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Met'l. report, 1906. on p. 31-37.

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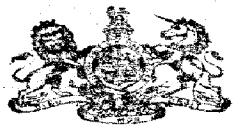

REPORT

ON THE

AGRICULTURAL

AND

BOTANICAL DEPARTMENTS, BARBADOS,

FOR THE PERIOD 1898 TO 1907, WITH A REVIEW OF THE SUGAR-CANE EXPERIMENTS SINCE 1884.

BARBADOS:
ISSUED BY THE IMPERIAL COMMISSIONER OF AGRICULTURE
FOR THE WEST INDIES.

1908.

National Oceanic and Atmospheric Administration

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REPORTS

ON

SUGAR-CANE EXPERIMENTS.

AT BARBADOS.

Report of the Agricultural Work for 1900 :—
Manurial Experiments and Experiments with varieties of Sugar-cane.

Report of the Agricultural Work for the season 1899-1901 :—
Manurial Experiments and Experiments with varieties of Sugar-cane.

Report of the Agricultural Work for the season 1900-2 :—
Manurial Experiments and Experiments with varieties of Sugar-cane.

Report of the Agricultural Work for the season 1901-3 :—
Manurial Experiments and Experiments with varieties of Sugar-cane.

Report of the Agricultural Work for the season 1902-4 :—
Parts I and II. Manurial Experiments. Part III. Varieties of Sugar-cane

Report of the Agricultural Work for the season 1903-5 :—
Parts I and II. Manurial Experiments. Part III. Varieties of Sugar-cane

Report of the Agricultural Work for the season 1904-6 :—
Parts I and II. Manurial Experiments. Part III. Varieties of Sugar-cane

IN THE LEEWARD ISLANDS.

Report on Experiments conducted with Sugar-canes in the season 1899-1900.

Report on Experiments conducted with Sugar-canes in the season 1900-1 :—
Part I. Varieties of Sugar-cane. Part II. Manurial Experiments.

Report on Experiments conducted with Sugar-canes in the season 1901-2 :—
Part I. Varieties of Sugar-cane. Part II. Manurial Experiments.

Report on Experiments conducted with Sugar-canes in the season 1902-3 :—
Part I. Varieties of Sugar-cane. Part II. Manurial Experiments.

Report on Experiments conducted with Sugar-canes in the season 1903-4 :—
Part I. Varieties of Sugar-cane. Part II. Manurial Experiments.

Report on Experiments conducted with Sugar-canes in the season 1904-5 :—
Part I. Varieties of Sugar-cane. Part II. Manurial Experiments.

Report on Experiments conducted with Sugar-canes in the season 1905-6 :—
Part I. Varieties of Sugar-cane. Part II. Manurial Experiments.

Report on Experiments conducted with Sugar-canes in the season 1906-7 :—
Part I. Varieties of Sugar-cane. Part II. Manurial Experiments.

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1908.

LETTER OF TRANSMITTAL.

Imperial Commissioner of Agriculture—to the Colonial Secretary, Barbados.

No. 3,798. November 13, 1908.

Sir,

I have the honour to forward, herewith, a report on the Agricultural and Botanical Departments at Barbados, and to offer the following remarks in review.

2. This report, besides dealing with the experimental work that has been carried on with sugar-cane, cotton, bananas, and other crops under the Imperial Department of Agriculture during the period 1898 to 1907, includes a brief historical account of the experiments with varieties of sugar-cane from 1884, of manurial experiments with sugar-cane since 1885, and of the establishment of the Botanic Station in 1886. It briefly sets forth the various efforts that have been made to improve and develop agriculture at Barbados from 1886 to 1907. There is also a general account of the Agricultural Education in the primary and secondary schools of the colony.

3. There are also included reproductions of photographs relative to the sugar, cotton, and banana industries. These should add to the interest and value of the report.

Sugar-cane Experiments.

4. Since sugar is the staple product of Barbados, the chief attention of the experimental agricultural work in the island has necessarily been directed to this crop. The experiments with sugar-cane may be said to date from 1884, when ten varieties of sugar-cane were received from Jamaica. These canes were gradually increased and were grown in comparative plots with eight varieties then known at Barbados, and were tested in 1887. Nine other varieties were obtained from British Guiana and included in the experimental cultivation. In January 1888, young seedling canes were noticed to be growing in a field next to that in which variety tests were being carried on, and in December of that year and the early part of 1889, arrows were planted in boxes of carefully prepared soil, and a number of seedling canes obtained. Since then, the raising of seedling sugar-canes and the testing of their economic value has formed a large portion of the work of the Agricultural and Botanical Departments of the island.

5. Manurial experiments were commenced at Dodds in 1885 with a view to ascertaining the manurial requirements of the sugar-cane under the conditions prevailing in the island. Various modifications were at first made in the conduct of these experiments, but since 1892-4, the same quantities of the various manurial constituents have been applied each year to the same plots. The nitrogen series has consisted of thirteen plots, the phosphate series of ten plots in two sections (eight superphosphate plots having existed for thirteen years, and two basic slag plots for twelve years), and the potash series of nine plots. The average results of these experiments are briefly set forward in the report.

6. The establishment of the Imperial Department of Agriculture in 1898 made it possible to extend to a considerable degree the sugar-cane and other agricultural experiments, and since that time the work of the Botanical and of the Local Agricultural Departments at Barbados has been carried out under the direction of the Imperial Department. The sugar-cane experiments were entirely re-organized and greatly enlarged. Large numbers of seedling varieties have been raised in an irrigated field at a central station for rigorous testing in the field and the laboratory. The more promising of the seedling varieties have been distributed to estates throughout the island for comparative trial under estate conditions, and for further testing in the laboratory. The manurial experiments carried out at Dodds have been continued under the charge of the Department, and, in addition, other manurial experiments have been conducted on typical black- and red-soil estates, through the kind co-operation of the owners and attorneys. Experiments in chemical selection have been made to ascertain whether it is possible to increase the richness of any variety of sugar-cane by continually replanting from those stools and canes that have been

found by chemical analysis to contain the greatest amount of saccharose. Tillage experiments have also been conducted, and the production of canes of known pedigree has received considerable attention.

7. Since 1898, nearly 30,000 canes have been raised from seed. These are in various stages of the process of testing. The seed-bearing parents alone of these seedlings have been known with certainty, and have been registered in each case. Vast numbers of the seedlings have proved to be far less valuable than the seed-bearing parents originally selected, and therefore it is hoped that the experiments carried on in artificial hybridization of the sugar-cane, where the parent on both sides is known, may be the means of more surely and more rapidly procuring improved varieties. At the Agricultural Conference held in the island in 1900, Professor J. P. d'Albuquerque recommended a method of securing cross-pollination in the sugar-cane. In 1904, Mr. Lewton-Brain (Mycologist on the staff of this Department), after consultation with Professor d'Albuquerque and Mr. Bovell, performed experiments at the Ridge plantation in artificial cross-pollination, and secured five hybrid sugar-canes of known parentage. Plants from these have been grown and are being submitted to rigorous selective tests. In the following two years, Mr. Stockdale (the present Mycologist) has had charge of these experiments. The scope of this work has been entirely remodelled, and enlarged experiments, covering about 5 acres of land, have recently been commenced at Dodds, and on Summervale plantations.

8. The experiments in raising varieties of seedling canes less susceptible to disease and yielding a larger amount of sugar, have proved of considerable value to the sugar industry of the island. Larger areas are being planted year by year with seedling canes, and the more enterprising members of the planting community are eager to obtain the newer varieties that are from time to time recommended by the Department, after careful experimental tests, for trial on small plots under estate conditions. The results of the manurial experiments on the estates have varied in different localities, but have shown that the general conclusions drawn from the experiments conducted at Dodds should be modified in certain directions when considered by planters where climatic or other conditions are different.

The Cotton Industry.

9. Although the cultivation of the sugar-cane is the chief industry of Barbados, yet efforts have been made to encourage and establish subsidiary industries. Experimental cultivations of cotton were begun on a few estates in 1902, when some 16 acres were planted. During the next year, a visit was paid to the Sea Islands of Carolina, in company with Mr. J. R. Bovell, the Agricultural Superintendent, for the purpose of studying the methods there practised of cultivating, selecting, and grading cotton. A large quantity of the best Sea Island cotton seed was purchased for use inthe West Indies, of which a considerable amount was planted at Barbados. In 1903, 800 acres were under cotton cultivation, and the total value of th exports of lint and seed for the season was £13,113. This may be said to be the turning point of the cotton industry at Barbados. It has developed rapidly, and in 1906-7 an area of 5,000 acres was planted in this crop, and the total value of cotton exports was estimated at £76,376.

10. This industry is one which has, since its inception, received special assistance and encouragement from this Department, which has paid particular attention to the study and treatment of the insect pests and fungoid diseases to which the crop is liable, to the methods of cultivating, manuring and of picking and ginning the cotton, and to the selection and picking of seed for planting purposes. The assistance given by the British Cotton-growing Association in loaning machinery in the first instance, and in providing for the services of a Travelling Inspector in connexion with Cotton Investigations (Mr. T. Thornton, A.R.C.S.), has been of the greatest value.

11. In the establishment of the cotton industry at Barbados, I desire to make special reference to the valuable services of Mr. J. R. Bovell. Also, to the important assistance rendered by Mr. H. A. Ballou, M. Sc. (Entomologist), and other scientific officers of this Department.

12. The value of the cotton industry to the island has been considerable. It has proved a valuable and remunerative adjunct to the sugar industry. The cultural and other operations conveniently fall into line with the routine work of the sugar estate, and it affords a valuable rotation crop with sugar-cane particularly when disease of the latter is at all prevalent.

Other Industries.

13. Efforts have been made in other directions to assist and encourage other subsidiary industries. Sweet potatos and yams have received attention and regular shipments of these products are continually made to firms in England, with a view to commencing an export trade in these commodities.

14. The banana industry has received considerable attention. In 1902, eighteen bunches only were shipped, while in 1905, the total shipments amounted to over 40,000 bunches. In 1906, however, difficulties of shipment were experienced owing to the lack of room in cold storage, so that only a small number of bunches, of the value of £718, were exported in the year 1906-7. Barbados bananas have a delicate flavour and are greatly appreciated in the English market. There is little doubt that a banana industry, on a moderately large scale, could easily be established in the island, if suitable facilities for shipment in cold storage were available.

15. This Department has also endeavoured to further the agricultural interests of the island by instituting experiments in regard to the cultivation of onions, leguminous crops, etc., and has rendered assistance by providing funds for local Agricultural Shows for peasants and small proprietors, and by furthering the interests of the island at Canadian and other Exhibitions.

Miscellaneous.

16. The insect pests and fungoid diseases of local crops have been carefully studied by the Entomologists and Mycologists who have from time to time held office in the Department, and the results of their investigations have been published in papers in the *West Indian Bulletin*, and in numerous pamphlets which have been widely appreciated in all parts of the world.

17. Attached to the report is an interesting account of the meteorology of the island, and a note on the rainfall and crops of Barbados from 1847-1906.

Agricultural Education.

18. Agricultural education in the colony has been furthered by the provision of a Lecturer in Agricultural Science, whose whole time has been devoted to the teaching of Natural and Agricultural Science, by Agricultural Exhibitions tenable for two years at Harrison College, by lectures to Elementary School teachers, by gifts to the Elementary Schools, and by prizes for school children at the Local Agricultural Exhibitions held every year under the auspices of this Department.

Conclusion.

19. In conclusion, I would desire to place on record my sense of the valuable services rendered to the agriculture of the colony, and of the West Indies, by the labours associated with the names of the workers in Barbados. The Sugar-cane Experiments of Barbados were inaugurated by Professor J. B. Harrison, C.M.G., M.A., and Mr. J. R. Bovell, I.S.O., in the early eighties, and carried on by them until 1889, when Professor Harrison was appointed to British Guiana. Professor J. P. d'Albuquerque, M.A., succeeded him, and the work has been continued on the original lines up to 1898, and on greatly extended lines of agricultural research from 1898 until the present time. Annual reports giving full details of the experiments have been issued since 1886, and numerous papers and annual pamphlets relating to them have been issued by this Department since 1898. The present report which I have the honour of transmitting indicates in outline the nature and scope of this work.

I have, etc.,

(Sgd.) D. MORRIS,
Commissioner of Agriculture
for the West Indies.

REPORT ON THE AGRICULTURAL AND BOTANICAL DEPARTMENTS, BARBADOS,

For the period 1898 to 1907,

with a review of the Sugar-cane Experiments since 1884.

As this is the first report on the Agricultural and Botanical Departments of Barbados that has been prepared for publication, it may not be out of place if the reasons for its preparation are given.

As is well known, since 1886, reports for each year have been issued on the results of the sugar-cane experiments that have been carried on, as well as on the meteorology of Barbados. As the Sugar Industry was, up to the last few years, practically the only industry of any importance carried on in the colony, it was not considered necessary that other reports should be made. Latterly, however, the attention of planters has been directed to the cultivation of cotton and bananas, and it may not be without interest if an account is given of these industries, together with any matters that may be of agricultural interest.

ESTABLISHMENT.

The establishment of the Botanic Station consists of the Superintendent and a clerical assistant.

The establishment of the Agricultural Department consists of the Island Professor of Chemistry and Agricultural Science, with two assistants, and the Agricultural Superintendent (who is also Superintendent of the Botanic Station), two assistants, and two assistant clerks.

During the whole period under review, the office of Superintendent of the Botanic Station, and from 1899 onwards, that of Agricultural Superintendent, has been held by Mr. J. R. Bovell, I.S.O., F.L.S., F.C.S. The office of Island Professor of Chemistry and Agricultural Science was held from 1880 to 1889 by Professor J. B. Harrison, C.M.G, M.A., F.I.C., F.G.S., F.C.S., and from 1890 till the present time by Professor J. P. d'Albuquerque, M.A., F.I.C., F.C.SS. (Lond. and Berlin).

BRIEF HISTORICAL ACCOUNT OF THE BOTANIC STATION AND THE SUGAR-CANE EXPERIMENTS AT BARBADOS.

The Botanic Station at Barbados may be said to date from the beginning of 1886, when the area at Dodds devoted to that purpose was selected by Dr. (now Sir) Daniel Morris, when he was passing through Barbados on his way to take up the appointment of Assistant Director of the Royal Gardens, Kew, England. At that time a Committee, consisting of Mr. A. St. John Watts, Police Magistrate of the district; Professor J. B. Harrison (the then Island Professor of Chemistry); and Mr. J. R. Bovell, was appointed for carrying out the work in connexion therewith. Five years later, i.e., in 1891, Sir Daniel Morris

reported on the Botanic Stations of the West Indies at the instance of the Secretary of State for the Colonies, and the following is a copy of that portion of the report which deals with his visit to Barbados :—

'I arrived at Barbados on January 17, and, in accordance with an arrangement previously made with Mr. J. R. Bovell, Superintendent of the Botanical Station at Dodds, I visited that institution. The station is attached to the Boys' Reformatory School, and the labour of the boys is utilized to cultivate about 90 acres of land chiefly in sugar-canes. The idea of establishing a Botanical Station here is due to Sir William Robinson, who made the suggestion when he was Governor of the Windward Islands in 1886. Numerous varieties of canes were obtained from Jamaica and elsewhere, and in conjunction with Professor Harrison, Mr. Bovell, the Superintendent, undertook and carried out a very valuable series of cultural experiments to determine the best varieties of cane suitable for the circumstances of Barbados. After this, the scope of the experiments was enlarged, and the effect of artificial and other manures on the growth and yield of canes was carefully followed. The results of these investigations were published in annual reports prepared by Professor Harrison and Mr. Bovell. In 1887-8 there were noticed in the cane fields at Dodds grass-like growths which were supposed to be seedling sugar-canes. The first information respecting this discovery (or rather rediscovery, for similar growths had been noticed before at Barbados), was published in the *Kew Bulletin* for December 1888. Both botanists and sugar planters had hitherto sought in vain for seeds of the cultivated varieties of sugar-cane. The subject was closely followed in subsequent years, and the fact was ultimately established that under certain conditions some varieties of sugar-canes still retain the power of producing fertile seed. A description of the flower and fruit of the sugar-cane, with plate, is given in the *Journal* of the Linnean Society, Vol. xxviii (Botany), p. 197, pl. 33. Observations on the same subject, which proved afterwards to be earlier than those made at Barbados, as regards a description and drawings of the seed, were published by Dr. Benecke at Java in 1889.

'The observations and investigations carried on at the Barbados Botanical Station are generally acknowledged to be of the highest value to the staple industry of the island. The facts so far obtained show that a good deal more is possible to be done to improve the yield of canes : and considering the great importance of the sugar industry to the West Indian Islands, it is surprising that no systematic efforts have hitherto been made to establish experimental stations properly equipped for the special purpose of doing for the sugar-cane what has been so successfully accomplished in European countries in regard to the beet. It is true that something has been done in this direction on private estates in Trinidad and Demerara, but what is evidently required now is an experimental station devoted to scientific agricultural research controlled by competent men, and acting as the training school for the planters of the future.

'Besides the experiments in sugar-cane, an effort has been made at the Dodds Botanical Station to cultivate other plants, especially species of *Agave*, *Furcraea*, *Sanseveiria*, and *Boehmeria*, for fibre purposes. The land is, however, of too clayey a character for such plants, and also too much exposed to strong and dry winds. While it has answered very well up to a certain point for useful experiments with sugar-cane, the land at Dodds is quite unsuitable for the cultivation of other plants. The wind is most injurious to them, and during certain seasons of the year there is little or no water available for purposes of cultivation. It would be of considerable advantage, in the interests of the sugar industry, as well as of others, to possess an experimental station in another part of the island. A petition of the Barbados Agricultural Society and Reid School of Practical Chemistry has been presented to the Governor, asking "that a Bill be sent down to the Legislature, appropriating a sum of money for the purpose of establishing on the highlands in the ratooning district of the island, a second botanical and experimental station similar to that already existing at Dodds." If such a second station were established, it is possible that land might be found that is well suited for the cultivation of many other plants likely to prove of great value to Barbados. The island is so entirely dependent on sugar, that it is very desirable to encourage as far as possible any measure calculated to improve and establish it. It is also equally important to support it by other and subsidiary industries. There are several thousand acres of waste land in Barbados where a fibre industry might be successfully established, and there are also other lands where plants yielding tanning barks might be cultivated. None of these can be experimentally tried under favourable circumstances at Dodds, owing to the unsuitability of the soil and the exposed character of the locality.'

In consequence of the situation and nature of the land at Dodds, and the conditions which usually prevail there, as described in Sir Daniel Morris' report, the site has not proved satisfactory for a Botanic Station, and little is now done, beyond caring for the trees, etc., already growing there.

SUGAR-CANE EXPERIMENTS.

During the period under review (1886-1907) the sugar-cane experiments have been carried on in four directions, viz :—

(1) To ascertain the value of certain varieties of seedling and other sugar-canes when grown under the soil and climatic conditions existing in different parts of the island ;

(2) The growing of new seedlings, not only from seed ordinarily obtained, but also from seed obtained by means of cross-pollination effected by hand ;

(3) To ascertain the effects of certain manurial constituents of plant food on the sugar-cane, under the soil and climatic conditions existing in different parts of the island ;

(4) To try to increase the saccharose of the sugar-cane by selecting for replanting purposes canes rich in that constituent.

EXPERIMENTS IN RAISING NEW SEEDLING SUGAR-CANES AND WITH CANES OF DIFFERENT VARIETIES.

The sugar-cane experiments in Barbados may be said to date from 1884, when six barrels containing the following varieties were received from Jamaica, viz : Mauritius, Keni-Keni, Naga, Norman, Sacuri, Mamuri, Batramic, Bouronappa, Hillii, and Elephant (Jamaica). In addition, the following varieties then growing in Barbados were also obtained, viz : Bourbon, Ribbon, White Transparent, Elephant (Barbados), Purple Transparent, Salangore, Demerara, and Barbados Native. Subsequently, the following other varieties were obtained from British Guiana, viz : Lahaina, Honolulu, Rappoe, Keening, Queensland Creole, Chigaca, Meera, White Mauritius, and Striped Singapore. The canes sent from Jamaica were selected by Sir Daniel Morris, K.C.M.G., who was then Director of Public Gardens and Plantations in that island.

