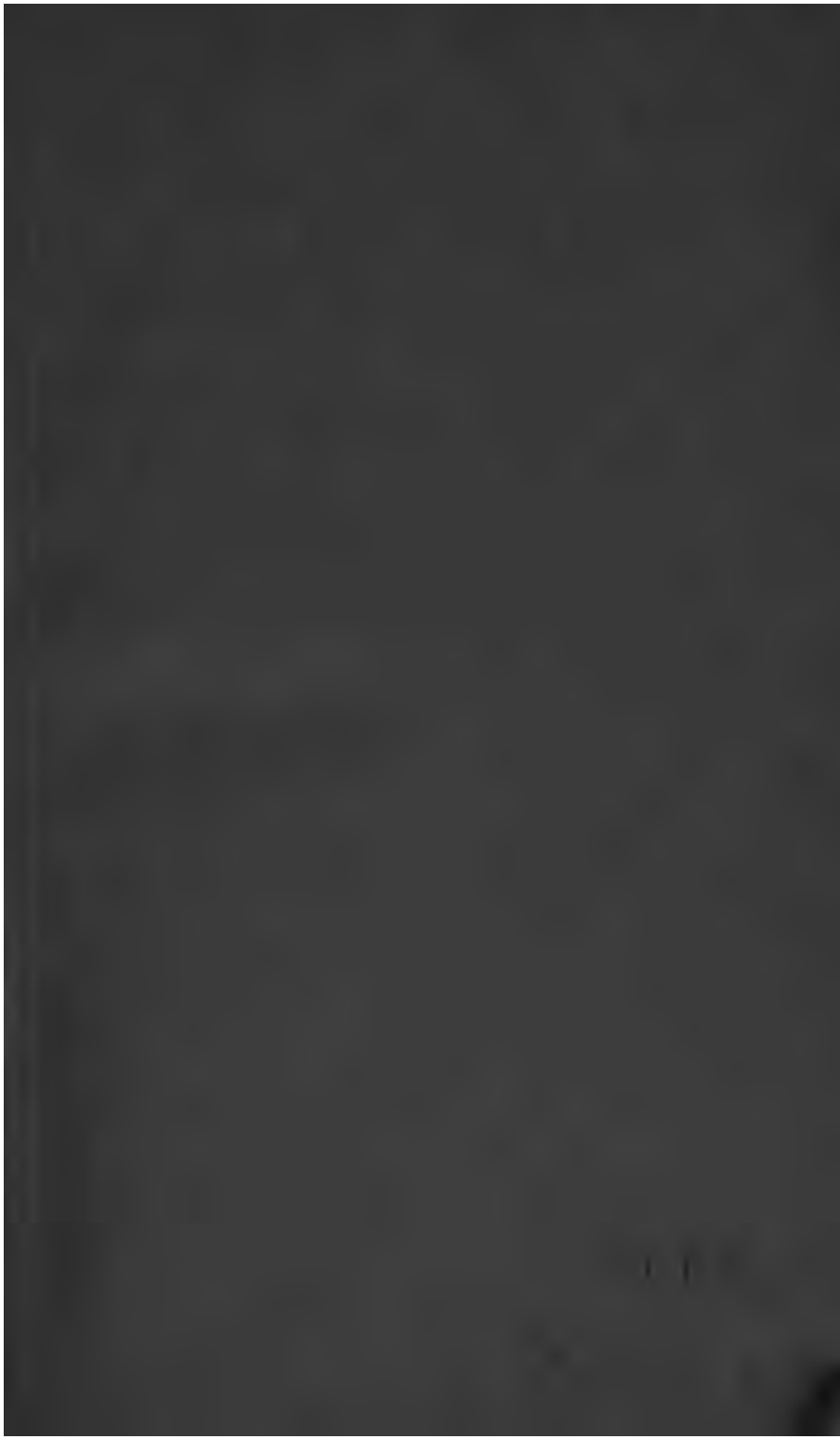

INDUSTRIAL TRINIDAD.

ISSUED BY THE

VICTORIA INSTITUTE

OF

TRINIDAD AND TOBAGO.

(INCORPORATED.)

Patron:

HIS EXCELLENCY SIR ALFRED MOLONEY, K.C.M.G.

TRINIDAD:

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1903.

PREFACE.

MANY of the following papers were read at meetings of the Institute; others were written for this publication by gentlemen having special knowledge of the respective subjects. The papers cover a fairly wide area, but it has not been considered necessary to deal separately with long established and well known industries. However, these, as well as other industries which could not for various reasons be treated independently, are touched upon in the closing paper, where Professor CARMODY, late President of the Institute, gives a complete view of "Industrial Trinidad."

The Board of Management desire to heartily thank all who have assisted in this publication, the first of its kind issued in the Colony:—the contributors of papers; the Government, for kindly undertaking the printing; and His Excellency the Governor, Sir ALFRED MOLONEY, K.C.M.G., for his deep and unflagging interest in this work, as well as in the general work of the Institute.

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THE VICTORIA INSTITUTE.

DISTRIBUTION OF PRIZES.

His Excellency Sir ALFRED MOLONEY, K.C.M.G., Presiding.

ON Friday 6th February, 1903, at the Victoria Institute, His Excellency Sir Alfred Moloney. K.C.M.G., presided at the annual distribution of prizes and certificates to the students of the classes of that institution. During the early part of the afternoon, painting, art and fancy needlework, done by the students, were exhibited in the class room, and were very much admired by the numerous spectators. At the function in the evening fully 500 persons were seated, among them being the *elite* of Port-of-Spain. His Excellency, Lady Moloney and party arrived at about 8.30, and were received by Professor P. Carmody, President of the Institute and the Hon. R. H. McCarthy.

Professor Carmody, in the course of his remarks, said : Ever since the arrival of His Excellency and Lady Moloney they had taken a deep and personal interest in the working of the Victoria Institute, and that night, for the first time, they were inaugurating the ceremony of distributing prizes to the successful students of the classes, and in some cases certificates to those who had not been fortunate enough in obtaining prizes. He thought that His Excellency and Lady Moloney would be pleased to hear of the success of the classes and of the progress which had been made in the institution in which they had taken so deep an interest. The classes, they knew, were first of all of a commercial nature, including Spanish, Book-keeping, Shorthand, Type-writing and English Composition. They also had classes for Needlework, Dress-making and a few others, which, although not so very profitable in a commercial sense, were useful in their own way: there were Painting Choral Music and Physical Culture, the last of which had

been started quite recently. This year they had enrolled in the various classes 429 students, as compared with 258 last year. (Cheers.) Of the 258 that attended the classes last year, 221 submitted themselves for examination, and that, they would see, was a very large proportion. His Excellency and Lady Moloney had come there for the purpose of distributing the prizes and of giving a few words of encouragement to those who were attending the classes. He might say that the prizes had not been bought out of the funds of the Institute; they had for the most part been contributed by persons whose names he was not at liberty to mention, but who were principally merchants in town. (Cheers.) He mentioned that to shew that the work they were undertaking was fully sympathised with by the commercial community. (Cheers.) Spanish was of much importance in Trinidad, and the merchants were very anxious to encourage it. With that object in view, one of them had promised a prize of $20 to the first student in the advanced class, and $10 to the second student in the same class. (Cheers.) Others had taken an interest in the class of dress-making, which was a subject of very great importance to every lady, and that class was very well attended indeed. Another merchant had given a very nice sewing machine as a present to the lady who took the first prize in dress-making. (Cheers.) In connection with the future of the Institute, one of the merchants in town offered the other day to lay aside a sum of money which would bring in $50 a year interest to be used for starting a bursary for the successful students of the Institute. He was quite sure that he would not be right in suppressing the name of the generous donor in this case; it was Mr. Smith of the "Bonanza." (Cheers.) They had also received marks of sympathy in other directions The hall of that memorial wing was built by contributions from merchants, and to a certain extent from persons more or less connected with the colony. On that very evening they had received a further mark of appreciation from a gentleman in no way connected with the Colony. They had received a promise of £50 from the Resident Director of the Margarita Pearl Fishing Company. (Loud cheers.) With regard to Short-hand and Type-writing, the Government had been kind enough to encourage the latter class by giving them two type-writing machines. There had been a certain amount of bad fortune attending those machines. He only mentioned that because he wanted to tell the students of the

Short-hand and Type-writing classes that this year they would be able to do better for them, through the kindness of the merchants, and they now had three excellent machines—two of them quite new. One merchant had promised to give employment to the first lady who was able to typewrite and write shorthand at a fairly rapid rate. He thought it would not be right for him to finish without saying a word in favour of the teachers, as they had been of the greatest possible aid in making the classes a success In some cases they arranged to hold classes on terms that could scarcely be remunerative to them, and in some cases they had given special prizes. Some gave three hours' work and only insisted upon payment for two, while one teacher took nothing at all. Not only would the last mentioned teacher take nothing, but she had chartered a steamer and invited the pupils of her class that had attended regularly to accompany her down the Islands to-morrow (Saturday). (Cheers.) It had been suggested to them by one of the newspapers—that it would be well if their examinations were conducted by a public body in England, and that they should get certificates from them corresponding to the systems known in England. That would be very desirable. They had that standard as regards shorthand at present. It had been suggested that they should work in conjunction with the College of Preceptors and obtain certificates from them. If it were not for the expense they would have done that. Neither had they lost sight of the scheme His Excellency had so constantly at heart—Technical Education. (Cheers.) They were laying the foundation for its introduction, but they must have larger buildings to carry it on, and they hoped that the merchants would again contribute to another building, and that assistance would come from the people and the Government. (Cheers.) There was another question which they had not lost sight of, and that was the establishment of a commercial museum, so that persons coming to the Colony could see what articles were produced here, and what they could introduce with success. The Professor then announced that the Governor and Lady Moloney had kindly consented to distribute the prizes.

His Excellency said the first great pleasure to him was to find himself among his fellow-members of the Victoria Institute, and it was still greater pleasure to find himself in a position not only to give himself pleasure, but to give

others also, in connection with the distribution of prizes. (Cheers). He believed he was purely to be the spokesman, because he had gathered from the Managing Body of that important centre that they wished his better half—Lady Moloney—to undertake the distribution of prizes. To recognize the great and important work that had been so far developed in such a short space of time must be gratifying not only to himself, but to every body who was associated with that institution. It was only in March, 1901, that they had that unpretentious building which represented the first part of that institution, and it was then an appeal was made to the generous public of the Colony to turn about and erect something worthy of the memory of their late beloved Queen; and there was no time that he went around the savannah that he did not look round with a great amount of pride on the outcome of the generosity of the people of Trinidad. (Cheers). Apart from it being a worthy memorial wing, he believed it was one of the first erected in any Colony out of memory of the late Queen, and they must look with the greatest amount of pleasure and gratification to the work that was being imparted from that centre. They had heard from the President that they had great aspirations for the future, and in connection with that they could have no more encouraging person than himself. It was his privilege to address them when they were trying to raise that wing, and it was his greater privilege to open it, and on that occasion to give a paper on Technical Education; and as Governor of the Colony, he would continue to use his influence and give all the support he possibly could to that centre, recognizing that it was the only one at the present time representing Technical Education in the Colony. (Cheers). He had the advantage that afternoon of witnessing what had been the work of the students in connection with the last term, and he was further encouraged by learning of the very large increase in attendance. He was very pleased to hear of the attention that was being paid to the acquisition of Spanish. After referring to the healthy increase in the number of students, His Excellency alluded to the importance attached to book-keeping and the great increase that was coming about as regards the acquisition of shorthand and type-writing. He was rather interested in the remarks of the President on those two subjects. He was in perfect sympathy with the views and aspirations of the

Board of Management as regards the extension of that centre. It was his opinion that it should have its own workshop, and be a centre for the promotion and carrying out of technical education in such directions as were essential to the requirements of the Colony. Technical education was of the greatest importance to Trinidad and its people, and he could not lose sight of the fact that he attached equal importance to the wider subject of agricultural instruction. With the happy co-operation of the education staff and agricultural centres, proprietors and others, they had made a very proper step in that direction, by including in primary education agriculture as a subject. He still wanted to go further. He wanted to see their colleges taking up keenly and judiciously the work of agriculture. His Excellency then associated himself with the expression of gratification of the Board of Management for the encouragement the Institute had received from the mercantile part of the Colony. The Press had also come forward to the support of that centre, and he attributed a great deal of the support he had referred to to the encouragement it had given to the work of the Institute. He was perfectly in sympathy with the desire to see a museum added to that institution, and, so far as he could afford, he would be delighted to give his support by contributing himself, or from the funds of the Colony. As previously stated, he had had the opportunity of inspecting the work of the students, and although he did not know much about ladies' dress-making, he had heard it was all excellent. (Cheers.) His Excellency then referred to the art needlework on exhibition, remarking that he considered it was worthy of being placed on exhibition in England. In conclusion he congratulated the President and Managing Body for the great work done by the Institute, and the success that had attended it, and after impressing upon the audience the necessity of increasing the number of associates, members and students, assured them of always extending to them his hearty sympathy. (Cheers.)

The prizes were then distributed by Lady Moloney, His Excellency assisting. The names of the prize and certificate winners are as follows:—

LIST OF PRIZES.

DRAWING.

1st Prize ... Lady's Dressing Case ... Miss Mathilda Tywang.
2nd „ ... Chatelaine Bag and Purse ... „ Eugenia Cameron.

CHORAL MUSIC.

1st Prize ... 2 Vols. Wordsworth & Scott's Poems ... ... Mrs. Louisa Tanner.

BOOK-KEEPING. (Beginners.)

1st Prize ... Gold Scarf Pin ... ... Mr. W. M. Landeau.
2nd ,, ... Ink Stand ... ... ,, Bismark Arnold.

BOOK-KEEPING. (Advanced.)

1st Prize ... Gent's Dressing Case ... Mr. J. N. Daniel.
2nd ,, ... Pair Gent's Hair Brushes and Case ... ... ,, Fred. L. Guitan.

ENGLISH COMPOSITION.

1st Prize ... Chambers' Dictionary, Macaulay's Essays, History of our Own Times by Justin McCarthy ... ... Mr. J. N. Daniel.

SPANISH. (Beginners.)

1st Prize ... Flower Vase ... ... Miss Amy Hackshaw.
2nd ,, ... Writing Case ... ... Mr. Jas. Akow.

SPANISH. (Advanced.)

1st Prize ... Gent's Dressing Case ... Mr. Jos. Glaudon.
2nd ,, ... Silver Cigarette Case ... ,, Assang Thomas.

SHORTHAND. (1st Division.)

1st Prize ... Lady's Silver Watch ... Miss Mathilda Tywang.
2nd ,, ... Chatelaine Bag ... ... ,, Audrey Dancla.

SHORTHAND. (2nd Division.)

1st Prize ... Keyless Watch ... ... Mr. John Bansfield.
2nd ,, ... Fountain Pen and Silver Pencil Case ... ... ,, Sam. James.

SHORTHAND. (1st Division.)

1st Prize ... 1 Vol. Longfellow... ... Miss Mathilda Tywang.
2nd ,, ... 1 Volume ... ... ,, Audrey Dancla.

