and there was little change in the wind direction. Data of wind speed kindly communicated by the Director of Observatory are given in table 35.

Table 35. Wind speed (miles per hour).

		Cyclone 18th-19th March		Cyclone 7th-9th April	
Sector	Locality	Highest mean speed over one hour	In gusts	Highest mean speed over one hour	In gusts
West	Médine	34	73	37	80
North	Pamplemousses	29	55	27	57
East	Union Flacq	22	54	20*	57*
South	Plaisance	35	68	28	55
Centre	Vacoas	. 1	60	31	62

* *Estimated.*

Surveys. Surveys of the damage done to sugar cane throughout the island were carried out in post-release trials and in estate fields in the vicinity of Dines anemometers located in the North, South, East and West sectors of the island.

The main objects of the surveys were to assess the relative resistance to cyclone of the varieties under cultivation and to obtain preliminary data of the possible relationship between wind velocity and magnitude of damage.

Sound and broken canes were counted in ten linear feet of row per plot of post-release trials, and in eight to ten plots of the same size in estate fields. Simultaneously, observations were made on the general condition of the cane in a small area circumscribing the plots, namely, lodging, leaf breakage and shredding according to adopted arbitrary scales.

The surveys showed that the varieties studied could be classified in decreasing order of resistance as follows:

Resistant: B.3337, M.147/44, B.37172

Moderately resistant: M.31/45, M.134/32, B.34104.

Susceptible: B.37161, Ebène 1/37.

At the top of the scale of resistance is B.3337 which withstood the blow remarkably well, remaining erect even in high wind. At the other extreme can be placed the variety Ebène 1/37 which showed great vulnerability to wind because of its broad leaves and its long brittle stalks. Frequent borer holes in the stalk increased its susceptibility to wind.

There was a good correlation between the data collected in experimental plots and regular fields, except for Ebène 1/37 which suffered less in post-release trials, a fact which suggests that this variety had received some protection from the neighbouring plots of the resistant varieties.

The results of the surveys, although not absolute, were used to evaluate losses in cane tonnage sustained by the 1958 crop.

Post-Release trials. The actual results of these trials in ratoons for two cyclone-free years (1956 and 1957) and a cyclone year (1958) are given in table 36. B.3337 was taken as control for this special purpose as it proved to be highly wind resistant.

The above data are generally in good agreement with those of the surveys, and it should be stressed that, following the cyclones, there has been a considerable reduction in the sugar content of Ebène 1/37 at harvest.

The results obtained with this variety emphasize the need for interplanting it with B.3337, a variety also adapted to superhumid conditions in order to protect it as far as possible from cyclone damage. It is therefore suggested that B.3337 be included in future plantations of Ebène 1/37 in the proportion of 20% of the area: one line B.3337 alternating with four lines of Ebène 1/37.

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Table 36. Cyclone effects in terms of tons C.C.S. p.a. and C.C.S. % cane on three varieties compared to B.3337 in ratoons at different locations.

Variety	Year	Beau Vallon Bon Espoir (suited to B.37172)		Mount Fuel (suited to Ebène 1/37 & B.37172)		Eau Bleue Bonne Veine (suited to Ebène 1/37)	
		C.C.S. p.a.	C.C.S. % cane	C.C.S. p.a.	C.C.S. % cane	C.C.S. p.a.	C.C.S. % cane
M.134/32 ...	... 1956, 1957	—0.65	+0.63	—0.62	+1.21	—0.66	+1.13
	1958	—0.87	+0.34	—0.73	+0.72	—0.78	+0.51
Cyclone effect	...	**—0.22**	**—0.11**	**—0.11**	**—0.49**	**—0.12**	**—0.62**
B.37172 ...	... 1956, 1957	+0.02	+0.81	—0.15	+0.75	...	...
	1958	+0.22	+0.58	—0.26	+0.34	...	...
Cyclone effect	...	**+0.20**	**—0.23**	**—0.11**	**—0.41**	...	...
Ebène 1/37	... 1956, 1957	...	...	—0.03	+1.49	+0.40	+1.78
	1958			—0.22	+0.64	—0.18	+0.07
Cyclone effect	...	...	...	**—0.19**	**—0.85**	**—0.58**	**—1.7.**

EFFECT OF 2,4-D ON SUCROSE CONTENT OF CANE

E. ROCHECOUSTE

FOLIAR spray of 2,4-D as a means of increasing sucrose content has during recent years engaged the attention of research workers in different sugar countries. Beauchamp (1950) reported from experiments in Cuba that sodium 2,4-D at low concentrations increases sucrose content the first ten days after application was made. Loustalot et al (1950) reported that spraying sugar cane in Puerto Rico had no significant effect in increasing sugar content. Haskow (1954) working in Australia obtained no response to 2,4-D treatment in his experiments. Chacravarti et al (1956) in India on the other hand obtained with a 50 p.p.m. solution of 2,4-D an increase in sugar content from 0.33 to 0.80 unit, the effect being perceptible as early as two days after spraying and persisted even after a lapse of 31 days. The technique of 2,4-D spray is now operative in India (Ind. Jour.Sug.Res. & Dev. 1958) where it is claimed that an average benefit of 0.4 unit in sugar recovery is obtained. In Tanganyika it is also being used at Arusha Chini Estate, where Bjorking (1958) reports that sodium 2,4-D at the rate of 2 ounces per acre brings about an increase in sugar content of the order of 0.5 to 1 percent.

In view of the conflicting results mentioned above, two experiments were carried out during the years 1957 - 1958 at Bénarès, a sugar estate where sucrose content is usually below the island average. A variety with an erect habit B.37172 was selected in order to facilitate the work of the spraying unit. Spraying was made with a power sprayer to obtain a better distribution of the chemical.

The layout of these experiments consisted of a randomized block with four replications. The design was such that each replication was flanked on either side by a non-experimental block in order to minimize spray drift. Each plot consisted of ten cane rows of 40 feet long. The two middle rows only were sprayed thus leaving a blanket of 8 unsprayed rows between the sprayed rows.

The 1957 experiment was commenced in July, the beginning of the harvest season, and was completed during the first week of September. Sodium 2,4-D was sprayed at 50 and 200 p.p.m. In the 1958 trial spraying was begun and completed in July and the synthetic plant growth regulator was used at 50, 100 and 150 p.p.m. All sprayings were made at weekly intervals.

Data obtained from these trials are presented in Table 37 from which it will be observed that no increase in sucrose content was recorded. Contrary to expectations, a decrease was obtained in treatments 50 p.p.m. and 150 p.p.m. at three and two weeks after spraying respectively. No practical information can be derived from these experiments and in order to assess the economic possibilities of 2,4-D, foliar spray, a greater number of experiments would be required.

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Table 37. Effects of 2,4-D on Sucrose Content

1957 Treatments			C.C.S. % Cane	1958 Treatments			C.C.S. % Cane
Control		...	14.55	Control		...	14.22
50 p.p.m.	1st week after spraying	...	14.48	50 p.p.m.	1st week after spraying		14.66
,,	2nd ,, ,, ,,	...	14.24	,,	2nd ,, ,, ,,	...	14.08
,,	3rd ,, ,, ,,	...	14.62	,,	3rd ,, ,, ,,	...	13.04*
,,	4th ,, ,, ,,	...	13.72	,,	4th ,, ,, ,,	...	14.06
,,	5th ,, ,, ,,	...	14.29	100 ,,	1st ,, ,, ,,	...	14.04
,,	6th ,, ,, ,,	...	14.65	,, ,,	2nd ,, ,, ,,	...	14.20
200 ,,	1st ,, ,, ,,	...	14.19	,, ,,	3rd ,, ,, ,,	...	13.70
,, ,,	2nd ,, ,, ,,	...	13.93	,, ,,	4th ,, ,, ,,	...	13.79
,, ,,	3rd ,, ,, ,,	...	14.23	150 ,,	1st ,, ,, ,,	...	14.28
,, ,,	4th ,, ,, ,,	...	13.96	,, ,,	2nd ,, ,, ,,	...	13.09*
,, ,,	5th ,, ,, ,,	...	14.39	,, ,,	3rd ,, ,, ,,	...	13.85
,, ,,	6th ,, ,, ,,	...	14.52	,, ,,	4th ,, ,, ,,	...	14.20

* Significant at 5% level.

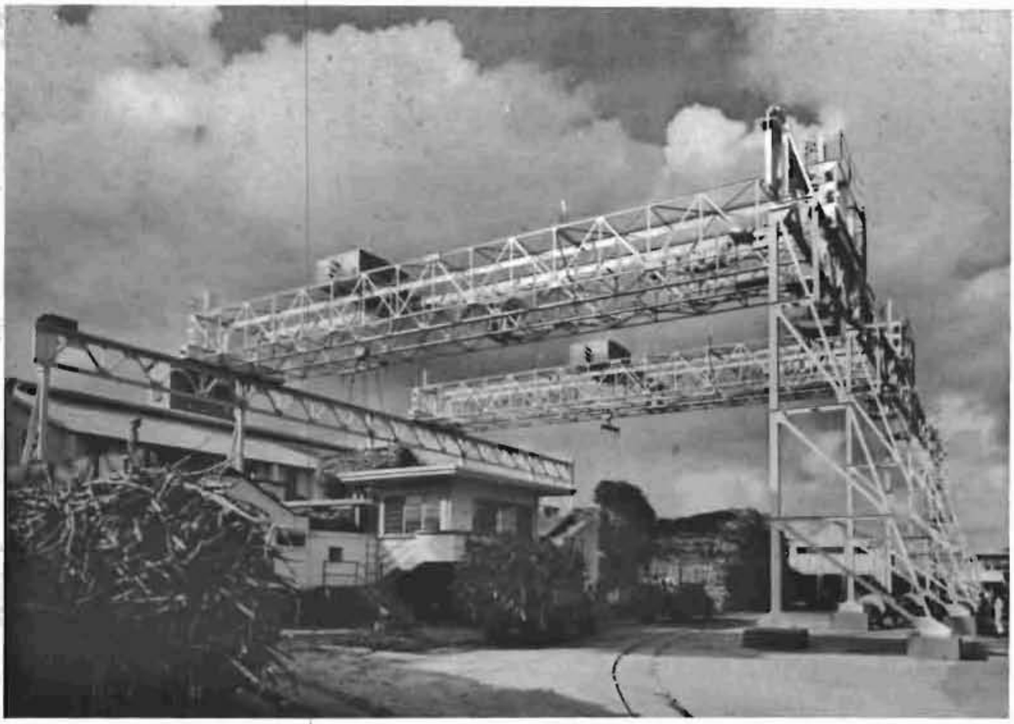

Fig. 39. Overhead travelling crane, at FUEL factory (*Phot. P. Halbwachs*).

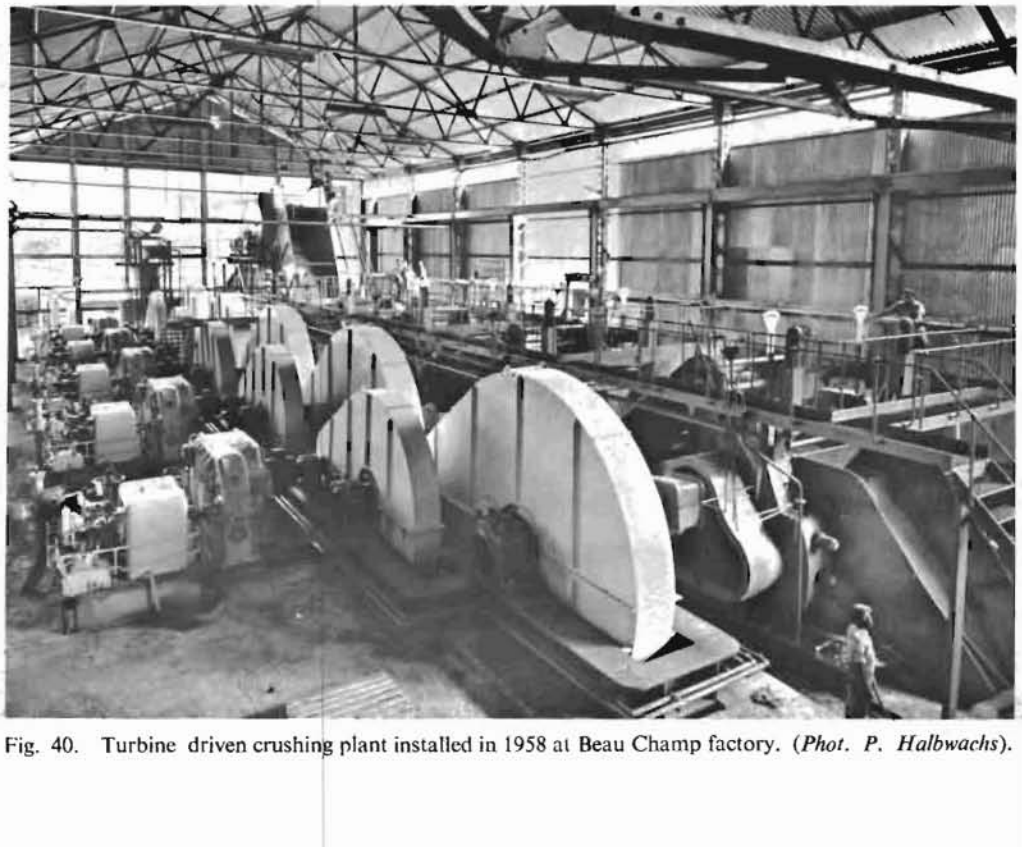

Fig. 40. Turbine driven crushing plant installed in 1958 at Beau Champ factory. (*Phot. P. Halbwachs*).

Fig. 41. Automatic control of lateral cane carriers at FUEL factory.

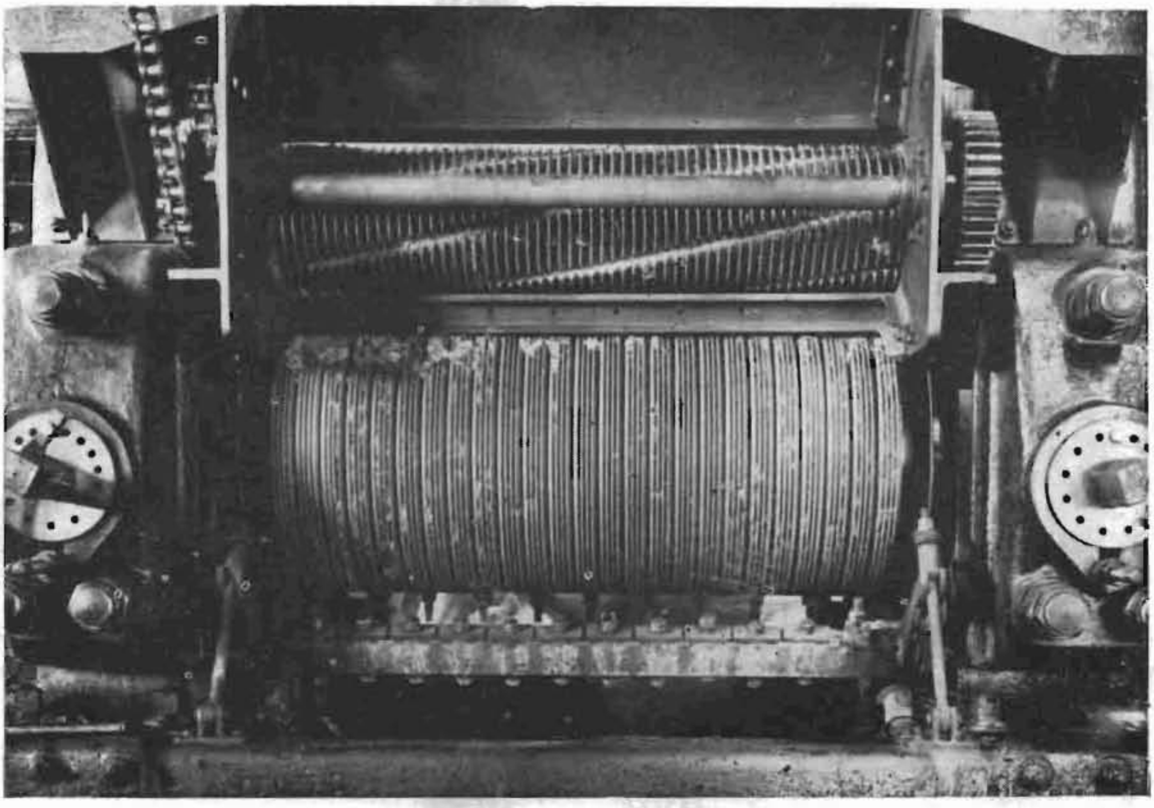

Fig. 42. Underfeed pressure feeder at Mon Désert factory.