The canes received from Jamaica and those obtained at Barbados were gradually increased, until sufficient were available to plant 100 holes of each variety, during December 1885. These canes were reaped in 1887, and the Bourbon cane, the one then usually planted in Barbados, gave the best result of the eighteen then under experimental cultivation.

SEASON 1886-8.

During the season 1886-8, the experiments with the different varieties of sugar-cane were carried on both at Dodds and, with the permission of W. T. Armstrong, Esq., then Police Magistrate of District 'F,' at his estate, Little Island. That year at Dodds, out of the eighteen varieties tested, the best return was again given by the Bourbon, and the same thing occurred at Little Island with the seventeen varieties cultivated on that estate.

In January 1888, some sixty-nine young seedling canes were noticed by an overseer (Mr. I. B. Pilgrim) growing spontaneously in a field next to that in which the different varieties were being cultivated. The seedlings were later transplanted into an adjoining field and kept under observation.

SEASON 1887-9.

For the season 1887-9, out of thirty-one varieties cultivated at Dodds, the best result was obtained with the Queensland Creole, the Bourbon coming out seventeenth. The canes which were plant canes the year before at Little Island were reaped as ratoons this season, and the best result was obtained with the Norman, the Bourbon coming second.

During this year the seedling sugar-canes discovered and transplanted as above mentioned, were, after a certain number had been made into cuttings and replanted, crushed, and the juice was analysed ; and as it is probable this is the first analysis of seedling sugar-canes made in any dependency of the British Empire, it may be of interest to place the results on record :—

ANALYSIS OF FIRST SEEDLING SUGAR-CANES AT BARBADOS, 1888.

	Canes.	Cane Juice.	Megass.
Water	68·11	81·18	48·20
Sucrose	12·62	15·13	8·70
Glucose	0·69	0·83	0·48
Ash	0·47	0·30	0·75
Albuminoids	0·33	0·17	0·59
Fibre	15·44	...	36·69
Organic matters	2·34	2·39	1·68
	100·00	100·00	100·00

From the middle of December 1888 to February 1889, a further careful search was made through the fields for growing seedlings and for arrows containing fertile seeds. Both of these quests proved successful, and 130 seedling canes were raised and subsequently planted in a field. The method adopted in growing the seedlings was as follows:—

The panicles were gathered as soon as the spikelets began to be blown away by the wind, or as soon as a slight shake of the stem of the cane caused a few to fall. The panicles were then put in thin muslin bags and hung in a dry, airy place exposed to a certain amount of sunshine. At the end of a few days, when all the spikelets were readily detachable, they were rubbed off and returned to the bags to dry for a couple of days longer. The seeds were then sown in well-drained boxes of sifted garden soil, covered lightly with fine soil, and watered. At one time they were covered with sheets of glass and put under cover where they could only receive a limited amount of direct sunshine. Latterly, however, it was found that they grew more hardily if the boxes were exposed to the sunshine from the beginning. Usually at the end of the fifth day a few of the plantlets began to appear. At the end of the second week, nearly all of those likely to germinate were above ground. By the middle of the second month they were fit for transplanting, and they were then pricked off into small pots. Three months from the time the seed was sown the plantlets were ready to be transplanted. In about twelve months' time all the canes which from their field characters appeared suitable for reproduction were cut, weighed, the juice was extracted and a partial analysis made. The stools of those canes which from their combined agricultural and chemical characters promised to be acquisitions were dug up, cut in half and planted where they could be irrigated. By the following December the canes from these stools were made into cuttings and grown under ordinary plantation conditions. In twelve months these canes were again made into cuttings and grown on plots of 100 holes each.

The above line of work thus adopted in the first instance, is still continued in the Barbados experiments. The canes are tested against the White Transparent (the standard cane) for from three to four years, when, if it is found that the results obtained are not as good as those given by the White Transparent, the canes are destroyed. Those that have done better than the standard cane are cultivated on the various estates until the average results for a sufficiently long period justify their being recommended to the planters.

During the season 1887-9, experiments were undertaken at Halton plantation to ascertain as far as possible upon a large scale, whether it was better to grow canes in rows 5 feet apart, and 5 feet apart in the rows, or in rows 6 feet apart, and 6 feet apart in the rows. The conclusion arrived at was that the canes planted in rows 5 feet apart and with a distance of 5 feet from plant to plant in the rows, gave a yield of about ½ ton of saccharose per acre more than those planted in rows 6 feet apart, and at a distance of 6 feet from plant to plant in the rows.

SEASON 1888-90.

For the season 1888-90 the best result obtained on the plot in which the different varieties of sugar-canes were grown was given by No. 1 Trinidad, out of thirty-one varieties. This was closely followed by Naga B., a sport of the Naga, which had been obtained at Dodds; the Bourbon cane took third place. In the case of the second ratoons at Little Island, the best result was obtained with the Bourbon.

In addition to the usual trials, there were carried on in this season, experiments for the purpose of ascertaining whether cane tops or pieces of cane gave better results for planting purposes. In the case both of plant canes and first ratoons, better results were obtained with pieces of cane than with cane tops.

During this season twenty-three varieties out of the sixty different varieties found growing spontaneously in January 1888 were replanted and the remainder discarded. The number of young seedling canes grown reached about 2,500. Of these 1,000 were kept and planted out in the fields, a number of the remainder being given away or destroyed, as it was found impossible to deal with the whole lot, owing to the want of level land for plots, etc. Nearly 200 seedlings were sent to the Royal Gardens at Kew, as well as small bottles of seed, and some seeds that had germinated, put up in glycerine. In addition to those sent to Kew, sixteen small bottles were distributed to various Botanic Gardens, and to several individuals who applied for them, and in many instances a small vial containing a few seeds that had germinated, put up in glycerine, was sent along with the seed.

THE SUGAR-CANE: NOTES ON ITS HISTORY, PROPAGATION, AND POWER OF PRODUCING FERTILE SEED.

The following paper relating to some of the sugar-cane seed forwarded to Kew, and which also contains other interesting information on the subject of the sugar-cane, was read before the Linnaean Society by Sir Daniel Morris, who was then Assistant Director of the Royal Gardens, Kew, on March 6, 1890:—

'The common sugar-cane (*Saccharum Officinarum*, L.), as a cultivated plant, is known throughout the tropical and subtropical regions of both hemispheres. It is supposed to have originated in some portion of South Asia, but where, it is not known. Roxburgh, Wallich, Royle, Aitchinson, and other Anglo-Indian botanists saw no really wild plants of the sugar-cane in Hindustan or in any of the neighbouring countries. Rumphius, who carefully describes the cultivation of the sugar-cane in the Dutch colonies, says nothing about the home of the species. Miquel, Hasskarl, and Blanco mentioned no wild specimens in Sumatra, Java, or the Philippines. Crawford expressly sought to find the wild sugar-cane in the Indian Archipelago, but failed to do so. Bentham at a comparatively recent date and after an exhaustive survey of material from all parts of the world, says: "We have no authentic record of any really wild station for the common sugar-cane."*

'Another point connected with the life-history of the sugar-cane, which has occupied attention is—whether the sugar-cane, owing to the fact that it has been propagated for so many centuries by cuttings, or slips, has not, in common with other plants, such as the banana, plantain, and bread-fruit, lost the power of producing mature seed. A very general opinion exists at the present time, and indeed has existed for nearly a hundred years, that the sugar-cane does not produce seed. Hughes,† in 1750, speaking of the sugar-cane at Barbados, states: "The glumes of their panicles contain a whitish dust or seed, yet these being sowed, never vegetate."

'Rumphius‡ does not expressly state that the sugar-cane does not flower and seed, but remarks "Floresque semenque nunquam profert nisi per aliquot annos steterit in loco quodam saxoso."

'Macfadyen**, in regard to Jamaica, says that "it is a peculiarity of the sugar-cane in this climate, that it refuses to perfect its seed. Ever since its cultivation in this island it has been raised from cuttings of the joints."

'Sir William Hooker,|| citing Roxburgh, states that "notwithstanding the long residence of the latter in the country of the Ganges, he never saw the seed of

* Flora, Hong-Kong, p. 420.
† Hughes: 'History of Barbados' (1750), p. 244.
‡ Rumphius, Amboin. Vol. V, p. 186.
** Hooker's Bot. Misc., Vol. I, p. 99.
|| Ibid.

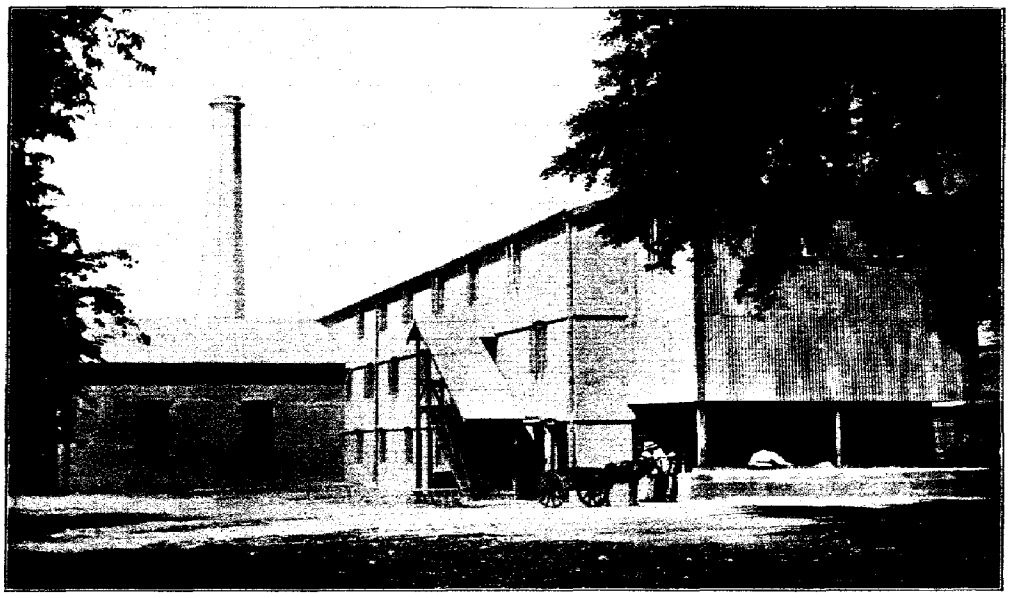

FIG. 1. BARBADOS CENTRAL COTTON FACTORY. OUTSIDE VIEW.

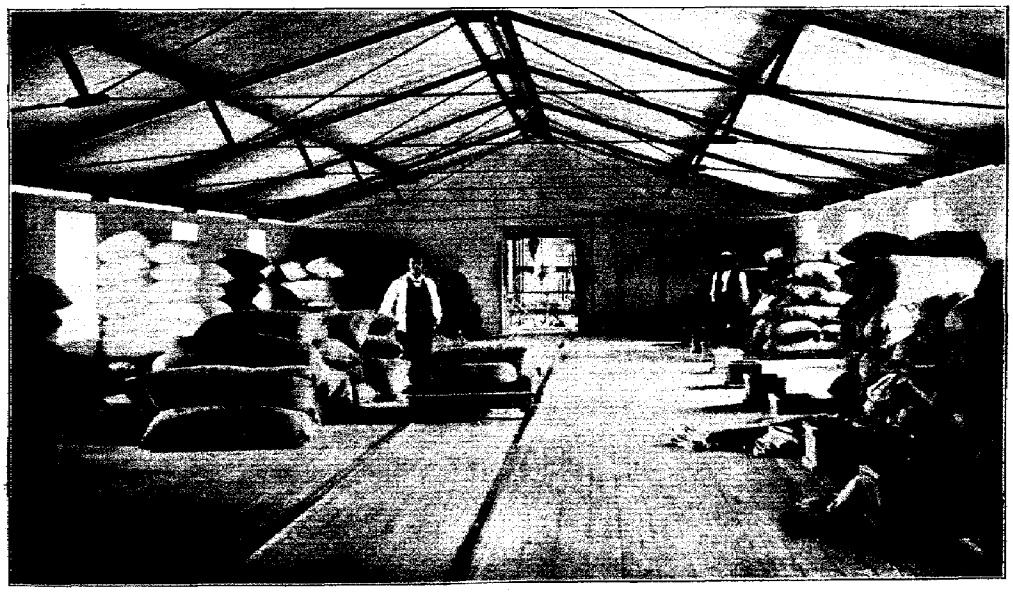

FIG. 2. BARBADOS CENTRAL COTTON FACTORY. TOP FLOOR.
The openings on the right show the chutes through which the cotton is sent down to the gins.

500 Wt P 2 12/07 D & S 32 30587

FIG. 3. BARBADOS CENTRAL COTTON FACTORY. SECOND OR GINNING FLOOR.

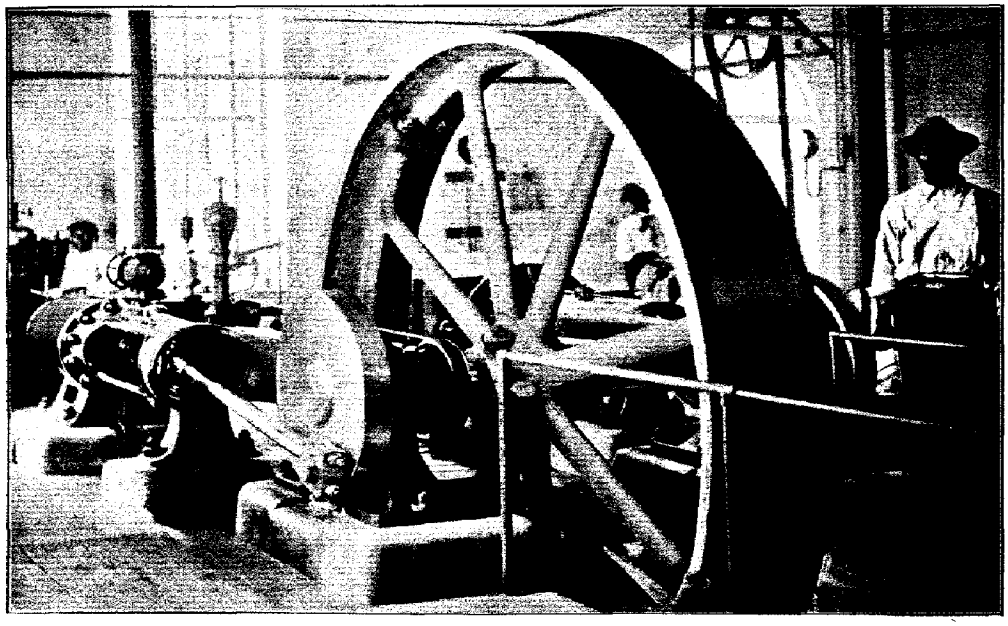

FIG. 4. BARBADOS CENTRAL COTTON FACTORY. ENGINE OR BASEMENT FLOOR.

the sugar-cane." And lastly we have Hackel, the recent "Monographer of the Andropogoneae in de Candolle's Monographiae Phanerogamarum," under *Saccharum Officinarum*, L., p. 112, adding "Caryopsis nemo adhuc videsse videtur."

'De Candolle is therefore no doubt correct in the statement that no one has hitherto described or drawn the seed of the sugar-cane.††

'The flower of the sugar-cane, on the contrary, has often been figured and described. One of the earliest figures is given by Tussac ("Flora Antillarum," 1808-27), copied by Hayne "('Arzneykunde" ix, tt. 30, 31). These exhibit the character of the stems and general habit, but the analysis of the flower is poor. Later there is given a good drawing of the plant and flower, in Hooker's Bot. Misc., i., p. 101; to this is added a full account of the sugar-cane and its cultivation in Jamaica, by Macfadyen. An excellent drawing, with a full analysis of the flower and pistil, is given by Schacht ("Maderia and Teneriffe," tab. 1). This I regard as the most satisfactory representation of the floral structure of the sugar-cane. The description given by Bentley and Trimen ("Medicinal Plants," tab. 298) is excellent, but the analysis of the flower is by no means good.

'In all these no attempt has been made to describe the seed. It is probable, therefore, that so far no ripe seed had come under the notice of the numerous botanists who had described the plant and flowers.

'During the last two years, owing to very intelligent experiments carried on at the Botanical Station at Barbados, Professor Harrison and Mr. Bovell have shown very conclusively, that certain varieties of the common sugar-cane still produce mature fruit. The first statement on the subject by Professor Harrison has already been published.* It is only necessary to mention here, that for many years self-sown seedlings of sugar-cane appear to have been observed at Barbados and elsewhere. Some of these natural seedlings have been successfully raised and established. Owing, however, to the very few fertile fruits produced in each panicle—possibly not more than one in every three or four thousand spikelets—and owing also to their very small size, it is very difficult indeed to observe them.† The experiments at Barbados, confirmed by observations at Trinidad, Demerara, and lately at Kew, have now clearly proved that the varieties of sugar-cane known as "Purple Transparent" and "White Transparent" periodically produce seed at Barbados; and that the Bourbon cane, known also as the "Otaheite cane," does so very sparingly. From seed of the former, received from Barbados, sugar-cane plants have been successfully grown at Kew, and observations have been made which are embodied in this note.

'Although there are numerous varieties of the common sugar-cane, only a few are widely cultivated in sugar-producing countries. These being propagated by cuttings or shoots, retain all the character and peculiarities of the parent plant. In the West Indies the chief variety cultivated is the Bourbon or Otaheite cane. This is also widely cultivated in Mauritius, and under other names it is the favourite variety in the East Indies and Polynesia.

'At the Jamaica Botanic Gardens in 1884, there were in all sixty varieties of sugar-cane under experimental cultivation, and these were readily distinguished by the foliage, by size, colour and character of stem, and by general habit.‡

'The flowering panicle (without the hollow stem) varies from 2 to 3 feet in height.** The numerous spikelets are arranged in pairs, one being sessile, and the other stalked, surrounded by a dense ring of long, white, straight, spreading hairs, arising immediately below and coming away with the spikelets. All the spikelets examined were one-flowered and hermaphrodite. The single purple pale enclosed in the upper glume is present or sometimes reduced to a film. The red lodicules vary from two to three, and are either truncate or 2-3 lobed. The yellow stamens were fully developed, and in a few instances, the pistil was rudimentary. The upper part of the bifid purple stigma is large and densely plumose. The caryopsis, where present, is free and enclosed within the pale and glumes; it is about $\frac{1}{16}$ inch long, $\frac{1}{48}$ inch wide, elliptical-oblong, smooth or finely striated, flesh-coloured, and surmounted by the persistent bases

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†† Origin of Cultivated Plants (1882), p. 157.

* Kew Bulletin, 1888, p. 294.

† On the economic value of the fact that the sugar-cane does produce seed, see *Kew Bulletin* 1889, p. 242.

‡ Jamaica Botanical Department Report, 1884, pp. 31-4.

** According to Munro (Journ. Linn. Soc., Vol. VI, p. 36) the specimens marked by Linnaeus himself as '*Saccharum Officinarum*' are not the true sugar-cane but *Erianthus japonicus*, Beauv.

of the style. The albumen is nearly white, sub-transparent. The embryo is lateral, one-sixth the length of the caryopsis. In germination, the plumule and radical emerge without the cotyledon.

'(NOTE.—Since this paper was read I have received through the kindness of Dr. van Eeden, Director of the Colonial Museum at Haarlem, a copy of "Mededeelingen van het Proefstation Midden-Java te Semarang, over suikerriet uit zaad, door Dr. Franz Benecke, met 23 figuren." Semarang: G. C. T. van Dorp & Co., 1889. In this a very complete account is given of observations made in Java, which have undoubtedly to a great extent anticipated those made at Barbados and described above.