PAINTING.

1st Prize ... 3 Vols. Poems ... ... Miss Amy Main.
2nd ,, ... Pair Panels and 3 Studies ... ,, Knowles.

DRESSMAKING.

1st Prize ... Sewing Machine ... ... Miss Beatrice Cave.
2nd ,, ... Lady's Hand Bag ... ,, Anna Joaquim.

DRESSMAKING. (Special Prize.)

Work Basket ... ... Miss Beatrice Cave.

ART NEEDLEWORK.

1st Prize ... Lady's Companion ... Miss Mathilda Tywang.
2nd ,, ... Do. do. ... ... ,, Hosang.

ART NEEDLEWORK. (Special Prize for Progress.)

Miss Eugenia Cameron.

PRIZE FOR GOOD WORK AND REGULAR ATTENDANCE.

Lady's Companion ... Mrs. Frances Henley.

LITERARY AND DEBATING SECTION.

Best Paper.. Camera ... ... Mr. Wm. Leslie.
,, Speech. Gent's Dressing Case ... ,, G. T. McDougall.

BILLIARD TOURNAMENT.

1st Class ... Billiard Cue ... ... Mr. Alfred Lynch.
2nd ,, ... ,, ,, ... ,, B. B. Littlepage.

PING PONG.

Cricket Bat ... ... Mr. Leslie La Croix.

CHESS.

Set Chessmen and Board ... Mr. Em. Mouttet.

DRAUGHTS.

1 Vol. Shakespeare ... Mr. Geo. Bancroft.

LIST OF CERTIFICATES.

BOOK-KEEPING. (Beginners.)

W. M. Landeau, Bismark Arnold, Stafford D. Wilson, Alex. Wattley, Geo. Branch, Miss Laura Best.

BOOK-KEEPING. (Advanced.)

Jas. N. Daniel, Fred. L. Guitan, Philip Gaines, Assang Thomas, Robt. Mahand, Alf. Pildain, Chas. Assue.

SPANISH. (Beginners.)

Miss A. Hackshaw.

SPANISH. (Advanced.)

Jos. Glaudon, Assang Thomas, Chas. Hunt, Chas. Sanchez, Philip Gaines.

ENGLISH COMPOSITION.

Jas. N. Daniel, Chas. Sanchez, Assang Thomas, Mrs. Frances Henley.

DRAWING.

Miss Mathilda Tywang, Miss Eugenia Cameron, Mrs. Frances Henley, Miss L. Redman, Chas. Cecil Williams, Miss Audrey Dancla, Clement Jos. Frederick.

DRESSMAKING.

Miss Beatrice Cave, Miss Anna Joaquim, Miss May Ferreira, Miss Mathilda Tywang, Miss Angelique Hall, Miss Adella Cray, Miss A. Yowkee, Miss Phillipa Hunt, Miss Augusta Marks, Miss Virginia Marks, Miss Rosalie Bailey, Miss Philomene Bresto, Mrs. Lucia Mahand.

ART NEEDLEWORK.

Miss Mathilda Tywang.

CHORAL MUSIC.

Mrs. Louisa Tanner, Miss Nora Inniss, Miss Eva Overton.

At the conclusion of the concert which followed the President called upon Sir Mitchell Thompson to propose a vote of thanks to His Excellency and Lady Moloney.

Sir Mitchell Thompson said although he was a comparative stranger to Trinidad he considered it an honour to have been asked to propose a vote of thanks to Sir Alfred and Lady Moloney for their kindness in coming there and presenting the prizes to the students. He knew how popular both the Governor and Lady Moloney were in Trinidad; and he knew not only here, but at home, how devoted Sir Alfred Moloney was to the welfare and interest of the colony over which he ruled. (Cheers:) He would like to take that opportunity of making one or two remarks regarding the interesting evening they had had. It was a recognised fact throughout the civilized world that the British colonies now occupy a more important place than at any other previous period of their history. He must remind them that Great Britain was not the only civilized power which possessed large colonies. Spain, Portugal, France and Holland, at one period of their histories, owned large colonial possessions. There was a famous French Statesman who said that the colonies were like fruit which clung to the tree until it was ripe. Whether his prediction was true with regard to the colonies of those countries to which he referred, he ventured to say that the ties which bound Great Britain to her colonies were never drawn more closely than at this dawn of the 20th century. (Cheers.) The remarkable man who at present occupied the prominent position of Secretary of State for the Colonies—(cheers)—had done yeoman

service in that respect. Although they might have a good Government, and he granted that it was necessary to the prosperity of a community—and he must here state that they had that (a good Government) in Trinidad—the prosperity depended to a much greater extent upon themselves; and he would adopt the words, if not the feelings, expressed by Professor Carmody in his opening remarks, and say that the foundation-stone of the prosperity of a colony or a community was and must ever be "Education." (Cheers.) For some years he (Sir Mitchell) had occupied the position of President of one of the largest and most successful technical colleges at home—he referred to the Heriot Watt Institution in Edinburgh. He wondered if there were any students of that institution present there that night; he knew they had gone forth to almost every part of the world. George Heriot Watt left many years ago the sum of £20,000 to be devoted to the education of the sons of burgesses of Edinburgh. That sum, having been judiciously invested now yielded about £40,000 to £50,000 a year, and all that money was spent in educating young people. Heriot Watt College was attended every evening by something like 800 pupils, who went there to attend classes in various branches. He was very glad on that account to be present that night and to see that they had an Institute which he hoped, as Professor Carmody had said, would blossom into a technical college. His Excellency before presenting the prizes said their interests were commercial and agricultural. He need not remind them that in both those branches it was absolutely necessary to understand their principles. Some people had the idea that technical education was the teaching of a man his trade. It was nothing of the kind. They had there that night one of the foremost of practical engineers in England, Mr. Fowler, and he was sure he would bear him out when he said that the boy must be taught his trade at the workshop and then he must go to the technical school to learn to apply scientific principles to the work which he had to do. (Cheers). This was his second visit to Trinidad and he had become more impressed than on the first occasion with regard to its future. He adopted the opinion of some of the friends present, that there was a great future before the island of Trinidad, and especially before Port-of-Spain—(cheers)—looking to its proximity to the large South American continent, and especially to that country with which, unhappily, he hoped only for a short

time, they had been estranged; and also seeing that the Orinoco river being so very shallow that it could only be wrought by means of steamers or vessels drawing very little water, he thought one could perfectly come to the conclusion that when that trade revived and a more stable form of Government existed on the other side of the water that Trinidad might become another Hong-Kong. (Cheers). A very intimate friend sitting near him would tell them that that was impossible until they had a deep-water harbour. (Cheers). .If that was so, they ought to have it without any loss of time, as he knew Sir Alfred Moloney was so interested and devoted to their interest that it would be his pleasure to do all in his power to further that movement. Sir Mitchell concluded by asking the audience to pass a hearty vote of thanks to Sir Alfred and Lady Moloney.

Mr. Robert Wilson (of the firm of Wilson, Son & Co.), who seconded the vote of thanks, said, unlike Sir Mitchell Thompson, he could not say that he was a stranger to Trinidad, and in rising to second the motion he did so with great pleasure. It was his good fortune to be asked to propose a vote of thanks to the Governor when he laid the foundation-stone of the wing in which they were assembled; and he remembered distinctly that the expressions made at that time were supposed by many to have been too sanguine as to the possible future of the Victoria Institute. He now left them to judge whether they were not warranted in saying what they did as to the success predicted for the Institute. (Cheers.) He was sure His Excellency and Lady Moloney were much gratified to find such an audience assembled to meet and to greet them, and it was in the most sincere manner that he asked the audience to express their feelings of the thanks proposed by Sir Mitchell Thompson to Sir Alfred and Lady Moloney for the interest they had displayed towards the Institute, and which they so kindly promised to continue.

The Governor, in acknowledging the remarks of the seconder and proposer, said he was very grateful for the vote of thanks they had proposed. It was his duty in return to thank the Institute and the excellent teaching staff associated with it. After touching upon the remarks of Sir Mitchell Thompson, His Excellency said from the position he (the Governor) occupied he could not make any remarks upon the distinguished statesman, who was then working

out most important problems in South Africa, but he thought he could venture to hope that his next visit (and he had grounds for saying so,) would be to the West Indies. (Loud cheers.) As far as the Colonies were concerned, he could prophesy that he would receive a hearty welcome in Trinidad, His Excellency concluded by thanking the speakers for the remarks to Lady Moloney and himself, and assured them it was only their pleasure and duty to be always associated with anything that had for its object the development of Trinidad. (Cheers.)

On the Occurrence of Gold and Coal in Trinidad.

With a Brief Sketch of the Geological History of the Island.

By R. J. LECHMERE GUPPY.

Delivered at the Victoria Institute September, 20th, 1902.

I HAVE been asked by several persons if I would not put into writing or give in the shape of a paper or lecture some of the statements and information I have given orally on the subjects of Coal and of the geological history of the island. I have therefore been impelled to offer the lecture I am about to give you. The form of the discourse I am about to deliver to you I call a Lecture. The technical difference between a Lecture and a Paper is that one is spoken while the other is read. A Lecture is from this fact more discursive and admits of a certain amount of repetition in the statements made for the purpose of recalling them to mind. If I had written this Lecture out so that it would be ready to go into the hands of the printer it would have been a Paper and not a Lecture —for this reason that though the matter of it has for the most part appeared before either in the Geological Report on Trinidad or in my own writings, yet it has never appeared in a connected form. The details have been published but I doubt if any one would take the trouble to evolve from them the connected and brief outline which I purpose to put before you to-day. Some portions of this outline I have on various occasions given orally to friends and it has seemed to have excited some interest, hence my excuse for bringing the matter before you to-day. But in this Lecture I do not profess to cover all or nearly all that is to be said about the Geology of Trinidad. There is indeed very much more to be learnt on the subject. We are only at the threshold of knowledge upon this subject. You are aware that Geologists have divided the sedimentary rocks which form the crust of our globe into three main divisions. The oldest of these is called Paleozoic—the

middle Mesozoic—and the newest Kainozoic or Neozoic. Other terms for these are primary, secondary, and tertiary: but as these words have other meanings, I shall chiefly use the Greek words. There are some differences among Geologists as to the exact classification. But I have given what I find to be the most convenient. In this island we have representatives of each of these divisions which I have roughly sketched in different colours on this map. (Refers to map). Our oldest rocks are paleozoic, so far as I know. I have here a Diagram showing the succession of the sedimentary Rocks forming the crust of the Earth. Of course all these various strata do not occur in any one place, but I have shown in colours those occurring here. Now I am going to tell you a little about Coal and a little about Gold as found here. True Coal is only found in the oldest rocks, but tertiary Coal such as ours, is found in the third or upper division of these rocks. It is possible that some of the points I have brought before you to-day are not as clear to you as they are to me: if so, I hope during the course of my Lecture you will note them and give me an opportunity afterwards of clearing up any such points. Gold occurs originally I believe in all cases in the oldest sedimentary rocks only. I have met with statements of its occurrence in other rocks, but I cannot assert that such is really the case. Quartz, the matrix of Gold—a substance whose qualities and properties are, it may be said, the exact opposite of Gold, occurs originally in reefs, seams, or veins deposited among other sedimentary beds. The conditions under which it was deposited are different from any we have any knowledge of. Under certain circumstances Gold was developed in this quartz. The Gold found in alluvial deposits and in tertiary and in other gravels has all been washed out of quartz veins or reefs. I have had some experience and am familiar with Gold deposits and the manner of working them. I was engaged for a couple of years in this business. While, I think that in certain parts of Trinidad there are indications of the possibility of Gold occurring, I do not know that I am sanguine as to the great results arising therefrom. We have Gold here, there is no doubt, for here is a specimen found in Trinidad. (Specimen shown). This is not the first case so that the discovery is not altogether original, for Gold had already been found in Caura and St. Ann's. What I consider to be the most likely district for the occurrence of Gold begins at the

valley of Caura and extends eastwards along those low hills at the foot of the Main Range. It is possible that in this or perhaps others of the localities wherein Rocks of an auriferous Type occur Gold may be found in paying, though probably small quantities, but such localities should, I think, be left to chance discovery, as it would scarcely pay to spend time and labour in searching for it. I have prospected in a country having all the character of a Gold country without finding so much as a speck of Gold, thus showing that all that a Geologist can do is to indicate the formation and the kind of country that Gold is found in—the actual finding must be determined by experience. Murchison predicted that Gold would be found behind the Blue Mountains of New South Wales, but the actual finding was done by a shepherd.

A description of the Coal and Lignite Deposits of Trinidad is contained in the geological Report of 1860, p. 92. The Coal-bearing strata were called the Caroni Beds or series by the Government Geologists. The Manzanilla and Tamana Series lie, geographically speaking, between them and the Series of equivalent date deposited on the other side of the ridge of cretaceous and lower tertiary rocks forming the core of the Montserrat range. These strata (to which I assign an equivalent age) also contain beds of carbonaceous minerals, among others the Manjak, described by Francis and myself in the Proceedings of the Scientific Association of Trinidad 1877 p. 110. We had not recognised the mineral as being identical with the Manjak of Barbados, and in fact it seems to vary slightly from it chiefly in the presence of a notable quantity of sulphur in the Trinidad article. The occurrence of Manjak in Trinidad was noticed by the Government Geologists it being briefly described in the Report, pp. 146–147, but they did not any more than we did recognise its similarity to the Barbados mineral. The Manjak of Barbados is described by Schomburg at pp. 551 and 569 of his history of Barbados. The description accords perfectly with that of our mineral by Francis, even as to the proportion of gas which can be made from it. But the Barbados article has the advantage which ours has not of containing no sulphur, hence its superiority. The presence of sulphur is disadvantageous to the use of the article for almost any purpose. Manjak and allied substances are geologically coal, though technically nearly related to the asphaltic substances. Manjak occurs in seams

similarly to the Lignite. Asphalt occurs in beds, having no particular relation to the strata, it having oozed out from the strata in which it was originally deposited. The asphaltic oils have also penetrated and impregnated many rocks of other date than that of their formation. The differences between these substances are probably superinduced by causes acting subsequently to their deposition as indicated in the Geological Report on Trinidad p. 144–147. But in any case it is pretty certain that the beds of asphalt occur very near or probably in the same place as originally deposited. And although the vast quantity of this substance found at the Pitch Lake may seem difficult of explanation yet it is highly probable that its origin is due to deposition in a locality peculiarly favourable for the deposition and retention (during long ages perhaps) of vegetable material brought down by rivers from the adjacent continent. I think the Geologists somewhere protested against the use of the word 'Pitch' for Asphalt. Asphalt is quite a good enough name—there is a synonym-Bitumen, but we need not use the word 'Pitch.' It is quite sufficient for us to use its own proper name.