SUGAR MANUFACTURE

1. SYNOPSIS OF CHEMICAL CONTROL DATA 1958 CROP.

J. D. de R. de SAINT ANTOINE

A SYNOPSIS of chemical control figures is given in Table XVII of the Appendix, from which it will be noted that with the closing down of Trianon only 25 factories were in operation in 1958, as against 26 in 1957.

Cane and Sugar Production. Climatic conditions had been such in the late 1957 and early 1958 periods that a new production record would probably have been set in 1958 had it not been for the mid-March and early April cyclones, as a result of which sugar production amounted to only 525, 654 metric tons, or about 47,000 tons less than the 1956 record production.

Table 38 gives the cane and sugar productions of the island for the past three years.

Table 38. Cane and sugar production 1956-1958, thousand metric tons.

	1956	1957	1958
Cane Crushed	4,421.2	4,343.8	4,329.0
Sugar Produced	572.5	561.6	525.7

Cane Quality. As a result of the March and April cyclones, cane quality was poor, sucrose per cent cane averaging 13.77 as against 14.59 in 1957 and 14.62 in 1956. The eastern sector of the island, with an average sucrose content of only 12.74 per cent was the most affected, as shown in table 39.

Table 39. Sucrose per cent cane, 1956 - 1958.

	Island	West	North	East	South	Centre
1956	14.26	15.06	15.19	14.51	14.20	14.35
1957	14.59	14.87	15.53	14.33	14.16	14.33
1958	13.77	13.99	14.53	12.74	13.25	13.62

Also, as a result of damage caused by cyclones, juice purities were appreciably lower in 1958 than in the previous years (table 40).

Table 40. Juice purity and fibre per cent cane, 1956 - 1958.

	Gravity purity 1st expressed juice	Fibre per cent cane
1956	89.9	11.67
1957	90.1	11.86
1958	89.3	12.21

Fibre content figures are also included in the above table from which it may be seen that fibre per cent cane has been steadily increasing during the past three years. This is the net result of an increasing cultivation of Barbados and new Mauritius varieties (M.147/44 and M.31/45 in particular) of high fibre content. The percentage of cane varieties harvested on factory lands during the past three years is given in table 41.

Table 41. Percentage of cane varieties harvested on factory lands, 1956 - 1958.

	1956	1957	1958
M.134/32	77.3	59.6	46.0
Ebène 1/37	12.2	21.2	24.7
M.147/44, M.31/45, M.112/34	4.5	7.2	15.1
B.3337, B.34104, B.37161, B.37172 ...	5.5	10.9	12.6
Other varieties ...	0.5	1.1	1.6

Milling. A synopsis of crushing data and milling figures is given in table 42.

Table 42. Milling Results 1956 - 1958.

	1956	1957	1958
No. of factories ...	26	26	25
No. of crushing days...	109	105	108
No. of crushing hours/day	20.87	20.89	19.50
Hours of stoppages/day* ...	0.97	0.80	0.89
Time efficiency ...	95.6	96.3	95.6
Tons cane/hour ...	74.7	76.1	82.5
Tons fibre/hour ...	8.72	9.03	10.07
Imbibition % fibre ...	222	231	217
Sucrose % bagasse ...	2.63	2.63	2.50
Moisture % bagasse ...	47.8	47.5	48.2
Reduced mill extraction	95.4	95.3	95.3
Extraction ratio ...	36.8	37.1	38.5

It will be noted from the above table that the average number of crushing hours per day has amounted to only 19.50 this crop as against 20.87 in 1956 and 20.89 in 1957. The main reasons for this reduction are:

(a) Smaller weight per unit volume of the raw material.

(b) Lodging of the cane in many fields.

(c) Greater number of rainy days during the crop period in 1958, as indicated in table 43 which gives the total rainfall in inches for the various sectors of the island for the period 16th of July to 30th November.

Table 43. Total rainfall: inches, 16/7 - 30/11.

	West	North	East	South	Centre
1956	3.31	6.74	12.64	7.89	11.47
1957	4.04	5.65	18.38	11.64	13.45
1958	4.79	9.33	20.91	20.81	15.91

In spite of these explanations, one would have thought that with an ever increasing population cane delivery to the mills would cease to be a problem. Such, unfortunately, does not appear to be the case, and it is pertinent to point out that if the average number of crushing hours per day had been 23.0, say, instead of 19.5, the average duration of the crop would have been only 92 days instead of 108. That, of course, would have meant bagging more sugar, cutting down the running expenses and deriving full benefit from the capital expenditure incurred in increasing the capacity of factories.

Although milling efficiency has not, on the average, varied much during the past three years, yet there has been a slight deterioration of the work, as indicated by the extraction ratio which has increased from 36.8 in 1956 to 38.5 in 1958. Further, whilst in 1957 only four factories had reduced mill extractions below 95 per cent, the number climbed up to seven in 1958. However, it is anticipated that better results will be obtained in 1959, mainly for the following reasons:

(a) With only six 72 inch mills, Union Flacq, the biggest factory in the island, was able to crush as much as 191.5 metric tons of cane per hour on the average, and yet obtain a reduced mill extraction of 94.6. That figure should go up a few tenths of a degree next year with the installation of a seventh mill.

(b) As a result of the closing down of Trianon sugar factory, Réunion crushed 79.6 tons of cane/hour this crop as against 51.1 in 1957. The centralization was effected in a few months only, during the intercrop — a courageous effort indeed. Although the result achieved is quite praise worthy, yet there is still room for improvement and there is no doubt that a higher reduced mill extraction than that of 94.5 recorded this crop will be achieved in 1959.

(c) The reduced mill extraction of Beau Vallon factory which was 95.2 in 1957 dropped to 94.4 in 1958. Riche en Eau factory on the other hand, obtained 95.8 this crop. With the closing down of Beau Vallon and centralization at Riche en Eau in 1959, the overall situation should improve.

(d) Factories where shredders were in operation for the first time in 1958, and whose milling efficiency has not been better than that of the previous year, will no doubt benefit from the experience gained this crop with their new equipment.

* *Exclusive of stoppages due to shortage of cane.*

Once more Mon Loisir recorded the best milling efficiency of the island, averaging 96.3 reduced mill extraction. A close second is Beau Champ which averaged 96.1 with its new milling train composed of two sets of knives and five 35″ × 72″ mills each driven independently by a 450 H.P. steam turbine (see fig. 40) as against 95.1 with its old milling train in 1957.

In addition to Mon Loisir where a Gruendler shredder has been in operation since 1957, four other factories, Constance, Réunion, Bel Ombre and St. Félix were equipped with shredders for the 1958 crop. Table 44 shows the results obtained in each case. Results for Réunion are not included, as in addition to the shredder, the whole crushing plant was replaced.

in 1957 as it had been with the feed hopper in 1956. Also, for some eight weeks prior to the end of the 1958 crop the second set of knives was put back into service. The net result was a further increase in reduced mill extraction which averaged 96.3 in 1958, whilst it amounted to 96.6 for the latter part of the crop when the two sets of knives were in service.

It must be pointed out, however, that the amount of bagacillo increased so considerably, when the two sets of knives were used, that it was no longer necessary to add any to the muds for filtration; that chokeless pumps had to be used for imbibition; and that for the 1959 crop the juice strainer of 10 mesh cloth will have to be replaced by 20 mesh vibrating screens.

Table 44. Milling Work of Factories Equipped with Shredders.

	Mon Loisir				Constance		Bel Ombre		St. Félix	
	1956	1957	1958*	1958+	1957	1958	1957	1958	1957	1958
Cane knives	2 sets	1 set	—*	2 sets	2 sets	2 sets	2 sets	1 set	2 sets	1 set
2 R crusher	—	—	—	—	1	Nil	1	Nil	1	Nil
Mills	5	5	5	5	4	4	4	4	3	3
Sucrose % cane	15.10	15.43	14.87	15.37	14.71	14.12	14.76	13.27	14.25	13.26
Fibre % cane	11.90	12.16	12.38	12.56	12.72	13.17	12.72	12.84	11.83	12.14
Tons fibre/hour	14.34	14.66	14.15	—	10.86	11.05	7.17	7.24	5.19	5.54
Imbibition % fibre	275	285	293	—	254	240	198	159	189	240
Sucrose % bagasse	2.36	2.33	2.12	2.07	2.63	2.52	2.73	2.72	3.50	2.92
Moisture % bagasse ...	48.7	48.9	49.8	—	47.4	48.0	46.7	47.8	46.0	46.8
Reduced mill extraction ...	95.9	96.1	96.3	96.6	95.5	95.5	95.3	94.7	93.7	94.6
Extraction ratio	32.8	31.3	29.8	27.2	36.1	36.4	37.4	42.3	49.9	43.2

* One set during the first six weeks and two sets during the remaining eight weeks.
\+ Applies only to the 8 week period when 2 sets of knives were used.

When a Gruendler shredder was first installed at Mon Loisir in 1957 two modifications were brought to the milling tandem following the recommendations of the shredder manufacturers: the second set of knives was discarded and the drag-type intermediate carrier and feed hopper of the first mill was replaced by an apron carrier. The reduced mill extraction averaged 96.1 as against 95.9 for the previous crop.

Prior to the 1958 crop, however, it was decided to resort again to a drag carrier and feed hopper for the 1st mill as it was felt that the feeding of this mill, and hence its extraction, had not been as good with the apron carrier

In spite of an increase of about 7 per cent in the tonnage of fibre crushed per hour this crop, St. Félix factory obtained a reduced mill extraction of 94.6 with a shredder and three mills as against 93.7 with the same mills plus a two-roller crusher in 1957. It must be pointed out, however, that imbibition per cent fibre which was only 189 last year was increased to 240 this crop.

At Bel Ombre, on the other hand, imbibition per cent fibre dropped from 198 in 1957 to 159 this crop. Reduced mill extraction also dropped from 95.3 to 94.7, not only as a result of the reduced amount of imbibition water used, but for several other reasons, the most important of which are:

(a) Harvesting having started late, production rate had to be maintained at a high level at the expense of efficiency.

(b) Insufficient juice drainage capacity of the mill front and rear rollers, especially those of the 1st mill whose work was facilitated in 1957 by the presence of a two-roller crusher.

(c) Mechanical difficulties with the trash plates of the two last mills.

At Constance the same average reduced mill extraction as in 1957, namely 95.5, was obtained this crop. This may be attributed to the fact that a smaller amount of imbibition water was used and that during the first few weeks relatively low mill extractions were registered until the mill settings had been adjusted to cope with shredded feed material. In this connection it should be emphasized that for the same tandem, the mill settings and work ratios that apply to shredded cane are quite different from those applying to unshredded feed. As mentioned earlier, there is no doubt that Bel Ombre and Constance will benefit from the experience gained this crop to increase their milling efficiency next year.

Before leaving the subject of milling, it is interesting to mention the results obtained at St. Antoine factory where the five feet, 50° chutes to the 2nd, 3rd and 4th mills were replaced by 8.5 feet, 52° ones prior to the crop. Whilst the same mill settings as in 1957 were used, there resulted an increase of about 8 per cent in capacity expressed in tons of fibre per hour, although the mill speed was reduced by 12 per cent. The fact that a large number of chokes were experienced at the 5th mill, whose chute had not been modified, shows that the improvement was not due to some other reason.

Juice Straining, Weighing and Liming. With the adoption of modern methods of cane preparation and milling, the amount of bagacillo that finds its way into the juices has increased to such an extent in some factories that it has become desirable to replace the drag type screens with stationary perforated plates by vibrating screens. Riche en Eau has been the first factory to install such screens and several other factories will doubtless follow suit in view of the excellent results obtained and of the numerous advantages of vibrating screens over the drag type ones, namely: better sanitation, low maintenance cost and power consumption. Further, vibrating screens take no floor space and, by retaining a much higher proportion of bagacillo, facilitate clarification and yield sugars of better keeping qualities and filtrability. Finally, it should be stressed that all the bagacillo that finds its way into the mixed juice is weighed as mixed juice and leads to a higher sucrose per cent cane figure than if no bagacillo were present.

In 1957 Union Flacq factory was equipped with a small Servo Duplex Weigher manufactured by N. V. Servo-Balans, Holland, for molasses weighing, and this crop a bigger scale of the same make was installed for juice weighing. Beau Champ and St. Antoine factories were also equipped with Servo-Balans scales for juice weighing in 1958. In each case the new scale has proved fully satisfactory. However the cover plates of the receiving tank have had to be removed to facilitate cleaning, and the oil of the hydraulic system, which was too thin for our tropical conditions, has had to be replaced by a thicker one. The new scale is fully automatic and has a totalizer which registers the actual difference in weight between the filled and emptied weigh hoppers; thus any juice not discharged is not totalized.

Two more factories, Médine and Mon Loisir, were equipped with pH controllers for the crop and it is expected that within a few years all the others will have automatic pH control.

One more factory, St. Antoine, has abandoned cold liming and adopted the process used at Beau Plan, Belle Vue, Labourdonnais and Solitude, which is as follows: the secondary juice is brought to boiling, mixed with the cold primary juice (temperature of mixture 50 -55°C) limed and brought again to boiling before being sent to the clarifier. It would appear that this liming process offers definite advantages over cold liming and it is contemplated to carry out a comparative study of the two processes next crop.

Filtration. Once more there has been a marked improvement in filtration this crop in comparison with previous years. As shown in table 45, two more factories were equipped with rotary vacuum filters in 1958; average pol. per cent cake dropped to 4.41 whilst cake per cent cane increased by 0.25 per cent, the net result being a small reduction in the amount of pol. lost in cake per cent cane.

(d) Insufficient boiling house capacity, especially in connection with C centrifugals whose number and top speed should be carefully considered.

With reference to (a) above, it is interesting to mention the results obtained at St. Antoine factory where a two massecuite process was successfully used throughout the crop. Table 46 below gives the cu. ft. of total massecuite obtained per ton Brix in mixed juice with this process as against that obtained the previous year when the three massecuite system was employed. Comparative figures are also given for two neighbouring factories that use the three massecuite system, Labourdonnais and Mon Loisir.

Table 45. Filtration Results 1956 - 1958.

	1956		1957		1958	
	Filter Presses	Rotary Filters	Filter Presses	Rotary Filters	Filter Presses	Rotary Filters
No. of factories	16	10	15	11	12	13
Pol. % cake	7.92	3.30	7.80	2.55	6.99	2.02
Pol. cake % average ...	6.14		5.57		4.41	
Cake % cane	2.15		2.12		2.37	
Pol. lost in cake % cane ...	0.13		0.09		0.08	

Boiling House. Boiling house work has on the avearge been very much the same this crop as it was last year. The weight of molasses per cent cane (at 95° Brix) has increased from 2.45 in 1957 to 2.59 in 1958 with the result that sucrose lost in molasses per cent cane has also increased slightly from 0.90 to 0.93.

Yet it is believed that the boiling house is the factory department where sucrose losses could be cut down the most appreciably and the most profitably. If, for instance, the avearge gravity purity of final molasses had been 36.0, say, instead of 37.9 this crop, additional income close to one million rupees would have accrued.

Since each factory has its own boiling house problems, it is impossible to generalize on the steps that should be taken to improve average boiling house performance. But it would appear that the main stumbling-blocks at present are:

(a) Excessive boiling back of molasses.

(b) Poor pan circulation.

(c) Partial resolution of sucrose on reheating C massecuites, as a result of defective equipment or control.

Table 46. Cu. ft. Total Massecuite/Ton Brix in Mixed Juice.

	Labourdonnais	Mon Loisir	St. Antoine
1956	51.7	51.1	—
1957	51.5	51.1	46.9
1958	50.9	51.7	42.9

At St. Antoine the sucrose losses in final molasses per cent cane have dropped from 1.20 tn 1957 to 0.90 this crop, the weight of molasses (at 95° Brix) per cent on cane having decreased from 3.38 to 2.85 whilst the gravity purity of the molasses has been the same for both years, 36.7.

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2. THE USE OF POLYELECTROLYTES IN CANE JUICE CLAR'FICATION

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Introduction

During the past five years a number of reports have been published on the use of synthetic polyelectrolytes in cane juice clarification. The first two of the series appeared simultaneously in the November, 1953, issue of *Sugar* and presented the findings of two independent workers: Dr. Ching-an-Lee of Formosa who tested krilium in laboratory experiments and A. Briggs Bonneville of the Monsanto Chemical Company who used Lytron x—886 in a number of factory-scale trials in Louisiana, Cuba and and Puerto Rico.