'Dr. Benecke shows clearly that the occurrence of fruit in sugar-cane had been observed by him during the years 1887-9, and he is probably the first to have published (in 1889) a description with drawings of the fruit and the mode of germination. Those interested in the subject are referred to Dr. Benecke's pamphlet. In the meantime the above short summary will emphasize the fact and bring to the notice of botanists generally, the possibility now of multiplying the sugar-cane by seminal reproduction.—D.M.).

SEASON 1889-91.

During the season 1889-91, the cane Naga B., which had taken the second place the year before, gave the best results out of the twenty-eight different varieties planted. Of the seven varieties planted at Little Island, the Caledonian Queen gave the best results, the Bourbon this year coming out sixth.

In this same year, for the first time, the new seedling varieties obtained the first year were tested on plots under the same conditions as the Bourbon, and for the season the Burke headed the list, followed by the Bourbon, all the other seedlings giving lower yields than the Bourbon. Of the 1,000 seedlings replanted in 1889, the best (106 varieties) were made into cuttings and replanted, the remainder not being worth keeping. A further lot of 1,000 seedlings was this year grown and planted in the field.

SEASON 1890-2.

For the season 1890-2, the experiments with different varieties of canes at Dodds were divided into two groups. In the first, twenty-two different varieties of canes, together with eight varieties of seedling canes raised at Dodds, were grown. The best result was obtained with the Nora Tava, the seedling B. 4 coming third, and the Bourbon coming fourteenth. In the second group, twenty-two varieties derived from seedlings were grown together with a plot of the Bourbon and a plot of the Caledonian Queen canes. In this group, the best result was obtained with the seedling named Yearwood, the Bourbon coming out seventh, and the Caledonian Queen eighth. At Little Island the canes were grown partly as plants and partly as first ratoons, the best results being obtained on the plot with the Caledonian Queen first ratoons; the Bourbon first ratoons coming forth, and the Bourbon plants seventh.

SEASON 1891-3.

For the season 1891-3, out of thirty different varieties of canes, including seedlings, the best result was obtained with the Lahaina, the Bourbon taking seventh place. In the experiments with twelve varieties of seedling canes along with the Bourbon, the best result was given by the seedling B. 12, the Bourbon coming out second.

SEASON 1892-4.

In 1892-4, twenty-one different varieties of canes and seedlings were under trial. The highest place was taken by the Rappoe, the Bourbon being placed fifteenth on the list. In the experiments with the seedling varieties compared with the Bourbon, of those grown in the first instance the best result was obtained with the seedling cane B. 2, the Bourbon coming out eleventh. Of those found later, the best result was obtained with the seedling cane B. 147, the Bourbon coming out twelfth. The seedling cane, B. 147, it may be stated, has for a number of years given very satisfactory results on suitable soils.

SEASON 1893-5.

In 1893-5, Caledonian Queen gave the best result out of twelve different varieties of canes and seedlings, the Bourbon coming ninth.

SEASON 1894-6.

For the season 1894-6, out of thirty-four different varieties of canes and seedlings, the highest place was taken by the seedling cane B. 147, which had also given the best result for the season 1892-4 in comparison with the Bourbon, the Bourbon this season coming out twelfth.

In addition, there were ten plots of seedlings raised from plants, the parent of which was presented to the Botanic Station by A. Cameron, Esq., who obtained them from the Botanical Gardens, British Guiana. These were grown along with twenty-seven plots of Barbados seedlings, and a plot of the Bourbon. The best result was obtained with the seedling D. 145, the Bourbon coming out twelfth.

As a result of the experiments with the newer seedlings compared with the Bourbon cane, the seedling B. 150 came first on the list, the Bourbon taking seventh place.

SEASON 1895-7.

For the season 1895-7, excellent results were obtained with some of the different varieties, and with some of the newer seedling canes; for instance, the Striped Singapore gave 1,235 lb. of saccharose per acre more than the Bourbon. In another instance, B. 147 gave 3,423 lb. of saccharose per acre more than the White Transparent.

In this year, experiments were also carried on with the object of ascertaining the possibility of increasing the average richness and purity of the juice of a given variety of sugar-cane, by selecting plants from those canes which, on a chemical analysis of the juice, were found to yield a richer and purer juice than the average of the variety. The lower halves of each of a number of canes were crushed, and the juice of each analysed. Cuttings from the upper portions of those canes, the juice of which contained an amount of available sugar above the average for the variety, were planted in a plot by themselves, and cuttings from those canes which gave a sugar return below the average were also planted by themselves. A plot was also planted in the ordinary way. The result of the first season's work was that the canes planted from those which gave the high analysis yielded at the rate of about 1,500 lb. of available sugar per acre more than the ordinary plot. These results were very promising, but unfortunately, subsequent experiments have failed to confirm them (see further reference on page 19 of this Report).

SEASON 1896-8.

For the season 1896-8, excellent results were again obtained with the seedlings, the Burke seedling giving 7,787 lb. of saccharose per acre more than the Bourbon, while B. 147 gave 3,151 lb. of saccharose over and above that yielded by the Bourbon. The Jamaica cane, the Rock Hall cane, and the seedling canes B. 347, B. 376, and D. 130 also gave good results.

SEASON 1897-9.

For the season 1897-9, the best results were given by B. 147, followed by the Jamaica cane, B. 379, B. 347, D. 115, D. 145, and the Rock Hall cane.

ESTABLISHMENT OF IMPERIAL DEPARTMENT OF AGRICULTURE.

In 1898, the Imperial Department of Agriculture for the West Indies was established, and since that time the work of the Botanic Station and of the local Department of Agriculture has been carried out under the Department. A sum of £1,500 for sugar-cane and other agricultural experiments was in 1899-1900, added to the amount already granted by the Government of Barbados and grants have been continued each year since. The staff was increased on the Agricultural side ultimately by two assistants and two clerks, and that on the Chemical side by two assistants. With this increase of staff and resources, the plan of sugar-cane experiments and agricultural research was entirely reorganized. First it was arranged to raise large numbers of seedling varieties at a central experiment station, with records of parentage of these seedlings, to study their characteristics in the field and laboratory, and in the light of that study, while rapidly propagating the more promising varieties (selected varieties), simultaneously to exercise a rigorous weeding-out process with regard to the less promising varieties.

An irrigated field was laid out for the purpose of ensuring the growth of the seedlings when first planted out, and for ensuring a 'spring' from their stumps in the dry season of the following year, after the canes had been cut down for analysis. The effect of this was to enable the complete cane to be analysed, and yet secure a supply of 'seed cane' for the subsequent propagation of the variety. Secondly, Select Variety Stations were established in all the typical parts of the island, and at each of these the select varieties were planted in experimental plots, together with the standard commercial variety and certain other older varieties, the object being to test under actual estate conditions of cultivation, the relative merits in field and laboratory of these seedling varieties, in all parts of the island. Thirdly, those of the select varieties that commended themselves most highly to the planters were next planted on a small estate scale, and facilities were afforded for records of the weighing of the canes, volume of juice, and chemical analysis. As a result of this process of selection and multiplication, the best varieties are being ultimately made available for distribution on a commercial scale. Since the establishment of the Department some 29,943 canes have been reared from seed and are in various stages of the process of testing.

The manurial experiments which since 1886 had been carried on at Dodds experimental station were there continued. In addition, large fields were laid out in manurial experiment plots in plant canes in typical black soils, and in plant canes and ratoons in typical red soils.

The experiments on the possibility of increasing the richness of the sugar-cane by the chemical selection of the cuttings from the richest canes were continued on a greatly increased scale. The relative merits of different varieties of Leguminosae and of sweet potatos, and of different methods of tillage also formed the subject of careful investigation. These different developments of the agricultural work as well as that in connexion with cotton are dealt with in separate parts of this report.

SEASON 1898-1900.

For the season 1898-1900, experiments with the following ten varieties of seedlings and other sugar-canes which in previous years had given the best results at Dodds, were conducted at Dodds, Pine, Waterford, Coverley, and Husbands plantations in the black-soil district, and at Blackmans and Henley in the red-soil district, viz: B. 147, B. 156, B. 306, B. 208, B. 347, B. 254, Jamaica cane, Rock Hall cane, D. 130, and D. 145. In addition, the following were grown at Dodds: Queensland Creole, White Transparent, Caledonian Queen, Burke, and Bourbon: the White Transparent was also grown at Waterford and the Pine.

In the black soils with plant canes, the best result was obtained with B. 147, B. 347 coming second, B. 254 third, and B. 208 fourth, while the White Transparent, the cane which had now become the standard, owing to the practical destruction of the Bourbon by the rind and root fungoid diseases, came out seventh.

In the red soils with plant canes, the best results were again given by B. 147, B. 156 being second, and B. 208 coming third.

In addition, experiments were conducted with seedling canes of the first year's growth at Waterford, and of the second, third, and fourth year's growth at Dodds, Oughterson, Sunbury, and Hampton. A large number of new seedlings were also raised and planted out.

SEASON 1899-1901.

For the season 1899-1901, the experiments with the selected varieties were carried on at eleven estates, nine being black-soil and two red-soil estates. At the two red-soil, and at two of the black-soil estates, the canes were also grown as first ratoons. The best results as plant canes, on the average, on the black-soil estates, were obtained with the White Transparent, B. 208 coming second, and B. 147 third. In the red soils, as plant canes, Sealy Seedling took the highest place, B. 208 coming second, and the White Transparent sixth. In the first ratoons, the White Transparent gave the best returns, the Jamaica cane coming second, and B. 208 third. Taking the average of all the plots on both black and red soils, plants and first ratoons, the best result was obtained with B. 208, the White Transparent being second, and B. 147 third.

In the experiments with the other varieties of seedling canes at Dodds, the cane T. 24 gave the best results, the next best being B. 645 and B. 620.

SEASON 1900-2.

For the season 1900-2, twelve selected varieties were cultivated at nine estates in the black-soil district, and two in the red-soil district as plants and as first ratoons. As a result, in the black soils, as plant canes, the cane B. 376 came first on the list, B. 208 being second, and the White Transparent occupying ninth place. As ratoons, the best result was obtained with B. 208, the White Transparent coming sixth. In the red soils, Sealy Seedling took first place, both as plant canes and as ratoons. Taking the black and red soils together as plant canes, however, the best result was obtained with B. 208, the next best being B. 347. As ratoons the seedling cane B. 208 gave the best return.

At the end of this season a number of new seedling canes, raised since the Imperial Department of Agriculture was started, were crushed and analysed for the first time. Of these, B. 2,769 proved to be the most promising, the next best being B. 2,550.

SEASON 1901-3.

For the season 1901-3, seventeen selected varieties were cultivated at eight black-soil estates and at one estate in the red-soil districts.

In the black soils as plant canes, the best result was obtained with the Sport White cane, a sport obtained from the Red Ribbon at Kirton plantation in St. Philip, and presented to the Department by the Hon. F. J. Clarke, C.M.G., M.A., M.C.P., the Attorney: B. 208 came second, B. 645 third, B. 147 fourth, and the White Transparent fifth. In the black-soil ratoons, B. 147 gave the best return, White Transparent coming out second, D. 95 third, the Jamaica cane fourth, and B. 208 fifth.

On the red-soil estates B. 208 took first place among the plant canes, the White Transparent coming out eighth. As ratoons, the Jamaica cane gave the best results, the next best being B. 379, D. 95 coming out third, B. 208 fifth, and the White Transparent tenth.

Taking the black and red soils together, B. 208 came first among the plant canes, B. 147 being second, B. 376 third, and White Transparent fourth. As ratoons, D. 95 gave the best results, the next best being the Jamaica cane.

Of the other seedlings under cultivation at Dodds, B. 1,376 gave the best return, while White Sport did best at Waterford.

SEASON 1902-4.

In the season 1902-4, the experiments were carried on at sixteen estates in typical parts of the island as well as at the two Central Stations, viz: Dodds in St. Philip, and Waterford in St. Michael.

Of the eight selected varieties, in the black soils and as plant canes, the best result was obtained with B. 1,529, B. 208 coming second; and as ratoons, the best result was given by D. 95, B. 208 being second.

In the red soils as plant canes, B. 208 gave the best returns, B. 1,529 being second; while D. 95 took the leading place among the ratoons.

During the season 2,843 varieties were raised from seed and planted out, and 653 varieties of the second or third year's growth were reaped and analysed.

SEASON 1903-5.

In the experiments of the season 1903-5, of the thirteen selected varieties, the best return, on black soils and as plant canes, was given by B. 147; B. 1,529 came second, B. 208 fifth, B. 376 sixth, and the White Transparent seventh. As ratoons, on black-soil estates, the best result was obtained with D. 95; B. 208 came second, and the White Transparent third.

In the red soils as plant canes, the leading position was taken by B. 208, B. 1,529 coming second, and the White Transparent sixth. As ratoons, on red soils, the best result was obtained with D. 95, the White Transparent coming second.

In this year (1904) 1,166 varieties were raised from seed and planted out.

SEASON 1904-6.

For the season 1904-6, out of thirteen selected varieties, in the black soils as plant canes, the best result was obtained with D. 95. The next best was B. 3,696, White Transparent coming thirteenth. As ratoons on black soils, B. 1,529 came first in the returns, and B. 376 second.

In the red soils as plant canes, B. 1,566 came first on the list of returns, B. 376 took second place, B. 1,529 third, D. 95 fourth, B. 208 fifth, and the White Transparent sixth. As ratoons also, B. 1,566 gave the best result, the next best being D. 95. White Transparent came third, and B. 208 fourth.

During this season, 6,777 varieties were raised from seed and planted out.

IMPORTANCE OF THE SUGAR-CANE EXPERIMENTS TO THE SUGAR INDUSTRY.

That the seedling sugar-cane experiments are of the highest value to the Sugar Industry in the West Indies may be gathered from the facts given below.

The Agricultural Superintendent of the island has lately been able to obtain the returns given by some of the better seedlings grown in the same field and under the same conditions as the White Transparent, or standard cane, and the following is a brief summary of these results :—

At Husbands, there were planted in the same field and under the same conditions, nearly ½ acre each of the White Transparent, B. 147, and B. 208, as plants. The White Transparent yielded 7,212 lb. of saccharose per acre, B. 147 gave 8,321 lb., while 9,810 lb. of saccharose per acre were obtained from B. 208. Thus B. 147 gave 1,109 lb., and B. 208 2,598 lb. of saccharose per acre more than the White Transparent.

At Mangrove Pond, there were 3 acres each of the White Transparent and B. 208. The yield of the White Transparent was 7,720 lb. of saccharose per acre, while the B. 208 gave 9,770 lb. of saccharose per acre, or 2,050 lb. of saccharose more than the White Transparent.

At Henley, there were nearly 2 acres each of the White Transparent and the B. 208 grown under the same conditions. The White Transparent yielded 8,421 lb. of saccharose per acre, while B. 208 yielded 10,919 lb.—a difference in favour of B. 208 of 2,498 lb. of saccharose per acre.

With regard to B. 147, it may be mentioned that Mr. A. Cameron, the Attorney for several estates at Barbados, has been good enough to supply returns obtained with this cane on four estates under his charge. On one estate the returns were for three years as plant canes and two years as ratoons. On the remaining three estates, the returns were for two years as plant canes and two years as ratoons. On the first estate for the three years there were nearly 114 acres of B. 147 as plant canes, and 45 acres of the White Transparent. The B. 147 gave, on the average, 320 lb. more sugar per acre per annum than the White Transparent. On the other three estates the average area under B. 147, as plant canes, was 92 acres, and there were 55 acres under White Transparent. The cane B. 147 in this instance gave, on the average, 226 lb. of sugar more per acre per annum than the White Transparent. As ratoons on the four estates, there were, on the average, 77 acres of B. 147 and 117 acres of White Transparent. During that period B. 147 yielded, on the average, 370 lb. of sugar per acre per annum in excess of that given by the White Transparent.

At Carrington plantation, for the four crops 1903-6 inclusive, there were about 200 acres of plants and ratoons of B. 147 and White Transparent grown each year. During that period B. 147 gave, on the average, 398 lb. of sugar per acre per annum over and above that yielded by the White Transparent.

In regard to the good returns given by these canes when cultivated under suitable conditions in other countries, it may be mentioned that in the island of St. Kitt's, one proprietor has stated, with regard to B. 147, that he had reaped 130 acres in 1902, and 160 acres in 1903; that the estates had formerly been materially affected by ravages of fungus and borer, and that in consequence of the introduction of the new varieties of cane, notably B. 147, the output of sugar on his estates had been materially increased, and he was certain that if he put the increase at 33 per cent., he was not overstating it.

The proprietor of another estate, writing in 1903 about the seedling cane B. 147, stated that he had planted 45 acres of B. 147 for the crop of each year,

and 7 acres of the White Transparent. Some fields of B. 147 for the crop of 1902 had given 3 tons of sugar per acre, and none less than 2 tons. For the crop of 1903, he got 3 tons and 2½ tons per acre from plant canes, and 2 tons from ratoons. Since B. 147 had done so well this planter did not care to try any other varieties.

In British Guiana, on a large estate, for the year 1906, 40 acres of fourth ratoons of cane B. 147 yielded an average return of 2·80 tons of sugar per acre.

In the report on the sugar-cane experiment work at Jamaica for 1904, it is stated that B. 208 had given a return of 66·5 tons of cane per acre, the Bourbon 39·5 tons, and the Mont Blanc 33·8 tons; and Mr. Cousins in his report says: 'The outstanding features of this year's trial are the splendid qualities of B. 208. In his report for 1905-6, he says: 'B. 208 appears to be the most promising variety for general cultivation in Jamaica.'

At an Agricultural Conference held in Queensland in May 1905, Mr. Edward Grimley read a paper 'The Improvement of Plants,' in which he referred to the seedling cane B. 208 in the following terms: 'We have now a report from Messrs. Gibson, of Bingera, which gives a return of 60 tons 6 cwt. of cane per acre, with 22·2 per cent. of sucrose, and Brix 23·9, or 21·45 per cent. obtainable cane-sugar, which represents a return of over 14 tons to the acre.' It is, however, only fair to state that these results were obtained under irrigation, and the experiment plot was well manured. The average yield for Queensland for the previous seven years was 13·16 tons of cane per acre, so that the B. 208 gave more sugar per acre than the average in Queensland.

The B. 208 has been cultivated now for some years at Diamond plantation in British Guiana, and in March 1904, Mr. John M. Fleming, who was in charge of the estate, reported that for the short grinding season just completed, 605 acres of Bourbon and 104 acres of B. 208 were reaped. The Bourbon gave 1·95 tons of sugar per acre while B. 208 yielded 3 tons per acre, or about 57 per cent. in excess of the Bourbon return. In December 1906, the same gentleman, writing to the Imperial Commissioner of Agriculture, stated: 'On the 11th inst. we completed our crop of 16,300 tons of sugar for 1906; 6,000 acres were cut—an average of 2·716 tons per acre.

'This area of land comprised:—

2,495	acres	Bourbon	at	2·42	tons	sugar	per	acre.
272	,,	mixed varieties	,,	2·50	,,	,,	,,	,,
3,233	,,	seedlings	,,	2·96	,,	,,	,,	,,

'Of B. 208, 1,775 acres were cut, which gave an average of 3·01 short tons per acre.' On the remaining area, there were also some of the seedling canes raised in British Guiana by Professor J. B. Harrison, C.M.G., and his late colleague Mr. J. S. Jenman.

In this case, B. 208 gave an average of 0·59 short ton of sugar per acre more than the Bourbon. In other words, 1,755 acres planted with B. 208 gave 1,035 short tons of sugar more than if the same land had been planted in Bourbon, and it is estimated that the estate made a profit of something like £8,000 from growing this cane.

During the six years 1901-6, there was an average of 2,555 acres planted in Bourbon on the Diamond plantation, from which 6,029 tons of sugar were obtained, equal to 2·36 tons of sugar per acre. The average area under seedling canes during this period was 1,751 acres, from which 5,111 tons of sugar were obtained, or 2·91 tons of sugar per acre. The increase of the seedling canes over the Bourbon was 23·16 per cent. Among these canes, it must, however, be stated, there were a number of seedling canes which were raised by Messrs. Harrison and Jenman.