The Coal-bearing strata extend across the island from Point Noir on the East of Couva on the West. These deposits are miocene in age containing fossils similar to those contained in the miocene of Haiti, Jamaica and Cumana. Some recent writers have assigned an older age to these fossils but I am not prepared to acquiesce in this opinion. We have older beds here to which I assign an eocene age but Paleontologists do not seem to discriminate between the Faunas of these two (or more) series. To me they are perfectly distinct. The Coal-bearing series as I have shown you is delineated in this map of the Geological Survey of Trinidad (produced), and up to the present time we have no better information than is contained in it. We have other Coal-bearing series here but whether they will turn out to be of value is more than I can tell. They extend along the south coast and are called the Moruga series. (Geol. Rep. p. 48). Appendix E to the Geological Report pp. 120–130 contains a full report on the nature and extent of the Coal deposits, together with an excellent report of the trial of the Coal on board H. M. S. Buzzard. I do not know that I will take up your time by reading any extracts from those reports. It will be sufficient for me to call your attention to them because I presume that the

Geological Report of Trinidad is not exactly a sealed book. I will quote one observation respecting our Coal which I think is most appropriate, and that is the reason that I will trouble you with it. "The real value of the island fuels probably consists in their being available for local purposes whenever the settlement and population of the districts where they occur may render their extraction a matter of greater facility than at present. The authors have felt it their duty to call attention to the existence of these substances and to make every exertion to have their merits properly tested; but wish it to be distinctly understood that they do not consider them calculated to compete with foreign coals for marine or other purposes where the latter are easily obtainable." That was of course written about 1858. It is probable that the origin and mode of occurrence of tertiary Coal, Manjak, Asphaltum, etc., are in all cases the same or similar. The tertiary Coal or Lignite usually shows leaves and woody texture. But then there is a difficulty about the Barbados deposit. Was there at any time during the deposition of those beds a sufficient extent of land to furnish vegetable matter for these deposits? Or were they transported by the sea? On the coast of some countries immense quantities of trees and other vegetable matter are deposited, and sometimes accumulate in masses in the lagoons at the mouths of rivers.

I will allude only very briefly to the question of Petroleum or Mineral Oil. Some trials have been made more or less successful. When I came here in 1859, there were rather extensive operations for winning this substance going on at San Fernando and Oropuche but none were successful. The Petroleum Spring near Guayaguayare now being worked by Mr. Rust is marked on the Geological map and was visited by Governor Keate in 1858. In the Geological Report this form of Petroleum is called Asphaltic Oil or Rock Oil.

In the Geological Report the Geologists have referred to the subject of Boring, which is an excellent means of ascertaining what is the nature of the subjacent rocks and in this way is most useful. But there are some differences between boring as practised in Europe and boring as proposed to be practised here. Boring for Coal is practised in Europe where the Coal strata are covered by hundreds or thousands of feet of more or less horizontal strata. Here,

however, where the Coal strata are at the surface and approach the vertical in position, you find the outcrop and follow it down. It is quite obvious if you sink a shaft in a perpendicular direction you might not come across any seam—the boring might miss it. In fact you might have to go in a slanting direction. There is another point I should not lose sight of, which is, if you have a Coal seam lying at a high angle and you bore through it, the depth of the boring through the Coal seam would be very much greater than its thickness because you strike the Coal seam at an angle and may get a depth of ten feet, whereas the real thickness of the seam might be only five feet. While discussing the question of the Manjak which I described and which I called Coal—found at Williamsville,—I recommended that instead of boring, trenches should be dug in likely places at right angles to the line of strike—in fact horizontal instead of vertical boring. While however giving you my opinion on the subject of boring, I am bound to admit that that method of investigation was recommended by the Government Geologists, and may possibly, under expert management, prove of a limited utility. Hence is another reason why boring for Coal here stands on a different footing from that it holds for paleozoic Coal. The latter was formed on ancient land surfaces and the seams or beds still remain more or less horizontal. Such seams are continuous for many miles in several directions. One boring when it did reach the Coal would suffice for the exploitation of a large extent of ground But here our tertiary Coal beds were probably deposited more or less discontinuously as driftwood in Backwaters and Lagoons: and even when a Coal seam was reached it might only be productive of a few tons or a few hundred tons of Coal, varying of course, according to the extent of the seam.

With regard to other minerals found here, I may say that specimens of Galena and Graphite have been shown to me as occurring in different parts of the island—but even if the occurrence were verified, the value of the discovery must depend on further considerations. Whether these minerals, or Coal, Gold, or Petroleum will in any case pay, must depend on the quantity found and the facilities for working. If Trinidad voted and paid £10,000 to any geologist, he could not tell you more than I have done. I should not refuse a moderate recognition of all I have done for geological science in Trinidad if the Government voted

it for me. My researches have cost me thousands of pounds and I have got nothing in return. If in any case my advice were asked I should say, "Unless you have money to throw away, do not spend any of it until you have some assurance that you will get a return."

I shall now endeavour to give you a brief sketch of the geological history of Trinidad. In my preface I referred to the three great divisions, named respectively, Paleozoic, Mesozoic and Neozoic. I believe that the rocks of the Northern or Parian Range belong to the first named. The strata forming our Northern hills are the oldest in the island and consisted originally of gravel sand and clay derived from the destruction and degradation of some older land. Some of the strata are fine-grained and laminated, some coarse and pebbly. Then we have the limestone strata which pass through the middle of the Northern range. Some of the higher summits are formed of limestone indicating deeper water; but limestone is entirely absent from Tucuche. The limestones contain indications of organic remains which I described in a paper read to the Geological Society of London (*see proceedings Scientific Association Trinidad 1877, page 105*). Very great changes took place in these rocks after deposition, altering their condition and causing change and deposit of minerals. They were elevated to a height considerably above what they at present attain. The evidence as to the age of these rocks is to be found in (1) the great changes (chemical and physical) these rocks have undergone; (2) the enormous amount of denudation the strata have undergone, as exhibited by the deep valleys worn out of them; (3) the organic remains, though few and scanty, described in a paper read to the Geological Society of London (*see* their Journal 1870, volume 26, p. 413). We have evidence of a great extension north of the island of similar strata now sunk beneath the Caribbean Sea. This evidence partly consists of banks, shoals and rocks extending about 50 or 60 miles north of the present land—the northern boundary of this sunken area being approximately parallel with the present shore of the Caribbean Sea. But much more conclusive than this is the evidence of depression afforded by the Bocas, the Gulf of Paria and the lines of depression running through the northern range as explained and indicated in my Papers already referred to (Pro. Scient. Assoc. Trinidad 1877, page 103 and Agric. Rec. 1891). Long after the strata were

elevated into high land all to the south of them was sea. The shore line of this sea is shown in my Paper on the microzoic Deposits of Trinidad (Journ. Geol. Soc. 1892 Vol. xlviii p. 518), and approximately speaking, it coincided with the present shore of Trinidad from the Bocas to Port-of-Spain and with the line of the main road from Port-of-Spain to Arima. South of this was a gradually deepening sea, shallow water deposits extending as far as the Montserrat ranges and their extensions westward. South of this was a deeper sea perhaps extending to 100 fathoms at Pointe-à-Pierre, and anywhere from 500 to 1,000 fathoms at South Naparima. The oceanic beds are not found south of Oropuche Lagoon and it is possible that the sea there was not so deep. The succession of tertiary rocks forming the Moruga series was deposited in shallower water, and the submarine ridge on which they were deposited, when elevated above the sea level, hemmed in to the South the waters of the Orinoco, leaving a broad channel for them—a channel itself afterwards filled up and elevated. After the deposition of the oceanic beds of Naparima, there was a gradual rise of the land, and when this had reached its extreme height, the island of Trinidad was in one with the continent of South America. A branch or branches of the Orinoco flowed across Trinidad between Oropuche and La Brea, and probably other branches of that river were in existence and flowed across Trinidad. Certainly river beds containing gravel have been found in Naparima and Savana Grande. The Guarapiche river flowed across Trinidad nearly where the Caroni river now flows, and its waters went from West to East instead of as at present from east to west. The Oropuche river (Northern) was also a portion of the course of the Guarapiche. A good deal of the lands extending eastward from the watershed between the present Caroni and Oropuche rivers were laid down in the Estuary of the Guarapiche, which probably extended approximately from Aripo to the present mouth of the Oropuche or even much further East. The deposits in the region including the space between the Montserrat Hills and the Northern range seem to have been continuous or nearly so from early or middle tertiary times to a very recent epoch. Subsequent to this period when Trinidad was part of the continent, an immense series of subsidences occurred, as I have already indicated. Chief among the subsidences which threw down the land formerly existing to

the North of the Parian range was that along a line occupying what I may call the axis of the Gulf of Paria, passing through the Gran Boca and continuing Northward between the islands of Tobago and Barbados on the east, and Grenada and St. Vincent on the West. I referred to and indicated this great depression in my Papers already referred to: and as a prime factor in the geological History of Trinidad in my Paper published in the Geological Magazine, July 1900, p. 325. I insisted upon its importance. The island to the West of this line of depression are volcanic, or rather masses of volcanoes. These islands are Grenada, the Grenadines, St. Vincent, St. Lucia, Martinique, Dominica and part of Guadeloupe. The ports of these islands are usually situated in or on volcanic craters. For instance the ports of Kingston, St. Vincent, Castries, St. Lucia and St. George, Grenada are merely sunken craters with their seaward sides broken down. The forms of these craters are well known to geologists. Examples of this formation are found in most volcanic regions. It is on account of their form more or less approaching the circular that these craters have been chosen as harbours. But the islands to the East of the depression referred to, are all non-volcanic—Trinidad, Tobago and Barbados. Catastrophes occur in all countries, non-volcanic as well as volcanic, though they may be of different kinds, and I could not assure you that no catastrophe will ever happen here, although we are in a region where there is an absolute absence of anything volcanic. Caracas is situated in a non-volcanic area, but it was nevertheless destroyed by earthquakes. How far the eruptions which have of late disturbed and are still disturbing the volcanic region of the Antilles may extend, it is not possible for me to say—but it is quite within the range of possibility that any of the numerous craters, including the harbours I have named, may at any time resume their former activity. Going back to the Bocas I have already referred to these submarine and sunken valleys in former Papers. In a Paper written by Mr. J. W. Spencer, a copy of which he has been good enough to send me, he has indicated the great depression of the Grand Bocas as a valley running northward. But all these valleys of the northern range run southward, as Cuesa, Chaguaramas, Diego Martin, etc., and so did the valley whose submergence formed the Gran Boca. In order to account for the formation of these large valleys and their subsequent filling up, it is necessary to assume the existence

of an extent of land adequate to supply the streams and the material for the excavation and partial refilling of these valleys. There must have been therefore a large extent of land to the North of that now existing. That land is, as I have already indicated, now submerged beneath the waters of the Caribbean Sea. Here comes the value of careful and accurate observation. In his account of his voyage round Trinidad (part II, Pro. S. A. Trinidad 1869, p. 394), will be found a description of the northern end of the Carenage (Cuesa) valley. "The beach (of Makarip Bay) is short of soft sand and steep terminated at either end by perpendicular cliffs and backed abruptly by a precipitous face of semi-indurated yellowish argillaceous sand about 50 or 60 feet high. In going up the valley from Carenage Bay to its head one is scarcely aware of a rise so easy and gradual is the ascent, and without mounting over the slightest dyke that could claim pretence for the term watershed one finds oneself looking down from a small precipice into a cove of the Caribbean Sea. So far from there being a watershed even a foot back from the edge every drop of rain that falls upon the Plateau runs.....into the valley—in fact the only natural watershed here is the edge of the precipice." I am sorry Mr. Carr could be never induced to complete his account of his voyage—and here I may remark parenthetically, that it would indeed be a good thing for our colony it we had some more men like Mr. Carr, and if we appreciated them at their value and accorded to them the consideration we ought for our own sakes to give them. This little matter of the watershed of the Cuesa Valley, proves that the valley of the Gran Boca and all the other submerged valleys of the northwest of Trinidad, inclined from north to south, and not from south to north, being in this respect similar to all the other parallel valleys of the northern or Parian Range.

The central portion of the Island is filled with a very varied series of Rocks of different kinds mostly belonging to the third geological period of which I have spoken—the Neozoic. These rocks have an abundant invertebrate fauna which show that they represent the principal stages of the period named. I have already alluded to some of them when speaking of the occurrence of Coal. Besides the pliocene and miocene the eocene period is indicated and also the cretaceous, the latter being our only representative of the mesozoic period. These deposits indicate a sea varying in depth from merely litoral conditions to those of

say one hundred fathoms. And now succeed to the southward of these rocks the microzoic Rocks of Naparima to which I have already referred and upon which I shall say a word or two. These rocks are of three distinct kinds. The first of these is characterized by the presence of Gypsum—the second by a very large proportion of calcarous matter and the third by a large proportion of siliceous matter. These last are called "Infusorial Earths" and would be suitable for the manufacture of dynamite. The Naparima soils generally do not require any manure other than can be obtained from the owner's cattle pen—they are incapable of attaining that perfect mechanical condition of soil referred to by Mr. Lamont and which is alluded to so feelingly by John Burroughs in his account of his visit to England. The reason of this exceptional nature of the Naparima rocks and particularly of the foraminiferal beds is that the surface is continually being removed and renewed, the material itself being a deep sea deposit consisting mainly of organic matter or matter that has been organized and therefore of a high degree of fertility. A new and fresh surface of this matter is presented annually to the plant for its nutrition, and manure is therefore superfluous or nearly so. Similar rocks and soils to those of Naparima occur in Barbados where the planters have quite unnecessarily spent large sums of money on Guano with the result besides the waste of money that owing to the importation of fragments of volcanic rock with the Guano, Agassiz wrote a fairy tale about Barbados, describing it as a volcanic formation, whereas like Trinidad there is a complete absence of any volcanic material other than the volcanic dust found in the oceanic beds, and which indicates the occurrence during the deposition of these beds of volcanic eruptions similar to those of Martinique in the present year.

The soils of the northern and middle parts of the Island and of the southern parts will most of them take as much manure as can be given to them, though many of them are very sterile and will not yield a crop of any kind, and some are quite amenable to a treatment which will result in that "perfect mechanical condition" referred to.

I show a specimen of the foraminiferal rock of Naparima giving one of the most fertile soils and containing 80 to 90 per cent. of calcareous matter. This is suitable also for the manufacture of cement—an industry which if estab-

TRINIDAD COAL.

Results of Analyses made at the Government Laboratory.