The results obtained by these authors were so encouraging that several sugar technologists investigated the use of polyelectrolytes for cane juice clarification in various sugar-producing countries: Wolff (1954, 1955) in Brazil, Thibaut (1954) in Louisiana, Sugar Research Institute (1954, 1955) and the Bureau of Sugar Experiment Stations (1956) in Australia, Sloane (1955) and Payne (1956) in Hawaii, Ghosh (1955) in India — to mention but a few of the investigations carried out in recent years.

These investigations have shown that the addition of small amounts of polyelectrolytes sometimes improves clarification markedly whilst in other cases it is of no benefit. In other words their action varies widely with the type of juice. Thus in Hawaii, Payne (1956) has shown that lytron is not effective in the treatment of juices from the high-rainfall, non-irrigated areas of the island. Similarly, with the refractory juice of isane grown under prolonged drought, only very carge quantities of lytron cause an increase in the rate of thickening of the clarifier muds, as observed by Schmidt (1954) in the British West Indies. On the other hand, spectacular results are sometimes obtained, industrial scale additions of polyelectrolyte in concentrations of 5-20 p.p.m. having been found by Payne (1956) to increase the settling rate 80 times and reduce the volume of settlings by 50 per cent.

During recent years both krilium and lytron have been used in a few factories in Mauritius when clarification proved to be difficult, and the results obtained have met with a varying amount of success. During the 1957 crop, however, clarification difficulties were rather spectacularly overcome at Mon Désert-Mon Trésor sugar factory with the help of krilium which was added at the rate of only one gram per ton of cane (about 1 p.p.m.). Unfortunately, however, no study was then made to measure the efficacy of the treatment and assess its value.

It was therefore decided to carry out a series of experiments in three factories during the 1958 crop in order to find out whether the addition of small amounts of krilium to the juices of these factories would prove beneficial, as it did at Mon Désert - Mon Trésor in 1957. Two of the factories chosen, Mon Désert-Alma and Highlands, lie in the high-rainfall area (about 90 inches per annum) and are known to have juices that do not clarify easily. The third factory, Labourdonnais, is situated in a drier district (about 50 inches of rain per annum) where juice clarification is no problem.

Procedure

The procedure adopted for the tests was the same at these factories, except for a few slight variations resulting from the conditions prevailing in each case.

Both at Mon Désert-Alma and at Labourdonnais, where there is only one clarifier the runs with krilium were made during several succeeding days and were immediately followed by a number of runs in which the polyelectrolyte was not used.

At Mon-Désert Alma the mineral P_2O_5 content of the juice is very low, about 100 p.p.m. It is the practice at this factory to add a little soluble phosphoric acid to the juice in order to bring up its content to about 125 p.p.m. as it has been observed that even this small addition improves clarification and facilitates processing. For the purpose of the present study, however, addition of phosphoric acid was deleted when krilium was used.

At Labourdonnais, on the other hand, there is no P_2O_5 deficiency in the juice, and straight comparisons with and without krilium were made. Such was also the case at Highlands where it is not the practice to add phosphoric acid in spite of its deficiency in the juices.

As there are two similar clarifiers at Highlands it was possible to add krillium to the juice going to one clarifier only and thus eliminate any change in juice quality which may occur from one week to the other, or even from one day to the next. Two short series of comparisons were thus made at Highlands, one using 1 p.p.m. of krilium, and the other using double that amount. It was unfortunately not possible to sample the mixed juice, due to the liming process used: the secondary juice is brought to 80-85°C, limed to a high pH (about 9.5) with almost the total amount of lime, mixed with the primary juice, the pH of the mixture being then adjusted to a final value of 7.8 - 8.2 before being brought to boiling and sent to the clarifers.

At Labourdonnais the secondary juice is brought to boiling, mixed with the cold primary juice and limed, whereas at Mon Désert-Alma ordinary cold liming is practiced.

For all the tests 12-hour night and/or day composite samples of mixed juice (except at Highlands) and of clarified juice were taken and were analysed for Brix, gravity purity, CaO, MgO and mineral P_2O_5. The pH and turbidity of the clarified juice were also measured, the pol per cent cake determined and the average flow of mixed juice per hour noted. Turbidity was measured by means of a Lumetron photoelectric colorimeter, model 401.

The results obtained are given in Tables 47 to 52.

Table 47. Mon Désert-Alma — Clarification with 1 p.p.m. of krilium.

	Mixed Juice						Clarified Juice								Muds
Date	Tons/ hr.	Brix	Gravity Purity	CaO	MgO	P_2O_5 mg/litre	pH	Brix	Gravity Purity	Turbidity	CaO	MgO	P_2O_5 mg/litre	Pol%
11/8	123	12.39	85.9	127	182	85	6.8	12.71	85.4	94.5	296	201	13	2.9
12/8	120	13.04	86.2	127	213	95	6.8	12.90	86.3	96.0	316	192	15	2.4
26/8	122	13.88	87.2	127	192	85	6.9	14.26	87.2	91.5	323	203	15	2.0
27/8	125	13.69	87.4	113	213	95	6.8	14.09	87.8	91.5	253	203	19	2.6
27/8	125	13.37	87.1	127	213	95	6.8	13.62	88.3	87.5	310	203	17	2.6
28/8	126	12.94	87.2	127	203	162	6.8	13.15	87.9	88.0	366	253	19	2.0
28/8	126	13.57	87.1	113	223	75	6.8	13.79	87.6	85.5	296	243	13	2.0
29/8	126	13.81	87.0	127	223	95	6.9	14.12	87.7	88.0	338	203	13	1.9
Average	124	13.34	87.0	123	208	98	6.8	13.58	87.3	90.3	312	213	16	2.25

Table 48. Mon Désert-Alma — Clarification with small addition of P_2O_5.

Date	Mixed Juice: Tons/ hr.	Brix	Gravity Purity	CaO (mg/litre)	MgO (mg/litre)	P_2O_5 (mg/litre)	Clarified Juice: pH	Brix	Gravity Purity	Tur- bidity	CaO (mg/litre)	MgO (mg/litre)	P_2O_5 (mg/litre)	Muds: Pol %
13/8	117	14.14	86.8	155	228	126	6.8	14.19	87.1	85.0	324	213	19	2.6
14/8	117	13.69	85.9	127	203	95	6.8	13.98	86.4	85.0	331	187	22	2.5
2/9	121	13.92	88.4	183	213	126	6.8	13.79	88.2	84.5	310	203	21	2.5
2/9	121	14.09	88.4	239	213	133	6.8	14.33	88.4	80.0	267	213	19	2.5
3/9	119	13.72	87.9	99	259	143	6.9	14.12	88.7	80.5	324	213	15	2.4
3/9	119	13.81	87.6	141	203	143	6.9	14.04	88.2	81.5	324	203	17	2.4
4/9	123	13.27	88.2	155	203	126	6.8	13.81	87.5	83.0	310	213	17	2.2
4/9	123	13.74	88.3	141	213	112	6.9	13.34	88.8	78.5	281	213	15	2.2
5/9	125	12.68	88.2	127	213	85	6.9	12.78	88.1	87.5	310	182	15	2.2
5/9	125	13.30	87.2	141	203	143	6.9	13 67.	87.1	87.0	310	191	17	2.2
Average	121	13.64	87.7	151	215	123	6.9	13.81	87.9	83.3	309	203	18	2.37

Table 49. Highlands — Clarification with 1 p.p.m. krilium.

Date	Clarified Juice (with 1 p.p.m. krillium): Brix	Gravity Purity	Tur- bidity	CaO (mg/litre)	MgO (mg/litre)	P_2O_5 (mg/litre)	Clarified Juice (without krilium): Brix	Gravity Purity	Tur- bidity	CaO (mg/litre)	MgO (mg/litre)	P_2O_5 (mg/litre)
5/11	15.71	88.8	78.0	363	257	3.0	15.46	88.4	77.5	426	239	1.5
6/11	15.62	88.4	76.0	343	244	3.0	15.60	88.5	77.5	381	261	2.5
7/11	15.78	88.2	75.5	—	—	4.0	15.50	88.6	74.0	—	—	3.5
Average	15.70	88.5	76.3	353	251	3.3	15.52	88.5	76.3	404	250	2.5

Table 50. Highlands — Clarification with 2 p.p.m. krilium.

Date	Clarified Juice (with 2 p.p.m. krilium): Brix	Gravity Purity	Tur- bidity	CaO (mg/litre)	MgO (mg/litre)	P_2O_5 (mg/litre)	Clarified Juice (without kriluim): Brix	Gravity Purity	Tur- bidity	CaO (mg/litre)	MgO (mg/litre)	P_2O_5 (mg/litre)
11/11	15.62	88.1	83.5	366	232	5.0	15.03	88.3	77.5	428	217	2.0
12/11	15.24	88.3	87.5	386	204	5.0	15.06	87.2	83.5	422	203	4.0
14/11	15.41	88.7	87.0	364	241	2.0	14.84	87.5	84.5	428	227	3.5
Average	15.42	88.4	86.0	372	226	4.0	14.98	87.7	81.8	426	216	3.3

Table 51. Labourdonnais — Clarification with 1 p.p.m. krilium.

Date	Mixed Juice: Tons/ hr.	Brix	Gravity Purity	CaO (mg/litre)	MgO (mg/litre)	P_2O_5 (mg/litre)	Clarified Juice: pH	Brix	Gravity Purity	Tur- bidity	CaO (mg/litre)	MgO (mg/litre)	P_2O_5 (mg/litre)	Muds: Pol %
6/10	64	17.06	90.4	199	283	260	6.9	17.19	90.1	24.5	376	237	14	1.4
7/10	64	17.26	89.4	188	295	320	7.0	17.26	90.7	27.0	392	256	10	2.2
8/10	65	17.25	90.9	194	302	200	7.0	17.32	90.5	20.5	387	273	8	2.1
9/10	61	17.11	90.4	215	302	180	7.0	17.12	90.6	26.0	398	256	8	1.3
10/10	60	17.05	90.1	199	310	260	7.0	17.26	90.4	29.5	409	252	8	1.3
Average	63	17.15.	90.2	199	298	244	7.0	17.23	90.5	25.5	392	255	10	1.62

Table 52. Labourdonnais — Clarification without krilium.

	Mixed Juice							Clarified Juice							Muds
Date	Tons/ hr.	Brix	Gravity Purity	CaO mg/litre	MgO mg/litre	P_2O_5 mg/litre	pH	Brix	Gravity Purity	Tur- bidity	CaO mg/litre	MgO mg/litre	P_2O_5 mg/litre		Pol%
13/10	62	17.15	89.7	199	306	180	6.9	17.39	90.0	35.5	382	264	8		1.5
14/10	63	17.25	90.0	210	298	260	7.0	17.41	90.1	35.5	403	264	8		1.4
15/10	62	17.19	91.2	193	318	260	7.0	17.41	91.7	26.5	371	279	9		2.8
16/10	64	17.37	88.2	204	318	200	7.0	17.58	88.5	21.0	414	267	2		1.8
17/10	63	17.30	89.5	199	295	180	7.0	17.34	90.8	15.5	419	252	3		2.0
Average	63	17.27	89.7	201	307	216	7.0	17.43	90.2	26.8	398	265	6		1.90

Discussion

At Mon Désert-Alma the addition of 25 p.p.m. of P_2O_5 to the mixed juice yielded better results than that of 1 p.p.m. of krilium. The former gave a clearer clarified juice in which the increase in (CaO + MgO) from mixed to clarified juice was 146 mg as against 194 mg when krilium was used. This may, in part at least, explain the fact that the use of krilium at this factory was apparently the cause of processing difficulties at the pan and centrifugal stations; whenever phosphoric acid addition was stopped and krilium added for a number of days consecutively, massecuites and runnings volumes in stock gradually increased and it soon became necessary to stop the krilium and resort again to phosphoric acid to bring the situation back to normal.

At Highlands and Labourdonnais, on the other hand, no processing difficulties were encountered with krilium, but no improvement was noticed either. Whereas at Labourdonnais no appreciable difference was found in the increase in (CaO + MgO) between the mixed and clarified juices of the two treatments, at Highlands the krilium-clarified juices gave lower (CaO + MgO) values, both at the 1 and 2 p.p.m. levels, than those of the corresponding untreated juices.

Pol. in filter cake of the treated juices has been slightly less than that of the untreated juices at Mon Désert-Alma and at Labourdonnais.

On the whole, it may be concluded that the addition of krilium at the rate of 1-2 p.p.m. on mixed juice has not proved beneficial in the three factories where comparisons were made during the 1958 crop.

It must be emphasized, however, that two of these factories lie in the high rainfall area of the island and that lytron was also found to be ineffective in the treatment of juices from canes grown in similar areas in Hawaii, as pointed out in the introduction. Such areas usually yield juices poor in phosphoric acid and it has been shown at the Sugar Research Institute in Australia (1955) that when juices contain only 100 p.p.m. of P_2O_5 — such is the case at Mon Désert-Alma and at Highlands — the clarifier muds do not settle readily, even with the addition of lytron.

Finally, polyelectrolytes have been effective in clarification mostly when they were added at higher levels (10-15 p.p.m.) than those used in the present experiments. For a factory crushing 250,000 tons of cane yearly, the addition of say 10 p.p.m. of krilium to the mixed juice would cost Rs. 35,000 in Mauritius, and it is only if clarification is a problem and threatens to become a bottleneck that expenditure of such order is justifiable.

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3. THE RELATIONSHIP BETWEEN BRIX AND DRY MATTER IN FINAL MOLASSES

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The determination of dry matter in sugar products is not normally included in the chemical control of sugar factories as it is time-consuming and requires the use of a vacuum oven. Yet dry matter is necessary for calculating the true purity of final molasses and comparing it with the so-called Douwes-Dekker purity.

Douves-Dekker (1949) developed the following formula for assessing the exhaustibility of Javanese molasses:

$$P = 35.886 - 0.8088r + 0.26047a$$

where P is the expected true purity
r is the reducing sugar % non sucrose
a ,, sulphated ash % ,, ,,

This formula has been found to apply well to the molasses of Queensland (Venton, 1951), of the Philippines (St. Domingo, 1956) and of Mauritius (Lamusse, 1958), as a result of which many factory chemists of the island determine the Douwes-Dekker purity of weekly composite samples of final molasses so as to exercise stricter control on low grade work. However they do not have vacuum ovens at their disposal and use Sijlmans's formula (1933) to calculate the dry matter. This formula reads as follows:

Dry Matter = Brix 10% — (0.72 × sulphated ash %).

For the Brix determination Sijlmans used a 10% solution obtained by diluting one part of molasses with nine times as much water (wt/wt), whilst in Mauritius 10% wt/vol solutions are used, so that even if Sijlmans's formula does apply to local molasses a small error is introduced as a result of the different dilutions used.

It was however anticipated that a much larger error was probably being introduced through the use of the formula as the constant obtained by Sijlmans for Javanese molasses does not necessarily hold for Mauritius molasses. Hence it was decided to analyse a number of final molasses for Brix, dry matter and ash in order to check the applicability of Sijlmans's formula and calculate, if necessary, a new formula for use in Mauritius.

Apart from the densimetric Brix at 10% wt/wt and wt/vol. dilutions, densimetric and refractometric Brixes were also measured at 1:1 (wt/wt) dilution, and the dry matter was also determined by drying at 105°C for two hours.

Twenty-one samples from defecation factories were analysed using the following procedure:

Sulphated Ash. About 5 gms of molasses are accurately weighed into a tared silica dish which has been previously heated to 550°C in a muffle furnace and allowed to cool in a dessicator. Five mls of 10% sulphuric acid are added and the dish cautiously heated to evaporate the excess acid, after which it is placed inside the muffle furnace and kept at 550°C for two hours. It is then allowed to cool and a few mls of 10% sulphuric acid are added drop by drop so as to moisten all the ash. The dish is then again cautiously heated to evaporate the excess acid, placed in the muffle at 550°C for 3 hours, allowed to cool in a dessicator and weighed. From the figures obtained the percentage of ash is calculated.

Dry Matter (Vacuum Oven). About 25 gms of dry acid-washed sand are poured into a metal dish that can be fitted with a tight lid. The open dish and its lid are placed inside a vacuum oven for two hours at 60 - 70°C under an absolute pressure less than 50 mm of mercury; it is then allowed to cool in a dessicator and weighed.

About 3 gms of molasses are accurately weighed into the dish, 3 mls of distilled water added and the contents of the dish stirred so as to cause the water to dissolve the molasses and allow the sand to absorb the solution. The dish is then placed in the vacuum oven at the same temperature and pressure as above and allowed to stay in for four days, at the end of which time further loss in weight is very slight. The dish is allowed to cool in a dessicator, reweighed and the percentage of dry matter calculated.