As exemplifying the importance to the sugar industry of the seedling canes, it may be mentioned that at the average price of sugar during the period, the gross value of the extra sugar obtained from growing seedling canes was nearly £22,000, and that after allowing for the cost of manufacturing the sugar, the net revenue for the period was somewhere in the neighbourhood of £19,000. In other words, the proprietors of the Diamond plantation are better off by that sum from growing seedling canes raised in Barbados and British Guiana, than if they had planted all the land in the Bourbon.

To give some idea of the length of time it takes for a seedling to reach the stage at which it can be tried on a large scale on sugar estates, and to show why it is that up to the present time it is impossible to give very much data about the newer canes that have been grown since the inauguration of the Imperial

Department of Agriculture, it may be mentioned that B. 376, which has recently been cultivated at Barbados on Brighton estate, on a comparatively large area, was first obtained in 1895. Over ten years therefore have elapsed before this cane was tried on a fairly large scale. For several years past the Hon. G. L. Pile, M.L.C., the proprietor of the estate, has been growing this cane on gradually increasing areas, until in 1906 he reaped 58 acres of this variety out of a total area of 90 acres of plant canes. The remaining 32 acres were planted in other varieties. At a meeting of the Agricultural Society held in December 1906, Mr. Pile stated that the 58 acres gave an average yield of 29·5 tons of cane per acre, the largest yield from one field being 36 tons per acre. With regard to the juice, he said it was particularly good, and that he had obtained, on the average, 2·95 tons of sugar per acre. In reply to a question put to him by a member present, Mr. Pile said that the 32 acres of other canes had given him about ¾ ton of sugar less per acre than B. 376, and that the latter cane gave a better yield as first ratoons than any other which he had reaped, giving, on the average, about 2 tons of sugar per acre, and that it was a cane which gave good germinating results, withstood dry weather well, and gave not only good plant canes, but also good ratoons.

With regard to the newer canes raised since the inauguration of the Imperial Department of Agriculture for the West Indies, it may be stated that there is at present being tried a number of canes which have given excellent results, even better than those obtained with B. 147 and B. 208. Among these canes may be mentioned B. 1,753, B. 3,390, B. 3,412, B. 3,675, B. 3,696, B. 3,747, B. 6,204, and B. 6,450; and judging by the way in which the cultivation of seedling canes is being extended on the various sugar estates, it would appear that within a very measurable period of time, practically no other canes will be grown in Barbados but those raised from seed, as not only do the better varieties give greater yields per acre than the kinds of cane so largely planted in the past, but they are as a rule freer from the fungoid root disease, *Marasmius Sacchari*.

EXPERIMENTS ON THE HYBRIDIZATION OF SUGAR-CANES.

At the Agricultural Conference heldat Barbados in 1900, Professor d'Albuquerque pointed out methods by which the crossing of varieties of sugar-cane might be effected with a view to the production of seedling varieties of known pedigree. No attempt, however, was made to carry out these suggestions until Mr. Lewton-Brain, the Mycologist of the Department, took the matter up, and after a careful examination of the flowers of a number of prominent varieties, effected cross-fertilization of certain varieties by first removing the anthers of the flowers of one variety and then dusting their stigmas with the pollen of another. In this way pedigree varieties were successfully produced and are now under trial. Since Mr. Lewton-Brain left the Department, his successor, Mr. F. A. Stockdale has devoted himself to a careful study of the subject, and has instituted a careful and extensive series of experiments based on the developments in plant breeding which have resulted from the recently awakened appreciation of the work of Mendel. Mr. Stockdale's experiments are proceeding on several lines and the reader is referred to the *West Indian Bulletin*, Vol. VIII, p. 79, for an account of this interesting and important work.

SUGAR-CANE MANURIAL EXPERIMENTS.

MANURIAL EXPERIMENTS AT DODDS.

The manurial experiments with the sugar-cane were started in June 1885. The following copy of the minute asking permission to undertake the experiments may be of interest:—

To the Honourable the Colonial Secretary.

SUBJECT.

Asks permission to be allowed to set apart a field of young sugar-canes for experiments with chemical manures.

Honourable Colonial Secretary,

I have the honour respectfully to ask permission to be allowed to set apart a field of young canes to experiment on with different chemical manures, so as to try and ascertain the best combination and the quantity most suitable for the sugar-cane. Professor Harrison (the Island Chemist) has kindly promised to assist me with the experiments.

FIG. 5. FIRST YEAR SEEDLING CANES.—ONE HOLE.

FIG. 6. FIRST YEAR SEEDLING CANES.
GENERAL VIEW OF FIELD.

FIG. 7. SECOND YEAR SELECTED SEEDLING CANES.—TWO HOLES.

FIG. 8. SECOND YEAR SELECTED SEEDLING CANES. GENERAL VIEW OF FIELD.

We propose, should permission be granted us, to divide the field into plots of 200 holes of sugar-canes, applying to each plot a different mixture, taking care to keep an accurate account of the quantity applied to each plot, and when the canes reach maturity, to weigh and test them so as to ascertain the yield per acre.

Professor Harrison thinks that in a great many instances the agents for chemical manures would give us as much as will be required for each plot.

(Intl.) J. R. B.

4. 5. 85.

Certainly a very interesting experiment.

(Intl.) W. R.

5. 5. 85.

These manurial experiments were instituted to ascertain (1) the quantity of nitrogen, in the forms of sulphate of ammonia, nitrate of soda, and dried blood, required to produce the best results when combined with sufficient phosphate and potash to enable the nitrogen to exercise its full effects; (2) to ascertain in like manner the requirements of the sugar-cane with regard to phosphoric acid when combined with sufficient nitrogen and potash, and (3) its requirements with regard to potash, when combined with the required amount of nitrogen and phosphate. At first the experiments were somewhat tentative, and various modifications were made before it was finally decided on what lines they should be definitely carried out.

In the first year the manurial experiments consisted of twenty-one plots, ten of which were plots to which various mixed commercial fertilizers, sold or made by various merchants in the colony, were applied. Through the courtesy of Mr. John Connell, the proprietor, and his attorney, Mr. Joseph Connell, the works at Halton plantation were placed at our disposal for the completion of the experiments.

The year was an exceedingly dry one, and the yields obtained were below the average of ordinary years. Leaving out of consideration the results obtained with the commercial fertilizers, the best return was given by the plot to which farmyard manure had been applied, the next best being where only sulphate of ammonia and muriate of potash had been applied.

SEASON 1885-7.

For the season 1885-7, certain alterations were made in the mode of conducting the experiments, and as the object was to ascertain the manurial requirements of the sugar-cane under normal conditions, farmyard manure was applied to the field some weeks before the canes were planted. This was also done to bring the soil into more favourable mechanical condition, especially with regard to its power of retaining moisture.

In order to lessen the danger of loss of nitrogen by drainage, only half of the quantities of the nitrogenous constituents used were applied at an early date, the remainder being added as a top dressing in August 1886.

When the canes were reaped in 1887, they were weighed and crushed, and the juice was measured at Bushy Park plantation, the property of Messrs. Thos. Daniel & Co. Ltd., which had been placed at our disposal for the purpose by Mr. G. A. Sealy, the Attorney.

In the nitrogen series, the best result was obtained on the plot which received, in addition to 100 lb. of assimilable phosphates and 30 lb. of potash, 75 lb. of nitrogen in the form of sulphate of ammonia.

In the phosphate series, the best return was given by the plot which received superphosphate of lime containing 80 lb. of assimilable phosphates per acre, in addition to 80 lb. of potash as sulphate of potash, and 50 lb. of nitrogen as sulphate of ammonia.

In the potash series the best result was obtained on the plot to which 80 lb. of potash were applied, in addition to 100 lb. of assimilable phosphates as superphosphate of lime, and 50 lb. of nitrogen as sulphate of ammonia.

SEASON 1886-8.

For the season 1886-8, in accordance with the results of previous years, the addition of nitrogen to the manurings with phosphate and potash gave in all cases increased yields, the increase varying with the amount of nitrogen used. The best result was obtained where 80 lb. of nitrogen as sulphate of ammonia were applied in addition to 75 lb. of assimilable phosphates as superphosphate of lime, and 25 lb. of potash as sulphate of potash.

In the phosphate series, the best result was obtained on the plot which received, in addition to 40 lb. of nitrogen as sulphate of ammonia, and 20 lb. of potash as sulphate of potash, 70 lb. of assimilable phosphates as superphosphate of lime.

In the potash series, the highest yield was given by the plot which received, in addition to 40 lb. of nitrogen as sulphate of ammonia, and 80 lb. of assimilable phosphates as superphosphate of lime, 40 lb. of potash as sulphate of potash.

SEASON 1887-9.

For the season 1887-9, in the nitrogen series, the plot gave the best return which received 40 lb. of nitrogen as dried blood in January, and 40 lb. as sulphate of ammonia in July, in addition to 200 lb. of assimilable phosphates as superphosphate of lime, and 50 lb. of potash as sulphate of potash, half being applied in January and half in June.

In the phosphate series the best result was obtained on the plot which received 380 lb. of mineral phosphates in January, in addition to 25 lb. of potash as sulphate of potash applied in January, and 25 lb. of potash and 80 lb. of nitrogen as sulphate of ammonia, applied in July.

In the potash series half of the plots were used for experiments with potash applied in January, and half for experiments with potassic manure applied in June. The best return was given by the plot which received 60 lb. of potash as sulphate of potash in January, in addition to 250 lb. of assimilable phosphates as superphosphate of lime applied in January, and 250 lb. of superphosphate of lime, and 80 lb. of nitrogen as sulphate of ammonia, applied in June.

SEASON 1888-90.

For the season 1888-90, in the nitrogen series, the most satisfactory return was given by the plot which received 80 lb. of nitrogen as sulphate of ammonia applied in June, in addition to 100 lb. of assimilable phosphates as superphosphate of lime, and 60 lb. of potash as sulphate of potash, applied in June.

In the phosphate series the best result was obtained where 280 lb. mineral phosphates were applied in January, in addition to 60 lb. of potash as sulphate of potash applied in January, and 60 lb. of nitrogen as sulphate of ammonia, applied in June.

The plot taking the leading place in the potash series was that which received 90 lb. of potash as sulphate of potash, in addition to 75 lb. of assimilable phosphates as superphosphate of lime, applied in January, and 60 lb. of nitrogen as sulphate of ammonia applied in June.

In 1889, Professor Harrison was appointed to the post of Government Chemist of British Guiana, and for the season 1888-90 both the agricultural and chemical work was carried on by the Agricultural Superintendent of Barbados.

SEASON 1889-91.

For the season 1889-91, the best result in the nitrogen series was obtained on the plot which received 50 lb. of nitrogen as sulphate of ammonia (15 lb. in January and 35 lb. in June), in addition to 80 lb. of assimilable phosphates as superphosphate of lime, and 40 lb. of potash as sulphate of potash per acre, half of which was applied in January, and the remainder in June.

In the phosphate series, the highest return was given by the plot which received 80 lb. of mineral phosphate in January, in addition to 40 lb. of potash as sulphate of potash (20 lb. in January and 20 lb. in June), and 60 lb. of nitrogen as sulphate of ammonia (15 lb in January and 45 lb. in June).

In the potash series, the best plot was that which had received 80 lb. of potash as sulphate of potash (40 lb. in January and 40 lb. in June), in addition to 80 lb. of assimilable phosphates as superphosphate of lime (40 lb. in January and 40 lb. in June), and 60 lb. of nitrogen as sulphate of ammonia (15 lb. in January and 45 lb. in June).

SEASON 1890-2.

During the season 1890-2, the canes were so badly attacked by insect and fungoid diseases that it was impossible to draw any conclusions from the results of the experiments, which were also in some cases not in accordance with the results of previous years.

In the nitrogen series the best result was obtained on the plot which had received 60 lb. of nitrogen as sulphate of ammonia, in addition to farmyard manure, which was applied at the rate of 20 tons per acre before the canes were planted.

In the phosphate series, the best plot was that which had received 280 lb. of mineral phosphates in January in addition to 60 lb. of nitrogen as sulphate of ammonia applied in June, and 90 lb. of potash as sulphate of potash applied in January.

In the potash series of experiments, the manuring which gave the best return consisted of 180 lb. of potash as sulphate of potash applied in January, in addition to 60 lb. of nitrogen as sulphate of ammonia applied in June, and 75 lb. of assimilable phosphates as superphosphate of lime, per acre, applied in January.

SEASON 1891-3.

For the season 1891-3, in the nitrogen series, the best result was obtained on the plot which received 60 lb. of nitrogen as nitrate of soda in June, in addition to 75 lb. of superphosphate of lime and 90 lb. of potash as sulphate of potash in January.

In the phosphate series the plot giving the best return was that which received 100 lb. of assimilable phosphates as superphosphate of lime in January, in addition to 60 lb. of nitrogen as sulphate of ammonia in June, and 100 lb. of potash as sulphate of potash in January.

In the potash series, the best plot was that which had received 135 lb. of potash as sulphate of potash, in addition to 60 lb. of nitrogen as sulphate of ammonia, and 75 lb. of assimilable phosphates as superphosphate of lime.

RESUME OF RESULTS OBTAINED SINCE 1892-4.

Since the season 1892-4, the same quantities of the various manurial constituents have been applied each year to the same plots, and the following is a resumé of the results obtained for the past thirteen years—that is up to the season 1904-6 :—

There have been thirteen plots in the nitrogen series. One of these has received nothing further than the dressing of 20 tons of farmyard manure per acre, which has been applied each season to all the plots; one received an additional dressing of farmyard manure at the rate of 20 tons per acre, making in all 40 tons per acre. The remaining eleven plots each received 80 lb. of assimilable phosphates, applied as superphosphate of lime, and 60 lb. of potash as sulphate of potash. In the case of one plot only, this has formed all the manure applied. A second plot has received 40 lb. of nitrogen as sulphate of ammonia applied in June, another plot receiving 60 lb. and another 80 lb. One plot received 15 lb. of nitrogen as sulphate of ammonia in January with a further 25 lb. in June; another 15 lb. in January and 45 lb. in June. One plot received 60 lb. of nitrogen as nitrate of soda; one received 15 lb. of nitrogen as dried blood in January and 25 lb. in June; one received 15 lb. as dried blood in January and 45 lb. in June; one plot received 40 lb. of nitrogen as dried blood in January, and another 60 lb. of dried blood, also applied in January.

For the thirteen years the best result in the nitrogen series was that obtained where 60 lb. of nitrogen as sulphate of ammonia were applied in June, in addition to the 80 lb. of assimilable phosphates and 60 lb. of potash as sulphate of potash, the average yield being 7,911 lb. of saccharose per acre.

In the phosphate series, there were ten plots, eight of which have existed for thirteen years and two, the basic slag plots, for twelve years. One plot received only the dressing of 20 tons of farmyard manure per acre applied to all the plots, and a second received an additional dressing of farmyard manure at the rate of 20 tons per acre, making in all 40 tons per acre. The remaining eight plots received 15 ℔. of nitrogen as sulphate of ammonia, and 60 ℔. of potash as sulphate of potash in January, and 45 ℔. of nitrogen as sulphate of ammonia in June. In the case of one plot only, this formed all the manure applied. One plot received 40 ℔. of assimilable phosphates as superphosphate of lime in January, another received 80 ℔. and yet another 120 ℔. To one plot was given 40 ℔. of assimilable phosphates as superphosphate of lime in January, and 40 ℔. in June, while another received 60 ℔. in January and 60 ℔. in June. The ninth plot received 80 ℔. of phosphate as basic slag in January and the tenth 100 ℔. at the same time.

In the superphosphate portion of this series the best result has been that given by the plot which received only 60 ℔. of nitrogen as sulphate of ammonia (15 ℔. in January and 45 ℔. in June), and 60 ℔. of potash as sulphate of potash, that is, the plot to which no phosphate has been applied. The average yield for the thirteen years was 8,150 ℔. of saccharose per acre.

In the basic slag portion of the phosphate series, which was carried on for twelve years, the best result was obtained on the plot which received 100 ℔. of phosphate as basic slag, the yield being 8,446 ℔. of saccharose per acre. For the same twelve years the average yield of the no-phosphate plot was 8,406 ℔. of saccharose per acre.

On Lower Bay Tree field for the six years, the average yield in the no-phosphate plot was 9,265 ℔. of saccharose per acre, and on the plot which received the 100 ℔. of basic slag, the average yield was 8,807 ℔. On the other hand, the basic slag plots in Summervale field, which received respectively, 80 and 100 ℔. of phosphates per acre, in addition to the nitrogen and potash that all the plots received, gave 8,063 and 8,085 ℔. of saccharose per acre; while the no-phosphate plot gave an average yield of 7,546 ℔. It is worthy of note, however, that the two plots in Summervale field on which the basic slag gave better results than the no-phosphate plot, are plots the soil of which is somewhat clayey. It is therefore probably fair to assume that the increase is due in great measure to the lime in the basic slag, and not to the phosphoric acid.

In the potash series of experiments there were nine plots, one of which received only the dressing of 20 tons of farmyard manure per acre applied to all the plots, and one an additional dressing of farmyard manure at the rate of 20 tons per acre, making in all 40 tons per acre. The remaining seven plots each received 15 ℔. of nitrogen as sulphate of ammonia in January and 45 ℔. in June, as well as 80 ℔. of phosphate as superphosphate of lime. Four plots received 40, 60, 80 and 100 ℔. respectively, of potash as sulphate of potash in January. One plot received 30 ℔. of potash as sulphate of potash in January and 30 ℔. in June, and one received 40 ℔. in January and 40 ℔. in June.

The best result obtained in this series for the thirteen years was on the plot which received 80 ℔. of potash as sulphate of potash, in addition to 15 ℔. of nitrogen as sulphate of ammonia in January and 45 ℔. in June; and 80 ℔. of phosphate as superphosphate of lime, applied in January, the average yield being 7,739 ℔. of saccharose per acre.

MANURIAL EXPERIMENTS AT LOCAL STATIONS.

Manurial experiments on an extensive scale were laid down soon after the establishment of the Imperial Department of Agriculture, and were carried out, with the permission of proprietors and attorneys of the estates, in the black-soil districts at Belle, Foursquare, Hampton, Ruby, Balls: and in the red-soil districts at Hopewell and Blowers estates. The object of these experiments was to ascertain how far results obtained formerly only in black soils would hold for red soils, and how far the results obtained in one black soil at Dodds would hold in other black soils under somewhat different climatic conditions. In addition, a much larger number of points came under experiment than was possible in the area available at Dodds, and finally, ratoons which had previously not come under experiment were included. The results are too voluminous to be set out in detail in this report, but some of the more important points may briefly be referred to.

It is usual in Barbados to apply, before planting the canes, from 10 to 40 tons of moulded farmyard manure, consisting of a rotted mixture of cane trash, animal excreta, and mould. When this farmyard manure is not available, it is

sometimes made up by sheep manure, or sheep manure and green dressings turned in. The experiments showed that where farmyard manure was not applied, large and remunerative increases of yield of cane followed the application of nitrogen (as sulphate of ammonia or nitrate of soda), of phosphate as superphosphate, and of sulphate of potash.

In experiments where a large quantity (generally 30 tons per acre and upwards) of farmyard manure was applied, the results were markedly different. To such plots, the application of sulphate of ammonia, and, on the whole, to a lesser extent, nitrate of soda, produced varying, but generally large and remunerative increases of yield, both in the case of plants and ratoons, but especially in the case of ratoons. The quantities indicated as most favourable were about 200 lb. sulphate of ammonia to plants, and 300 to 400 lb. sulphate of ammonia to ratoons. The plots that received phosphatic applications in the form of superphosphate or basic slag, gave very different results from those which up to that time had been indicated on the plots at Dodds. In the majority of cases, there was no increase in plant canes as a result of the application of phosphate, and, on the contrary, a small diminution often followed the application of basic slag, its alkalinity notwithstanding. It is not clear at present whether phosphate when applied together with potash is beneficial in the case of ratoon canes.