Year.	Percentage Composition.				Bitumen Percentage.	Calorific Value. Thompson.	Sulphur Percentage.	Locality.	Remarks.
	Water.	Volatile Matter.	Coke.	Ash.					
1900	18·60	...	...	7·40	...	...	2·48	Cr. Survey	Lignitic. High percentage of water.
	10·45	43·90	38·45	7·20	2	11·47	4·57	Cunapo 1 ft.	Lignitic.
	12·30	41·45	43·50	2·75	...	7·16	1·86	Cunapo 2 ft.	Lignitic.
	11·80	42·30	40·50	5·40	...	10·40	3·80	Cunapo 3 ft-	Lignitic.
	25·75	30·75	36·20	7·30	...	8·80	6·14	Cameron (Pri. S)	Lignite. Water—high percentage.
	1·85	...	...	1·68	90	15·15	3·94	Vista Bella	Bitumen resembling manjac.
1901	33·72	33·48	30·60	2·20	1·6	...	...	...	Fairly good Lignitic. Water—high percentage.
	29·50	32·40	35·30	2·80	0·8	8·80	4·80	Tamana	Lignitic. Water—high percentage.
	2·25	48·05	48·70	1·00	24·80	16·38	3·01	Montserrat No. 1 ...	
	3·75	45·40	45·60	5·25	2·00	14·33	2·20	Montserrat No. 2 ...	Slightly Lignitic.
	14·28	31·72	30·64	23·36	...	7·58	...	Moruga	

Results of Analyses made at the Government Laboratory.—*Continued.*

Year.	Percentage Composition.				Bitumen Percentage.	Calorific Value. Thompson.	Sulphur Percentage.	Locality.	Remarks.
	Water.	Volatile Matter.	Coke.	Ash.					
	11·80	25·55	21·65	41·00	...	...	...	Black River, Oropuche ...	
	·24	...	...	7·80	92·80	...	...	Coolie Town	Surface resembles Vista Bella.
	3·48	57·67	29·93	8·92	...	...	...	Coolie Town	Glance Pitch.
	5·40	42·60	49·64	2·36	6·2	...	...	Piparo	
	3·96	45·74	45·98	4·32	...	...	...	Montserrat	
	3·55	58·45 58·00	31·95 32·40	*6·05*	...	...	...	Oropuche	
	20·08	39·92	36·80	3·20	...	...	...	Mamural River, Chaguanas ...	Lignitic. Water—high percentage.
	21·16	43·74	29·74	5·36	...	...	...	Mamural River, Chaguanas ...	Lignitic. Do.
	20·40	38·00	25·78	25·82	...	..	...	Mamural River, Chaguanas ...	Do.
	21·56	46·84	26·92	4·68	...	...	...	Chaguanas No. 1	Do.
	20·80	24·20	20·64	34·36	...	...	...	Chaguanas No. 2	Do.
	29·32	35·68	36·52	3·48	...	...	...	Chaguanas No. 3	Do.
	27·24	36·91	32·61	3·24	...	...	...	Chaguanas No. 4	Do.
	12·65	37·75	40·65	8·95	Trace	10·75	...	Sardoo River	Lignitic.
1902	25·20	37·65	32·35	4·80	...	...	·80	Brasso Caparo	Water—high percentage.
	17·65	39·35	35·80	7·20	...	5·53	3·69	Black River, Oropuche ...	
	3·70	61·25	31·70	3·35	58·00	14·34	3·96	Montserrat, La Mariquita Est.	
1903	20·00	29·20	42·52	8·28	...	...	...	Brasso Caparo	Lignitic. Water—high percentage.

lished here would save us the large sums annually spent on that article and provide employment for some of our people.

I show also a specimen from Mr. Rust's boring at Oropuche. The nature and composition of this material proves conclusively that the rock was deposited near the mouth of a large river. The Manzanilla series is rich in very interesting fossils. When I was at Manzanilla I collected fossils which were all new. I described them in a Paper read before the Geological Society in 1866. Since that time although I have begged of the people who go there to collect specimens for me none of them have been able to find a single thing. Before leaving this subject I want to point out that in one of my most recent Papers I mentioned the possibility of finding water in Naparima. About 1858 the Government offered £2,000 for the discovery of water but nobody seemed to care about the offer. I have in the Paper referred to given reasons why water may be found in certain places beneath the Naparima rocks.

(Other specimens exhibited besides that of Gold found in the island: of Lignite and Manjak; a specimen of gneissic or gneissoid rock found on digging the wells for the St. Joseph waterworks: a specimen of the Ditrupabed of Pointe-à-Pierre; and a series of specimens of Lignite Manjak, Asphalt and Glance Asphalt shown by Professor Carmody).

(NOTE.—Reference to some highly important Papers on the subject of Asphalt will be found in proceedings Scient. Assoc. Trinidad, 1866, p 59. *See* also Goding on Petroleum, etc., in the same proceedings page 37).

In recapitulation I may say that we have geological evidence of a time, a very ancient time, when no part of Trinidad existed as land; next of a time, long after that, when the Northern or Parian Range existed as part of a continent which occupied a portion of what is now the Caribbean Sea while all to the South of that Range was sea; and again of a time after innumerable changes had slowly taken place when the whole of the present land of Trinidad was elevated and entirely joined to South America; and finally of a time when by the sinking of the area now occupied by the Gulf of Paria and of the region to the North of the Parian Range the Island of Trinidad assumed generally its present form and altitude.

PETROLEUM.

Delivered at the Victoria Institute October 30th 1902.

MR. RUST said if they had come expecting to hear a learned or a scientific discourse they would go away most bitterly disappointed. He could only give them his experience as a prospector. It might prove interesting, or it might not; but every effort which could be made to put before the public of Trinidad either by himself or by others, the capabilities of the Colony should be made; and that he might assist in doing so was his only apology for being there. Petroleum, as probably they were aware, was derived from two Latin words, *Petra—Rock, Oleum—Oil,* "Rock Oil." He had found, though until recently he was not aware of the fact, that it was one of the most universally distributed of the natural products of the earth. It was also one of the oldest known. References to it were to be found very early in Holy Scripture. When he spoke of petroleum he meant to be understood as including also all the various products of it, pitch, asphalt, bitumen, &c. He regarded all these as the products of petroleum. They bore to petroleum the relation which cheese and butter did to milk. He had said petroleum was known in the earliest ages. It was mentioned by Herodotus as found and used on the shores of the Persian Gulf some 450 years before Christ, where it was baled out of wells as one of three substances always found together, asphalt, salt, and oil, and of which it was recorded that the latter floated on the surface, while the two former readily separated out. It was also referred to as used in the form of asphalt in the building of Babylon. Amongst scripture references we noted the following. In *Genesis* xiv. verse 10 it was spoken of as a "slime," that is soft bitumen, in *Genesis* ix. verse 3 we were told "they used slime for mortar," in another place we read of a rock which poured forth "rivers of oil," while in II Maccabees it was spoken of, or at least its product, natural gas, was as a fire which the priests of the sun worshipped in the East. And a writer thinks it to be referred to in the New Testament under the name of the salt which had

lost its savour, that is, asphalt from which the volatile oil had evaporated and which was only fit to be trodden under the foot of man,—"no doubt they had asphalt walks in those days." Pliny also referred to its use for embalming purposes, Noah owed his life to the pitch he made his Ark water tight with, (but for which pitch in all probability neither he (Mr. Rust) or his audience would be here to-night), and Moses also was saved from Egyptian wrath by a boat of bulrushes coated with asphalt, and thus also owed his life to petroleum. This should be enough to prove the antiquity of its discovery. With regard to its origin there were several theories, all of which could be classified as either the organic or the inorganic hypothesis. The first assumed it to be the product of animal and vegetable matter which had gone through a process of decomposition; and this was the more generally accepted theory. The other theory supposed it to be a natural product of the earth, but was considered inadmissible by the best authorities. Which was the real origin was more than he could say: perhaps both were. At any rate it was formed in the earth, and at sometimes great depths, even 3,000 ft. How did it get up from there? Partly by capillary attraction, partly by the carrying force of the natural gas always found in connection with it. If you more than half filled a bottle with petroleum and stoppered it up; after a few days you would find the liquid had crept up the sides of the bottle and forced its way out of the stopper, such was the upward force of the flow of petroleum. And this force aided by the upward rush of natural gas sufficed to drive the oil up from whatever depths it might be found at, sometimes into a column several hundred feet high when a powerful spouting well was tapped. Another remarkable thing about petroleum was the widespread belief in its medicinal uses. Years ago in America it was obtained from the brine pits, (for oil was always found in connection with deposits of salt, as was to be noticed at Guayaguayare wells which were a mile and a half inland from the sea, and at depths far below the level of the sea); and under the name of '*Senecca Oil*' used extensively for rheumatism. Coming nearer home we found the well known Barbados "*Green Tar*," which sold for 1/- or 1/6 per bottle, (he could supply it now at 2 cents a bottle!), and which was drunk by Barbadians, sitting in a state of nature in a bath of water, as a remedy for many ills. One use, however, Barbadians might be advised to put asphalt to at the present time, was to burn several tons of

it all over the Island to drive away the small-pox; for in 1871 when we had the epidemic here a most beneficial result followed Mr. Stollmeyer's burning of huge blocks at the street corners of Port-of-Spain. And the absence of all lung complaints amongst those who habitually worked in oil and asphalt work was again a proof of its medicinal efficacy. The lecturer then proceeded to sketch the history of the discovery of petroleum in various countries, its rise into an article of commercial value, and the effect it had on the increase of prosperity of the country. Prior to the great American discoveries in 1860 and onwards, it appeared that, under the name of "*Shale Oil*" a substance was distilled from lignite by a process discovered by Dr. Young; and a reference to the work on oil of Prof. Redwood, the greatest living authority on the subject, showed that in 1894 Scotland manufactured 1,986,000 tons of the oil But after the close of the Civil War of America, probably in consequence of the sudden cessation of the call upon their energies by the men who had been fighting on either side, oil was prospected for in good earnest in the States; and the growth in the industry since then could be gathered from the fact that in the year 1900, the last for which he had been able to get figures, the output was 59,500,000 barrels, valued at $1 per barrel; placing oil third or fourth on the list of America's products. One of the greatest of European supplies was that of Russia; and that supply was of great interest to us in Trinidad by reason of the many points of similarity between the Baku and the Guayaguayare Fields. This was pointed out three years ago by Professor Zuba, then on a visit to Venezuela when passing through Trinidad; who remarked he had never seen a field so closely resembling that of Baku? Now what was the history of Baku? In the 13th century it was recorded that a spring existed there yielding a kind of oil, (not good to drink said Marco Polo, its historian), but used for anointing mange in camels. Naptha gas was also found coming out of the East in abundance and a burning stick approached towards it, caused a blaze of flame; and this fire the priests of the sun worshipped. To-day the Baku wells provide cargoes for fleets of a hundred ships at a time. How similar was this to Guayaguayare. Here there also existed the gasholes, the whole territory was blowing naptha, showing the vast store of oil below. It was not worshipped it is true, but the hunters and labourers used it to cook their food by these

natural gas stoves. And in the opinion of his chief engineer fully 100,000 cubic feet of gas was blowing of the well daily. If that were the case in Canada or the States there would be roads and railways built, and pipes, and pumps and reservoirs built and the whole Island would be lit by natural gas and the Electric Company would have to shut down. But things were,—well, different in Trinidad It was on the 1st of September, 1883, that oil was struck in Baku, when a well came in and a column of oil expanding to about 18 inches in diameter when it left the pipes, shot up to a height of 210 feet into the air, and continued to gush at the rate of 1,600,000 gallons per day, until 220,000 tons had formed a lake all around. Since then the output had been maintained until in 1900 the world's production of Russian oil was 60,000,000 barrels of 42 gallons each, and for the 7 months of 1902 ended 31st of July last, it had reached 1,413,292,242 gallons. There was no need to fear for the Trinidad oil however, for as the value of Russian oil was about ¼d. per 3½ gallons, and the Government duty was ¾d. thereon, no one hoped for the discovery of spouting wells in the Baku district. Reference was also made to the oil fields of Borneo, where the Shell Company, (of which Sir Marcus Samuel, the newly elected Lord Mayor of London was president), were producing some one hundred thousand tons of oil per day; to the recently tapped fields of British Columbia in North-west Canada, which supply was considered by eminent experts to be the real source whence came the oil drawn in Texas, U.S.A.; and finally the lecture came to the Trinidad supply. The earliest reference he had been able to find of the use of Trinidad bitumen was that on the 23rd of March, 1595. Sir Walter Raleigh sailed into La Brea harbour saw the pitch lake and used some of the asphalt to make his ships once more water-tight, finding the stuff better, because less affected by the sun, than Norwegian pitch. Thomas' history of the Island, bearing date 1830 also described it; adding that from its edges to the sea there flowed numerous streams of petroleum oil,—now no longer to be found. By Thomas the lake was described as 80 acres in extent, with a liquid centre of 3½ acres. While on this he might mention a remarkable mistake made by Professor Redwood, the great authority as to the size of our lake; he described it as of 11,467 acres in extent, which was almost as curious an error as that of a Canadian journal which described the spot as a lake of

water which had an island of pitch floating on its surface. Two of the earliest attempts to make use of our asphalt were those of Sir Ralph Woodford. He laid down a series of asphalt paved walks in Brunswick Square to keep down the growth of grass; but the pitch mixing with the soil fertilized it and the grass grew quicker than ever. The second experiment was the use of the stuff as an illuminant. Sir Ralph tried to burn the crude hydro carbide gass as a beacon fire in the steeple of Trinity Cathedral; but the stench was so great—(almost as great as that of the distillation of Prof. Carmody had now in progress beside him!), that it was abandoned. For years it had been known that Trinidad asphalt yielded the best rock oil by distillation; and in 1856–1857 the Merrimac Company of which Mr. C. F. Stollmeyer was agent, made "Pitch Oil" by distillation from asphalt. In 1867 came the Walter Darwent syndicate, including in its membership the Hon. C. Leotaud, Leon Agostini, L. F. Ambard, Graham, Watts and others; which with a corkscrew plant sunk a well 150 feet deep near San Fernando, without success. They made the mistake however of having first imported in anticipation some 15,000 barrels to put their oil in; and there they lay in three huge pyramids when Mr. Agostini came out from Europe. Then came the diggings, also unsuccessful, though full of promise made on San Fernando hill by permission of the late Mr. Robt. Guppy; and finally those in *Aripero* estate, where oil was really found, but for some reason the works were abandoned on the death of Mr. Darwent. In the same year 1867 came the Petroleum Company of Trinidad with a capital of £150,000, a London firm which was the immediate predecessor of the present Trinidad Asphalt Company. This Company was more successful, for according to a copy of the *Port-of-Spain Gazette* of the 16th of May, 1867, oil was actually found, and rose 180 feet in the pipes put down. Still, however, it did not seem to have been worked much. Time passed on, and after having years before heard the legends told by his friend Mr. Fretney Pantin of the Crown Lands Office as to finds of oil made by hunters he had forgotten the circumstances until when he was agent of the Asphalt Company of New York, one day Mr. Kirton, the Manager of the Bank offered him the option of purchasing for his company the pitch bearing *Aripero* estate. Together they visited the spot, and there he found Darwent's old deserted machinery and well, still showing oil pulsating

LIQUID AND SEMILIQUID ASPHALTS.—TRINIDAD.

Results of Analyses made at the Government Laboratory.