Dry Matter (Oven at 105°C). The method is similar to the one described for the vacuum oven except that the drying is carried out for 2 hours only in an ordinary oven at 105°C under atmospheric pressure.

Brix. An Abbé precision refractometer was used to determine the refractometric Brix of the samples. One in one dilution (wt/wt) was used.

Densimetric Brix was measured by the standard method with the help of N.P.L. - stamped specific gravity hydrometers.

Results. The results obtained are given in Table 53.

As may be seen from Table 53, the difference in Brix between 1:10 (wt/vol) and 1:9 (wt/wt) dilutions is slight and cannot, on the average, affect markedly the accuracy of dry matter values obtained through the use of Sijlmans's formula. This formula, however, does not apply to Mauritius molasses, as shown in Table 53, because in all cases studied but one it yielded dry matter values higher than those obtained with the vacuum oven, the maximum deviations found being + 3.1 and — 0.1.

A statistical analysis was made of the figures in Table 53 with a view to correlating the dry matter with the Brix and the sulphated ash per cent. It was thus found that the best correlation obtains when the Brix value at 1:10 dilution (wt/vol.) is used, for which case the following equation has been calculated.

Dry Matter = Brix 1:10 (wt/vol.) — 0.43 Sulphated Ash % — 5.8. The correlation coefficient of this new equation is 0.77 and the probable error 0.5.

The dry matter values obtained with this equation are also given in Table 54 from which it will be seen that in all but four cases deviations from the vacuum oven dry matter are less than one unit and that the maximum deviations are + 1.1 and — 1.4.

It is recommended that under present conditions the equation proposed should be used instead of Sijlmans's formula by those factory chemists who want to calculate the true purity of final molasses with a view to comparing it to the Douwes-Dekker purity. This procedure will reveal a larger positive or a smaller negative difference between actual true purity and Douwes-Dekker purity and will give a better insight of the efficiency of the low grade department.

Table 53. Brix; Dry Matter and Sulphated Ash per cent of Final Molasses Composite Samples — 1957 Crop.

Sample		Bx 1:10 (wt/vol.)	Bx 1:9 (wt/wt)	Bx 1:1 (wt/wt)	Ref. Bx 1:1 (wt/wt)	Dry Matter Vac. Oven	Dry Matter 105°C	Ash%
Médine, 17/8 - 21/10		94.6	95.5	84.8	81.1	82.1	81.7	14.85
Solitude,	Sept.	95.9	95.3	87.1	82.1	83.4	82.3	15.66
,,	Oct.	97.2	97.2	91.4	84.3	83.8	80.8	16.85
B. Plan,	Sept.	92.7	92.6	88.7	84.1	80.1	77.3	13.18
,,	Oct.	93.5	93.1	89.6	84.7	80.9	79.6	14.01
,,	Nov.	89.9	90.2	87.0	83.1	79.2	79.3	12.13
B. Vue,	Sept.	97.4	97.2	92.5	83.0	83.6	81.3	17.67
Mon Loisir,	Aug.	92.7	93.4	89.9	86.4	81.9	79.0	14.13
,,	Oct.	93.3	92.9	89.9	85.7	82.6	81.3	13.57
Constance,	Aug.	93.5	93.4	89.1	84.0	80.3	78.0	13.99
,,	Sept.	92.5	92.4	88.5	82.2	80.3	78.7	13.74
,,	Oct.	91.9	91.9	88.1	84.2	79.5	77.9	13.53
Fuel,	Aug.	91.7	91.2	88.0	85.0	80.2	79.1	13.05
,,	Sept.	91.9	91.2	88.4	85.5	80.7	79.8	13.38
,,	Nov.	91.9	91.4	88.2	85.4	81.6	80.0	11.67
B. Champ,	Nov.	90.9	90.7	81.6	80.0	80.7	80.2	11.31
Benares,	Oct.	96.6	96.5	92.2	85.1	83.8	81.7	17.62
Union,	Aug.	93.0	92.4	89.0	83.7	80.2	78.8	16.20
,,	Oct.	96.4	96.0	91.8	86.0	84.3	83.0	16.98
M. Désert,	Oct.	93.5	91.4	89.2	85.1	81.2	80.9	15.43
M. Molasses Co. Ltd.		89.1	89.0	85.6	82.9	78.3	78.1	12.53
Average		93.34	93.09	88.60	83.98	81.37	79.94	14.36

Table 54. Dry Matter by Vacuum Oven, Sijlmans's Formula and New Formula.

Sample		Bx 1:10 (wt/vol.)	Ash%	A Dry Matter (Vac. Oven)	B Dry Matter (Sijlmans's)	A—B	C Dry Matter New formula	A—C
Médine, 17/8 - 21/10		94.6	14.85	82.1	83.9	1.8	82.4	–0.3
Solitude,	Sept.	95.9	15.66	83.4	84.6	1.2	83.4	—
,,	Oct.	97.2	16.85	83.8	85.1	1.3	84.2	–0.4
B. Plan,	Sept.	92.7	13.18	80.1	83.2	3.1	81.2	–1.1
,,	Oct.	93.5	14.01	80.9	83.4	2.5	81.7	–0.8
,,	Nov.	89.9	12.13	79.2	81.2	2.0	78.9	0.3
B. Vue,	Sept.	97.4	17.67	83.6	84.7	1.1	84.0	–0.4
M. Loisir,	Aug.	92.7	14.13	81.9	82.5	0.6	80.8	1.1
,,	Oct.	93.3	13.57	82.6	83.5	0.9	81.7	0.9
Constance,	Aug.	93.5	13.99	80.3	83.4	3.1	81.7	–1.4
,,	Sept.	92.5	13.74	80.3	82.6	2.3	80.8	–0.5
,,	Oct.	91.9	13.53	79.5	82.2	2.7	80.3	–0.8
Fuel,	Aug.	91.7	13.05	80.2	82.3	2.1	80.3	–0.1
,,	Sept.	91.9	13.38	80.7	82.3	1.6	80.3	0.4
,,	Nov.	91.9	11.67	81.6	83.5	1.9	81.1	0.5
B. Champ,	Nov.	90.9	11.31	80.7	82.8	2.1	80.2	0.5
Benares,	Oct.	96.6	17.62	83.8	83.9	0.1	83.2	0.6
Union,	Aug.	93.0	16.20	80.2	81.3	1.1	80.2	—
,,	Oct.	96.4	16.98	84.3	84.2	–0.1	83.3	1.0
M. Désert,	Oct.	93.5	15.43	81.2	82.4	1.2	81.1	0.1
M. Molasses Co. Ltd.		89.1	12.53	78.3	80.1	1.8	77.9	0.4

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APPENDIX*

I. Description of cane sectors.

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* *Grateful acknowledgment is made to the Secretary, Mauritius Chamber of Agriculture, for providing the necessary data to compile Tables II to VI.*

Table I. General description of sugarcane sectors of Mauritius.

SECTORS	WEST	NORTH	EAST	SOUTH	CENTRE
DISTRICT	Black River	Pamplemousses & Rivière du Rempart	Flacq	Grand Port & Savanne	Plaines Wilhems & Moka
ORIENTATION	Leeward	—	Windward	Windward	—
PHYSIOGRAPHY	Lowlands and Slopes	Lowlands	Slopes	Slopes	Plateau
GEOLOGY	Late lava — Pleistocene.				
PETROLOGY	Compact or vesicular doleritic basalts and subordinate tuffs.				
ALTITUDE	Sea level—900 ft.	Sea level—600 ft.	Sea level—1,200 ft.	Sea level—1,200 ft.	900—1,800 ft.
HUMIDITY PROVINCE	Sub-humid	Sub-humid to humid	Humid to super-humid		
ANNUAL RAINFALL, inches. Range and mean	(30—60) 44	(40—75) 55	(60—125) 94	(60—150) 90	(60—150) 90
MONTHS RECEIVING LESS THAN TWO INCHES RAIN	June to October	September to October	None		
AVERAGE TEMPERATURE °C — JAN.	27.0°	26.5°	25.5°	25.0°	23.5°
AVERAGE TEMPERATURE °C — JUL.	21.0°	20.5°	19.5°	19.0°	17.5°
CYCLONIC WINDS, greater than 30 m p.h. during 1 hour.	December to May				
PEDOLOGY Soil Groups: (*) A. Low Humic Latosol	«Richelieu» bouldery clay (11,000 arpents)		—		
B. Humic Latosol	—	«Réduit» bouldery clay (60,000 arpents)			
		—	«Sans Souci» bouldery clay (18,000 arpents)		
C. Lithosol	«Mapou» stony and gravelly clay (18,000 arpents)		—		
(*) Other unclassified groups occur chiefly in the West and North (2000 arpents)		«Plaisance» stony and gravelly clay (51,000 arpents)			
		—	«Rose Belle» stony and gravelly clay (24,000 arpents)		
IRRIGATION	Common	Some	Rare		
APPROXIMATE AREA 1000 arpents — Sector	56	91	72	160	63
APPROXIMATE AREA 1000 arpents — Cane	10	52.	39	59	24
CANE PRODUCTION 1000 metric tons Average 1956 - 58	256	1,102	848	1,549	609
SUGAR PRODUCTION 1000 metric tons Average 1956 - 58	33	148	106	189	77
SUGAR FACTORIES Production in 1000 metric tons Average 1956 - 58	Médine 33	Mon Loisir 29 St. Antoine 22 Solitude 22 The Mount 21 Beau Plan 20 Labourdonnais 18 Belle Vue 16	Union Flacq 56 Beau Champ 29 Constance 21	Savannah 30 Mon Trésor 25 Union 22 Britannia 19 Rose Belle 18 Bénarès 15 Riche en Eau 13 Bel Ombre 14 Ferney 12 St. Félix 11 Beau Vallon 10	Mon Désert 33 Highlands 23 Réunion 21

Table II. Area under sugar cane in thousands arpents(1), 1954 - 1958. The first column gives the total area under sugar cane; the others the area reaped for milling.

Year	Island	Area reaped					
		Island	West	North	East	South	Centre
1954	178.82	168.44	8.55	48.06	37.37	52.40	22.06
1955	180.05	168.59	8.82	47.80	36.90	52.78	21.86
1956	181.21	167.90	8.74	48.16	35.95	53.17	21.88
1957	182.67	169.58	8.95	48.27	35.72	54.25	22.29
1958(2)	184.00	173.96	9.20	49.16	37.06	56.14	22.40

NOTE : (*1*) *To convert into acres multiply by 1.043*
" " " hectares " " 0.422

(*2*) *Provisional figures.*

Table III. Sugar production in thousand metric tons (1), 1954 - 1958.

Crop Year	No. of factories operating	Av. Pol.	Island	West	North	East	South	Centre
1954	27	98.6	498.6	28.12	140.29	98.05	163.31	68.83
1955	26	98.6	533.3	31.52	148.39	103.40	173.96	76.07
1956	26	98.6	572.5	31.06	167.14	110.22	187.60	76.47
1957	26	98.5	562.0	36.05	141.28	103.31	198.86	82.50
1958(2)	25	98.5	525.6	31.79	136.84	105.96	179.00	72.07

NOTE : (*1*) *To convert into long tons multiply by 0.984*
" " " short " " " 1.102

(*2*) *Provisional figures.*

Table IV. Yield of cane metric tons per arpent (1), 1954 - 1958.

	1954	1955	1956	1957	1958(2)
ISLAND					
Millers	31 .0	31 .0	32 .0	32 .2	30 .5
Planters	20 .4	19 .7	21 .0	19 .1	19 .4
Average	25 .4	25 .1	26 .3	25 .6	24 .9
WEST					
Millers	32 .2	34 .3	32 .2	35 .9	32 .4
Planters	25 .4	24 .3	24 .1	27 .8	25 .2
Average	27 .7	27 .8	27 .0	30 .8	28 .0
NORTH					
Millers	30 .9	29 .0	32 .2	29 .0	29 .5
Planters	21.4	20 .5	22 .2	16 .9	17 .5
Average	24 .6	23 .5	25 .5	21 .1	21 .5
EAST					
Millers	29 .9	31 .8	31 .6	31 .5	31 .5
Planters	18 .4	17 .3	19 .2	17 .2	18 .1
Average	22 .6	22 .5	23 .9	22 .9	23 .4
SOUTH					
Millers	31 .1	30 .7	31 .7	32 .8	30 .3
Planters	20 .4	19 .7	20 .9	22 .0	22 .0
Average	27 .5	27 .2	28 .3	29 .3	27 .6
CENTRE					
Millers	31 .5	32 .4	32 .7	34 .1	30 .6
Planters	19 .4	19 .7	19 .0	20 .4	21 .0
Average	26 .2	27 .1	27 .1	28 .6	26 .5

NOTE : (1) *To convert in metric tons/acre multiply by 0.959*
" long tons /acre " " 0.945
" short tons/acre " " 1.058
" metric tons hectare " " 2.370

(2) *Provisional figures.*

Table V. Average sugar manufactured % cane (1), 1954 - 1958.

Crop year	Island	West	North	East	South	Centre
1954	11.65	11.87	11.88	11.62	11.35	11.89
1955	12.61	12.85	13.22	12.43	12.11	12.83
1956	12.95	13.17	13.59	12.84	12.47	12.89
1957	12.94	13.07	13.86	12.64	12.49	12.88
1958 (2)	12.14	12.30	12.92	12.21	11.56	12.12

NOTE : (*1*) *To convert into tons cane per ton sugar manufactured : divide 100 by above percentage.*

(*2*) *Provisional figures.*

Table VI. Tons sugar manufactured per arpent reaped, 1954 - 1958.

	Island	West	North	East	South	Centre
1954	2.96	3.29	2.92	2.62	3.12	3.12
1955	3.17	3.57	3.10	2.80	3.30	3.48
1956	3.41	3.56	3.47	3.07	3.53	3.49
1957	3.31	4.02	2.92	2.89	3.66	3.68
1958 (1)	3.02	3.45	2.78	2.86	3.19	3.20

NOTE : (*1*) *Provisional figures.*

Table VII. Monthly rainfall in inches. Average over whole sugarcane area of Mauritius.

	GROWTH PERIOD (deficient months in italics)								NOV.-JUNE (sum of monthly deficits)	MATURATION PERIOD (excess months in italics)				JULY-OCT. (sum of monthly excesses)
Crop year	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE		JULY	AUG.	SEPT.	OCT.	
Normals 1875-1949	3.77	7.09	11.04	11.06	12.09	9.50	6.91	4.96	15.00	4.59	4.15	2.90	2.81	2.50
Extremes	0.52 13.18	1.74 39.92	2.69 32.46	3.07 36.04	3.35 38.98	1.45 27.60	1.62 21.41	0.97 16.49	2.20 29.20	1.62 10.23	0.60 12.52	0.69 6.41	0.76 9.83	0.00 9.40
1947	10.36	*3.42*	*8.06*	*6.83*	*4.26*	9.69	*3.50*	5.66	22.57	2.76	3.91	2.20	1.24	0.00
1948	*2.52*	*6.83*	*8.23*	*5.10*	*8.04*	12.13	*2.61*	*1.80*	21.79	4.12	2.84	*3.34*	*2.98*	0.61
1949	4.01	*5.48*	*4.81*	16.71	*8.86*	*7.01*	*3.30*	10.09	17.17	4.11	1.91	1.39	1.39	0.00
1950	*3.34*	*3.42*	*10.20*	*5.21*	23.18	11.39	*2.98*	7.02	14.72	4.47	*5.02*	2.80	2.35	0.87
1951	*3.15*	*5.86*	11.65	*8.20*	*10.89*	*7.98*	7.00	7.26	7.43	*4.91*	*5.41*	*4.16*	*3.84*	3.87
1952	4.08	*2.22*	*5.26*	11.17	16.88	10.11	*5.69*	*4.86*	12.31	*8.22*	*5.20*	*3.47*	*3.13*	5.61
1953	6.06	18.05	11.65	*6.59*	*10.57*	*8.35*	11.95	12.75	7.14	*10.10*	*4.72*	*3.07*	2.68	6.25
1954	*3.76*	11.47	*5.00*	*7.96*	14.89	*6.20*	*6.49*	6.06	12.88	*6.44*	*5.04*	*4.11*	1.53	3.76
1955	4.81	*5.19*	*4.50*	23.28	19.60	10.97	8.83	7.73	8.44	*4.66*	3.85	3.68	1.12	0.85
1956	*3.03*	7.70	12.02	13.59	*10.60*	*4.14*	*5.93*	*4.90*	8.63	2.94	2.82	1.68	1.40	0.00
1957	*2.08*	8.11	*7.80*	*6.98*	*8.93*	10.66	*6.14*	*3.66*	14.24	3.55	2.54	*3.32*	0.96	0.42
1958	*2.09*	10.26	13.49	13.28	29.54	13.29	*4.95*	*2.20*	6.40	*8.22*	*4.51*	1.50	2.47	3.99

NOTE: To convert into millimetres, multiply by 2.54

Table VIII. Highest wind speed during one hour in miles (1). Average over Mauritius.