The plots that received potash showed, on the whole, an increase of yield both in plants and ratoons, but in some cases the application was, at low sugar prices, but barely remunerative. In practice, an application of about 80 lb. of sulphate of potash containing some 40 lb. potash appears, on the whole, to be an ample one.

In more recent years, the results at Dodds have tended towards agreement in respect of phosphatic applications with the results obtained elsewhere, and there can be no doubt that the large proportion of phosphates, which used to be the predominant ingredient of the mixed commercial manures a few years ago, has been shown to be unnecessary.

The application of slaked lime to heavy soils at the rate of about ½ ton to the acre has been shown to be followed with very profitable results, especially in heavy soils. This is doubtless mainly due to the flocculating action of lime on the fine particles of clay leading to an improvement in the texture and drainage of the land.

These large series of manurial plots which have been brought to a close have served a valuable purpose both in extending the experiments to ratoon canes to red soils, and in showing in what directions we must modify the conclusions obtained at Dodds to plantations where the climatic and other conditions are different. They have served also to show that the application of certain constituents of artificial manures may profitably be applied to cane land that has received heavy applications of farmyard manure, and to indicate that the kind and amount of application of artificials will depend upon the varying conditions of individual estates, and especially upon the amount of farmyard manure applied: so that ultimately, just as a planter must determine for himself, the seedling variety most suitable for his needs, so must he use his own observation and discretion in determining how to apply the results of these manurial experiments to his own individual needs.

TILLAGE EXPERIMENTS.

DURING THE SEASON 1901-3.

At Hampton plantation a very level 6½-acre field (Drinkwater field) was marked out into ten large strips and subjected to the different processes of tillage detailed below.

The strips differed somewhat in length and width: the width in different strips varied between ten and fourteen holes. The results are calculated to the acre.

Numbers of Plots.		Tons of cane.
1, 6	Subsoiled close: lined 6 x 6 feet: cane holes dug: manured and cultivated in the usual estate manner. Mean results	15·75
2, 7	Ploughed flat with Disc plough, turning under farmyard manure 8 inches deep; cane holes dug: and cultivated by ordinary estate methods. Mean results	15·59

Numbers of Plots.		Tons of cane.
3, 8	Subsoiled close; furrows opened with mould-board plough 6 feet apart; manure spread on banks; and canes planted in furrow 6 feet apart. Mean results	14·94
4, 9	Ridged with Disc plough, turning under farm-yard manure 8 inches deep; planted in rows in bottom of furrow; cultivated with Diamond cultivator; and trashed as usual. Mean results	13·20
5, 10	Subsoiling opened one way; forked piece of land left between cane holes; and cultivated in the ordinary estate way. Mean results	14·20

It will be seen that an extreme difference of 2½ tons of canes per acre occurred between (1) the most favourable plots, and (2) the least favourable plots.

(1) The most favourable plots were subsoiled close, cane holes dug and manured, and cultivated in the usual estate manner.

(2) The least favourable plots were ridged with the Disc plough turning under farmyard manure 8 inches deep, the canes being planted in rows at the bottom of the furrows and cultivated with the Diamond cultivator.

EXPERIMENTS ON CHEMICAL SELECTION.

At Sandy Lane a portion of a field arranged for irrigation was laid out in an experiment to ascertain whether it is possible to increase the richness of a given variety of the sugar-cane by continually replanting from the richest individual canes and stools as determined by chemical analysis. For six successive years the richest canes from the richest stools were replanted in one series of plots, and the poorest canes from the poorest stools were replanted in another series of plots, so that if any differences were produced between these two series, those differences might be increased each year of planting until they became sufficiently great to be observable. The results, however, went to show that no such differences were produced by this process of 'chemical selection.'

THE COTTON INDUSTRY.

About June 1902, just about the time that the results of experiments in growing cotton, started by the Imperial Department of Agriculture at St. Lucia and Montserrat, were published, a number of planters in Barbados commenced growing the crop, the principal ones being Mr. A. Cameron and Mr. H. E. Thorne, M.C.P. The area planted in cotton that year was about 16 acres. The result of these experiments proved so satisfactory that the cultivation of cotton was enthusiastically taken up by a number of planters.

At the beginning of 1903, on the suggestion of the Imperial Commissioner of Agriculture, the Agricultural Society appointed a Committee of their body to co-operate with the Imperial Department of Agriculture in furthering the establishment of the cotton industry. The Committee consisted of the Hon. F. J. Clarke, M.A., M.C.P., Chairman; Hon. Sir Daniel Morris, K.C.M.G., Messrs. J. R. Bovell, F.L.S., F.C.S., G. S. Evelyn, A. Cameron, H. E. Thorne, M.C.P., J. J. Law, Dr. C. E. Gooding, M.C.P., and Professor J. P. d'Albuquerque, M.A., F.I.C. F.C.SS.

At this time, Sir Daniel Morris, the Imperial Commissioner of Agriculture, perceiving the great possibility for the West Indies that lay in the cotton industry, paid a visit to the Sea Islands, accompanied by Mr. J. R. Bovell, made a complete study of the methods of cotton cultivation, as well as of seed selection and ginning there practised, arranged for the engagement in the West Indies of a Sea Island cotton expert, and clinched the matter by purchasing about £800 worth of the best Sea Island cotton seed. The wisdom of this purchase was shown, when in a following year the further supply of seed from the Sea Islands was prohibited. This visit and its consequences formed the turning point in the cotton industry, and it has been aptly expressed by a Barbados planter that the Imperial Department gave at the very beginning a start of at least ten years to cotton growers in Barbados. Since that time the Department has maintained

and improved the quality of the seed by its continued work on selection, and has preserved the industry from the extinction threatened by insect pests and fungoid diseases, by the unremitting vigilance exercised through the technical officers of the Department.

About the same time the Agricultural Society petitioned the Governor-in Executive Committee, asking him to submit and recommend to the Legislature the passing of a Resolution for £250 for the purpose of erecting a small factory for ginning the cotton that had been grown. The Legislature readily voted this sum: but before the factory could be erected, so much progress had been made with the industry that it was seen that a factory of the small dimensions originally suggested would not be capable of ginning, within reasonable time, all the cotton sent to it. Then, at the request of the Imperial Commissioner of Agriculture, the Governor-in-Executive Committee was good enough to loan to the Cotton Committee a building originally erected in the parish of Christ Church at a cost of £283, for the purpose of serving as a smallpox hospital, but which had never been used. The building, which was 100 feet long by 26 feet wide, was, with the assistance of a number of the planters, who lent carts and waggons, moved into Bridgetown and erected on the Pier Head; a boiler and engine were purchased, and a gin and baling press, which had been loaned by the British Cotton-growing Association, were put up.

From 16 acres of cotton grown in 1902 there were ginned 4,286 lb. of lint. In December 1903, the Cotton Committee, finding that the funds at their disposal were insufficient for the completion of the factory, applied to the Governor-in-Executive Committee for an additional grant of £120 for that purpose, and in the following month the Legislature, on the recommendation of his Excellency the Governor, were good enough to vote that sum.

At the beginning of 1904, Mr. Seabrook the cotton ginning expert, who had been engaged by Sir Daniel Morris in connexion with the erection of factories in the West Indies, arrived in Barbados and rendered valuable assistance in setting the gins and showing the persons in charge of the factory how cotton should be ginned and baled.

In 1904, the Governor-in-Executive Committee authorized advances to peasants and other small growers, on the seed-cotton sent to the factory, to the extent of £275. The amounts of the loans were deducted from the proceeds of the cotton shipped, and the balance was paid to the growers.

In December 1904, a disintegrator, loaned to the Committee by the British Cotton-growing Association was erected for the purpose of crushing cotton seed, thus enabling the seed to be readily used for feeding the estate animals.

For the season 1903-4, about 800 acres were planted in cotton, from which the Barbados Cotton Central Factory received seed-cotton which yielded 104,923 lb. of lint.

In January 1905, a baling press similar to those used in the Sea Islands for baling long-stapled cotton was imported by the Committee, and erected. The old baling press which had been sent out in the first instance by the British Cotton-growing Association was, at the request of the Imperial Commissioner of Agriculture, sent to the island of St. Lucia.

In 1905, owing to the rapid advances made in growing the cotton, the Legislature loaned the Cotton Committee £1,200, at the rate of 6 per cent. per annum, for the purpose of making advances to the peasants and other small proprietors on the seed-cotton sent by them to the factory.

The first year the cotton was ginned, baled, etc., at the rate of 1½*d.* per lb., the price usually charged in the United States of America. At the end of that year, however, the Cotton Committee found that it was possible to refund to the cotton growers ½*d.* for every pound of lint ginned. The following year they charged 1*d.* per lb., and at the end of the season they were able to return a further ¼*d.* per lb., the charge for ginning and baling being thus reduced to ¾*d.*

For the season 1904-5, about 1,647 acres were planted with cotton in Barbados, and from this area the Central Factory received seed-cotton, which yielded 215,500 lb. of lint.

On November 1, 1905, the factory with its appurtenances, was with the approval of the Governor-in-Executive Committee and the Legislature, transferred to the Barbados Co-operative Cotton Factory, Ltd., a company that had

been started for the purpose, for £600 first mortgage debenture bonds, at 3 per cent. per annum, the bonds to be redeemed at any time within twenty-one years at the option of the company. The Barbados Co-operative Cotton Factory, Ltd., also agreed to pay to the British Cotton-growing Association the sum of £150 for the gins and disintegrator at the factory belonging to the Association.

The following table shows the progress of the cotton industry since its institution, as indicated by the quantity of lint, etc., exported from the ginneries of the Barbados Co-operative Cotton Factory, Ltd., and Messrs. H. E. Thorne & Son :—

ESTIMATED QUANTITY AND VALUE OF COTTON EXPORTED FROM BARBADOS DURING THE PERIOD 1902-7.

Year.	Area planted.	Lint.	Seed.	Value of lint.	Value of seed at £5 per ton.	Total Value.
		lb.	lb.			
1902-3	16	5,550	13,450	...	...	£318
1903-4	800	102,061	472,510	£12,388	£1,055	£13,443
1904-5	1,647	344,282	846,882	£20,869	£1,890	£22,759
1905-6	2,000	479,418	1,179,468	£30,363	£2,633	£32,996
1906-7	5,000	852,408	2,042,840	£72,326	£4,560	£76,376

As will be seen from the above table, the progress of the industry is highly creditable to the planters and others who have brought it to its present condition. Still, there are a number of planters who have failed to recognize the desirability of paying the attention to the industry which its importance demands. Fields are still to be seen so thickly over-grown with the cotton plants that the bolls are dropping for the want of sufficient light and air. Futhermore, on some estates, in carrying out operations against the cotton worm, Paris green and lime are dusted so heavily on to the leaves that the latter are unable to perform their functions, with the result that the bolls, not being sufficiently nourished, often drop in large numbers.

COTTON MANURIAL EXPERIMENTS.

In 1905, owing to the rapid increase of the cotton industry, it was deemed desirable to institute a series of manurial experiments for the purpose of ascertaining the requirements of the Sea Island cotton plants under the soil and climatic conditions existing in the different districts of the island. The objects of the experiments were to ascertain (1) the quantity of nitrogen needed to produce the best results when combined with sufficient phosphoric acid and potash to enable that constituent to exercise its full effects : (2) to ascertain in like manner the requirements of the cotton plant with regard to phosphoric acid when combined with sufficient nitrogen and potash, and (3) its requirements as regards potash when combined with the necessary amount of nitrogen and phosphoric acid.

The experiments for 1905 were conducted on two estates. On one estate, unfortunately, however, owing to the attack of the black scale (*Lecanium nigrum*), the results could not be taken into consideration. On the other, the results were eminently satisfactory. The plots were divided into four series :—

1. No manure series.
2. Nitrogen series.
3. Phosphate series.
4. Potash series.

In the nitrogen series, each plot received 60 lb. of phosphoric acid as superphosphate of lime, and 20 lb. of potash as sulphate of potash. One plot in the series received nothing further, but the other three plots received in addition 10, 20, and 30 lb. of nitrogen respectively.

FIG. 9. BANANA SUCKERS: THE RIGHT KIND TO PLANT.

FIG. 10. BANANA SUCKERS: THE WRONG KIND.

FIG. 11. BANANA TREES IN BEARING.

FIG. 12. PACKING BANANAS FOR SHIPMENT.

In the phosphate series, each plot received 20 lb. of nitrogen as sulphate of ammonia, and 20 lb. of potash as sulphate of potash. One plot received nothing further. The other four plots received 20, 30, 60, and 80 lb. of phosphoric acid respectively, as superphosphate of lime.

In the potash series, each plot received 20 lb. of nitrogen as sulphate of ammonia, and 60 lb. of phosphoric acid as superphosphate of lime. In the case of one plot this formed all the manure supplied. The other three plots received 10, 20, and 30 lb. of phosphate respectively, as sulphate of potash.

In the nitrogen series, there was a proportionate increase in the return as the result of the addition of nitrogen. The best result was obtained where nitrogen as sulphate of ammonia was applied at the rate of 30 lb. per acre. The increased yield amounted to 279 lb. of seed-cotton. This was estimated to be of the value of 7c. per lb., and after deducting the cost of the manure, the profit over the no-nitrogen plot was $9·36, and over the no-manure plot $10·11.

In the phosphoric acid series, the best results were obtained where 40 lb. of phosphoric acid as superphosphate of lime were applied. The increase due to manuring was 281 lb. of seed-cotton, and after deducting the cost of the manure, the profit over the no-phosphate plot was $14·87 per acre, and over the no-manure plot $12·99.

In the potash series, the most satisfactory returns were given where 20 lb. of potash as sulphate of potash were applied. The increase in this case, due to manuring, was 196 lb. of seed-cotton, and after deducting the cost of the manure, the profit by manuring over the no-potash plot was $1·77 per acre, and over the no-manure plot $5·95.

COTTON SEED SELECTION EXPERIMENTS.

In addition to the manurial experiments, experiments were started in 1905 for the purpose of maintaining, and, if possible, increasing the quality and the quantity of the cotton grown upon the acre. With that object in view, the best plants growing in the field on four estates were selected. The plants thus selected in the field were free from disease, cone-shaped with plenty of lateral branches, short internodes, i.e., plants capable of bearing a large number of bolls. To each plant was attached a numbered label and a piece of red tape, and by the side of the plant was placed a pole which reached above the level of the plants so that it could be seen from a distance and the marked plant easily found. At the same time a number of Osnaburg bags for holding the cotton, and numbered to correspond with the numbers attached to the plants, were obtained. As soon as the cotton from each plant was ripe, it was carefully picked and put in the bag numbered to correspond with the number of the plant, and sent to the office of the Imperial Commissioner of Agriculture. There it was examined by Mr. Thomas Thornton, A.R.C.S., Travelling Inspector in connexion with Cotton Investigations, with the object of ascertaining the length of the staple, the proportion of lint to seed, the proportion of weak fibres, the fineness and silkiness of the fibres, etc. The seed from the best plant on each estate was kept separate from the remainder and returned to the estate to be planted in a plot by itself, from whence the best plants were selected the following year.

These experiments have now been carried on for two years of the period under review, and the results have so far been satisfactory.

EXPERIMENTS WITH SWEET POTATOS.

In 1901, an effort was made to ascertain the best kinds of sweet potatos cultivated in Barbados, by growing a certain number of each variety under similar conditions, and twenty-eight varieties were planted on lands rented by the Imperial Department of Agriculture from Waterford estate. The plants grew well at first, and at one time there was every prospect of satisfactory results being obtained. Unfortunately, however, as soon as they were about two months old they were attacked by red spider, and other insect pests which were then prevalent in Barbados on sweet potato plants, and so great was the injury done that it was impossible to get any reliable data from the experiments.

In June 1902, another effort was made to carry out these experiments, and the following twenty-eight varieties were planted in Foaster field at Waterford, viz: Barker, Bequia, Blue Bird, Boot Heel, Brass Cannon, Caroline Lee, Cover-

the-World, Fill-the-Pot, Fire-Brass, Honeychurch, Hurley, Joe Mende, Johns, Love Drops, Minuet, Moffard, Red Bourbon, Red Sealy, Trinidadian, No 1. from Trinidad, No. 2 from Trinidad, No. 4 from Trinidad, Vincelonian, White Bourbon, White Gilkes (3 months), White Gilkes (6 months), White Mary, White Sealy.

In the following September the plants suffered from small green caterpillars and flea beetles, which fed upon the leaves; but Mr. Maxwell-Lefroy, then Entomologist of the Department sprayed them with a mixture of Paris green, lime, molasses and water. This had the desired effect, and soon the vines were free from insects, and remained so until the potatos were dug up. In spite, however, of the prompt measures taken to eradicate these pests, they appear to have affected the yield, as the weights per acre of some of the varieties were below the average yield of sweet potatos in Barbados. The best results were obtained from the White Gilkes (6 months), which gave 11,116 lb. per acre, Hurley 10,275 lb., Minuet 9,903 lb., and Vincelonian 7,823 lb. The lowest yields were obtained from Fill-the-Pot, 2,782 lb., White Mary 1,984 lb., and Red Bourbon 1,019 lb.

A full analysis was made of the roots and vines, and the results were published in the *West Indian Bulletin* (Vol. V, p. 41).

THE SWEET POTATO AND THE YAM INDUSTRIES.

With the object of starting an export trade in sweet potatos from Barbados to the United Kingdom, the Imperial Commissioner of Agriculture for the West Indies, in May 1901, addressed a circular-letter to various firms in London, offering, in the first instance, to deliver at their address, free of cost, a barrel of sweet potatos once every fortnight by the Royal Mail steamers. These potatos were given by various planters who were desirous of assisting in starting the industry. The Commissioner also arranged at the same time for the distribution of leaflets giving hints as to the best methods of cooking and using these vegetables. From then onward, a small trade has been maintained in them, the Army & Navy Auxiliary Co-operative Supply, Ltd., of Francis St., Victoria St., Westminster, S.W., taking 2 barrels per month, and Messrs. Jas. Philip & Co. (now the West Indian Produce Association, Ltd.), taking 5 barrels.

Soon after the shipments of the sweet potato were begun, shipments of the yam were also made, and a small quantity of these have been regularly sent during the season to the Army & Navy Auxiliary Co-operative Supply, Ltd., and to the West Indian Produce Association, Ltd.

BEE KEEPING.

At the beginning of 1901, Mr. W. K. Morrison, the bee expert, whose services had been engaged by the Imperial Commissioner of Agriculture for the purpose of assisting persons desirous of keeping honey-bees, arrived in the island and afforded considerable help and information not only to the novices in bee keeping, but also to many others who had started keeping bees, but who were not quite conversant with the requirements of a well-equipped apiary. Many of the latter, in fact, were keeping their bees in old kerosene cases. Owing to the interests created in the industry, a number of hives and accessories were imported for beekeepers in this colony. Unfortunately, however, owing to the scarcity of honey-producing plants in Barbados, the production of honey has not increased as it was hoped would be the case.

FUMIGATION OF PLANTS.

Owing to the danger of the introduction into the island of new insect pests and fungus diseases, in 1905 the Governor-in-Executive Committee, at the suggestion of the Commissioner of Agriculture, made provision that all plants, cuttings, buds, bulbs, roots, seeds, and also fruits and vegetables intended for propagation and not for consumption, imported into the island, together with the packages, boxes, etc., should be fumigated or disinfected, or both fumigated and disinfected.

Since September 4, 1905, on which date the system of fumigation was inaugurated, the importers of plants, seeds, etc. have been required to submit them for treatment.

From September 4 to December 31, 1905, forty-six consignments of plants were fumigated, while the number of consignments treated in 1906 reached 197.

DISTRIBUTION OF ECONOMIC PLANTS.