Laboratory No.	Description.	Results of Fractional Distillation %.				Percentages of			Specific Gravity.	Flashing Point.	Remarks.
		Petroleum Spirit.	Illuminating oil.	Lubricating oil.	Residual Bitumen.	Water.	Ash.	Sulphur.			
1900.—32	Ariperio oil	1	43	38	18	...	0·4	...	935	77° F.	
72	Semisolid asphalt Lagoon Bœuff ...	10*	29	27	34	11·76	3·36				
73	Liquid „ „ „ ...	26*	53	3	18	29·57	0·72				
195	Semisolid „ „ „ ...	10*	29	27	34						
1901.—33	Liquid Asphalt	19	39	34	8	...	0·1	0·44	900		
61	„ „ I.	38	40	17	5	...	0·01	0·62	826		
62	„ „ II.	15	49	30	6	...	0·01	0·3	884		
1307	„ „ Piparo ...	23*	46	trace	6	36·73	4·94				
1399	„ „ Manzanilla ...	...	50	...	50	1·28	5·28				
1455	Semiliquid Asphalt Mayaro 'Ginipar'	27*	50	3	20	29·67	1·68				

* Including water.

Results of Analyses made at the Government Laboratory.—*Continued.*

Laboratory No.	Description.	Results of Fractional Distillation %.				Percentages of.			Specific Gravity.	Flashing Point.	Remarks.
		Petroleum Spirit.	Illuminating Oil.	Lubricating Oil.	Residual Bitumen.	Water.	Ash.	Sulphur.			
1456	Liquid Asphalt Mayaro 'Pilot' ...	12*	71	...	17	...	...	...	972		
1457	,, ,, ,, Petit Goudron	14*	73	...	13	...	...	...	972		
1458	,, ,, ,, Lizzard ...	53	45	...	2	...	...	...	941		
1459	Solid Asphalt, Mayaro ...	18*	46	...	36	19·61	1·56				
1902.—19	Liquid Asphalt	...	73	25	2	...	...	Very slight.	867	Above 154° F.	
25	,, ,, A.	15	44	36	5	...	...	0·41	896	Below 50° F.	
26	,, ,, B.	...	...	...	...	...	...	...	926	143° F.	Calorific value=18·2.
56	,, ,, ...	...	...	...	...	...	...	...	...	Below 45° F.	
109	,, ,, ...	6	30	55	7	..	0·26	0·39	977		
507	For Victoria Institute Lecture 'P.I.'	19·5	38	36·5	6	...	...	...	893		

* Including water.

upwards. He was favourably impressed, and urged on his company the desirability of purchasing, but again and again they declined, eventually taunting him that if he deemed it so good they guessed he had better buy it himself. This roused his spirit and he resolved to do so if ever he could. And a couple of years later he did so. That was the beginning of his interest in oil. Then he met Mr. Lee Lum, who had interested himself in oil found at Guaya-guayare, an analysis of which was found to contain 15 per cent. of naptha, 46 per cent. of illuminating oil, 36 per cent. of lubricant, and only 5 per cent. of residual bitumen. Since then exploiting had been done by both of them together, with the assistance of his Canadian associates; and he might say that they had been rewarded by the discovery of an oil producing 73 per cent. of illuminating oil, which was so pure in its crude state as to have been denounced as an artificially distilled product by expert analysts to whom it had been submitted for report as well as by a gentleman in this room, —he might give his name, it was Mr. N. F. Graham,—who on having distilled it for him, had said he did not wish to be humbugged by being asked to distil oil which had been already been distilled. Mr. Rust then gave a very clear and interesting discription of the exploiting methods in the virgin forests of Mayaro, and of the machinery used, and the difficulties of transport: and after a tribute and an acknowledgment of the great assistance received from both Prof. Carmody and Mr. N. F. Graham in the work, he closed an address of over 2½ hours duration by urging the need for concessions and Government assistance in the development of an industry which would in the future make the Colony as well known for its petroleum as for its sugar and cocoa.

The Forest Resources of the Colony.

AT the Victoria Institute on Saturday 7th March, 1903, Mr. C. S. Rogers, Forestry Officer, read the following paper on "The Forest Resources of the Colony":—

Trinidad is the only British West Indian Island which still has a fair proportion of land under primæval forest, and in which the Government has realized the necessity of having a Forest Policy. The question of adopting a forest policy has been brought to notice at various times by different persons, and especially by Mr. Hart, the Superintendent of the Royal Botanical Gardens and the St. Clair Experiment Station, who reported on the subject of forest conservancy in 1891, and was largely instrumental in the appointment of a committee to report on the subject in 1898, of which he was a member. The report of that committee led to the visit of Mr. Lodge, Deputy Conservator of Forests of the Indian Forest service, in 1900, whose excellent report was the cause of my own appointment as Forest Officer and the adoption of a forest policy by the Government of this colony. The policy includes the reservation of certain areas of land from sale and their management as forests for the protection of the climate, the regulation of the water supply in the rivers, the prevention of landslips and floods, and the production of timber and other forest produce. Now, let us consider the part which forests play in the economy of nature, and the reasons for their preservation. First, as regards their utility. The utility of forests may be divided into direct and indirect utility. The most important direct effects of forests are (1) The produce they supply; (2) The capital they represent; (3) The work they provide. The principal produce of forests is timber, which in its various forms is so largely used in building construction, bridges, ship and boat building, paper manufacture, furniture and fuel. Though of late years iron has, for many purposes, taken the place of wood, and coal of wood fuel, we shall never be able to do without timber. Besides timber, forests yield many other useful materials, such as bark for tanning, rubber, gum, dyes, turpentine, resin, fibre, leaves for thatching, medicines, fruit, and seeds which produce oil. In

Trinidad, where so much timber is used in house-building, over £40,000 worth is annually imported. Although it is true that much of this is the produce of coniferous trees, there is still room for a much larger use of our valuable hardwoods and our most durable cedar. The capital of forestry consists of the soil, *i.e.*, the land, and the trees growing on it, which are termed the growing stock. The soil is called the fixed, and the growing stock the movable capital, and the two together represent a considerable money value. Forests provide work for the woodmen actually engaging in felling the trees, in squaring and sawing the timber, in collecting other produce and in replanting, besides the work provided by the industries dependent on the forests for their supply of raw material. Now let us consider the indirect utility of forests, with which we are largely concerned in Trinidad. These are their action on the climate, their power of preserving the water supply of rivers, and their actual effect on the rainfall. Forests reduce the temperature of the air and soil during the daytime by their shade and keep them a little warmer at night by reducing radiation, so rendering the climate more equable, and preventing great daily changes of temperature. Of course, the effect is most noticeable inside the forests, but as there is a constant motion in the air, hot air arising and cold taking its place, from cooler adjoining areas, their effect is felt by the surrounding country. Forests reduce evaporation, prevent erosion and landslips, and increase the relative humidity of the atmosphere. In forests, especially evergreen ones, such as those of Trinidad, the soil is always moist, even in the dry season, when grass lands or those cultivated in annual crops are quite dry; consequently their moisture is then available for evaporation and keeps the air moister than it would be were the forests non-existent. This is a matter of great importance to the cacao grower, as this crop requires a hot, damp atmosphere. We may therefore say that for cacao to be grown successfully, a considerable area of the island must be kept permanently under forest. Now, cacao plantations cannot take the place of forests for supplying the necessary moisture during the dry season, or for keeping up the permanency of our springs and rivers. It is true that they provide a good deal of shade, but being kept clear of undergrowth wind easily passes through them, and a dry wind, or even merely a circulation of dry air at such a slow rate as to be scarcely perceptible as wind, takes

up a great deal of moisture. Anyone who dries clothes knows that a good breeze is as effective as a strong sun. Then during a good part of the dry season the *bois immortelle*, almost invariably used as a shade tree, is out of leaf and lets in the sun. And what is of still greater importance in the matter of preserving moisture, I mean the power of the soil to retain it, is in most cases lost in cacao plantations which, as you all know, are usually extensively drained by open channels; whereas in our forests the roots of trees and accumulations of decaying leaves do prevent rain water that falls from immediately running off into the streams, and retain much of it till it soaks into the ground and feeds the springs; and for this reason forests regulate the flow of water in springs and rivers, making them more permanent. Where, in a treeless country, the water in streams and rivers becomes much less and even may cease to flow in a dry season, in a forest-clad country the flow is nearly even all the year round, especially if the forests are not subject to fires. The question of the effect of forests on the actual rainfall has been much discussed and varying opinions formed. I will, however, give you one or two instances of their effect when actually registered, which I take from Dr. Schlich's Manual of Forestry. In one place in the South of France, during a period of seven years, it was found that sixteen per cent. more rain fell in a well-wooded area at an elevation of 1,247 feet, than in a comparatively treeless area only some ten miles distant from it. In Prussia also an average increase of fourteen per cent. at an elevation between 328 and 526 feet, nineteen per cent. between 1,969 and 2,279, and forty-three per cent. between 2,297 and 2,625 feet was recorded in favour of a forest-clad area over open country. These figures show that the value of forests as rain producers increase with the elevation at which they are situated, but even at an elevation of only 300 to 400 feet they are of considerable value. To sum up, the importance of forests in Trinidad is great, for the following reasons of indirect utility, and they may even be considered necessary to the welfare of the colony:—

1. They reduce the variations of the temperature and render the climate more equable.
2. They preserve and regulate the water supply in the streams and rivers.
3. They reduce the rapidity of evaporation and increase the relative humidity.

4. They increase, or at any rate tend to increase, the actual rainfall.

Let us now see what other countries do in the matter of the preservation of forests. According to Dr. Schlich the proportion of forests to total area in the following countries is as follows:—France, 16 per cent.; Germany, 26 per cent.; Russia, 42 per cent.; while Great Britain has only 4 per cent. I believe that in Trinidad we require not less than 16 per cent. permanently reserved as forest. Taking the area of Trinidad as 1,750 square miles we should have 280 square miles under forests. At present there appears to be 851 square miles still covered by forests, these, of course, being Crown land. We may safely conclude that private owners will not maintain any appreciable quantity of land under forest, for the simple reason that it will not pay them as well as under cacao or other crops. Besides, forests require skilled management of a highly technical character to yield satisfactory returns and this is not generally available in Trinidad. Consequently, it is to the Government that we must look for the preservation of the necessary forests. These protection forests which I have already shown to be necessary must be made to produce our supply of timber and other forest produce. It is impossible, in our present state of knowledge in detail of the forests of the island, to estimate the amount of the various kinds of timber available with any degree of accuracy. With one exception, our best timber trees forms such a small proportion of the growing stock in our forests, that they are of small commercial importance outside the island. There is, howevre, enough for local use, could it only be brought to market at reasonable cost. I will mention some of our more important timber trees, but for anything like a complete list I must refer you to a paper contributed to the Imperial Institute Journal by Mr. John T. Rea, F.S.I., Surveyor, War Department, Mr. Hart's report on Forest Conservation in Trinidad, and including lists of Trinidad woods embodied in it, by Messrs. Bourne and Prestoe; in the latter the specific gravities are by Dr. Crueger, from which I have drawn most of my information. Cedar—*Cedrela odorata*, L., known in Europe as West Indian cedar, a large tree 60 to 80 feet high, 4 to 6 feet diameter, wood a red or brown colour, splits easily, soft and porous, has a strong scent, and for this reason it is much used for wardrobes and such like articles of furniture, weighs about 36 lbs. per cubic foot,

crushing strength 2·94 tons per square inch. It is much used for boards, shingles, furniture and framing, and is exported to Europe for cigar boxes. It grows singly or in small groups, preferring sloping ground. The accessible forests which contain it in Trinidad are nearly worked out. Balata or Bullet wood—*Minusopia globosa*, Gærtn, a large tree 80 to 100 feet high, 4 to 6 feet diameter, wood dark-red, dense, heavy, hard, very durable, weighs 70 lbs. per cubic foot, crushing strength 4·77 tons per square inch. It is eminently suitable for posts, bridges and all kinds of outdoor work, and is much used by wheelwright, it requires to be seasoned in the shade and is not attacked by wood ants. Value £10 per ton. Grows singly or in small groups, preferring ridges or sloping ground, not particular as to soil. The supply of this tree has been much reduced by tapping or bleeding for its gum, which is intermediate in character between rubber and guttapercha. Poui—*Tecoma serratifolia*, Don. A tree 30 to 50 feet high, 1½ to 2½ feet in diameter, wood grey or green, hard, heavy, very durable, weighs about 70 lbs. per cubic feet. It is the best wood in the colony for posts and all kinds of out-door work, and grows in a mixed forest, forming only a small proportion of the growing stock. Value £10 a ton. Locust—*Hymenæa courbaril*, L. A large tree 60 to 80 feet high, 2 to 4 feet diameter, wood of a reddish brown colour, streaked, close-grained, hard and tough, weighs 69 lbs. per cubic foot, crushing strength 5·17 tons per square inch, it will not last in the ground, but is suitable for cabinet work and furniture. Value £10 a ton. Purpleheart—*Peltogoyne porphyrocardia*, Gr. A large tree 50 to 80 feet high, 1½ to 3 feet diameter, wood of a dark purple colour, hard, heavy, close-grained, tough and durable, suitable for furniture, cabinet work and buildings. Crappo or Carapa, *Carapa Guianensis*, Aubl. A tree 40 to 60 feet high, 1½ to 3 feet diameter, wood reddish in colour, liable to warp if used unseasoned, weight 42 lbs. per cubic foot, durable, easily worked, and suitable for building, is plentiful in mixed forests. Value £8 per ton. Oliver– *Terminilia buceras*, L. A tree 40 to 60 feet high, 2 to 4 feet diameter, durable especially in water or damp situations, used for boards, planks, posts and shingles, etc., suitable for all out-door work, grows quickly and is fairly common. Mora—*Mora excelsa*, Benth. A large tree 80 to 120 feet high, 2 to 4 feet diameter, wood a chestnut brown colour, hard, heavy, tough, strong, close-grained, very durable in water or damp

situations, weight about 65 lbs. per cubic foot, suitable for boards, scantlings and especially for large beams, is one of the first-class woods at Lloyds, grows gregariously on low-lying land, subject to inundations and does well on poor soil, especially when sandy. Acoma—*Siderox glon masticho-dendron*, Jacq. A large tree 50 to 80 feet high, 2 to 3 feet diameter, wood chestnut or brown colour, dense, hard, heavy, durable, weighs 66 lbs. per cubic foot. used for posts and frames of buildings, and out-door work. Watercaire or Aquatapana—*Lecythis lævifolia*, Gr. A large tree 60 to 80 feet high, 2 to 3 feet diameter, wood very durable, used for posts and out-door work, lasts well underground, value, £8 per ton. Cyp—*Cordia gerascan-thus*, Jacq A tree 40 to 50 feet high, 2 to 3 feet diameter, wood light brown, of medium hardness, tough, easily worked, weight, 38 lbs. per cubic foot, used for joinery furniture and cabinet work. Balsam—*Copaifera officinalis*, Jacq. A large tree 40 to 60 feet high, 2 to 3 feet diameter, wood dark brown, finely marked, used for shingles, staves and repairs to railway carriages, suitable for furniture and cabinet work. Roble—*Platymiscium platystachium*, Benth. A tree 30 to 40 feet high, 1½ to 2 feet diameter, wood reddish brown, hard and durable, suitable for outdoor work, cabinet work and furniture. Fustic—*Maclura tinctoria*, L. A small tree 20 to 40 feet high, 1 to 2 feet diameter, weight about 44 lbs. per square foot, is used by wheelwrights, and yields a yellow dye for which it is exported occasionally, value, £3 to £5 a ton. At present, of our timber, only cedar and mora are at all well known in Europe, and the latter is not now exported from Trinidad. Cedar is chiefly sent to Germany where it is used for cigar boxes. It is not probable that our other timbers are likely to be exported in any quantity in the near future. The chief reason for this is the great difficulty in transporting the timber in logs or squares to our ports. Also, most of our forests are very unhealthy, both for man and beast, and in this damp climate where natural soil roads are unfit for wheel traffic, it does not pay to haul timber from many of our forests. We cannot make use of water transport because most of our timbers will not float, and streams suitable for floating are very scarce. These reasons prevent the extraction of timber, both from lands being cleared for cultivation and from Crown land, except for local use. It is only where a metalled cart road exists close to the forests that timber can