Crop Year	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
NOVEMBER	—	21	17	24	18	18	14	16	12	13
DECEMBER	18	16	24	21	15	16	15	17	13	13
JANUARY	27	26	21	22	18	28	13	20	20	14
FEBRUARY	20	24	20	25	15	15	*34*(2)	16	19	18
MARCH	20	17	18	25	15	15	29	19	18	*33*(2)
APRIL	18	21	17	22	20	16	16	17	16	28
MAY	20	19	20	24	22	22	19	18	15	14
JUNE	24	20	23	25	23	20	22	17	13	14
JULY	21	23	21	20	24	16	17	15	12	11
AUGUST	18	19	24	25	24	23	20	14	17	20
SEPTEMBER	20	21	21	21	20	19	19	17	17	18
OCTOBER	18	19	20	20	19	20	14	18	15	17

NOTE: (*1*) *To converts into: knots multiply by 0.87.*
kilometres/hr. multiply by 1.61.
metres/sec. multiply by 0.45.

(*2*) *Cyclonic wind above 30 miles per hour.*

Table IX. Variety trend in Mauritius 1930 - 1957.

% Area Cultivated.

	Tannas	M. P. seedlings 55 and 131	Demerara seedlings DK/74, D 109 D 130, RP/6 RP/8	POJ. 2878	BH. 10/12	M. 134/32	Other M. seedlings	Ebène 1/37	B. 3337, B. 34104, B. 37161, B. 37172
1930	57	10	16	—	2	—	—	—	—
1935	48	7	16	1	15	—	—	—	—
1940	29	1	1	5	40	2	5	—	—
1944	5	—	—	2	27	37	7	—	—
1950	—	—	—	—	—	91	6	—	—
1953	—	—	—	—	—	83	5	8	—
1954	—	—	—	—	—	83	5	10	2
1955	—	—	—	—	—	74	5	15	6
1956	—	—	—	—	—	66	8	17	9
1957	—	—	—	—	—	55	12	21	12

Table X. Percentage annual plantations under different cane varieties on sugar estates, 1954 to 1958.

Years / varieties	Island					West					North					East					South					Centre				
	1954	1955	1956	1957	1958	1954	1955	1956	1957	1958	1954	1955	1956	1957	1958	1954	1955	1956	1957	1958	1954	1955	1956	1957	1958	1954	1955	1956	1957	1958
M.134/32	50.0	28.5	16.3	4.2	2.0	16.7	3.9	—	—	—	89.5	76.3	49.4	12.6	6.9	62.2	20.0	7.4	1.7	0.5	41.1	24.3	14.7	4.3	1.1	20.0	8.5	1.7	—	0.4
M.134/32 (white)	0.5	3.4	4.3	3.3	1.0	78.0	47.5	20.6	23.8	6.2	—	0.3	3.4	5.2	1.2	—	8.0	9.6	—	—	—	1.2	2.5	3.6	1.9	—	1.0	—	—	—
M.112/34	2.1	5.0	2.2	2.1	0.8	—	6.0	—	9.4	2.8	5.6	3.7	4.3	3.5	2.4	2.2	2.2	1.4	0.8	0.2	0.4	7.1	1.8	2.0	0.3	3.1	3.9	2.6	1.1	0.6
M.147/44	—	—	14.0	35.6	28.9	—	—	40.8	46.4	25.2	—	—	6.8	47.3	35.3	—	—	16.6	32.1	34.8	—	—	11.5	39.6	25.1	—	—	16.1	13.5	22.0
M.31/45	—	—	9.0	9.1	8.0	—	—	—	6.9	13.1	—	—	1.4	5.8	4.8	—	—	8.4	10.1	15.7	—	—	13.6	12.6	7.3	—	—	8.0	1.0	2.8
Ebène 1/37	26.5	31.4	28.5	33.2	28.9	—	19.7	7.6	—	—	0.7	5.3	8.6	6.6	5.2	19.2	49.5	35.4	43.1	27.5	30.3	26.4	22.0	24.7	30.5	50.7	55.2	61.4	81.2	57.5
B.3337	10.0	10.7	7.4	1.8	4.8	—	—	—	—	—	—	0.2	0.6	—	—	6.5	3.2	2.9	1.0	1.7	13.0	11.1	12.2	—	7.6	16.1	22.9	8.6	1.8	8.4
B.34104	—	—	2.9	2.2	2.9	—	—	11.5	7.8	32.0	—	—	0.8	1.6	5.6	—	—	0.5	0.5	0.1	—	—	4.7	3.3	3.2	—	—	—	0.3	2.7
B.37161	5.5	7.1	8.4	2.1	0.9	0.8	4.4	16.6	1.1	1.1	2.1	6.6	14.7	4.6	4.4	5.9	8.1	7.6	2.7	—	5.8	9.7	8.6	1.6	—	8.2	2.0	0.8	—	—
B.37172	3.8	6.0	6.4	5.7	20.6	—	—	2.4	3.9	13.3	1.3	4.1	8.4	11.6	32.3	2.1	5.3	9.3	7.3	18.8	7.0	10.0	7.6	4.8	22.3	0.4	0.5	0.5	0.1	3.0
Other varieties	1.6	7.9	0.6	0.7	1.2	4.5	18.5	0.5	0.7	6.3	0.8	3.5	1.6	1.2	1.9	1.9	3.7	0.4	0.7	0.7	2.4	9.2	0.8	0.5	0.7	1.5	6.0	0.3	1.0	2.6
Total area, arpents	11204	12726	12706	13948	13011	337	364	678	536	403	1972	2176	2169	2105	2573	1709	1927	2029	3076	2964	5022	5522	5438	6224	5536	2164	2527	2392	2007	1939

Table XI. Percentage weight of ratoons in total cane production on estates.

Year	Island	West	North	East	South	Centre
1949	82.0	75.9	78.9	81.7	83.3	82.3
1950	83.0	79.1	82.3	83.5	87.3	83.9
1951	87.6	80.0	82.5	85.6	91.5	86.3
1952	88.6	85.0	83.4	87.9	90.2	86.7
1953	87.8	85.9	87.7	88.1	88.5	85.4
1954	88.0	83.8	86.8	89.6	89.4	85.3
1955	87.1	86.7	88.6	87.7	86.4	86.1
1956	84.5	87.5	86.4	84.9	83.8	82.9
1957	85.0	79.0	86.9	83.6	85.7	83.7
1958	82.9	77.9	86.3	77.5	83.1	85.5

NOTE: The weight of cane produced on estates in 1958 was: virgins 444,403 tons ; ratoons 2,167,733 tons.

Table XII. Average yields of virgin and ratoon canes on estates.
Tons per arpent. A: 1947 - 1957 ; B: 1958.

	Island		West		North		East		South		Centre	
	A	B	A	B	A	B	A	B	A	B	A	B
Virgin	35.3	36.5	41.2	42.2	34.5	36.3	39.0	40.7	33.8	35.4	35.1	33.5
1st Ratoon	33.0	32.3	35.5	31.9	33.2	32.0	34.2	33.6	32.4	31.7	32.8	32.6
2nd ,,	31.2	30.6	33.4	32.9	31.9	29.9	33.2	31.6	30.7	30.4	30.4	30.6
3rd ,,	29.5	30.1	31.6	33.0	29.1	29.2	31.0	29.5	28.8	30.2	29.4	30.6
4th ,,	28.9	28.7	30.4	30.0	28.0	27.2	29.9	28.2	29.1	29.3	28.3	29.2
5th ,,	28.2	27.8	30.7	27.2	27.5	27.2	27.6	27.2	28.8	28.4	28.0	27.5
6th ,,	28.3	27.5	31.3	27.6	27.2	27.4	—	27.5	29.0	27.5	—	27.7

Table XIII. List of crosses made in 1958.

CROSS	No. of Crosses			No. of seedlings obtained		
	R.S.E.S.	P.S.E.S.	TOTAL	R.S.E.S.	P.S.E.S.	TOTAL
B.3439 x M.147/44	2	—	2	928	—	928
B.34104 x self	2	—	2	1	—	1
B.34104 x C.P.36-13	1	—	1	0	—	0
,, x Ebène 1/37	4	3	7	69	45	114
,, x M.63/39	1	1	2	544	80	624
,, x M.213/40	—	2	2	—	199	199
,, x M.147/44	4	3	7	354	37	391
,, x M.202/46	—	3	3	—	10	10
,, x M.142/49	—	1	1	—	0	0
,, x P.O J.2878	3	3	6	0	339	339
,, x P.O J.2940	1	2	3	51	5	56
,, x P.R.905	—	1	1	—	3	3
B.37161 x Ebène 1/37	2	—	2	0	—	0
,, x M.147/44	4	—	4	15	—	15
B.37172 x Ebène 1/37	2	—	2	0	—	0
,, x M.147/44	2	—	2	0	—	0
B.4362 x M.147/44	3	—	3	14	—	14
Ba.11569 x M.147/44	1	—	1	0	—	0
Co.281 x M.63/39	1	2	3	24	198	222
,, x P.R.905	1	2	3	0	332	332
Co.421 x Ebène 1/37	—	2	2	—	14	14
,, x M.147/44	2	4	6	324	1001	1325
,, x M.202/46	—	2	2	—	336	336
,, x P.O.J.2940	1	—	1	0	—	0
,, x P.O.J.3016	—	1	1	—	200	200

CROSS	No. of Crosses			No. of seedlings obtained		
	R.S.E.S.	P.S.E.S.	TOTAL	R.S.E.S.	P.S.E.S.	TOTAL
Co.421 x Sdg. (C.P. 34-120 x Co.421)	2	—	2	15	—	15
Co.779 x self	1	—	1	0	—	0
,, x *Coix lachryma jobi*	2	—	2	0	—	0
D.109 x self	2	—	2	7	—	7
,, x M.109/26	1	—	1	131	—	131
,, x M.147/44	3	—	3	4	—	4
Ebène 1/37 x B.37172	1	—	1	0	—	0
,, x self	2	—	2	0	—	0
,, x M.47/38	1	1	2	2	10	12
,, x M.63/39	1	2	3	5	20	25
,, x M.213/40	—	2	2	—	292	292
,, x M.147/44	13	7	20	784	127	911
,, x M.31/45	2	—	2	1	—	1
,, x M.202/46	1	2	3	0	35	35
,, x M.142/49	—	3	3	—	0	0
,, x 27 M.Q.1124	1	—	1	0	—	0
,, x P.O.J.2940.	—	1	1	—	76	76
Ebène 1/44 x M.147/44	2	2	4	8	54	62
,, x M.202/46	—	2	2	—	20	20
M.27/16 x self	2	—	2	1	—	1
M.109/26 x D.109	1	—	1	440	—	440
,, x self	1	—	1	2	—	2
M.134/32 x B.37172	1	—	1	22	—	22
,, x Co.290	—	1	1	—	0	0

CROSS	No. of Crosses			No. of seedlings obtained		
	R.S.E.S.	P.S.E.S.	TOTAL	R.S.E.S.	P.S.E.S.	TOTAL
M.134/32 x Co.419	1	3	4	0	0	0
„ x Ebène 1/37	4	4	8	121	26	147
„ x M.147/44	8	6	14	133	123	256
„ x M.202/46	1	3	4	0	7	7
„ x P.O J.2940	2	1	3	1	145	146
„ x P.O.J.2961	—	2	2	—	9	9
„ x P.O J.3016	—	1	1	—	181	181
M.134/32 White x M.147/44	3	—	3	7	—	7
M.112/34 x Co.290	2	2	4	45	1	46
„ x *Coix lachryma jobi*	1	—	1	0	—	0
„ x Ebène 1/37	2	2	4	35	70	105
„ x M.63/39	1	—	1	0	—	0
„ x M.73/39	1	—	1	14	—	14
„ x M.147/44	1	2	3	0	26	26
„ x M.31/45	1	—	1	1	—	1
„ x M.202/46	1	2	3	0	15	15
„ x M.92/53	1	—	1	101	—	101
„ x 27M.Q.1124	1	—	1	1	—	1
„ x P.O.J2940.	—	2	2	—	93	93
„ x Trojan	1	—	1	0	—	0
M.241/40 x Enène 1/37	1	2	3	55	0	55
„ x M.204/40	—	2	2	—	6	6
„ x M.147/44	2	3	5	400	19	419
„ x M.202/46	—	2	2	—	196	196
„ x P.O.J.2940	1	2	3	0	6	6

CROSS	No. of Crosses			No. of seedlings obtained		
	R.S.E.S.	P.S.E.S.	TOTAL	R.S.E S.	P.S.E S.	TOTAL
M.377/41 x B.34104	1	—	1	0	—	0
,, x C.P.36-13	1	—	1	0	—	0
,, x Ebéne 1/37	—	1	1	—	6	6
,, x M.213/40	—	2	2	—	252	252
,, x M.147/44	1	2	3	0	5	5
,, x M.202/46	—	2	2	—	3	3
,, x M.85/53	1	—	1	0	—	0
,, x P.O.J.3016	1	—	1	0	—	0
,, x U.S.48-34	1	—	1	0	—	0
M.129/43 x Ebène 1/37	1	2	3	0	0	0
,, x M.147/44	1	2	3	39	1	40
,, x M.202/46	—	2	2	—	0	0
M.147/44 x B.34104	3	—	3	0	—	0
,, x D.109	1	—	1	5	—	5
,, x Ebène 1/37	3	—	3	0	—	0
,, x self	5	—	5	17	—	17
M.31/45 x M.147/44	1	—	1	8	—	8
M.24/47 x M.147/44	1	—	1	0	—	0
,, x P.O J.2940	1	—	1	12	—	12
M.354/51 x M.147/44	1	—	1	2	—	2
M.379/51 x M.147/44	1	1	2	0	0	0
,, x S C.12/4	1	—	1	18	—	18
M.381/51 x Ebène 1/37	1	—	1	92	—	92
,, x M.147/44	1	1	2	0	0	0
M.106/55 x Ebène 1/37	1	—	1	0	—	0

CROSS	No. of Crosses			No. of seedlings obtained		
	R.S.E.S.	P.S.E.S.	TOTAL	R.S.E.S.	P.S.E.S.	TOTAL
M.106/55 x M.147/44	1	—	1	38	—	38
M.107/55 x Ebène 1/37	1	—	1	1	—	1
„ x M.147/44	1	—	1	5	—	5
Mapou Perlée x M.147/44	—	3	3	—	5	5
„ x M.202/46	—	1	1	—	1	1
M.L.3-18 x Ebène 1/37	—	1	1	—	82	82
„ x M.147/44	1	2	3	56	48	104
„ x M.202/46	—	1	1	—	14	14
N:Co.310 x B.34104	1	—	1	4	—	4
„ x C.P.36-13	1	—	1	7	—	7
„ x *Coix lachryma jobi*	2	—	2	0	—	0
„ x D.109	1	—	1	1	—	1
„ x Ebène 1/37	1	2	3	12	1	13
„ x M.63/39	1	4	5	280	375	655
„ x M.213/40	—	2	2	—	7	7
„ x M.147/44	4	4	8	616	263	879
„ x M.31/45	1	—	1	2	—	2
„ x M.202/46	1	4	5	0	37	37
„ x M.85/53	1	—	1	0	—	0
„ x self	1	—	1	0	—	0
„ x P.O.J.2940	1	—	1	0	—	0
„ x P.O.J.3016	1	1	2	12	144	156
„ x U.S.48-34	1	—	1	184	—	184
131P. x C.P.36-13	1	—	1	0	—	0
„ x M.147/44	1	—	1	167	—	167

CROSS	No. of Crosses			No. of seedlings obtained		
	R.S.E.S.	P.S.E.S.	TOTAL	R.S.E.S.	P.S.E.S.	TOTAL
Pindar x M.147/44	—	2	2	—	0	0
P.O.J.2727 x M.147/44	1	—	1	127	—	127
P.O.J.2878 x Co.290	1	2	3	1016	10	1026
„ x M.147/44	2	2	4	472	141	613
„ x M.202/46	—	2	2	—	31	31
P.R.1000 x Ebène 1/37	1	—	1	0	—	0
„ x M.147/44	4	1	5	817	804	1621
„ x M.31/45	1	—	1	4	—	4
„ x M.202/46	—	2	2	—	41	41
Q.44 x Ebène 1/37	1	—	1	2	—	2
„ x M.147/44	2	—	2	11	—	11
Q.47 x P.O.J.2940	1	—	1	0	—	0
Trojan x M.147/44	1	—	1	2	—	2
U.S.48-34 x self	3	—	3	0	—	0
Sib-Crosses						
(B.34104 x M.63/39) x (B.34104 x M.63/39)	1	1	2	24	0	24
(M.134/32 x Ebène 1/37) x (M.134/32 x Ebène 1/37)	—	1	1	—	0	0
M.147/44 x M.202/46	—	1	1	—	38	38
M.202/46 x M.147/44	—	2	2	—	19	19
Arrows treated to induce parthenogenesis						
Co.779—I.A.A. treated	1	—	1	0	—	0

CROSS	No. of Crosses			No. of seedlings obtained		
	R.S.E.S.	P.S.E.S.	TOTAL	R.S.E S	P.S.E.S.	TOTAL
Co.779 Gibb. acid treated	1	—	1	0	—	0
N: CO.310 — I.A.A. treated	1	—	1	0	—	0
„ — Gibb. acid treated	1	—	1	0	—	0
	189	152	341	8,713	6,684	15,397

Table XIV. Evolution of 1958 sugar crop. Production data at weekly intervals.