The receipts for the sale of plants, etc., for the past five years, i.e., from 1902-6 inclusive, amounted to £82 12*s.* 5½*d.*

The plants distributed during that period locally and abroad are as follows:—

Cane plants	79,198	
Seedling Cane B. 208	1¼	tons.
Yams, 6,989 lb. (5 plants to 1 lb.)	34,945	plants.
Sweet Potatos for planting	262	lb.
Eddos	445	,,
Banana suckers	756	
Vegetable seeds*	13	packets
Eschalots	3	lb.
Artichokes	2	,,
Turmeric	6	,,
Leguminous plants, etc.,	326	gallons.
Cassava cuttings	812	
Ground nuts	612	lb.
Avocado pear	17	plants.
Grafted Mango	16	,,
Palms and ornamental plants	2,064	,,
Palms and ornamental plants distributed for Arbor Day	899	,,
Mahogany seed	9	barrels.

ECONOMIC PLANTS IMPORTED AND DISTRIBUTED LOCALLY.

Grafted Mango plants	147	
Budded Limes	31	
,, Oranges	255	
,, Grape fruit	21	
,, Citron	5	
,, Tangerine	6	
,, Mandarin	3	
,, Shaddock	17	
Lemon plants	25	
Nutmeg	50	
Cacao	50	
Pine-apple suckers	663	
Cocoa-nuts	224	
Yampie	136	lb.
Bliss Triumph Seed Potatos	30	barrels.
White Onion seed	380¼	lb.
Red Onion seed	267¾	,,
Cabbage seed	3	,,
Tobacco seed	2½	,,

LOCAL AGRICULTURAL SHOWS.

Since the inauguration of the Imperial Department of Agriculture, eight local Shows have been held with the object of improving the material welfare of the peasant proprietors, tenants on sugar estates, etc. At these shows money prizes are awarded for the best exhibits of small stock, poultry, vegetables, fruit, starches, honey, Sea Island cotton, etc. The first show was held in 1901, at Hopewell, and since then local Shows have been held at Blowers in 1902, Todds 1903, Lower Estate 1904, Dunscombe in January 1905, Bushy Park in December 1905, Maynards 1906, and Applewhaites 1907. Since 1902, a special class has also been provided for children from the Elementary Schools, to whom prizes are

* This does not include the seeds distributed to peasants and others who are likely to exhibit at the local Shows.

awarded for plants grown by them in half-barrels, tubs, pots or boxes, and for produce grown in the school gardens. In 1907, twenty-eight prizes were awarded in this class. Diplomas of Merit are also offered to the large proprietors for the best exhibits of canes, vegetables, Sea Island cotton, bananas, etc. These Shows have been held in different parts of the island, so that the peasants of each district may have the advantage, as it were, of the object-lessons inculcated by the exhibits brought to their doors.

CANADIAN AND OTHER SHOWS.

In 1902, Barbados was represented at the Exhibition held at Toronto, Canada, and in 1903 it was represented at the Exhibitions held at Toronto and Ottawa. In 1906, a Permanent Exhibition Committee (of which the Agricultural Superintendent was a member), was appointed to prepare exhibits for any exhibitions at which it may be decided for Barbados to be represented.

Exhibits of the principal products of the colony were sent to the Toronto and Halifax Exhibitions held in August and September, both in 1906 and in 1907. The duty of receiving, preparing, and forwarding these exhibits has to a great extent been undertaken by the Local Department of Agriculture. In addition, in 1904, exhibits were sent to the Royal Horticultural Society's Show, and these were so satisfactory that a Gold Medal was awarded to Barbados. Exhibits have also been prepared for the past three years for the West Indian Produce Association, Ltd., London, and the Royal Mail Steam Packet Co., Ltd., for the purposes of display at the Royal Horticultural Society's Show. In 1907, a small number of exhibits was also prepared and sent to the Liverpool Colonial Products Exhibitions.

EXPERIMENTS WITH LEGUMINOUS PLANTS.

In 1900, experiments with different varieties of leguminous plants were undertaken with the object of ascertaining the comparative values of a certain number of different varieties as animal fodders and as green dressings. The vines from each plot were cut and the roots dug up, and both the plants and roots weighed and analysed.

The detailed results of these experiments were attached to the Sugar-cane Experiments Report for the season 1898 to 1900, to which persons interested are referred. It may, however, be mentioned, that owing to unsuitable weather conditions, the canes planted in the portion of the field in which the leguminous plants were grown were not as good as the remainder of the field. This was apparently due to the fact that the leguminous plants dried the soil to such an extent that there was very little moisture left in it for growing the young canes. Plants with thin leaves, such as those included in the experiments are known to transpire a large quantity of water.

The following table gives an extract showing some of the results obtained with the more favourable varieties :—

Name of Plant.	Pounds per acre.		
	Total weight of plants.	Organic matter.	Nitrogen.
Bengal bean	17,520	3,962	120
Velvet bean	12,600	3,954	96
Louisiana cowpea	11,736	2,730	70
Monkey pea	11,160	1,620	51
Woolly pyrol	9,576	2,481	57

The outcome of these experiments was to show that snatch crops of leafy plants, like the Leguminosae, must be grown with caution on the thin soils of Barbados, and that they should be grown sufficiently early to be cut not later than the middle of September, so that time may be allowed for tillage and the accumulation of moisture near the surface for the following planting of canes. In places where this can be done, the Bengal bean and velvet bean show, according to the above results, considerable advantages over the woolly pyrol, the most commonly grown leguminous green dressing in Barbados. The following is a list of the plants tried in the experiments: Bengal bean, velvet bean, Louisiana cowpea, monkey pea, woolly pyrol, flax red cowpea, horse bean, saddle back cowpea, calico cowpea, everlasting cowpea, black cowpea, speckled cowpea, white cowpea, *Dolichos formosus*, *Vigna Catjang*, Smith No. 9 cowpea, *Dolichos cultratus*, red cowpea, unknown cowpea, new era cowpea, clay cowpea, *Dolichos* sp. (?), couch cowpea, mulatto cowpea, *Phaseolus semierectus*, *Cyanopsis* sp., black eye cowpea, *Phaseolus helvolus*, red yellow-hull cowpea, coffee cowpea.

THE BANANA INDUSTRY.

In May 1902, the local Superintendent of the Royal Mail Steam Packet Company invited the Imperial Commissioner of Agriculture to test a new banana carrier, in which it was proposed to convey bananas from the West Indies to England. The inventor, who had had considerable experience in shipping fruit from the Canary Islands, was anxious to devise a plan whereby West Indian bananas could be taken to England so as to arrive in as good condition as those from the Canaries.

In order to ascertain whether the new carrier was any improvement on the method adopted by the banana growers in the Canary Islands, a bunch of bananas was at the same time packed in the usual Canary Islands' fashion by wrapping it in cotton wadding, paper, and then, in the first instance, wood-wool.

Both bunches of bananas arrived in fairly good condition, and the following report was communicated from England to Captain Owen, who forwarded a copy to the Imperial Commissioner of Agriculture:—

'The two bunches which I saw at your office this afternoon just in from the West Indies were in excellent condition. From their freshness and good green colour they might have come merely from the Canaries. The bunch packed in the "Canary" fashion had a particularly fine and clean appearance, but I fear the packing will be found rather too hot as a general rule. Owing to a mistake in the way of placing the bunch in the new carrier, this one was not quite so good. But what particularly impressed me was the fact that both bunches are not the usual West Indian kind of banana (the Gros Michel) but are the Chinese or Cavendish banana, which is the variety imported so largely from the Canaries. If the Cavendish banana proves on trial to carry better than the other, an impetus in the West Indian fruit trade should follow, because this is the kind which is preferred in the English market.'

Soon after this report was received, i.e., in the following July, two bunches of Cavendish or dwarf bananas, packed like those sent from the Canary Islands were forwarded to Covent Garden. These arrived in good condition and sold for 18*s*. 10*d*. From then on, with the help of Messrs. W. Pink & Sons, and the Royal Mail Company (the latter at first taking the bananas freight free), an effort was made to establish a banana trade between Barbados and England.

At first, either from want of knowledge as to the best time to cut the fruit, or from the fact that the shipments took place in the hot season, when it has been shown that bananas are apt to spoil if carried in the ordinary hold, several of the shipments arrived over-ripe, and with a large number of the bananas in a rotten condition. Later on, however, the difficulty was to some extent overcome, and in the cool season the bananas almost invariably arrived in good condition. The trouble recurred again, however, with the return of the hot season, and in the hope of remedying matters, the Royal Mail Company installed a system of cold storage on the s.s. 'Tagus.' This system, however, proved unsuitable, and after an entire consignment of bananas was lost, the company installed Hall's system of cold storage on the s.s.' Tagus' and 'Trent.' On the first voyage of the s.s. 'Tagus' after the installation of this system, the fruit arrived in

England in good condition, not one bunch spoiling *en route*. On the next voyage, however, the Royal Mail Company leased a portion of the cold storage hold to a gentleman in Jamacia, in consequence of which most of the Barbados bananas had to be put in other parts of the steamer, with the result that of 1,074 bunches shipped, sixty-eight arrived rotten, and over 300 were 'over-ripe and spotty.' From the beginning of 1905 up to July of that year, the bananas carried in the ships fitted with cold storage arrived in good condition. From July, however, bananas were shipped in such quantities from Trinidad that a considerable amount of the fruit intended for shipment from Barbados was excluded from the cold storage holds, and had to be put in other parts of the vessels. The bananas consequently arrived in such bad condition that from October 5, 1905, to March 31, 1906, the net amount realized for the 10,489 bunches shipped during that period was about 2*d*. per bunch. As the cost of the crates, packing, etc., amounted, on the average, to 1s. 2*d*. per bunch, the planters, in addition to losing their fruit, had to pay about 1s. per bunch towards the freight and other expenses. The result of this was that the growers discontinued shipping and destroyed their plants.

From April 1906, owing to the fact that only a few bananas were shipped from Barbados, it was found possible to carry these in the cold storage holds along with the fruit exported from Trinidad. To show that the loss incurred during the close of 1905 and the beginning of 1906 was entirely due to the fruit not being carried under proper condition, it may be mentioned that the 604 bunches shipped from the beginning of April to the end of December 1906, arrived in England in good condition and realized, after paying the shipping and selling expenses, 2s. 6½*d*. per bunch.

THE ONION INDUSTRY.

In 1902, an effort was made to establish an onion industry in Barbados, and to that end, on the requisition of a number of planters, the Commissioner of Agriculture imported 13½ lb. of white, and 19½ lb. of red onion seed from Messrs. Hamilton & Co., of Teneriffe. This seed was grown on a number of estates, and on the whole, the results were satisfactory. So successful had been the results for 1902, that in 1903, a further lot of 96 lb. of white, and 78 lb. of red onion seed was imported on behalf of the planters. At one time it was suggested that onions should be shipped to the United States' market, and information with reference to the size and cost of crates, pro forma sales, etc. was obtained. As, however, the planters found a ready sale for the crop in Barbados, it was disposed of locally.

In 1904, 179½ lb. of white and 117½ lb. of red onion seed were imported by the Commissioner of Agriculture. In 1905, 52¾ lb. of white and 10¾ lb. of red, and in 1906, 7½ lb. of white and 8 lb. of red onion seed were imported.

On the whole, the onions grew satisfactorily, but unfortunately, in one season the crop was attacked by some disease which caused the upper portion of the bulb at the base of the leaves to rot, while in another year the crop suffered from attack by thrips. The attacks of these fungoid and insect pests to some extent decreased the yield obtained, but the industry would, it is thought, have been extended, had it not been that the cotton industry was demanding so large a share of attention that planters did not have the time to instruct the labourers in the details of cultivation of both crops, and also to carry on the general management of the estates; consequently the areas planted with onions have gradually declined.

INSECT AND FUNGOID DISEASES OF THE SUGAR-CANE AND OTHER ECONOMIC CROPS.

The Headquarters of the Imperial Department being located in Barbados, the colony has received a large amount of attention from the Entomologists and from the Mycologists employed on the staff of the Department.

In 1900, Mr. H. Maxwell-Lefroy the Entomologist, completely worked out the life-history and agricultural treatment of the Moth Borer (*Diatraea saccharalis*) of the sugar-cane, and the results of his labours, published in pamphlet form, proved of great interest and value to planters.

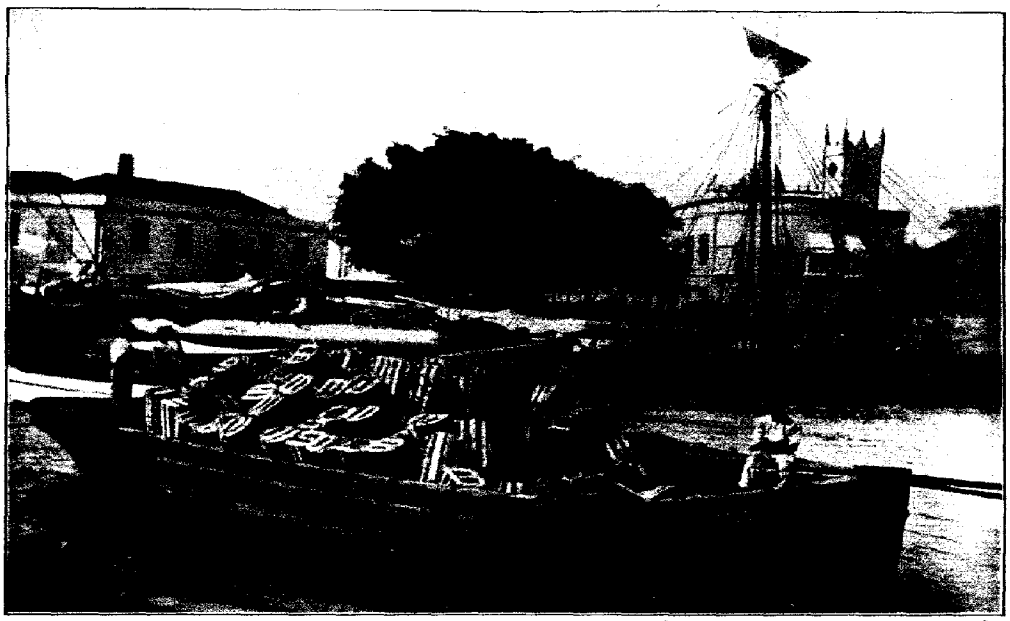


FIG. 13. A LIGHTER-LOAD OF BANANAS IN CRATES.

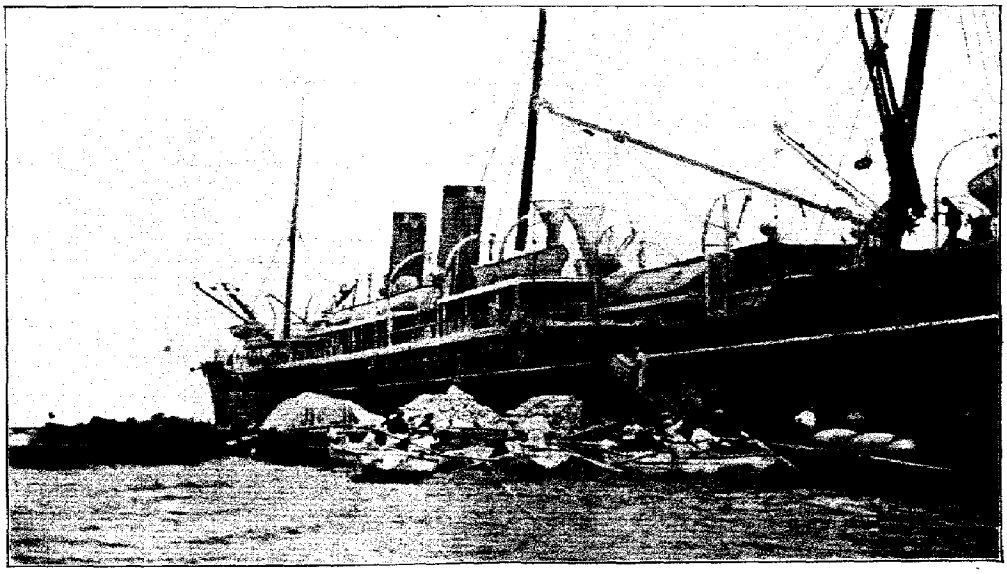


FIG. 14. SHIPPING BANANAS AT BARBADOS.

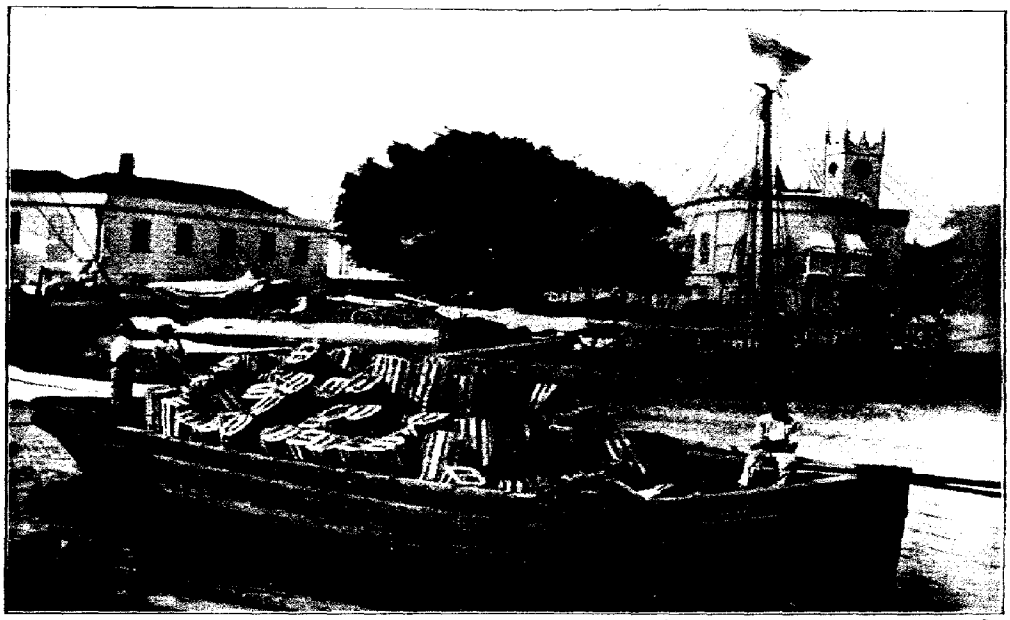


FIG. 13. A LIGHTER-LOAD OF BANANAS IN CRATES.

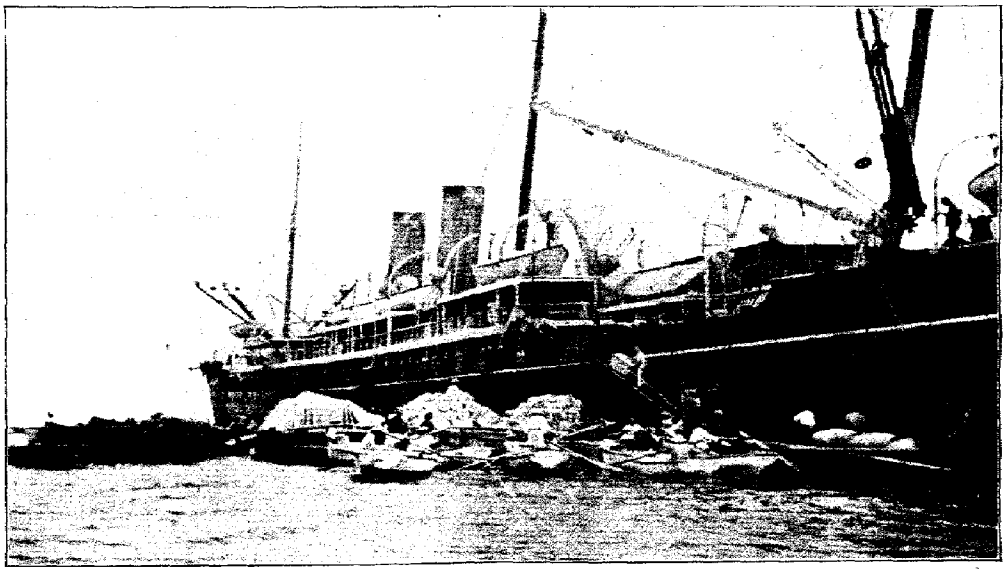


FIG. 14. SHIPPING BANANAS AT BARBADOS.