be profitably extracted for export. The export of cedar reached its highest point in 1900 and has already fallen off considerably, last year being less than 4,000 logs, and is still steadily decreasing. This decrease is principally due to the easily accessible forests being worked out. Now, as to mora, although this wood is known as a first class timber in Europe, the demand for it is limited. It has been exported to some extent from British Guiana but not I believe from Trinidad. As far as I have been able to ascertain about 1,000,000 could with safety be cut every year in Trinidad, but before cutting on a large scale is commenced it would be necessary to systematically examine our forests and make as careful an estimate of the available supply as can be done at reasonable cost. In 1855-56 some 20 to 25 thousand cubic feet of hard wood, principally mora was cut by the Government and used in public buildings. In past years samples of local wood have been sent to exhibitions in various places, but so far no trade in them has resulted, with the exception of that in cedar. The total exports of timber from Trinidad for the past years have been valued at 1897, £4,479; 1898, £1,610; 1899, £8,190; 1900, £12,802; 1901, £8,779. Now, I want to say something about the development of a trade in timber. When sending samples to an exhibition we should state the amount that could be annually supplied and be able to answer questions as to the rate per ton at which we could supply it. Trade in timber is like trade in other commodities; either you must have a demand already in existence, which you propose to supply, or you must enter into competition with goods already in the market, and to do this successfully in timber you must submit with your samples, proof of the technical qualities of your timber, and be able to guarantee a regular supply of the same quality. This is necessary in order to induce consumers to substitute the timber you want to sell for that which they have been in the habit of using, and of which they know the technical qualities, and that they can always get when they want. Before we can put our native timber on the market, we must, besides collecting proof of their qualities, make an estimate of the quantity of marketable timber in our forests, and of the annual increment of this timber. It is this annual increment which will consitute our available supply. To obtain this estimate we must ascertain the extent of our accessible forests and the amount of marketable

timber that annually can be extracted, having due regard to the preservation and improvement of our forests. This is a work which will take a considerable time and cost a good deal of money. The only forests that can be included in this estimate are those which are to be permanently reserved and systematically worked. Now suppose we had decided that we could cut 10,000 tons a year, it would not pay to cut only those trees that were over matured, scattered as they would be over the whole area of our forests, but we should have to cut the required number on as small an area as possible in order to keep the cost of extraction as low as possible. This would be easy enough if our forests had been created by planting, when on each of a number of equal areas we had all the trees of the same age, and each area contained trees one year younger than its neighbour. We could then replant each area after it was felled over and so go on cutting the same quantity year after year indefinitely. Of course our forests are not at all of this character, and we only have one tree which grows gregariously or socially, *i.e.*, which quite occupies the ground on which it grows to the exclusion of other kinds, and that tree is mora. In our mora forests trees of all ages are irregularly mixed together, which of course makes systematic working of the forest more complicated than it would be if the age classes were regular. Consequently we cannot expect any considerable increase in our timber exports till we have laid out our reserves and collected the necessary data to make what is termed in forestry "Working Plans" for them, by which the areas to be felled over are prescribed and the annual out-turn approximately known. It may be asked why we do not make use of the timber annually felled in clearing land for cultivation? The reason for this is simply want of facilities for getting the timber to the market. Where land is cleared near a metalled cart road some timber is extracted, but far from a road it cannot be done profitably.

Now as to planting and the improvement of our forests—up to the present no systematic attempt has been made to replace the timber removed by planting. To effect this object the planting of a few trees here and there is useless. Plantations to be of any value must be systematically made over considerable areas, each plantation being considered in relation to the others. And besides the actual creation of forests by planting, much can be done in improving our

natural forests by increasing the stock of our valuable timber trees in them by planting. This method is eminently suitable to our Trinidad forests, where many of our best timber trees form such a small proportion of the growing stock that it will hardly pay to work them on a large scale unless we can considerably increase the proportion of valuable timber trees in them. This is also in accordance with nature as is shown in the process of the natural formation of a forest which can be observed in India. This process is roughly as follows: a tract of waste land is taken in hand by the Forest Department and the first thing that is done is to protect it from fire. I am considering a case of a forest which is not burdened with rights of user to take timber, &c. from it. Such an area might perhaps be for the most part covered with coarse grass, the flowering stalks, which would be fifteen feet high, and trees scattered about in groups and clumps of greater or less extent. The area would be demarcated and brought under the forest law, and eventually planted up and systematically worked, but if left to nature and fires prevented, the trees already existing on it owing to their power of being able to withstand the annual fires that formerly swept over it, would gradually increase in number and spread out until the area was covered with trees, and then shade would reduce and eventually kill out the coarse grass. These trees would be for the most part deciduous, quick growing, soft wood trees, then, under their shade harder wooded trees, some of them perhaps evergreen, would come up, and these harder wooded trees, capable of enduring shade, especially during their youth, would be much longer lived than the original soft wood tree. As the old soft wood trees died out, their places would be taken by these harder wooded trees, and the soft wood would not be able to regain a footing owing to their not being able to compete with seedlings of the hard woods, due to the fact that they are unable to bear shade to any extent. Thus the forest would by gradual stages become a hard wood forest, or at any rate, one containing a fair proportion of hard woods. I use the term hard wood in its Trinidad sense, meaning a durable timber as a rule. This process in nature takes centuries to accomplish, but could of course be done much quicker by artificial means.

Now, to apply it to Trinidad, we begin with forests containing a proportion of hard woods, and cut out the worthless trees and replace them by planting hard woods.

In some cases in India in such a forest it has been found sufficient to only cut out and remove the poorer kinds of wood, and the better sorts come up from seed in their places. This could, I believe, be applied to our Cedar forests, for I have observed a fine crop of Cedar that has come up in a clearing with a few Cedar trees left standing either on it or in the adjoining high woods. It might also be possible to increase, the stock of our other hard woods in the same manner, but from observations I have made I believe we should have to plant Poui and Balata, as I have found very few natural seedlings of these trees in our forests.

As I have already said we require to increase the proportion of valuable timber trees in our forests in order to render them commercially valuable. We shall then be able to work them at a profit and such timber as is in excess of Local requirements will be available for export. Besides, if sufficient timber of the right kind is available new industries may spring up which will increase the wealth of the Colony. If we can increase the supply of our valuable timber trees from say five or ten per acre to forty or fifty, our forests would pay to work and yield a satisfactory profit to all concerned. This much refers to our protection reserves. In some cases, however, there are too far away from some centres of industry to supply local needs, and in these cases we require reserves of one hundred to six hundred acres. which should be improved by planting in the same way, These smaller reserves should be in accessible places and treated to supply local requirements. For the firewood supply of a village perhaps one hundred acres would be sufficient, but for timber we should require at least five or six hundred acres.

Now, in selecting trees to plant, we must of course consider their suitability to the soil, and this must be done for each area separately; for instance, it would be useles to plant Cedar on flat land subject to inundation, a place where we never find it growing naturally.

For a Cedar plantation both for local requirements and for export, Quinam, which is a tract of land on the South Coast between Erin and Moruga, where the Cedar forests have been almost worked out, would be a suitable place and a reserve of fifty or a hundred square miles would be a very valuable asset to the Colony. For by planting we could get an annual supply of fifty to sixty trees per acre, from two

to three feet in diameter, in fifty years. I say fifty years, for I am informed that a Cedar tree in the open grows to two feet in diameter in twenty-five years, though of course, if they were grown close together they would not grow so fast, but their timber would be of a much higher technical quality. Now, if one hundred square miles was reserved we could plant up two square miles a year, and at the end of fifty years have an assured annual supply of say six hundred trees concentrated on two square miles, taking only fifty trees per acre and allowing the odd ten acres for river beds, &c. Trees grown in such a plantation would yield two or three fine logs of twenty feet in length and of very fine quality, and as the quality became known in Europe, Trinidad Cedar would gain a name and the demand for it soon quite equal if not exceed the supply, and then perhaps the price might rise to the benefit of all concerned.

Now as to the exploitable age, that is the age at which it is most profitable to fell a given tree, we have not yet sufficient data from other trees, but it would probably be safe in this forcing climate to fix it provisionally at 100 years for them.

I have gone into the question of cedar more fully than of other trees because we already have a demand for it.

It may be said that 50 years is rather a long time to look ahead, but the available supply of timber is being reduced year by year, and it is generally considered probable that the price of timber is likely to rise in the future. This of course applies still more to our other hard woods, for which I have allowed 100 years as the time which they take to mature. At present it does not seem likely that the price of iron can be reduced to such an extent as to compete further with timber than it does at present.

Now it may be said that these plantations will not be of much use without roads, but if we can cut 50 trees per acre over two square miles each year, we can afford to make roads to get the timber out to the sea coast or to the present market, and the roads of the colony are rapidly improving and extending as it is.

At present we are engaged in marking out our protection reserves on the ground, and this work will take some time to complete, for owing to the density of the forest and the distance of the boundary from the sources of food supply, I

find that one gang of men can only do 6 to 10 miles a month.

By taking this elevation line as a boundary the reserve on the northern range is considerably reduced from Mr. Lodge's original proposals, but there are tracts of land in the colony unsuitable for cultivation, such as that in Mayaro between the Ortoire and South Coast, which I am informed is as a rule very poor, from which the necessary area of reserves can be made up.

Of course in considering these questions a Government has to take into account the question of general policy of the colony, and it must be left to them to decide what should be done in the best interest of the colony. What I have said in this paper must be taken as my views on the matter, remembering that I am not in possession of all the other facts bearing on general policy which have to be considered by the Government.

At the close the Chairman said that he had a letter from the Governor. His Excellency, as they were all aware, was very much interested in everything concerning the Institute, and had considerable knowledge of forestry, he having written a book on that subject. The letter was addressed to Professor Carmody, but it was inconvenient for that gentleman to be present.

The letter read as follows :—

GOVERNMENT HOUSE, TRINIDAD,
7th March, 1903.

MY DEAR PROFESSOR CARMODY.

Although I have had the advantage of perusing (which I did with interest and advantage), Mr. Rogers's paper on Forestry, it is with regret I find myself unable, through a previous engagement, to be present at its delivery this evening.

The importance of this subject cannot be over-estimated, and I heartily congratulate the Committee of Management on their securing a paper on it, especially from one of the writer's training and experience.

It should be evident to most people, at least to those observant, that as natural condensing apparatus, forests exert a considerable influence on the climate and upon the condition of the water supply. Shade is sought for and appreciated even by the brute creation. Such growths are Nature's guards against droughts which have been and still are so disastrous to countries denuded of their natural clothing. How true it is that forests precede a population and deserts follow it.

The tendency in not only newly established, but also in long settled countries, to regard the timber as a mere encumbrance to the land, has been short-sighted, unfortunate, and disastrous in many directions. The harm done would not have proved or prove so great were there some system of reservation, conservancy, control and management. With such objects amongst others, a Forestry branch has been added to the Crown Lands Department.

Humboldt truly said that by felling trees which are adapted to the soil, sides and summits of mountains, men in every climate prepare for future generations two calamities at once,—want of firewood and scarcity of water.

According to the view of my old friend, that distinguished botanist and authority, Sir Joseph Hooker, forests in the estimation of the average Briton are of infinitely less importance than the game they shelter. He also has said that wherever the English rule extends, with the single exception of India, the same apathy or at least inaction prevails; that in South Africa, according to Colonial Botanists reports, millions of acres have been made deserts, and more are being made deserts annually through the destruction of indigenous forests; that in Demerara, the useful timber trees have all been removed from accessible regions, and no care or thought given to planting others, that from Trinidad we have the same story.

It is impossible with our eyes open to minimise or ignore the effect on our colony of deforestation on water supply. The deficiency of the supply from Maraval valley, as one instance, has been largely due to denudation which has at certain seasons of the year turned the supply water feeders into dry streams which they will permanently become if such denudation be not arrested. The necessary reservations should have been generally made in the colony before there was any alienation of Crown land, such not having been done the remedy lies in the direction of re-aforestation and expropriation, where such a course in the public interests becomes necessary.

Large areas along our highlands in various direction up to their very summits have been and are being laid bare. Blind ignorance and selfish disregard of consequences, in removing or modifying which should Mr. Rogers's paper effect it will have been fruitful of good work.

"Trees and forests contribute to the formation of springs and water courses, not only by means of the humidity which they produce and the condensation of vapours by refrigeration, but also by reason of the obstacles which they present to the evaporation of the water in the soil itself, and by means of the roots which, by dividing the soil like so many perforations, render it more permeable and facilitate filtration."

Allow me to convey my appreciation of Mr. Rogers's paper and to thank the Governing Body for receiving thus briefly the expression of my experience and views.

Allow me to remain,

Very sincerely yours,

ALFRED MOLONEY,

Governor.

THE ORANGE.

By H. CARACCIOLO, F.E.S.

THE ORANGE, "Citrus aurantium," which is a native of Southern Asia, is a long-lived plant, and bears a fruit, the commercial value of which is well established; growing readily here it bids fair to become an important industry of the island.

We possess several varieties of it, all of which are highly appreciated in the English and American markets. This, however, does not remove the fact that there is room for improvement which can be attained by grafting.

In all cases it is advisable to graft good species on the sour orange as recommended by Professor McOwen who has experimented on that form of cultivation, this process preserving the tree against the well known attack of gum disease "*mal-di-goma*" or stem rot, and he recommends the Washington navel as the best kind to use as a graft. In the Cape Agricultural Journal, Mr. Van Deman writes: "Referring to cause of fungus disease in orange plants: one grove on heavy hummock land is about gone with gum disease *mal-di-goma*," out of 1,500 trees we have lost at least half, but have replanted all with others on the sour roots, many of which are five years old and in bearing, showing no signs of foot-rot.

Mr. Hart, Superintendent of our Royal Botanic Gardens in his Bulletin for July, 1901, informs us that Jamaica has adopted that system, and that as a further proof his Department received a number of healthy and vigorous plants worked on this method, however our oranges generally speaking, being sweet and of good flavour, given the proper facilities and advantages of shipping accommodation, there is no reason why we should not be able to develop a fair business.

The same can be said of our limes "Citrus medica, var. acida." Of the Citrus medica the Cedrat or Citron grows very easily and bears profusely. There is a large export trade in this fruit from Corsica, a very large portion of which goes to England, but the larger share is

taken by France. It is exported in pickle and largely used in confectionery.