	Island	West	North	East	South	Centre	*Island*	West	North	East	South	Centre	*Island*	West	North	East	South	Centre	*Island*	West	North	East	South	Centre
	26th July 1958						*2nd August 1958*						*9th August 1958*						*16th August 1958*					
Cane crushed (1000 m. tons)	267	8	82	22	118	37	429	127	43	178	60	60	634	37	178	83	252	84	830	51	227	127	313	112
Sugar manufactured % cane	10.61	10.55	11.66	10.16	10.22	9.92	10.70	11.68	10.32	10.26	10.17	10.17	10.80	11.02	11.80	10.53	10.31	10.33	10.92	11.27	11.82	10.78	10.43	10.53
Sugar manufactured (1000 m. tons)	28.3	.9	9.5	2.3	12.0	3 6	45.9	14.8	4.4	18.3	...	6.1	68.5	4.1	21.0	8.8	25.9	8.7	90.6	5.7	26.9	13.5	32.6	11.9
	23rd August 1958						*30th August 1958*						*6th September 1958*						*13th September 1958*					
Cane crushed (1000 m. tons)	1066	67	288	172	395	144	1277	81	353	215	462	166	1538	97	425	266	551	199	1786	111	498	315	631	231
Sugar manufactured % cane	11.05	11.40	11.86	11.08	10.53	10.75	11.17	11.50	11.93	11.20	10.61	10.90	11.25	11.64	11.98	11.32	10.70	11.03	11.39	11.76	12.09	11.48	10.81	11.15
Sugar manufactured (1000 m. tons)	118.0	7.6	34.3	19.1	41.7	15.3	142.6	9.3	42.0	24.1	49.0	18.2	173.0	11.3	50.9	30.0	58.9	21.9	203.5	13.1	60.3	36.1	68.2	25.8
	20th September 1958						*27th September 1958*						*4th October 1958*						*11th October 1958*					
Cane crushed (1000 m. tons)	2032	126	571	361	710	264	2279	139	645	409	786	300	2510	153	716	449	859	334	2761	167	789	498	940	367
Sugar manufactured % cane	12.33	11.90	12.18	11.60	10.89	11.31	11.61	12.00	12.32	11.70	11.00	11.44	11.72	12.12	12.43	11.81	11.09	11.58	11.82	12.19	12.52	11.89	11.19	11.65
Sugar manufactured (1000 m. tons)	260.0	15.0	69.5	41.9	77.3	29.8	264.7	16.7	79.4	47.9	86.3	34.4	294.4	18.5	89.1	53.1	95.2	38.5	326.3	20.3	98.8	59.3	105.1	42.8
	18th October 1958						*25th October 1958*						*1st November 1958*						*8th November 1958*					
Cane crushed (1000 m. tons)	3002	181	860	544	1016	401	3229	194	925	587	1089	434	3434	207	963	631	1167	466	3643	221	1007	676	1243	496
Sugar manufactured % cane	11.91	12.25	12.62	11.97	11.28	11.76	12.01	12.30	12.72	12.05	11.37	11.85	12.06	12.32	12.84	12.10	11.42	11.90	12.10	12.34	12.87	12.16	11.48	12.01
Sugar manufactured (1000 m. tons)	357.6	22.1	108.5	65.1	114.7	47.2	387.8	23.8	117.7	70.7	123.9	51.7	414.2	25.5	124.0	76.3	133.0	55.4	440.9	27.2	129.5	82.0	142.6	59.6
	15th November 1958						*22nd November 1958*						*29th November 1958*						*Total Crop Production (Preliminary figures)*					
Cane crushed (1000 m. tons)	3843	235	1047	719	1316	526	4020	249	1059	766	1392	554	4156	257	1059	808	1458	574	4329	257	1059	868	1551	594
Sugar manufactured % cane	12.13	12.34	12.91	12.18	11.50	12.04	12.15	12.36	12.92	12.20	11.55	12.08	12.15	12.30	12.92	12.21	11.58	12.10	12.14	12.30	12.92	12.21	11.56	12.12
Sugar manufactured (1000 m. tons)	446.2	28.9	135.1	87.5	151.4	63.3	488.5	30.7	136.8	934.	160.6	67.0	505.0	31.6	136.8	98.7	168.8	69.1	525.6	31.8	136.8	1.05	17.90	91.72

CORRIGENDUM A. R. 1957: TABLE XIV. *Read* 14th & 28th September, 5th, 12th, 19th & 26th October, 2nd, 9th, 16th, 23rd & 30th November, *instead of* 16th 22nd & 29th September, 6th, 13th, 20th & 27th October, 3rd, 10th, 17th & 24th November 1957.

Table XV. Evolution of cane quality during 1958 sugar crop.

WEEK ENDING	ISLAND		WEST		NORTH		EAST		SOUTH		CENTRE	
	A	B	A	B	A	B	A	B	A	B	A	B
26th July	12.61	10.68	12.95	10.55	13.72	11.66	12.09	10.25	12.24	10.31	11.70	10.12
2nd August	12.70	10.87	13.00	10.94	13.71	11.86	12.40	10.50	12.20	10.30	12.12	10.55
9th ,,	12.77	11.16	13.12	11.48	13.62	12.01	12.79	10.92	12.27	10.74	12.29	10.73
16th ,,	13.15	11.28	13.30	11.76	13.69	11.91	13.64	11.28	12.56	10.67	12.71	11.15
23rd ,,	13.19	11.50	13.30	11.81	13.77	12.12	13.33	11.50	12.68	10.96	13.05	11.49
30th ,,	13.22	11.61	13.34	12.02	13.69	12.01	13.24	11.66	12.78	11.12	13.06	11.60
6th Sept.	13.39	11.79	13.74	12.31	13.89	12.34	13.40	11.83	12.92	11.21	13.35	11.83
13th ,,	13.61	12.09	14.00	12.60	14.13	12.68	13.64	12.17	13.14	11.48	13.41	11.93
20th ,,	13.78	12.23	14.21	13.00	14.44	13.05	13.75	12.36	13.52	11.75	13.65	12.25
27th ,,	14.13	12.60	14.38	12.93	14.73	13.25	13.96	12.60	13.74	12.03	13.94	12.43
4th October	14.21	12.63	14.71	13.36	14.92	13.34	13.94	12.63	13.74	11.87	14.01	12.61
11th ,,	14.37	12.80	14.58	12.91	15.18	13.58	14.14	12.81	13.77	12.15	14.08	12.66
18th ,,	14.48	12.92	14.78	12.96	15.29	13.72	14.21	12.85	13.83	12.17	14.29	12.86
25th ,,	14.58	13.03	14.85	13.00	15.61	13.85	14.40	13.03	13.79	12.30	14.47	12.92
1st November	14.36	12.83	14.51	12.69	15.63	14.15	14.19	12.71	13.84	12.23	14.35	12.91
8th ,,	14.53	12.93	14.49	12.55	15.84	14.26	14.37	12.84	13.86	12.87	14.50	13.09
15th ,,	14.08	12.67	14.26	12.38	15.60	14.02	14.15	12.58	13.66	11.96	14.27	12.91
22nd ,,	14.10	12.34	14.13	12.64	15.64	13.85	14.19	12.39	13.73	12.07	14.35	12.96
29th ,,	13.87	12.08	14.10	12.25	—	—	14.05	12.27	13.66	11.78	14.14	12.65
5th December	13.80	11.94	—	—	—	—	14.12	12.13	13.53	11.71	14.25	12.50

NOTE: *A = Sucrose % cane*

B = Commercial Sugar manufactured % cane.

Table XVI. Total duration of harvest in days (A) and weekly crushing rates of factories in 1000 metric tons (B) in different sectors of the island, 1947 - 1958.

YEARS	Island		West		North		East		South		Centre	
	A	B	A	B	A	B	A	B	A	B	A	B
1947	129	152.1	128	6.6	130	36.4	125	30.4	130	55.7	133	23.0
1948	132	167.6	140	7.3	122	42.1	136	33.6	140	60.0	125	24.6
1949	133	176.5	142	7.7	128	44.0	129	37.0	140	62.4	127	25.4
1950	141	184.6	130	10.1	140	47.9	145	35.1	144	65.0	135	26.5
1951	154	197.8	150	10.3	169	52.0	159	40.3	140	65.8	132	29.4
1952	149	192.4	151	9.9	149	50.5	155	40.2	154	63.4	131	28.4
1953	158	205.7	162	11.8	167	57.7	161	42.5	153	66.0	145	27.7
1954	140	214.1	142	11.7	137	60.5	138	42.9	147	68.7	134	30.3
1955	133	222.6	134	12.8	122	64.2	140	41.5	140	71.6	127	32.5
1956	136	227.3	129	12.7	137	62.7	138	43.4	138	76.2	128	32.3
1957	128	237.5	144	13.3	104	68.2	133	42.9	141	78.6	129	34.5
1958	130	233.0	128	14.3	106	69.9	137	44.4	141	77.0	133	31.3

Table XVII. Summary of chemical control data 1958.

(i) CANE CRUSHED AND SUGAR PRODUCED.

		Médine	Solitude	Beau Plan	The Mount	Belle Vue	Labourdonnais	St. Antoine	Mon Loisir	Constance	Union Flacq	Beau Champ	Ferney	Beau Vallon	Riche en Eau	Mon Trésor	Savinia	Rose Belle	Britannia	Bénarès	Union St. Aubin	St Félix	Bel Ombre	Réunion	Highlands	Mon Desert	Totals & Averages
CRUSHING PERIOD	From	23/7	9/7	21/8	21/7	11/7	7/7	18/7	11/8	4/8	18/7	28/7	16/7	30/6	21/8	12/7	7/7	26/7	7/7	23/7	21/7	21/7	18/8	4/8	19/7	14/7	—
	To	28/11	25/10	24/11	19/11	14/11	25/10	23/10	17/11	28/11	8/12	17/12	10/12	29/11	10/12	3/12	20/11	18/12	1/12	13/12	11/12	2/12	27/12	10/12	6/12	20/11	—
	No. of crushing days	108	91	81	100	105	93	81	82	93	121	120	123	127	94	121	114	121	125	121	122	112	109	104	113	110	108
	No. of crushing hours per day	20.23	20.05	21.61	20.60	20.34	21.00	22.24	21.66	21.46	20.00	19.15	16.79	15.54	15.53	17.50	20.68	20.01	15.37	18.07	18.65	18.27	19.42	19.60	22.77	21.03	19.50
	Hours stoppage per day	0.82	0.32	0.24	0.53	1.25	0.40	0.24	0.92	1.28	1.90	0.94	0.53	0.91	0.54	0.39	0.12	0.95	1.50	0.40	0.86	1.02	2.15	2.42	0.32	0.62	0.89
	Overall time Efficiency	96.2	98.4	98.9	97.5	94.6	98.1	96.3	95.9	94.4	91.3	95.3	97.0	94.4	96.6	97.8	99.4	95.5	89.4	97.8	95.6	94.7	90.0	89.0	98.6	97.2	96.5
CANE CRUSHED (Metric Tons)	Factory	115.011	34.972	50.873	103.590	72.685	63.207	59.069	115.703	58.783	265.144	141.145	62.764	68.998	68.463	151.048	179.772	107.413	134.416	93.251	179.110	32.555	50.009	99.226	111.117	183.516	2.595.840
	Planters	142.277	128.497	87.092	50.007	38.889	60.476	112.555	87.458	108.740	198.257	96.154	50.126	23.647	39.010	34.397	56.512	40.877	17.608	29.412	472	60.840	69.432	63.078	64.520	72.826	1.733.160
	Total	257.288	163.469	137.965	153.597	111.574	123.683	165.624	203.161	167.523	463.401	237.299	112.890	92.645	107.473	185.445	236.284	148.290	152.024	122.663	179.582	93.395	119.442	162.304	175.637	256.342	4.329.000
	Factory % Total	44.7	21.4	36.9	67.4	64.3	51.1	32.0	57.0	35.1	57.2	59.5	55.6	74.4	63.7	81.5	76.1	72.4	88.4	76.0	99.7	34.9	41.8	61.1	63.3	71.6	60.0
	Per day	2.382	1.796	1.703	1.536	1.062	1.328	2.045	2.478	1.801	3.830	1.977	917	729	1.143	1.533	2.073	1.226	1.216	1.014	1.472	834	1.096	1.560	1.554	2.330	1.609
	Per hour actual crushing	117.8	89.6	78.8	74.5	52.2	63.2	95.4	114.3	83.9	191.5	103.3	54.7	46.9	73.5	87.6	101.5	61.2	79.1	56.1	78.9	45.6	56.4	79.6	68.7	110.8	82.5
VARIETIES CRUSHED (Factory)	M.134/32 per cent	60.6	75.3	77.2	64.2	83.5	74.4	67.3	79.6	61.4	43.3	55.4	31.5	46.0	21.0	47.6	66.3	23.6	35.3	36.9	48.0	37.3	62.2	24.3	0.5	9.5	46.0
	Ebène 1/37 per cent	3.5	—	3.6	11.0	0.4	0.2	0.9	1.7	8.5	35.2	14.0	23.6	10.6	35.4	29.7	9.1	40.9	15.7	10.0	20.6	13.5	7.3	49.5	75.9	74.9	24.7
	M.112/34 + M.147/44 + M.31/45 per cent	24.7	20.5	12.0	11.7	10.9	20.0	17.7	10.2	21.1	13.7	15.7	19.5	18.3	19.9	4.7	13.8	12.4	28.9	13.5	24.4	23.1	9.0	17.9	7.1	5.5	15.1
	B.3337 + B.34104 + B.37161 + B.37172 per cent	8.1	4.2	7.2	5.6	4.4	5.4	9.9	8.5	9.0	7.8	14.1	22.8	23.8	23.7	12.7	10.8	23.1	20.1	34.3	6.9	22.3	17.6	7.2	16.5	10.0	12.6
SUGAR PRODUCED* (Metric Tons)	Raw Sugar	31.785	19.567	18.474	19.778	15.130	16.727	19.876	27.286	20.868	56.625	28.468	2.403	9.730	11.962	23.401	28.543	17.685	17.565	3.632	20.376	11.015	13.564	20.050	21.620	30.400	506.530
	Total Sugar	—	—	—	—	—	—	—	—	—	—	—	9.102	—	—	—	—	—	—	10.022	—	—	—	—	—	—	19.124
	Total	31.785	19.567	18.474	19.778	15.180	16.727	19.876	27.286	20.868	56.625	28.468	11.505	9.730	11.962	23.401	28.543	17.685	17.565	13.654	20.376	11.015	13.564	20.050	21.620	30.400	525.653
	White Sugar % Total	—	—	—	—	—	—	—	—	—	—	—	79.1	—	—	—	—	—	—	73.4	—	—	—	—	—	—	3.64
CANE/SUGAR RATIO	Ton cane per ton sugar made	81.	8.4	7.5	7.8	7.4	7.4	8.3	7.5	8.0	8.2	8.3	9.8	9.5	8.9	7.9	8.3	8.4	8.6	9.0	8.8	8.5	8.8	8.1	8.1	8.4	8.2
	” ” ” of 96° Pol.	7.8	8.2	7.3	7.6	7.2	7.8	8.1	7.3	7.8	8.0	8.0	9.5	9.3	8.7	7.7	8.1	8.2	8.4	8.7	8.6	8.3	8.6	7.9	7.9	8.2	8.0

* *Provisional figures.*

Table XVII. Summary of chemical control data 1958.

(a) CANE, BAGASSE AND JUICES.