Mr. Lefroy contributed a useful lecture on Insect Pests in the 'Lectures to Sugar Planters,' a number of papers to the Agricultural Conferences of 1901 and 1902, and devoted a good deal of attention to the study of the scale insects of Barbados.

In 1903, the Rev. N. B. Watson worked out the life-history of the Root Borer of the sugar-cane, and his interesting results were published in the *West Indian Bulletin*, Vol. IV, p. 37. Mr. H. A. Ballou who succeeded Mr. Lefroy as Entomologist has continued the study of scale insects, and contributed a number of papers to the Conferences and publications of the Department upon insect pests, especially those that attack cotton, and it may fairly be said that these contributions have played a large part in the success of the cotton industry.

The Mycologists of the Department (Mr. A. Howard 1900-2, Mr. Lewton-Brain 1902-5, and Mr. F. A. Stockdale (1905 to the present time) have studied the fungoid diseases of the sugar-cane, of cotton and other plants, and their pamphlets published by the Department have proved of great value to the agriculture of the island. The work of Mr. Lewton-Brain and of Mr. Stockdale on the hybridization of canes has been alluded to in another place.

Both the Entomologists and Mycologists have been of special value in constantly visiting and inspecting estates, and in examining the specimens which are from time to time forwarded to them by planters in difficulty, or by the local Department of Agriculture, to which they have at all times been accessible.

AGRICULTURAL EDUCATION.

STAFF, ETC.

In 1899, the Imperial Department of Agriculture for the West Indies made a grant of £350 per annum for the appointment of a Lecturer in Agricultural Science, whose whole time could be devoted to the teaching of Natural and Agricultural Sciences. This Lecturer was attached to the Island Department of Chemistry and Agricultural Science under the direction of the Island Professor of Chemistry. The staff of this Department consists of Professor J. P. d'Albuquerque, M.A., (Cantab.), F.I.C., F.C.S., Island Professor of Chemistry and Agricultural Science; and Mr. R. Radclyffe Hall, B.A. (Cantab.), Assistant to the Professor of Chemistry, both officers of the Government of Barbados, under the Education Board; and the Lecturer in Agricultural Science, under the grant from the Imperial Department of Agriculture. Mr. Albert Howard, B.A., (Cantab.), A.R.C.S., was appointed to the post of Lecturer in Agricultural Science in September 1899. He was succeeded in January 1901 by Dr. Longfield Smith, B.Sc., (Edin.), Ph.D., (Leipzig).

AGRICULTURAL EXHIBITIONS.

Agricultural exhibitions tenable for two years at Harrison College, Barbados, were offered by the Imperial Commissioner to candidates in Barbados and in the Windward and Leeward Islands. In Barbados three scholarships of the annual value of £10 to £16 were given to the sons of planters or others residing in or near town, and two scholarships of £25 a year for the sons of planters and others residing in the country districts. In the Windward Islands one scholarship of the annual value of £75 was awarded and in the Leeward Islands one scholarship of the same value. These scholarships were withdrawn at the end of 1907 owing to curtailment of Imperial funds.

CURRICULUM AND EXAMINATIONS.

The Agricultural Science Course at Harrison College is opened to boys who have reached the fourth form at the school, or to boys from other schools who have reached a similar standard. The course is a two-years' one. Three hours a day are devoted to the work. The following are the subjects of the course:—

Agricultural Chemistry.
Systematic Chemistry.
Practical Agricultural Chemistry.
Agricultural Botany.
Practical Botany.
Agricultural Physics.
Physiology and Entomology.
Principles of Agriculture.
Sugar and Cotton Planting.
Sugar Manufacture.
Practical Sugar Chemistry.

The pupils of each year are examined by the Cambridge University Examination Syndicate, who have appointed Mr. H. H. Cousins, M.A., lately Professor of Agricultural Chemistry at Wye, and now Government Analytical and Agricultural Chemist at Jamaica, to take the more strictly West Indian technical subjects of the course.

To those pupils who pass satisfactorily in all the subjects of the two-years' course, a Certificate of Proficiency in Agricultural Science is awarded. The number of pupils who have been awarded this certificate during the period 1900-8 inclusive is twenty-seven.

In all, during the years 1900-8, ninety boys have passed through the class. A few of these have attended only a portion of the course.

The work of the class has been so useful and successful that the local Government of Barbados decided to make the Lecturership in Natural and Agricultural Sciences one of the permanent appointments on the local Government staff, under the Education Board. This regulation comes into force on April 1, 1909.

A fair proportion of the boys who passed through this course have taken up agriculture as their life-work and occupy positions as overseers and assistant chemists on estates. A larger proportion find the class a valuable preparation for the Sciences of Medicine and Engineering.

A small proportion of the boys who have passed through the Agricultural Science course with credit are transferred to the Barbados Scholarship classes in Advanced Chemistry, Physics, and Botany.

The Barbados Scholarship is of the annual value of £175, and is tenable for four years at any British University. It is competed for by boys who offer either Classics, Mathematics or Science. During the years 1900-8, two boys have taken the Scholarship in Science. E. M. Cutting won the scholarship in 1901. He proceeded to St. John's College, Cambridge, where he won a foundation Scholarship and the Wright's Prize, obtained double first-class honours in the Natural Science Tripos in 1903 and 1904, and is at present a Demonstrator in Botany at Birbeck College, London. C. K. Bancroft won the Scholarship in 1905. He proceeded to Trinity College, Cambridge, where he succeeded in winning a Major Scholarship and is still studying for his degree in Natural Science.

AGRICULTURAL TEACHING IN ELEMENTARY SCHOOLS.

A course of lectures to Elementary School Teachers, designed to prepare them for teaching Elementary Agricultural Science in the primary schools was delivered, under the auspices of the Imperial Department of Agriculture, by Mr. R. R. Hall, B.A. (Cantab.), and Mr. J. R. Bovell, F.L.S., in September 1898 and in December 1899. Thirty-four school teachers attended in 1898 and thirty-two in 1899 and sat for the examination at the end of the course. Those teachers who successfully passed the examination began the teaching of the subject in their schools. In 1901, another series of similar lectures was delivered by the Lecturer in Agricultural Science at each of four centres. One hundred and forty-six teachers attended, and sat for the subsequent examination.

In 1904, gifts of gardening implements were made by the Department to primary schools that had established school gardens and the Inspector of Schools reports that over 30 per cent. of the boys' schools in the country districts have established and maintained school gardens during the past three years.

In 1904, the Education Board made agricultural instruction one of the ordinary subjects of the annual examination in boys' schools.

The success which has attended these efforts is shown by the numerous and excellent exhibits made by children at the Local Agricultural Exhibition held each year under the auspices of the Imperial Department of Agriculture.

Interesting details on this subject are given in the *West Indian Bulletin*, Vol. VIII, No. 3, in the paper on *Agricultural Teaching in Elementary Schools of Barbados*, by the Rev. Canon J. E. Reece, M.A., Inspector of Schools.

METEOROLOGY.

In 1890, Dr. R. B. Walcott, who had been recording the meteorological observations and compiling the rainfall returns for the island for many years, discontinued his observations, owing to ill health, and presented the meteorological instruments to the Agricultural Superintendent of Barbados, who with the permission of the Government undertook to carry on the observations. From then onward, monthly reports have been published in the *Official Gazette* of the colony, and in 1895, at the request of the Secretary of State for the Colonies, copies in duplicate were forwarded to the Secretary of the Meteorological Office, London. In 1894, the Hon. G. R. Le Hunte (now Sir George R. Le Hunte, Governor of South Australia), who was then Colonial Secretary of this colony, asked that observations should be recorded at 8 a.m. daily for the United States Hydrographic Office, Navy Department. The Navy Department of the United States after some time turned over the work of compiling the meteorological returns to the Department of Agriculture, to whom the records are now sent. The observations in Barbados are now taken thrice daily.

In the following pages are given the meteorological observations taken at the Botanic Station, and the rainfall returns for the island for the year 1906, together with tables showing the average meteorological readings for the past ten years, and a return showing the average rainfall of the island for the past sixty years, and the crop of sugar exported each year, during the same period.

Barometric Pressure.—During 1906, the average maximum pressure at 9 a.m. corrected for temperature and reduced to sea-level, was 29·956 inches, and the average minimum at 3 p.m. was 29·886 inches, the highest recorded (on February 17) being 30·073 inches, and the lowest 29·692 inches, on October 14. The average barometric pressure under the same conditions, for the past ten years was, at 9 a.m., 29·962 inches, and at 3 p.m., 29·82 inches. The highest average pressure at 9 a.m. was 30·024 inches, and the lowest at 3 p.m., 29·819 inches.

Temperature.—The average maximum temperature for the year 1906 was 84·6° F. and the average minimum 75·9° F. The highest temperature for the year was 89·7° F. This reading was registered on May 27, and again on September 18. The lowest temperature, 62·8° F., occurred on January 25. The mean average temperature for the year was 80·2° F.; the highest range for the year was 26·9° F., and the average range 19·7° F. For the past ten years, the average maximum temperature was 84·2° F., and the average minimum 75·8° F. The maximum extreme during the ten years was 88·1° F., and the minimum extreme 66·1° F. The mean average temperature for the ten years was 79·9° F., and the average range 17·5° F.

Wind.—The average velocity of the wind during 1906 was 10·7 miles per hour, the maximum being 23·9 on May 14, and the minimum 2·8 on December 12. The average velocity over the past ten years was 9·8 miles per hour.

Rainfall.—The rainfall registered at the Meteorological Station during 1906 was 56·21 inches. Rain fell on 181 days, the greatest fall being 4·50 inches on September 23, and the lowest 0·01 inch on January 8 and 30, February 11, March 6 and 18, May 10, June 27, and November 9.

Rainfall for the Island.—The rainfall for 1906 was, on the whole, favourable, and averaged 70·70 inches, being 13·16 per cent. above the average rainfall of the island for the past sixty years, which was 62·48 inches. During the first five months of the year the rainfall was less than the average for the same period during the past sixty years by 45·52 per cent., and in the last seven months it was greater than the average for the same period by 30·01 per cent.

See page 35

BARBADOS RAINFALL FROM JANUARY TO DECEMBER, 1906.

NAME OF STATION.	No. of Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
		Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
I. District 'A.'														
St. Michael Lowlands ..	22	1·10	·80	·52	1·18	·98	8·11	6·80	8·03	7·57	8·06	7·69	4·10	**55·84**
II. District 'B.'														
a. Christ Church Lowlands ...	23	1·06	·99	1·57	1·01	1·05	9·03	5·85	6·58	6·66	8·94	7·42	3·87	**54·03**
b. St. George Highlands ...	9	1·57	1·39	·89	1·97	1·72	10·58	7·24	8·67	8·65	10·38	8·78	5·72	**67·56**
b. St. George Lowlands ...	5	1·85	1·19	·74	1·12	1·23	9·63	6·67	7·97	8·64	10·56	8·55	4·08	**62·24**
III. District 'C.'														
a. St. Philip Highlands ..	3	1·47	1·57	1·15	1·20	1·00	10·57	6·26	5·61	10·77	10·96	8·35	5·55	**64·46**
a. St. Philip Lowlands ...	21	1·35	1·12	·94	·98	1·08	10·16	5·28	4·95	9·41	9·01	8·08	4·35	**56·71**
b. St. John Highlands ...	14	1·71	1·55	1·07	2·21	1·29	12·25	7·23	8·06	12·13	11·88	8·37	6·16	**73·91**
b. St. John Lowlands ...	4	1·11	1·19	·84	1·88	1·04	9·38	6·18	7·16	12·30	9·55	7·93	4·74	**63·25**
IV. District 'D.'														
a. St. Thomas Highlands ...	7	2·84	2·04	2·42	2·46	2·43	14·66	8·38	10·06	12·43	11·63	9·89	4·98	**84·22**
a. St. Thomas Lowlands ...	16	2·02	1·35	1·27	2·34	1·79	11·01	7·11	8·93	12·35	9·58	8·82	4·90	**71·47**
b. St. James Highlands ..	2	2·50	2·51	2·77	1·31	1·91	12·92	7·90	9·26	13·52	10·13	9·07	5·21	**79·01**
b. St. James Lowlands ...	15	1·84	1·15	1·48	1·42	1·53	12·67	6·25	8·14	12·66	8·37	8·00	3·82	**67·35**
V. District 'E.'														
a. St. Peter Highlands ...	10	2·14	1·95	2·19	1·72	1·26	15·42	8·27	9·80	13·56	9·07	8·41	8·60	**82·39**
a. St. Peter Lowlands ...	8	1·99	1·44	1·89	1·32	1·33	15·11	7·48	9·94	11·72	7·96	8·09	5·92	**74·22**
b. St. Lucy Lowlands ...	12	1·33	1·50	1·34	1·21	·97	11·04	7·95	9·33	11·06	6·74	6·35	8·42	**67·24**
VI. District 'F.'														
a. St. Joseph Highlands ...	6	2·05	2·07	1·48	2·52	1·82	13·65	8·61	7·64	13·16	11·38	9·17	6·73	**80·28**
a. St. Joseph Lowlands ...	6	1·72	2·05	1·14	2·36	1·47	13·20	8·80	8·69	14·96	10·53	8·45	10·24	**83·61**
b. St. Andrew Highlands ...	4	1·94	1·44	1·49	1·69	1·32	13·57	8·21	8·10	14·19	10·24	9·04	8·97	**80·20**
b. St. Andrew Lowlands ...	2	1·23	1·23	·88	1·21	1·04	13·30	7·93	7·44	12·37	8·97	7·98	11·79	**75·38**
Total	189	32·82	28·58	26·07	31·06	26·26	226·29	138·40	155·26	218·11	183·94	158·48	118·15	
Average ...		1·73	1·50	1·37	1·64	1·38	11·91	7·28	8·17	11·48	9·68	8·34	6·22	**70·70**

METEOROLOGICAL REPORT FOR 1906.

BOTANIC STATION, BARBADOS.

HEIGHT ABOVE SEA-LEVEL = 181 FEET.

Months.	Barometric Pressure reduced to sea-level and 32° Fahrenheit.			Temperatures.								Tension of Vapour.			Humidity.			Wind	Rainfall for 1906.	Number of wet days.
	9 a.m.	3 p.m.	Mean.	Maximum Mean.	Minimum Mean.	Max. Extreme.	Min. Extreme.	Max. Blackened Bulb 4 feet from ground in vacuo.	Mean for month.	Range for month.	Dew Point, 9 a.m.	Dew Point, 3 p.m.	9 a.m.	3 p.m.	Mean.	9 a.m.	3 p.m.	Mean.	Velocity, miles per hour.		
January 1906	29·905	29·916	29·956	82·1	73·4	85·7	62·8	148·0	77·7	22·9	66·2	64·9	·644	·615	·629	65·6	59·1	62·3	12·3	1·05	13
February	30·003	29·935	29·969	82·3	73·4	86·5	63·4	148·8	77·8	23·1	66·9	67·2	·659	·666	·662	66·8	63·9	65·3	11·3	·71	14
March	30·004	29·931	29·967	84·2	74·9	87·1	66·4	149·0	79·5	20·7	68·4	68·8	·694	·704	·699	67·4	64·1	65·7	12·2	·56	12
April	29·980	29·905	29·942	85·6	76·7	88·2	69·0	153·0	81·1	19·2	69·8	71·1	·728	·761	·744	66·2	67·3	66·7	12·8	1·05	3
May	29·960	29·897	29·928	87·0	77·5	89·7	69·0	151·2	82·2	20·7	69·9	70·3	·731	·741	·736	63·8	63·4	63·6	14·5	·70	8
June	29·973	29·909	29·941	85·1	76·5	88·7	69·4	153·0	81·3	19·3	75·1	75·4	·871	·880	·875	80·4	80·4	80·4	13·8	8·32	21
July	29·959	29·917	29·938	85·2	76·7	87·7	71·2	148·0	80·9	16·5	74·2	73·8	·846	·834	·840	78·6	74·7	76·6	11·2	6·54	20
August	29·942	29·892	29·917	85·7	76·8	88·3	69·0	147·2	81·2	19·3	74·5	75·1	·851	·871	·862	76·0	77·0	76·5	7·7	10·32	17
September	29·920	29·858	29·889	86·6	77·1	89·7	71·0	153·0	81·8	18·7	74·9	74·4	·865	·851	·858	74·2	72·1	73·1	6·5	6·60	15
October	29·918	29·837	29·878	85·0	76·3	87·7	70·4	149·2	80·6	17·3	74·0	74·0	·840	·840	·840	76·4	75·9	76·1	7·3	8·14	22
November	29·889	29·803	29·846	84·4	76·5	88·3	68·6	152·0	80·4	19·7	74·0	73·1	·840	·815	·827	76·9	74·6	75·7	9·1	7·52	20
December	29·924	29·833	29·878	81·8	74·5	84·1	65·6	146·0	78·1	18·5	70·7	71·0	·751	·759	·755	73·6	74·4	74·0	9·5	4·70	16
	29·956	29·886	29·921	84·6	75·9	87·6	68·0	149·9	80·2	19·7	71·6	71·6	·777	·778	·777	72·2	70·6	71·3	10·7	56·21	181

SUMMARY OF THE AVERAGES OF THE METEOROLOGICAL CORRECTIONS OF THE READING TAKEN AT THE BOTANIC STATION, BARBADOS.

FOR EACH OF THE MONTHS FOR THE TEN YEARS 1897-1906.

Months.	Barometric Pressure reduced to sea-level and 32° Fahrenheit.					Temperatures.									Tension of Vapour.			Humidity.			Wind velocity, miles per hour.	Rainfall.	Number of wet days.
	9 a.m.	3 p.m.	Mean.	Highest.	Lowest.	Maximum Mean	Minimum Mean	Max. Extreme.	Min. Extreme.	Max. Blackened Bulb 4 feet from ground in vacuo.	Mean for Month.	Range for Month	Dew point, 9a.m.	Dew point, 3 p.m.	9 a.m.	3 p.m.	Mean.	9 a.m.	3 p.m.	Mean.			
January 1897-1906	29·980	29·904	29·942	30·045	29·826	82·3	71·1	85·1	66·9	141·8	78·3	18·2	60·1	68·7	·713	·704	·708	69·6	67·4	68·5	10·4	2·83	15·5
February „ „	30·014	29·936	29·975	30·069	29·865	82·2	73·8	85·0	66·1	144·1	78·0	18·9	68·1	66·9	·687	·681	·685	69·7	65·5	67·6	11·1	1·16	13·0
March „ „	29·975	29·901	29·938	30·031	29·824	82·7	73·9	85·5	66·7	145·3	78·3	18·8	68·6	69·2	·701	·714	·708	69·9	68·4	69·1	11·2	2·63	11·6
April „ „	29·908	29·903	29·935	30·028	29·840	84·8	75·8	87·1	69·2	147·5	80·0	17·9	70·3	69·2	·741	·714	·727	68·8	64·5	66·6	11·2	1·78	8·0
May „ „	29·965	29·896	29·930	30·028	29·831	85·4	76·7	87·9	70·0	147·4	81·1	17·9	70·8	70·1	·756	·743	·749	67·2	64·6	65·9	11·4	2·56	10·6
June „ „	29·981	29·926	29·953	30·036	29·852	85·0	76·9	87·7	70·9	143·6	81·0	16·8	72·7	72·3	·806	·795	·800	73·1	70·6	71·8	11·7	5·69	16·9
July „ „	29·968	29·918	29·943	30·024	29·862	84·8	76·9	87·3	76·7	146·6	80·9	15·6	72·9	72·4	·811	·798	·804	74·3	70·7	72·4	10·8	6·20	20·0
August „ „	29·953	29·895	29·924	30·01.	29·826	85·4	76·7	87·7	70·4	147·3	80·5	17·4	74·0	73·8	·841	·836	·838	75·5	73·7	74·6	9·1	7·35	18·9
September „ „	29·944	29·870	29·910	30·00.	29·799	85·4	76·9	88·1	70·5	149·2	81·1	17·6	73·5	72·9	·826	·810	·818	73·3	70·9	72·1	7·4	6·08	15·4
October „ „	29·929	29·844	29·886	29·98(	29·762	85·0	75·5	87·6	70·1	148·6	80·8	17·5	73·3	73·0	·822	·814	·819	73·7	72·4	73·0	6·5	6·03	18·1
November „ „	29·916	29·834	29·875	29·98[illegible]	29·750	84·2	76·9	87·4	70·7	147·1	80·5	16·7	73·1	72·7	·816	·805	·810	74·4	72·9	73·6	7·8	4·93	14·5
December „ „	29·946	29·871	29·908	30·025	29·791	82·8	75·1	85·8	68·6	144·5	78·9	17·1	71·3	71·6	·769	·778	·773	74·5	74·1	74·3	9·3	6·10	16·5
	359·530	358·704	359·119	360·287	357·828	1010·0	909·2	1042·2	836·8	1756·0	959·4	210·4	857·7	853·1	9·289	9·195	9·239	864·0	835·7	849·5	117·9	53·64	179·0
	29·962	29·892	29·927	30·024	29·819	84·2	75·8	86·8	69·7	146·3	79·9	17·5	71·5	71·1	·771	·766	·770	72·0	69·6	70·8	9·8		

NOTE.—The height above sea-level of the Meteorological Station from 1897 to June 30, 1902, was 210 feet. On July 1, 1902, the instruments were moved to Codrington House, which is 181 feet above sea-level.