Mandarin and Tangerine oranges, varieties of "Citrus nobilis," and the forbidden fruit "Citrus decumana" are also in good demand. The lime and forbidden fruit, however, find a better market in the States. We make very little use here of the latter (and I believe that I have been the only one to ship that fruit) but it is nevertheless the fact that they fetched a fair price if $4 a barrel can be so considered.

In fact, though I have had many failures in that line, I consider that a great deal was due to want of knowledge of the subject, but have not the slightest doubt that properly carried out, it is sure to meet with success.

The Orange is a surface feeding plant, and where old trees are growing the surface of the soil presents a net-work of rootlets; care should therefore be taken in weeding not to injure them, and when trees begin to show signs of decay immediately to apply pen manure, in default of which 2 lbs. of guano to each root will do.

A field of oranges should be planted at 15 feet, provided with the same shade as cocoa.

The tree will begin to bear in 5 years, but will not bear its full before the second or third crop.

CULTIVATION.

If the orange grows easily here it is because the soil is suitable, but it will not last if abandoned to itself, for it must be cultivated.

It often occurs that a large number of trees in orange fields are seen at times to pine away, wither, assume a yellowish colour and eventually die; in some cases it is due to neglect, in others to the nature of the soil, and attack of insects, principally scale insects, one of the most injurious being the "Chionaspis citri." These appear like white spots all over the bark of the trunk. Its natural enemy is a parasitic insect called "Ophionectria Coccicola." These help to a certain extent to minimize the damage done by the injurious insects, but as a rule are not able to do so completely.

The "Mytilaspis citricola" is also a paarsitic form inflicting injury on the plant, but is kept in check by its

natural enemy "Sphaeroslilbe cocophila," which is recognized by a black dust on the leaves, this apparent black dust being in reality the young insect which becomes red when mature.

In such cases spraying should be resorted to, and in a very short time the enemy will be conquered.

One of the washes from which good results has been obtained in California being the lime, sulphur, and salt wash.

Lime	...	30 pounds.
Sulphur	...	20 ,,
Salt	...	15 ,,
Water	...	60 gallons.

The solution is steam boiled together in casks for about 4 hours, and the liquid sprayed at almost boiling temperature.

When this liquid was tried in California the question naturally arose in view of the extreme heat at which it was applied, whether any results gained might not be due to the high temperature of the liquid rather than from any insecticidal action.

To test this some plums and peach trees were tried with the wash at boiling temperature, the nozzle held within 3 or 4 inches of the bark and the spraying being very thoroughly done.

At a distance of 18 inches spray was barely warm, at a distance of 12 inches fairly hot and very hot at 4 to 6 inches. The bark of the trees sprayed was cold to the hand as soon as spraying stopped and the effect was very gratifying.

Two other mixtures have proved very effective, viz.:—

The Bordeaux kerosine emulsion.

Bordeaux Mixture	...	5 gallons.
Kerosine	...	1 gallon.

The kerosine and lime emulsion.

Fresh Lime	...	4 pounds.
Water	...	5 gallons.
Kerosine	...	1 ,,

The situation of the land is also of some account, a cold and damp soil being apt to bring on disease.

The orange thrives best in warm deep fertile and well-drained soil; the soil near rivers being as a rule sandy on top and adobe below will tend to produce a coarse and thick skinned fruit; in rich deep and porous land the trees will grow healthy and vigorous.

The land of course must be properly drained, as the tree will otherwise be exposed to get root disease, due to undue accumulation of water at the roots, drainage therefore is not only a preventative measure, but in every case increases the fertility of the soil promoting the health and vitality of the tree.

An acre of land planted at 15 feet apart will take 193 trees. Each tree should bear between 500 and 2,000 oranges. Taking half of this as an average, a tree will produce 1,250 oranges; at these figures and shipping in crates of 150 oranges, a tree will supply 8 crates.

Therefore, 193 trees at 8 crates = 1,544 crates. Sound fruit fetch between $2 00 and $3 00 per crate. Let us say we get $2 40. Then—

1,544 crates at $2 40		$3,705 60
EXPENSES—		
1,544 crates at 15c. each ...	$231 60	
2 men at 50c. a day for one year ...	360 00	
Extra labour and incidental expenses, say	240 00	
Expenses to Port—1,544 crates at 20c.	308 80	
Freight to Southampton—1,544 boxes at 2/-	741 12	
		1,881 52
		$1,824 08
If fruits are shipped to London —1/- per crate more ...		370 56
		$1,453 52

I did not think it necessary to go into the question of the first cost, but roughly speaking—

1 acre of land is worth ...	$ 7 20	
Supplying 193 trees—say, £10 —with shade, &c. ...	48 00	
Weeding, supplying, pruning, draining ($500) — which is plenty	500 00	
	$555 20	
Deducting again interest on capital of $555 20 at 8 per cent.		44 51
Balance		$1,409 01

At these figures we find that in a period of five years the land will yield a handsome profit, but admitting that under unexpected circumstances the field may not come up to expectation, there is, I believe, a wide berth for eventualities.

Whilst on the subject, it may be interesting to note that according to P. L Simmonds, one of the greatest authorities on tropical agriculture, the St. Michael oranges have been known to bear in the Azores as many as 20,000 oranges a tree per year, but these are planted at 25 to 30 feet apart.

In Florida where labour is worth $1 a day, oranges are grown plentifully, and a great deal of attention is paid to them, a tree being valued at £20.

In Los Angeles the trees bear from 1,000 to 3,000, and it is calculated that many of these yield a profit of £20 yearly to their owners.

Success however mainly depends on the time, the way of picking and packing.

Oranges should be picked with a fruit picker, which consists of a pole to which is attached a shear, under which is hung a net-work bag to receive the fruit.

They should be collected when full and before getting yellow, care being taken in clipping the stems to leave a small portion in the orange.

They must then be spread in an open and airy shed and left there for two or three days (depending on the weather) to dry, but they must not be sun-dried.

This process is adopted to drive away any extra moisture from the rind.

They will be then wrapped in tissue paper, packed tightly but not squeezed, as one orange that may get damaged will very soon rot and spoil the whole box, the last operation being to cart to Port. This should be done on springs as the jerking experienced by our system of carts will knock them about too much and cause much damage. It is also advisable to let fruits arrive to Port on the day of shipment to avoid unnecessary handling. Fruits should be shipped to arrive in England from July to October, but August and September are preferable, and to the United States from September to February.

In conclusion, I strongly recommend this business to my fellow colonists who will find it very remunerative; we

must not be intimidated by failures in the beginning, for nothing is attained without experiencing some difficulty and disappointment at first, but when this has been overcome, one will then look with satisfaction at the prospects that will be in store. I have had that experience already and paid dearly for it, but given those shipping facilities, the rest is in our hands, and the day will come when we will recognize its benefits.

THE ORANGE.

By JOSEPH BROWN.

AS applied to Trinidad this is a somewhat difficult subject to handle for the good reason that the cultivation of this Fruit has never been conducted on a sufficiently large scale to qualify one to treat it with any degree of authority.

My own experience has been very limited, and the following is written with a view rather to encourage than instruct. During the Administration of this Colony by Sir William Robinson, 1885 to 1889, much encouragement was given to Minor Industries, in order to mitigate as far as possible the losses directly and indirectly sustained here from the unfavourable condition of the sugar interests, then, and still prevailing. Jamaica about this time, I believe, laid the foundation of its present Fruit Trade with America, which from its inception gave promise of the important and profitable dimensions it has now attained.

With his eye fixed on Jamaica, Sir William Robinson saw no reason why, with proper encouragement and some help thrown in by the Government, the Bananas, which had so long been allowed to rot on the Cocoa Fields in Trinidad, should not be turned to good account, and in order to improve the stock large quantities of *Gros Michel* plants were imported and sold at a price merely to cover cost, by which means they were distributed all over the country. This effort received the support of a very large portion of the planting community, and, had more thorough organization followed, success must have attended it.

In order further to encourage this project, Sir William offered money prizes for portions of land, of a given size, planted in Oranges, the prizes to be awarded on the trees attaining a certain age. Several of our most enterprising planters competed; however I have reason to believe that after the plants were put in, but little attention was paid to their growth, and although in most cases they made a good appearance, this was due more to the nature of the soil than their careful treatment.

Of the patch to which either the 1st or 2nd prize was awarded the writer is now the owner and it is only within the last four years that the trees have yielded in sufficient quantity to allow of the fruits been placed in the local or other markets. Locally the demand is small and prices offered by no means encouraging. On this account I was led during last crop to seek other outlets, and besides sending sample cases to such Towns as Aberdeen, Edinburgh, Glasgow, Liverpool, Manchester and London, where they arrived in excellent order and were highly appreciated, I have also made consignments of fifty cases and upwards to other large centres in England; and from the reports received, supported by prices ranging from 5/3 to 9/6 per case of 128 Oranges, it will be seen that there are possibilities of a trade with Europe yielding profits equal or surpassing those derived from any other products of the Island.

As regards the cultivation I can say but little, as it is only within the last year that I have deemed the Orange Tree worthy of any notice. My trees numbering some 2,000, are planted in a light sandy soil possessing natural drainage. From this they yield in abundance a good sized, sweet, juicy fruit.

The quantity of the Orange depends largely on the soil in which it is grown, a stiff clayey soil producing fruit the reverse of the above. It is only lately that I have given my trees their first trimming, of which they stood much in need; and besides improving the fruit this will allow the picker to do his work with more ease and less danger. In Spain and Italy from whence the English market is chiefly supplied with oranges,, artificial manures are used, chiefly superphosphates; but to apply these, the nature of both soil and manure must be thoroughly understood, otherwise more harm than benefit may follow.

To dig a trench 6 inches deep by 12 wide round the tree, 6 feet from the trunk, and filling this with decayed vegetable matter may be simple, but it is a sure help and a process I would recommend.

After the cultivation of the tree, the handling of the fruit is most important, and if carelessness or neglect be permitted in either the picking, quailing or packing disastrous consequences are sure to follow.

The fruit for shipment should not be gathered until the rind begins to take on a yellowish tinge, and then the

picking should be carefully done with garden scissors, the stem being cut to within an eighth of an inch from the rind. All possibility of bruising, however slight, must be avoided as until the Orange has been properly quailed by 3 to to 5 days airing it is in danger, after this process it will bear very strong pressure without risk.

In Continental Countries the fruit is packed in cases to contain 700 to 800 Oranges, but when those have to undergo much handling, added to a long sea voyage as from Trinidad, a smaller case is advisable, say one to contain 128 large, 160 medium or 180 small.

Mr. W. W. Symington of the firm of T. Nash & Co., Limited, Plymouth, who lately visited this and some of the neighbouring islands, is sanguine of success in the efforts he is now making to inaugurate a Fruit Trade.

The Company has a very large fruit connection among the Southern and Western Counties of England, and hope in the course of a short time to be in a position either to buy small quantities of fruit in the Local Market for shipment, or deal with consignments to their house in Plymouth.

Up to a very recent date the R.M.S. Packet Co. showed little disposition to further schemes of this nature; happily the Company now realizes that the interest of these Islands is their interest, and I have had personal proof that the present Superintendent is willing to make any reasonable concession and give every assistance in his power.

I am somewhat sceptical as to the profitable shipment of bananas from Trinidad, but with regard to Oranges I have no doubt whatever, and am confident that an Orange Cultivation either by itself or in conjunction with Cocoa or Coconuts must prove both profitable and interesting employment for anyone of moderate means.

VANILLA.

By H CARACCIOLO, F.E.S.

THE VANILLA is an orchidaceous plant and one of the most productive as well as profitable cultivations of tropical countries. There are several species, amongst which figure V. planifolia from Mexico, V. sativa, silvestris and pompona, which by all accounts seem to be varieties of Planifolia or the vanilla of commerce; we also hear of V. Guayanensis, Palmarum and aromatica, the last of which is the least aromatic.

Vanilla is now largely used as a flavouring agent in the manufacture of confectioneries, chocolate, prepared cocoa, &c., which is prepared in the form of a liquid extract (one part to three parts of sp. proof) and is sold over drug counters in this island for flavouring cakes, iced creams, &c.

Medicinally, vanilla is scarcely used, though it has stimulating properties and has been recommended as a remedy for hysteria and low fevers in the form of an infusion. Its active principle is vanillin or vanillic acid.

It is a plant about the species of which there is the greatest difference of opinion, and Jaillet thinks, that Planifolia, Sativa and Silvestris are the same.

The planifolia grows in abundance in Mexico; it was introduced in the island of Bourbon in 1817 by one Marchand, from slips taken from Mauritius, which in 1883 it exported 22,736 kilograms to France. Since then, however, the plants became diseased and the exports diminished considerably. In Cayenne as well as Martinique they tried the cultivation without much success, but strange to say it was a success in Guadeloupe which in 1883 produced 5,506 kilogrammes from plantations 15 to 20 years old.

The vanilla of Guadeloupe resembles very much that of Java supposed to be the planifolia, which is indigenous to Mexico. There are two species found here, the large one, V. Pompona is locally called "Vanille de Cochon"; it has been accorded that epithet owning to the offensive smell it emits whilst drying, and V. aromatica which is not of very great commercial value.

This cultivation ought to occupy our attention more than it does, as it grows very freely here, our forests teeming with it.

In Laventille, Caura, Arima and Guanapo it grows very luxuriously and is very much like the species known as Guayanensis. Vanilla is being cultivated to-day in many parts of Central America and in 1901 was started in Ceylon where it is doing remarkably well.

CULTIVATION.

This plant which seems to partake both of the terrestrial and arboreal is a light green coloured vine with rather fleshy stems, leaves thick and about six to nine inches long, throwing tendrills just below the juncture of the leaves and the stock, wherewith it adheres to its support.

It is best to set cuttings in April or May. These should be about two to four feet long, though smaller ones may do. In planting, some cultivators recommend to place two to three joints in the earth, others prefer one; some resort to other means and place two joints within a piece of maypole.

The cuttings may be set from 12 to 14 feet apart and should be procured soon after the beans have been gathered, this distance being recommended in order to allow sufficient space for the plant which is a fast growing one to spread without hindrance of any kind.

In planting cuttings, care should be taken to cover them up with earth in the form of a little mound over which is placed some dried leaves or sand, so that it will be raised above the surface of the ground; this is done in order to prevent the water from settling around the roots.

Tie the cuttings to their support with dried plantain leaves and not with twine as the latter may injure the stem.

Keep the plants cool by watering daily until they catch, for this plant requires a great deal of moisture, though sun is indispensible; the reason of which is explained by the fact that it is a native of damp and humid soils which however never fail to receive the hot rays of the sun.

Various modes are employed in forming plantations; some recommending wild lands cleared of large trees, others preferring open plains.

A more economic and profitable system consists in cultivating it on the trunks of orange groves.

Immortel trees on Cocoa estates may be utilized for that purpose, but a vanilla orchard as I may call it is in my opinion preferable. This can be done on the border lines of estates on arbours, constructed at a man's height where young men or girls could be employed to fertilize the flowers.

The vine requires rich soil, heat, ventilation, shade and moisture, but rich lands along creeks and river bottoms are preferable; a profusion of wild vines growing in thickets with abundant loose soil affording ventilation at the roots being the best proof of the adaptibility of the land.