		Médine	Solitude	Beau Plan	The Mount	Belle Vue	Labourdonnais	St Antoine	Mon Loisir	Constance	Union Flacq	Beau Champ	Ferney	Beau Vallon	Riche en Eau	Mon Trésor	Savinia	Rose Belle	Britannia	Bénarés	Union St. Aubin	St. Félix	Bel Ombre	Réunion	Highlands	Mon Désert	Totals & Averages
CANE	Sucrose per cent	13.99	13.70	14.95	14.39	15.16	15.16	13.79	14.87	14.12	13.71	13.59	12.45	12.50	12.76	14.00	13.63	13.53	12.90	13.46	12.96	13.62	13.27	14.04	13.84	13.20	13.77
	Fibre per cent	12.84	12.30	12.40	11.69	12.71	12.62	13.16	12.38	13.17	11.45	12.48	13.30	13.81	12.72	11.98	12.43	11.86	12.21	13.16	12.11	12.14	12.84	12.23	10.55	10.31	12.21
BAGASSE	Sucrose per cent	2.33	2.39	2.73	2.52	2.68	2.84	2.40	2.12	2.52	2.76	2.05	2.51	2.72	2.05	2.61	2.57	2.78	2.30	2.50	2.03	2.92	2.72	2.88	2.84	2.26	2.50
	Moisture per cent	50.7	50.5	46.9	45.5	47.5	46.5	50.4	49.5	48.0	49.7	47.5	45.5	47.2	49.8	48.5	48.3	48.3	48.2	45.9	48.8	46.8	47.8	49.6	48.8	49.4	48.2
	Fibre per cent	46.1	46.5	49.2	51.1	49.1	50.0	46.3	47.8	48.7	46.7	49.5	51.1	49.0	47.7	48.0	48.4	48.3	48.5	50.9	48.0	49.6	48.5	46.8	47.5	47.8	48.1
	Weight per cent cane	27.9	26.5	25.2	22.9	25.8	25.2	28.4	25.9	27.1	24.5	25.2	26.2	28.2	26.7	25.0	25.7	24.6	25.2	25.9	25.2	24.5	26.5	26.2	22.2	21.6	25.4
1st EXPRESSED JUICE	Brix (B_1)	19.74	19.67	20.88	19.39	20.57	20.47	19.96	20.52	19.63	18.78	19.22	17.89	18.65	18.10	19.31	18.69	18.47	17.91	18.63	18.19	18.19	19.01	19.38	18.65	17.89	19.07
	Gravity Purity	88.8	87.8	89.0	91.1	91.3	90.4	88.3	90.0	88.6	89.7	88.6	86.0	87.4	88.8	89.9	90.0	90.0	91.1	88.4	89.1	90.0	87.8	90.4	91.0	89.0	89.3
	Reducing sugar/sucrose ratio	2.7	4.2	2.5	3.1	2.3	2.1	2.9	2.5	3.7	2.7	3.2	4.6	4.1	3.1	2.6	3.2	3.0	3.1	3.1	3.9	3.5	2.9	2.3	3.3	2.8	3.1
LAST EXPRESSED JUICE	Brix	3.89	3.93	3.95	2.49	2.50	3.62	4.08	3.33	3.82	4.53	3.19	4.82	4.11	5.36	3.95	4.97	4.80	3.04	5.42	2.44	2.55	5.70	5.43	3.32	4.27	3.98
	Apparent Purity	73.6	77.6	70.6	72.7	80.0	81.0	72.0	78.0	74.9	76.4	66.4	72.6	72.5	79.8	73.5	76.9	81.5	70.4	76.0	64.5	80.6	75.7	79.7	74.1	78.9	75.2
MIXED JUICE	Brix	15.30	15.28	15.92	15.04	15.97	16.01	15.99	14.78	14.82	15.66	14.84	13.81	14.63	14.64	14.65	14.45	14.35	14.07	14.85	13.64	14.03	15.63	15.60	14.91	13.53	14.90
	Gravity Purity	86.7	84.8	86.3	88.9	87.4	88.9	86.2	87.8	86.9	87.8	85.9	84.6	84.8	86.9	87.8	88.0	87.7	87.7	86.1	86.7	87.8	85.4	88.1	88.2	87.5	87.2
	Reducing sugar/sucrose ratio	3.0	4.6	2.8	3.7	2.8	2.4	3.4	2.9	3.9	3.1	3.8	5.1	3.8	3.9	2.9	4.0	3.7	3.4	3.4	5.0	4.2	3.5	2.8	3.8	3.3	3.6
	Gty. Pty. drop from 1st expressed juice	2.1	3.0	2.7	2.2	3.9	1.5	2.1	2.2	1.7	1.9	2.7	1.4	2.6	1.9	2.1	2.0	2.4	3.4	2.3	2.4	2.2	2.4	2.2	2.8	1.5	2.1
ABSOLUTE JUICE	Brix (B_A)	18.67	18.50	19.98	18.49	19.74	19.60	18.59	19.42	18.87	17.77	18.26	17.13	17.27	16.79	18.29	17.81	17.58	16.93	18.10	17.23	17.73	17.99	18.25	17.71	16.89	18.12
	$B_A/(B_1)$	0.946	0.940	0.957	0.953	0.959	0.958	0.931	0.946	0.961	0.946	0.950	0.960	0.926	0.927	0.947	0.953	0.950	0.945	0.970	0.947	0.975	0.946	0.942	0.950	0.944	0.950
	Gravity Purity	86.0	84.5	85.4	88.1	88.0	88.5	85.3	87.4	86.2	87.1	85.1	83.9	83.9	87.0	86.9	87.4	87.3	86.7	85.6	85.6	87.4	84.6	87.6	87.4	87.2	86.6
CLARIFIED JUICE	Brix	15.73	14.99	16.13	15.15	16.44	15.90	15.87	14.73	14.88	15.68	14.94	13.74	15.20	14.48	14.68	14.66	14.50	14.82	14.64	13.61	14.11	15.98	15.78	15.15	13.79	15.02
	Gravity Purity	—	—	86.4	89.2	88.4	88.9	—	—	87.0	88.3	86.1	83.8	85.1	87.3	88.0	88.0	—	87.6	85.6	87.9	88.1	86.0	88.6	88.6	87.7	87.2
	Reducing sugar/sucrose ratio	3.1	4.3	2.7	3.7	2.8	2.5	3.4	-	3.8	3.2	3.8	5.1	3.6	3.7	2.8	3.9	3.6	4.2	3.3	4.1	3.9	3.0	2.9	3.9	3.2	3.5

Table XVII. Summary of chemical control data 1958.

(iii) FILTER CAKE, SYRUP, pH, FINAL MOLASSES, SUGAR.

		Médine	Solitude	Beau Plan	The Mount	Belle Vue	Labourdonnais	St. Antoine	Mon Loisir	Constance	Union Flacq	Beau Champ	Ferney	Beau Vallon	Riche en Eau	Mon Trésor	Savinia	Rose Belle	Britannia	Benarés	Union St. Aubin	St Félix	Bel Ombre	Réunion	Highlands	Mon Désert	Totals & Averages
FILTER CAKE	Sucrose per cent	8.50	1.02	2.81	1.37	5.20	3.50	7.91	1.63	2.30	1.89	1.40	7.60	6.30	1.14	8 10	2.30	6.86	6.16	3.29	1.30	6.53	7.41	7.19	6.17	2.36	3.48
	Weight per cent cane	1.87	2.97	3.11	2.92	2.00	3.22	1.79	3.61	3.00	2.68	2.31	2.04	2.00	3.37	1.70	2.00	1.23	1.46	2.50	2 52	1.62	1 40	2.15	1.93	2.92	2.37
SYRUP	Brix	62.5	57.4	62.6	57.6	56.3	61.0	62.6	62.6	62.8	57.7	59.6	57.3	53.6	65.5	63 6	55.9	63.3	69 1	59.3	58.0	56.5	61.0	61.1	63.4	67.8	60.7
	Gravity Purity	—	—	86.5	88.8	—	88.9	—	—	86.7	88.2	82.6	83.2	85.0	87.7	88 3	88.4	—	88.4	86.1	88.4	87.5	85.4	88.5	88.6	87.9	87.3
	Reducing sugar/sucrose ratio	3.2	3.4	2.5	3.5	2.8	2 5	3.4	—	3.5	3.1	3.7	5.3	3 0	3.3	2.8	3.7	3.5	4.7	3.4	4.0	4.1	4.6	3.0	3.9	2.9	3.5
pH. VALUES	Limed juice	7.6	—	—	7.8	—	—	8.0	—	7.3	8.5	7 9	8.2	—	7.9	8.4	8 1	7.5	7.6	8.1	7.5	7.6	—	8.2	8.4	8.1	7.9
	Clarified juice	7.1	7.0	7.1	7.0	6.9	7.1	6 9	7.1	7.2	6.9	7 0	6 8	7.0	7.0	7.1	7.0	6.9	6 9	6.8	7.0	6.9	7.2	7.1	7.1	6.9	7.0
	Filter press juice	—	—	—	—	6.3	—	—	—	6.8	6.4	—	—	—	—	7.4	—	6.7	—	6.9	6 5	6.5	—	7.1	7.4	6.6	6.8
	Syrup	—	—	6.7	6.9	6.8	—	—	—	6.9	6 6	6 8	6.7	—	7.0	6.8	—	—	—	6.5	6.7	6.7	7.1	—	7.2	6.8	6.8
FINAL	Brix	95.6	97.3	94.6	95.3	98.8	96.2	97 7	90.7	93.1	91.5	96.5	92.2	90.8	95.1	92.2	95.4	88.7	90.9	95.5	96.2	90.7	93.2	92.4	91.9	94.4	93.6
MOLASSES	Sucrose per cent	36.6	35.9	34.5	35.5	35.7	35.9	35.8	33 9	32.5	35.5	34.2	35.6	35.6	34.2	32 3	35.2	35.9	33.4	38.5	36.2	34.2	36.0	37.1	34.7	34.5	35.5
	Reducing sugar per cent	13.0	18.4	15.2	17.4	—	12.1	11 7	15.0	14.5	12.2	17.1	15.1	—	14.2	15 9	16.0	15.8	17.2	12.1	14.1	15.5	—	14.6	14.7	12.9	14.8
	Total Sugars*	49.6	54.3	49.7	52.9	—	48.0	47.5	48.9	47.1	47.7	51.2	50.7	—	68.4	48.2	51.2	51.6	50.6	50.6	50.3	49.7	—	51.7	49.4	47.4	50.3
	Gravity Purity	38.3	36.9	36.4	37.3	36.1	37.1	36.7	37.3	34.9	38.8	35.4	38.7	39.2	35.9	35.0	36.9	40.4	36.7	40.2	37.7	37.7	38.6	40.2	37.7	36.5	37.9
	Reducing sugar/sucrose ratio	35.5	51.2	44.1	48.8	—	33.8	32.6	44.3	44.6	34 6	50.0	42.4	—	41.5	49.3	45.4	44.0	51.4	31.5	38.8	45.2	—	39.4	42.4	37.4	42.0
	Weight per cent cane at 95° Brix	2.62	3.27	2.77	2.53	2.68	2.29	2.85	2.66	2.76	2.28	2 91	2.98	—	2.43	2.25	2.73	2.22	2.57	2.99	2.65	—	—	2.44	2.44	2.37	2.59
SUGAR MADE†	White sugar recovered per cent cane	—	—	—	-	-	—	—		-	-		8 06		—			—	--	8.17	—	—	—	—	—	—	—
	Raw ,, ,, ,, ,,	12.35	11.97	13.39	12.88	13.56	13.52	12.00	13.43	12.46	12 22	12 00	2.13	10 50	11.16	12.62	12.08	11 93	11.55	2.96	11 35	11.79	11.35	12.35	12.31	11.86	—
	Total ,, ,, ,, ,,	12.35	11.97	13.39	12.88	13.56	13.52	12 00	13.43	12.46	12 22	12.00	10.19	10.50	11.16	12.62	12.08	11.93	11.55	11 13	11 35	11.79	11.35	12.35	12.31	11.86	12.14
	Average Pol. of sugars	98.33	98.30	98.19	98.58	98.20	98.22	98.66	98.51	98.31	98.55	98.54	99 41	98.57	98.59	98.48	98.49	98.62	98 55	99.32	98 69	98.43	98.50	98.40	98.36	98.33	98.50
	Total sucrose recovered	12.15	11.77	13.15	12.69	13.32	13.28	11.84	13.23	12.25	12.04	11.62	10.12	10.35	10.97	12.43	11.90	11.76	11.38	11.05	11.20	11.57	11.18	12.15	12.11	11.66	11.96
	Moisture content of raw sugar per cent	0.36	0.45	0.52	0.38	—	—	0 44	0.44	0.73	0.41	0.40	—	—	-	0.39	0.42	0.37	—	0.28	—	0.21	0.34	0.63	0.78	0.42	0.44
	Dilution indicator	27.5	36.0	40.3	36.5	-	-	48.9	41.9	—	39.4	—	-		-	34.5	28.0	36.6	—	..	—	—	29.6	65.0	—	34.0	37.1

* *Sucrose % † Reducing Sugars %*

† *Provisional figures.*

Table XVII. Summary of chemical control data 1958.