TABLE OF THE RAINFALL OF THE ISLAND OF BARBADOS, W.I.,
FROM THE YEAR 1847-1906 (A PERIOD OF 60 YEARS).

Years.	Number of Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Crops in Hhds. for the same period.
1847	3	2·83	·95	1·20	2·98	1·02	2·10	2·27	5·26	10·20	7·11	8·45	3·73	48·10	33,111
1848	3	4·76	2·04	2·66	1·58	6·74	2·21	6·25	7·53	5·41	11·78	5·79	7·04	63·79	28,165
1849	3	3·61	2·72	3·90	2·69	2·34	6·63	5·64	6·82	4·74	8·53	1·42	3·73	52·77	33,077
1850	3	1·14	2·52	·78	2·96	4·70	10·48	9·01	6·82	3·34	10·17	9·61	6·36	67·89	35,302
1851	6	1·62	3·01	1·99	1·58	6·13	5·31	6·63	7·00	9·25	6·53	4·29	6·05	59·89	38,731
1852	7	2·30	1·58	1·53	2·17	7·11	2·17	2·49	7·36	3·72	6·53	14·15	6·66	57·77	48,611
1853	11	4·04	3·94	2·38	3·38	9·26	5·21	3·89	8·08	7·75	10·43	8·36	2·20	68·92	38,719
1854	16	2·61	1·95	1·43	1·20	1·33	5·56	5·68	5·11	3·97	7·03	11·19	3·79	50·88	45,181
1855	18	6·96	2·95	1·85	5·49	6·82	6·61	8·00	12·84	9·27	5·12	5·98	5·41	77·30	39,290
1856	17	1·73	2·18	1·19	·81	2·94	5·49	2·86	7·80	5·88	6·15	7·25	4·21	48·49	43,077
1857	20	2·63	5·78	2·02	1·54	2·64	5·48	7·14	6·33	7·93	6·58	9·69	3·10	60·81	38,768
1858	21	1·52	1·28	1·40	·96	2·23	4·54	3·69	4·24	3·54	10·46	6·13	5·22	45·21	50,778
1859	26	2·10	2·64	1·22	1·24	3·56	5·68	5·72	3·21	4·80	10·13	10·18	3·74	54·22	39,666
1860	23	2·28	2·85	1·13	2·41	·66	3·13	3·90	7·93	7·31	13·30	7·97	5·09	57·96	42,684
1861	21	3·49	1·96	2·76	6·35	8·01	9·31	8·28	4·65	6·77	7·60	7·50	7·11	73·79	49,845
1862	19	7·60	1·12	·81	1·12	3·53	7·18	5·89	7·23	4·74	11·18	7·40	2·36	59·16	46,129
1863	27	1·19	3·88	2·36	2·26	·56	1·62	3·65	9·34	4·99	2·89	6·45	3·27	42·46	42,281
1864	26	2·74	2·47	·77	·66	3·07	2·17	7·51	7·37	10·77	9·14	6·31	6·16	59·14	36,199
1865	35	2·36	2·19	1·39	4·13	5·89	9·19	7·35	8·91	5·07	11·00	4·53	6·58	68·59	47,209
1866	36	3·75	2·75	1·57	1·26	2·74	2·63	6·23	11·89	4·22	8·99	7·85	5·80	59·68	57,241
1867	40	2·68	4·49	·88	1·64	2·66	10·94	7·50	9·62	8·54	12·74	4·30	3·89	69·88	53,898
1868	42	4·29	1·74	1·93	·97	1·68	3·45	6·26	5·62	4·63	8·20	4·42	1·40	44·59	58,242
1869	45	1·53	1·47	1·03	3·34	4·32	3·05	4·42	6·95	4·56	6·90	5·13	5·73	48·43	32,895
1870	91	3·96	1·35	·90	·93	2·80	10·15	5·62	5·61	5·03	11·24	8·37	3·38	59·34	30,270
1871	141	4·13	2·29	1·07	·56	·98	2·71	3·65	5·37	6·70	6·33	4·03	4·08	41·90	53,907
1872	165	2·10	2·38	·96	1.31	1·55	2·90	2·67	4·11	8·50	4·55	9.95	7·72	48·70	30,167
1873	214	3·91	2·00	1·02	1·40	3·75	1·35	5·57	7·09	10·27	10·31	1·76	2·83	51·26	37,337
1874	230	3·77	·93	2·90	2·63	1·23	5·30	5·88	8·11	12·59	8·91	4·06	2·91	59·22	47,293
1875	204	5·29	1·68	1·41	2·30	1·21	1·75	2·94	5·47	18·57	8·12	8·30	9·57	61·61	65,000
1876	78	3·28	1·23	2·37	1·17	1·96	4·61	7·13	3·63	10·64	7·93	4·91	3·89	52·75	37,847
1877	26	4·75	·51	3·96	2·19	5·49	9·27	11·02	4·50	5·60	8·69	8·88	11·11	75·97	49,879
1878	34	4·78	·27	1·53	6·13	5·20	5·31	7·66	9·55	6·53	9·42	13·08	3·56	73·02	43,511
1879	213	4·41	5·23	3·07	1·04	3·88	10·30	4·47	9·30	6·64	6·56	15·30	4·27	74·47	57,146
1880	222	11·23	4·38	1·75	5·61	1·70	6·26	4·41	9·95	10·94	4·15	6·56	2·16	69·10	54,217
1881	217	1·60	2·02	·42	2·89	2·26	8·93	7·80	10·29	13·14	9·07	7·67	4·58	70·67	51,433
1882	217	2·48	1·82	2·10	2·11	2·91	4·92	5·76	3·02	5·97	6·78	8·83	3·36	50·06	54,937
1883	233	6·28	2·65	1·01	1·84	2·86	7·11	4·87	5·67	7·02	11·30	6·15	5·54	62·30	52,851
1884	213	2·05	1·64	3·78	3·55	3·24	4·78	4·70	6·09	4·22	7·76	14·32	3·62	59·75	62,085
1885	191	2·17	1·82	1·73	·86	3·24	2·60	3·52	5·22	5·50	6·90	7·22	4·09	45·17	67,764
1886	99	1·79	1·95	1·82	1·08	3·56	4·05	13·80	18·47	12·65	9·73	11·30	2·67	85·87	15,709
1887	152	3·52	2·06	1·72	·55	5·11	6·96	9·76	10·65	6·23	8·03	8·27	6·15	69·01	68,872
1888	99	9·53	3·33	2·31	5·15	4·78	4·73	8·26	12·51	7·93	2·92	5·07	2·57	69·09	73,009
1889	114	3·10	1·66	3·36	1·68	3·48	7·71	9·57	7·22	12·59	5·28	7·72	13·55	76·92	65,268
1890	178	4·74	1·93	3·25	3·71	2·88	3·83	2·35	8·09	7·39	9·09	2·22	3·05	52·53	85,261
1891	187	3·42	3·21	·58	1·53	1·45	11·43	7·85	7·62	3·43	10·16	11·99	3·63	66·30	50,547
1892	177	3·24	1·92	2·48	3·87	7·47	14·17	7·52	11·49	13·48	5·55	10·73	4·29	86·46	50,254
1893	167	2·55	1·43	1·14	3·94	4·35	7·21	10·23	12·00	10·10	11·90	6·05	5·28	76·18	67,157
1894	162	2·74	1·56	2·08	2·05	1·22	2·83	4·02	4·20	9·91	7·21	5·77	3·12	46·71	66,262
1895	180	8·24	1·55	2·87	3·12	3·70	2·60	3·09	9·52	17·74	10·93	12·84	4·34	80·05	36,451
1896	194	3·57	2·76	2·29	9·51	7·80	5·22	5·69	7·80	6·43	7·41	22·60	9·07	89·68	49,349
1897	195	6·20	1·77	5·54	1·66	9·43	3·82	5·73	9·33	6·08	7·24	8·53	7·72	78·05	58,600
1898	194	1·72	1·88	5·13	1·52	·43	3·52	6·10	6·19	20·46	8·69	8·48	5·29	69·41	53,575
1899	185	3·12	3·82	3·80	1·05	·80	4·76	4·43	4·76	4·15	6·07	7·65	6·39	50·80	46,219
1900	170	3·45	1·72	2·33	2·78	7·48	3·97	7·71	11·41	7·21	5·60	5·32	2·99	61·97	50,571
1901	194	3·15	1·06	1·06	1·99	2·52	15·52	19·50	12·44	16·50	6·34	4·08	7·73	91·89	65,042
1902	215	2·01	·76	1·52	·84	6·46	7·31	7·21	6·20	5·03	4·36	6·67	8·28	56·05	52,087
1903	218	2·93	1·43	5·51	2·75	1·87	4·88	7·71	11·48	7·05	8·99	2·85	9·97	67·42	38,623
1904	199	6·65	2·04	3·09	7·78	1·89	3·48	4·93	9·26	7·21	5·97	4·22	2·86	59·38	63,754
1905	197	3·22	1·81	3·89	1·67	2·44	7·74	6·50	7·13	5·32	4·56	7·59	2·72	54·59	47,097
1906	189	1·73	1·50	1·37	1·64	1·38	11·91	7·28	8·17	11·48	9·68	8·34	6·22	70·70	57,863
	6,822	216·60	131·81	124·30	149·11	214·70	346·59	376·67	466·34	477·61	482·22	459·43	303·19	3,748·57	2,992,38
Average	115	3·61	2·20	2·07	2·48	3·58	5·78	6·28	7·77	7·96	8·04	7·66	5·05	62·48	49,873

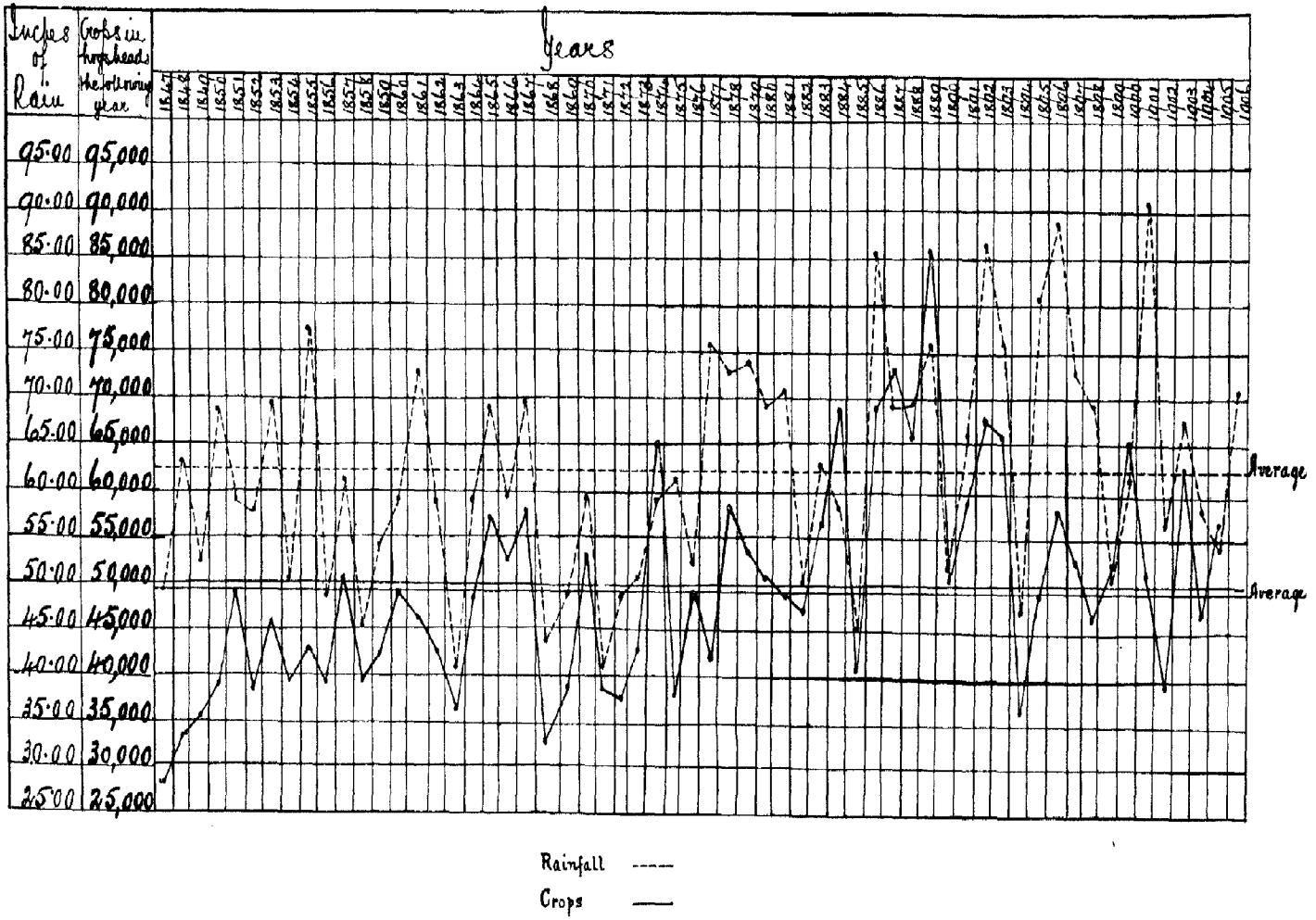
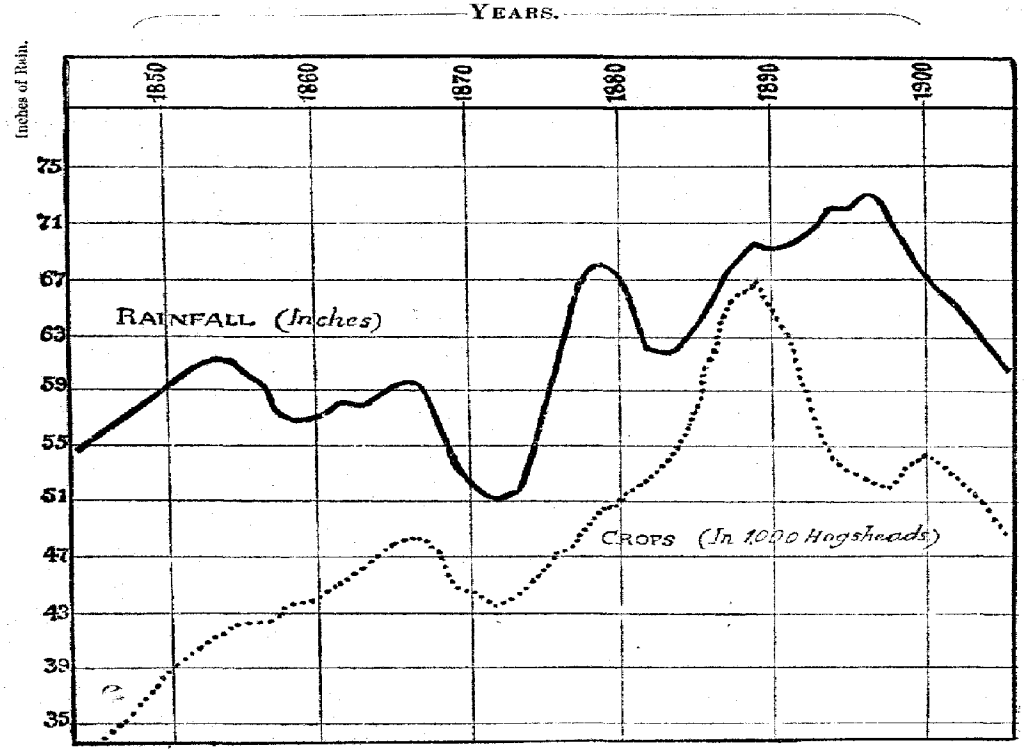


DIAGRAM showing the RAINFALL and SUGAR CROPS in HOGSHEADS the following Year at BARBADOS for the SIXTY YEARS ending DECEMBER 31, 1906.

NOTE ON THE RAINFALL AND CROPS OF BARBADOS, 1847-1906.

The full page diagram, facing page 35, which represents graphically the rainfall, and sugar crops in hogsheads, for the sixty years ending December 31, 1906, was submitted to Henry Harries, Esq., of the Meteorological Office, London, who has kindly sent the following notes on the subject, and also furnished the diagram shown on this page, in which the natural irregularities of rainfall



experienced in individual years, are smoothed out. Mr. Harries says :—

'The diagram showing the rainfall and sugar crops of Barbados for the sixty years ending December 31, 1906, is very interesting. At the first glance it seems to suggest an intimate relationship between the amount of rain experienced each year and the quantity of sugar harvested in the next season. But before arriving at any definite conclusions it is necessary to know more about the data upon which the curves are based. Evidence of periodicity in rainfall or any other phenomenon must be from continuous records at the same station, or from the same group of stations, over the entire period. The rainfall curve seems to suggest that it has been prepared from varying records ranging from a single station at the commencement of the period to the average of a number of stations later. For the first thirty years, 1847-76, the average rainfall was 57 inches, while for the next thirty years it was 67½ inches, so that it would seem that Barbados now receives very much more rain than formerly. Is this really so? Or is it only the result of comparing modern records in the uplands of the interior with the Bridgetown observations of sixty years ago?

'Then as to the quantity of sugar reaped. Obviously rainfall is only one factor in the problem. Probably the methods of cultivation and extraction of sugar from the canes have undergone no appreciable modification in sixty years, but the area under cultivation must have varied sufficiently to render a direct comparison between the rainfall and the quantity of sugar produced impossible. Would it be possible to give a diagram showing the annual rainfall at a single station, or the same group of stations, for sixty years (or a shorter period), and the number of hogsheads of sugar produced per acre, 100 acres, 1,000 acres, or whatever area is most convenient, for the same years?

'Taking the diagram as it is, and without any information as to how it has been prepared, the rainfall curve exhibits distinct evidence of periodicity in the amount of Barbados precipitation. The accompanying diagram [given on opposite page], prepared from the original sheet supplied, shows that by smoothing out the natural irregularities of individual years, there were wet years round 1853, 1864-5, 1879, and 1895, while the dry periods were round 1858, 1871, 1883-4, and the present. Of course, the duration of any period in these records, from crest to crest or trough to trough, must depend upon the manner in which the records have been handled.

'Turning to the crops curve, the smoothing down process shows that there is no direct relationship between inches of rain and hogsheads of sugar. Only between 1885 and 1890 was there any approach between the figures. The small increase in production round 1865 was merely an incident; the general curve rose from 1847 to its high-water mark about 1889, and since then there has been a decided decrease.

'Of course, it must be understood that these remarks are based solely on the two curves in the published diagram without any explanatory notes, and that the years mentioned are not intended as individual years but the middle period of a series of years.

'More definite information is required before the matter can be satisfactorily determined.'

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