(iv) MASSE—CUITES

		Médine	Solitude	Beau Plan	The Mount	Belle Vue	Labourdonnais	St Antoine	Mon Loisir	Constance	Union Flacq	Beau Champ	Ferney	Beau Vallon	Riche en Eau	Mon Trésor	Savinia	Rose Belle	Britannia	Bénares	Union St. Aubin	St. Félix	Bel Ombre	Réunion	Highlands	Mon Désert	Totals & Averages
A—MASSECUITE	Brix	94.6	94.8	95.0	93.1	96.1	93.3	95.9	95.4	93.5	94.8	95.3	94.8	94.6	94.9	94.6	94.1	93.0	94.8	94.2	92.7	93.7	95.3	93.6	94.5	94.2	94.4
	Apparent Purity	86.7	83.0	80.3	85.8	79.2	79.8	81.8	81.2	77.9	77.2	83.8	79.1	74.2	83.0	84.4	81.1	88.5	73.2	84.0	86.6	77.7	79.6	79.4	80.3	78.1	81.0
	„ „ of A— Molasses	67.9	60.4	56.8	66.7	58.5	59.0	55.5	59.4	56.0	55.8	61.1	62.4	53.8	64.5	60.5	59.4	71.3	54.6	68.2	67.8	55.6	53.4	63.3	58.8	57.6	60.3
	Drop in Purity	18.8	22.6	23.5	19.1	20.7	20.8	26.3	21.8	21.9	21.4	22.7	16.7	20.4	18.5	23.9	21.7	17.2	18.6	15.8	18.8	22.1	26.2	16.1	21.5	20.5	20.8
	Crystal per cent Brix in massecuite	58.6	57.0	54.4	57.4	49.9	50.7	59.1	53.7	49.8	49.3	58.4	44.4	44.1	52.1	60.5	53.4	59.9	41.0	49.6	59.1	49.8	56.2	43.9	52.2	48.3	52.4
	Cubic feet per ton Brix in Mixed Juice	24.4	23.4	30.1	29.6	34.2	36.5	33.5	33.4	79.7	28.4	25.3	23.5	38.5	29.2	27.5	31.2	31.6	38.0	24.9	26.6	28.3	33.7	35.5	27.9	34.2	30.1
	A—Massecuite per cent total massecuite	50.5	48.9	61.0	61.2	70.6	71.6	78.1	70.9	56.8	65.6	52.8	47.8	66.6	57.4	60.1	62.7	56.5	65.5	49.9	50.1	60.1	64.8	67.3	59.9	65.2	61.0
B—MASSECUITE	Brix	96.4	97.4	96.5	94.9	97.3	95.2	—	96.8	95.3	95.6	96.9	96.2	95.3	96.7	96.7	94.9	93.8	94.9	96.1	94.4	93.8	97.6	95.0	95.6	94.8	95.8
	Apparent Purity	73.5	70.3	67.4	74.3	67.2	68.8	—	70.0	67.7	68.5	68.6	70.3	64.5	70.5	65.6	70.6	76.4	63.9	74.2	75.1	67.0	65.2	72.5	68.5	68.0	69.5
	„ „ of B—Molasses	50.8	50.2	46.1	46.9	47.0	49.3	—	46.2	49.0	46.9	44.0	56.1	44.0	50.2	44.1	50.1	54.3	41.1	56.6	54.4	47.4	46.1	55.0	42.5	49.3	48.7
	Drop in purity	22.7	20.1	21.3	27.4	20.2	19.5	—	23.8	18.7	21.6	24.6	14.2	20.5	20.3	21.5	20.5	22.1	22.8	17.6	20.7	19.6	19.1	17.5	26.0	18.7	20.8
	Crystal per cent Brix in massecuite	46.1	40.4	39.5	51.6	38.1	38.5	—	44.2	36.7	40.7	43.9	32.3	36.6	40.8	38.5	41.1	48.3	38.7	40.5	45.3	37.2	35.4	38.9	45.2	36.9	40.6
	Cubic feet per ton Brix in Mixed Juice	15.0	15.3	11.5	12.3	8.0	8.5	—	8.5	14.0	8.0	13.4	13.6	8.4	12.5	11.9	12.0	15.3	11.2	14.5	17.4	10.7	9.1	10.2	12.0	10.8	11.2
	B—Massecuite per cent total Massecuite	31.0	32.0	23.3	25.3	16.5	16.7	—	16.4	27.5	18.4	27.9	27.6	14.5	24.5	26.0	21.6	27.3	19.3	29.1	32.8	22.8	17.4	19.3	25.8	20.5	22.7
	Kgs. Sugar per cubic foot of A & B Massecuites	20.3	20.1	19.2	19.8	19.6	18.4	—	18.0	—	—	20.4	—	—	18.3	20.8	19.6	17.3	16.7	15.5	17.8	20.6	18.1	17.9	20.4	17.7	18.4
C—MASSECUITE	Brix	99.6	99.6	100.3	98.7	102.3	99.0	99.1	99.0	98.3	96.3	99.6	99.2	98.2	99.7	101.1	99.0	97.9	97.2	99.7	98.9	96.7	100.3	97.7	93.4	99.0	98.8
	Apparent Purity	57.0	57.7	55.3	55.2	55.7	57.3	58.0	55.6	55.4	55.9	55.6	57.9	51.4	55.5	53.8	55.7	59.6	48.9	59.0	56.7	57.7	58.9	61.1	56.3	56.5	56.3
	„ „ of final molasses	33.3	33.1	30.4	33.9	31.4	33.6	32.7	36.8	28.9	35.6	30.2	35.7	33.8	33.0	29.8	36.9	35.9	32.1	35.6	33.5	33.7	37.7	36.4	33.0	33.1	33.6
	Drop in purity	23.7	24.6	24.9	21.3	24.3	23.7	25.3	18.9	26.5	20.3	25.4	12.2	17.6	22.5	24.0	18.8	23.8	16.8	23.4	23.2	24.0	21.2	24.7	23.3	23.4	22.7
	Crystal per cent Brix in massecuite	35.5	36.8	35.8	32.2	35.4	35.7	37.6	29.9	37.2	31.5	36.3	18.9	26.5	33.6	34.2	29.8	31.2	24.7	36.3	34.9	36.2	34.0	38.8	34.7	35.0	34.1
	Cubic feet per ton Brix in Mixed Juice	9.0	9.1	7.7	6.6	6.2	5.9	9.4	9.8	7.8	7.0	9.2	12.1	11.1	9.1	6.4	6.5	9.1	8.8	10.6	10.0	8.1	9.0	7.1	6.7	7.5	8.1
	C—Massecuite per cent total massecuite	18.5	19.1	15.7	13.5	12.9	11.7	21.9	12.7	15.7	16.0	19.3	24.6	18.9	18.1	13.9	15.7	16.2	15.2	21.0	17.1	17.1	17.8	13.4	14.3	14.3	16.3
TOTAL MASSECUITE	Cubic feet per ton Brix in Mixed Juice	48.4	47.8	49.3	48.5	48.4	50.9	42.9	51.7	51.0	43.4	47.9	49.2	58.0	50.8	45.8	49.7	56.0	58.0	50.0	53.0	47.1	51.8	52.8	46.6	52.5	49.4
	„ „ „ sugar made	60.2	74.0	60.9	58.5	58.4	61.2	54.8	61.8	63.4	52.7	60.7	67.2	76.3	64.0	55.3	60.6	68.9	70.4	66.8	67.0	58.7	67.1	64.4	56.3	64.3	61.3

Table XVII. Summary of chemical control data 1958.

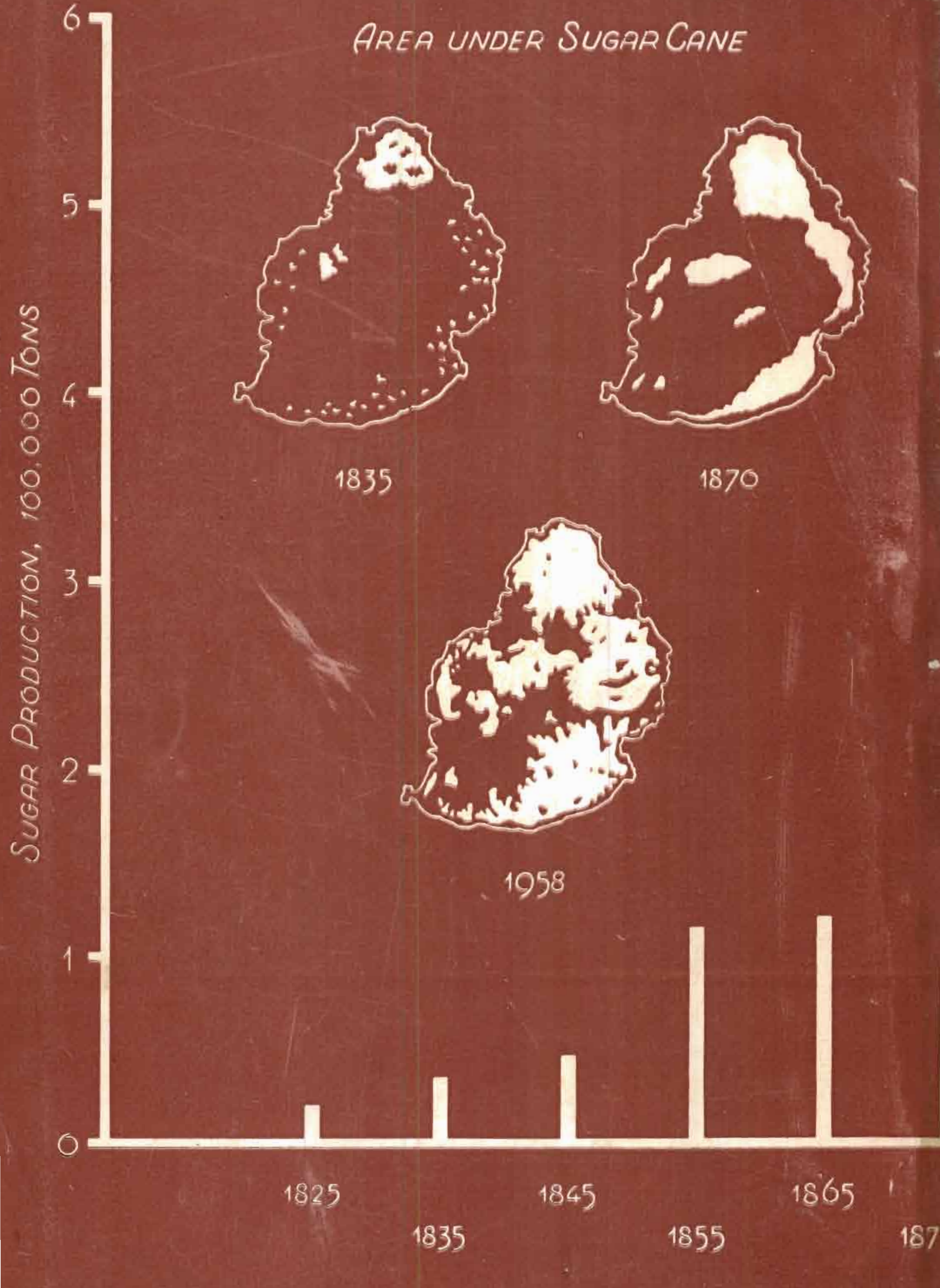
(v) MILLING WORK, SUCROSE LOSSES & BALANCE, RECOVERIES

		Medine	Solitude	Beau Plan	The Mount	Belle Vue	Labourdonnais	St. Antoine	Mon Loisir	Constance	Union Flacq	Beau Champ	Ferney
MILLING WORK	Imbibition water % cane	28.4	27.3	29.0	26.2	28.4	26.7	23.5	36.3	31.7	19.3	27.8	27.1
	,, ,, % fibre	22.1	22.2	23.4	22.4	22.3	21.2	17.9	29.3	24.0	17.2	22.3	20 3
	Extraction ratio	35.8	37.6	37.1	34.2	35.2	37.5	38.0	29.8	36.4	42.8	30.5	39.7
	Mill extraction	95.4	95.4	95.4	96.0	95 4	95.3	95 0	96.3	95.2	95.1	96.2	94.7
	Reduced mill extraction	95.5	95.3	95.4	95.7	95.5	95.3	95.4	96.3	95 5	94.6	96.2	95 1
SUCROSE LOSSES	Sucrose lost in bagasse % cane	0.65	0.63	0.69	0.58	0.69	0.72	0.69	0.55	0.68	0.68	0.52	0.66
	,, ,, in filter cake % cane	0.16	0.03	0.09	0.04	0.10	0.06	0.14	0.06	0.07	0.05	0.03	0.16
	,, ,, in molasses % cane	0.95	1.15	0.95	0.90	0.92	0.81	0.99	0.95	0.93	0.84	0.98	1.09
	Undetermined losses % cane	0 08	0.12	0.07	0.18	0.13	0.29	0.13	0.08	0.19	0.10	0.24	0.42
	Industrial losses % cane	1.19	1.31	1 11	1.12	1.15	1.16	1.26	1.09	1.19	0.99	1.25	1.67
	Total losses % cane	1.84	1.94	1.80	1.70	1 84	1.88	1.95	1.64	1.87	1.67	1.77	2.33
SUCROSE BALANCE	Sucrose in bagasse % sucrose in cane	4.63	4.62	4.60	4.03	4.56	4.73	5.01	3.69	4.81	4.94	3.83	5.30
	,, ,, filter cake % sucrose in cane	1.14	0.22	0.60	0.28	0.66	0.40	1.01	0.39	0.49	0.37	0.22	1.24
	,, ,, molasses % sucrose in cane	6.79	8.39	6.37	6.25	6.07	5.36	7.18	6.37	6.59	6.14	7.21	8.75
	Undetermined losses % sucrose in cane	0 59	0.88	0.47	1.25	0.86	1 90	0.94	0.58	1.34	0.73	1.76	3.37
	Industrial losses % sucrose in cane	8.51	9.53	7.44	7.78	7.59	7.66	9.13	7.34	8.43	7.22	9.19	13 41
	Total losses % sucrose in cane	13.15	14.15	12.04	11.81	12.14	12.39	14 14	11.03	13 24	12.18	13.02	18.71
RECOVERIES	Boiling house recovery	91.0	90.0	92.2	91.9	92.2	92.0	90 4	92.4	91.1	92.4	90.4	85.8
	Reduced boiling house recovery (Pty. M.J.85°)	89.6	90.2	91.3	90.4	89 3	88 4	89.4	90 4	91.0	90.3	89.4	86.8
	Overall recovery	86.8	85.8	88.0	88.2	87.8	87.6	85.9	89.0	86.7	87.9	87.0	81.3
	Reduced overall recovery (Pty M.J. 85°, F % C12.5)	85.6	85.9	87.1	86.5	85.7	84.2	85.3	87.0	86.9	85.4	86.0	82.5
	Boiling house efficiency	99 9	99.8	100.6	98.7	98.8	98.7	99.1	100.1	100.0	100.7	98 7	96.7

		Beau Vallon	Riche en Eau	Mon Trésor	Savinia	Rose Belle	Britannia	Bénarès	Union St. Aubin	St Félix	Bel Ombre	Réunion	Highlands	Mon Désert	Totals & Averages
MILLING WORK	Imbibition water % cane	22.7	22.2	28.8	27.7	26.7	25.0	26.2	30.4	29.2	20.5	22.8	22.7	29.0	26.5
	,, ,, % fibre	16.4	17.5	24.1	22.3	22.5	20.5	19.9	25.1	24.0	15.9	18.6	21.5	28.1	21.7
	Extraction ratio	44.8	33.9	38.8	39.5	42.4	36.8	36.6	32.6	43.2	42.3	43.7	43.6	35.8	38.5
	Mill extraction	93 8	95.7	95.4	95.1	95.0	95.5	95.2	96 1	94.8	94.6	94.7	95.4	96.3	95.3
	Reduced mill extraction	94.4	95.8	95.1	95.1	94.7	95.4	95.5	95.9	94.6	94.7	94.5	94.5	95.4	95.4
SUCROSE LOSSES	Sucrose lost in bagasse % cane	0.77	0.55	0.65	0.66	0.68	0.58	0.65	0.51	0.71	0.72	0.75	0.63	0.49	0.63
	,, ,, in filter cake % cane	—	0.04	0 14	0.05	0.08	0.09	0.08	0.03	0.11	0.10	0.15	0.12	0.07	0.08
	,, ,, in molasses % cane	—	1.00	0.75	0.96	0.85	0.82	1.14	0.95	—	1.07	0.94	0.87	0.82	0.93
	Undetermined losses % cane	—	0.20	0.03	0 06	0.16	0.03	0.54	0.27	—	0.20	0.05	0.11	0.16	0.17
	Industrial losses % cane	1.38	1.24	0.92	1.07	1.09	0.94	1.76	1 25	1.34	1.37	1.14	1.10	1.06	1.18
	Total losses % cane	2.15	1.79	1 57	1.73	1.77	1.52	2.41	1.76	2 05	2.09	1.89	1.73	1.54	1.81
SUCROSE BALANCE	Sucrose in bagasse % sucrose in cane	6.16	4.32	4.65	4.84	5.03	4.48	4.81	3.95	5.20	5.43	5.36	4.57	3.69	4.58
	,, ,, filter cake % sucrose in cane	—	0.30	1.00	0.37	0.59	0.70	0.61	0.26	0.78	0.75	1.10	0.86	0.53	0.58
	,, ,, molasses % sucrose in cane	—	7.83	5.35	7.04	6 28	6.37	8.49	7.32	—	8.06	6.68	6.29	6.23	6.75
	Undetermined losses % sucrose in cane	—	1.56	0.21	0.44	1.18	0.23	3 98	2.05	—	1.51	0.30	0.79	1.23	1.23
	Industrial losses % sucrose in cane	11.04	9.71	6.56	7.85	8.06	7.27	13.07	9.63	-	10.32	8.08	7.94	7.99	8.56
	Total losses % sucrose in cane	17.20	14.02	11.21	12 69	13.08	11.75	17.88	13.58	15.05	15.75	13.43	12.51	11.68	13.14
RECOVERIES	Boiling house recovery	88.2	89 8	93.1	91 7	91.5	92.4	86.3	89.9	89 6	89.0	91.5	93.2	91.7	91.1
	Reduced boiling house recovery (Pty. M.J.85°)	88 4	88.1	91.3	98.3	89.2	90.4	85 0	88.3	88.0	88.6	88.6	91.0	89.8	89.3
	Overall recovery	82 8	86.0	88.8	87.3	86.9	88.2	82.1	88.1	84.9	84.1	86.6	89.0	88.3	86.9
	Reduced overall recovery (Pty M.J. 85°, F % C12.5)	83.4	84.4	86.8	84.9	84 4	86.2	81.2	84.7	83.4	83.3	83.7	86.6	85.6	85.2
	Boiling house efficiency	99 1	98.0	99 8	99.0	100.5	100 0	96 4	98.5	97 2	98.8	99.9	99.0	99.3	99.5

Table XVIII. Production and Utilisation of Molasses.

Year	Production M. tons	Exports M. tons	Used for production of alcohol M. tons	Available as fertilizer M. tons	N.P.K. equivalent in molasses available as fertilizer M. tons		
					N	P_2O_5	K_2O
1948	85,308	—	42,640	42,768	222	107	2,198
1949	96,670	1,867	41,728	53,075	276	133	2,728
1950	98,496	79	25,754	72,643	378	182	3,734
1951	125,819	3,601	44,896	77,322	402	193	3,974
1952	113,756	40,537	29,878	43,339	225	108	2,228
1953	141,449	67,848	16,037	57,564	299	144	2,958
1954	120,495	89,912	8,300	22,383	116	56	1,145
1955	106,839	53,957	9,005	43,877	228	110	2,255
1956	118,716	52,694	8,661	57,361	298	143	2,948
1957	110,471	72,539	7,796	30,136	157	75	1,549


AREA UNDER SUGAR CANE
1835
1870
1958
SUGAR PRODUCTION, 100,000 TONS
6
5
4
3
2
1
0
1825
1835
1845
1855
1865
187