The ground should be kept clear of weeds and all undergrowth thrown around the vine to decay, serving as food and the ground around the vine should not be disturbed.*

FERTILIZATION.

The fertilization of this plant is one of the causes that have retarded its more extensive cultivation.

In the natural course of things most of our plants are fertilized by the agency of insects and wind, in this peculiar species it can but go on slowly owing to the special position of the reproductive organs.

The present system of fertilizing by human agency is supposed to have been started by Morren in 1837 though it had already been done by a black man called Edmond whose system is carried on to this date and is very simple; it consists in applying the pollen of the flower to the stigma and this is performed by moving the lip and placing the pollen in direct contact with the stigma, taking care always to carry out that operation in the morning.

The Very Reverend Father Pujade late curate of Carenage had started a vanilla field in his district which was succeeding remarkably well, when he was called away from us and the stimulus that was about to be given to that industry by that noble mind died away with him.

Each vine may produce from 30 to 50 pods and the last flowers are supposed to give the best pods, each flower producing from 4 to 6 pods.

The result of a successful fertilization is seen when the flowers last and dry at the extremities of the fruits; as soon

as this is obtained the rest of the flowers in that bunch should be taken away.

The fertilized flowers wither and fall after a few days leaving the navel attached to the fruit which continues growing for a month and should not be picked before six months, as it is only then fit for reaping; this can be ascertained by squeezing the pod which should then make a cracking noise, for the colour is no indication.

PREPARATION.

There are various ways of preparing the Vanilla, some allow them to dry until they lose their green colour. They are then placed between mats and exposed to the sun; from thence they are wrapped in blankets and placed in boxes covered over with cloth and again exposed to the sun, after which operation they should have attained a brownish colour, if not the process is repeated. They are then tied at the ends with thread smeared with oil and left in the open air (not in the sun) to cure. They can be left thus for 2 or 3 weeks after which they are supposed to be marketable.

Our Vanilla plants yield several sizes which are known in Venezuela as *primera*, the pods which are the longest and thickest, the second *Chica prima* which are shorter, the third sacate, smaller and fourth *nesacate* still smaller, the fifth and poorest is called *basura* or rubbish.

In Guayana they are placed in ashes and left there until they become wrinkled, they are then rubbed with olive oil and tied all over with thread and strung in the same manner as aforesaid.

In Peru they are dipped in boiling water and dried for 20 days after which they are rubbed with oil and strung in bundles to cure.

The chief use of Vanilla as I said before is in flavouring confectionery; it is greatly used in the manufacture of chocolate, one Vanilla being sufficient to flavour one and a half pound of chocolate.

It is also an aromatic stimulant exhilarating the animal energy. The oil used in the preparation however is unnecessary and even dangerous to use as it tends to rot the fruit. The pod should be collected before they are quite ripe, placed in the sun for a few hours then wrapped in a piece of dark woollen cloth for two days, then sunned again and placed in

boxes covered with plantain leaves for two more days then strung on threads in the air.

For shipping, pack in parcels of the size of a cocoa pod, apply a slight coating of a solution of 1 part Ol. Amygdalæ dulce and 3 part Spt. Vin. rect., by rubbing slightly with a feather or camel hair brush on the outer part of the parcelled Vanilla pods which is next tinfoiled, and lastly wrapped in fine tissue paper and shipped in tin lined boxes. I have known vanilla shipped in that way which fetched very high prices. The following is a quotation of price lists of McKesson, Robbins & Co., New York—Cal. 1901.

Vanilla bean Mexican	long	$15 to $16 per lb.
Ditto	medium	13 to 14 ,,
Ditto	short	9 to 10 ,,
Bourbon bunches	long	9 to 10 ,,
Tahite ...	Vanillin	$3 50 to $ 4 50.

Vanillin formula $C_{20}\ H_6\ O_4$ is analogous to Coumarin Tonka beans but is not identical with it—when the vanilla beans become covered with what looks like a white frost efflorescence of Minute Crystal Air it was thought to be Vanillin but Buchlong and Vogeltz German Chemists held that it was Benzoic acid, the Vanillin being produced by vapours given out only by the fruit, condensed like frost in its surface. It was artificially produced in Germany in the Carnbian layer of pines by E. Treman and W. Haarnum, Chemists. The indiscriminate use of Vanilla may produce poisoning, in the form of symptoms of gastro intestinal irritation induced by ingestion of cold iced creams.

The following is the mode of preparation to obtain these crystals or what is called "Vanille Givré."

1st. Bind the yellow extremities of the bean with a thread; if the bean is green, dip the green part in hot water; This operation is performed by taking the bean between the thumb and index where it still displays the green colour and dipping it in hot water up to where it is held, removing it immediately, for if it were left any time in the water it would be seized and be lost. Repeat the operation on every Vanilla you intend thus to prepare.

2nd.—You will observe that the Vanilla bean is angular in shape which gives it the form of a prism; take the bean between the thumb and index finger and press it all along taking care not to put undue pressure as it may crack and

split, if you find that it is apt to crack cease the operation and wait until it begins to get black, which will happen in a day or two—This is the most important part of the operation for if unsuccessful, the bean will not crystalise.

Repeat the operation every morning until the beans are nearly dry ; let the pressure be stronger day by day in order that the pulp may be properly equalized. It will be observed then that the pulp will be somewhat thicker near the point of attachment.

3rd.—Get the pods together and wrap in a piece of flannel, without pressing very much and expose this package to the sun, taking care not to place them in its direct rays, a few hours will do : but should the weather not be bright, they may be exposed to the air in a warm room, equalizing the pulp by the process given above every morning.

After ten days, more or less, you will observe small crystals of Benzoic acid; as soon as this happens, take them away and place them in a bottle where the crystalization is done quicker, place them in bundles of twenty to thirty, allowing them to remain in the bottle for one or two months, after which that time they will emit an acidulous smell. The vanilla only get its perfume a few hours after being removed from the bottle. The vanillas can then be used or if for shipment placed in tins properly soldered.

The local prices here range from six to ten shillings per pound on ordinary cured vanilla.

If an acre of land at 14 feet will take about 200 trees and each tree yields 50 vanilla beans, calculating 130 to the pound one will produce 76 lbs.—This I believe at prices quoted before ought to be a fairly satisfactory inducement to cultivate the plant.

The Savana Grande Produce Company.

ON Monday the 1st December at the Victoria Institute, Mr. George C. Wyatt, Secretary to the Savana Grande Produce Company, read the following paper :—

I have been honoured by the request to read a paper on the aim and object of the Savana Grande Produce Company; and although I feel myself unequal to the task, still, to show my willingness, I shall endeavour to do my best. After I decided to accept the invitation, and while thinking out the lines on which I should proceed, I must confess that I was somewhat bewildered at the thought of appearing before such an intelligent audience. I might have recalled the acceptance of the invitation had it not been for the fact that a possible opportunity for benefitting the company might have been lost. I resolved therefore to make an effort, relying on your sympathy with one, who, though conceiving a good idea, is unable to find suitable words to express it. Well, then, in order that I might not confuse matters, I shall deal with the different phases of the subject under headings, commencing with the

ORIGIN OF THE COMPANY.

On reading in our local dailies of the frequent scarcity of ground provisions, sometimes of the abundance from the neighbouring colonies, and sometimes of the reproaches hurled at our local agriculturists, and noting also the efforts of the Government to improve the tone of agriculture by including it in the curriculum of elementary schools, and by appointing individuals to lecture on scientific agriculture at different centres; and observing that agriculture was becoming the burning question of the hour, I discussed the matter with some of my friends who like myself thought the moment was opportune for action of some sort. Seeing the depression in the sugar and cane-farming industry (of which more will be said anon) and contrasting the indifference with which the gloomy out-look was regarded here with the vigilant committees and philanthropic endeavours

which prevailed in England and on the continent when agricultural and other depressions threatened their national independence, we decided to make an effort in a direction that would help the labouring population to overcome the difficulties in the way. The first idea which occurred to me was to establish an agency to receive the people's produce, carry it to the markets in the city, dispose of it and pay the growers the price it fetches, less the expense incurred; but I afterwards thought that the inducement in this way would not be sufficiently strong to serve as a deterrent to the falling off of that invaluable industry as it would be hampered by doubts for some time ere confidence was established. The sad cry of the cane farmers for the last two years, I presume, is still echoing in your ears, and I submit that the surest way of avoiding a recurrence of those plaints is the establishment of a concern of this nature, which will secure a ready market for all the vegetables that can be grown with the canes; for allow me to remark here that the company is not started with the intention of superseding the cane-farming industry, but rather to work in conjunction with it. The farmer's aspirations are identical with those of other men—viz., to make money, and a ready market being offered for canes all his energies were devoted to that cultivation, and consequently a depression in that industry could not be attended with other than very serious results. On the other hand there was very little inducement for the farmer to cultivate provisions largely; if he did, much of the produce would have to perish in the ground instead of realizing money, for there was no ready market for their purchase, and he did not like to itinerate with his provisions, or could only do so with small quantities at a time. Now, the establishment of the Savana Grande Produce Company will not only remedy this evil, but will actually create a demand for these commodities. Then, as corn, peas, potatoes, plantains, figs and cassava, can be, and are being successfully grown with canes, I submit that on this ground the company is a boon to that deserving class, and will greatly assist that industry to stem the tide, and as such deserves the sympathy and help of all who are directly or indirectly interested in it. Someone has said, "If anywhere there are efforts tending to curtail the fullest growth of the people, let these efforts be turned into stimulating, encouraging and making him the most useful and intelligent citizen. Efforts or means

so invested will pay a thousand per cent. interest." Such efforts will be twice blessed, blessing him that gives and him that takes.

CAPITAL OF THE COMPANY.

The capital of the company is $2,000, divided into 400 shares of $5 each, with power to increase such capital and to divide the same into shares of equal or any other value. Of this one half has been already subscribed, and the promoters have every reason to be grateful to those gentlemen who have so readily responded to their appeal. Indeed, it has come as an agreeable surprise to many, and tends to confirm the belief that a man must deserve success and then he can command it; and, furthermore, heaven helps only those who help themselves. Our company needs substantial help in money and influence, and it strikes me very forcibly that I cannot make too strong an appeal to this audience for mutual support to enable us to dispose of the remaining shares in the shortest possible time. In that case we would be placed in a position to carry out the object of the company which is to help a useful and deserving class of people to resist the angry waves during this period of agricultural depression and to form a nucleus for further co-operative enterprises. It has been contended that such a co-operation should be confined among ourselves, but it should be distinctly kept in mind, gentlemen, that it is not always those who will be benefited most by a scheme who are most willing or able to respond to it. Indeed, as it is in this case, they are the least able. The whole thing turns in averting a calamity—outliving a crisis; and those who will be directly benefited are possibly those who are scarcely able to realize either the situation or the advantage to be derived. They are the masses—the objects of perpetual solicitude in every land among the thoughtful and prudent.

SYSTEM OF WORKING THE COMPANY.

The buying of ground provisions in any appreciable quantity has been a thing unheard of by our people, and a doubt of its reality had been entertained. The company has therefore to school the inhabitants to it, and this is taking both time and money, which no one ought to grudge, when the manner in which the people are settling down to agricultural pursuits is fully observed. Agencies have been placed in various districts of the colony in order to assure

our farmers of a ready market and to conduce to the advancement of matters agricultural; helping, therefore, in carrying out one of the aims of the Government. The company is in its infancy, and has not yet dealt with any enormous quantity of provisions, but the supply is daily increasing and mighty possibilities are promised. It is intended to buy provisions in any quantity wherever they are to be found and place them wherever they are not; and it is well known that in some of our villages provision is as great a luxury as sugar is on the continent, which is an abnormal state of things. The amount of produce as yet disposed of by the company fully exceeds $300 monthly, and I take this golden opportunity of strongly appealing to the families of this city not to leave us to the mercy of auctioneering difficulties, as the result of such sales are seldom if ever satisfactory. In contemplating the launching of this company the promoters duly reckon on liberal support, for statistics show that from £30,000 to £40,000 is being spent annually for vegetables brought from the neighbouring colonies. Preference henceforward ought to be given to home-grown provisions. We think the Government should also assist by way of placing orders for their institutions with us, or making it a condition with contractors that preference be given to the company for the supply of provisions, as the object of the company is in keeping with the views of the Government and a reciprocity of this sort is not too much to expect. In this way that large amount of money would be circulated in the colony to its evident benefit. I presume that there are many business men in this audience who are deeply interested in the financial prosperity of the colony, and may it not be pertinently asked whether they will stand by and allow the sum aforementioned to continue to slip out of the colony? Echo, methinks, answers No! Gentlemen, you who have the interest of this thriving colony at heart, may not the question be asked you: Why should we be at the mercy of Venezuela for plantains when we can grow our own! As a practical gentleman puts it, any Saturday a man desires to be President there, the inhabitants of Trinidad are in want of plantains the following Monday. Why also should we depend on other neighbouring islands for ground provisions, which, like Barbados, for instance, are liable to quarantine? In fact, what is there to hinder us finding the necessary food for our own consumption when farmers and land are-

in sufficient quantity here. Yes, it is quite possible to attain all this if a helping hand from the desired direction is extended to the company. And I can assure you that our farmers will plant. Every day I am beset with letters and persons asking if it is true that a ready market will be given for provisions, and the apparent pleasure caused by an answer in the affirmative assures me that the farmers only want fair-play and all the talk about laziness shall be effectually silenced. I fancy someone saying over-production is to be feared, but although such is within the range of possibility it will be highly improbable if the affairs are conducted intelligently. The £30,000 spent on imported vegetables with all that can be had in the colony is not nearly sufficient to keep our population in regular supply. Then, again, as I have already said, we are strongly advising our farmers to adopt the system of rotation of crop as is advantageously done in other parts of the world, and which will certainly minimize the chances of over-production, so that we certainly feel the time has fully come for a systematic development of the agricultural resources of this progressive island. In our endeavour to put this new enterprise on a workable basis we earnestly beg for your best support which we hope to desire.

RAILWAY CHARGES.

The railway charges are very important items with us, and though we are very grateful to Mr. Smith, the General Manager, for what concessions he has granted us, the rates are yet too high. A striking contrast is here presented between the Government and a certain benevolent gentleman in the community who, realizing the far-reaching results of the company, promises a prize of $5 to the agriculturist who sells the most produce to the company within a period of 6 months. If such an inducement can be held out by a single individual as a stimulus what should be the attitude of the Government in connection with agricultural importance. The principal aim of the company is to develop the resources of the colony, and if necessary advantages are not denied us, the enterprise will achieve mighty things for the good of the community at large, and will considerably change the material condition of the people. I positively assert that our financial position is the only deterrent to the change of our social condition, and indeed I will be very pleased to see our representative men paying more attention

to the general improvement of our material condition, for then and only then will be secured them that political and social recognition their otherwise fitness entitles them to. We fancy that the Railway Manager will grant us further concessions when quantity shall have justified the course, but we submit that if the enterprise is to be encouraged now is the time to give the encouragement; it is the infant who needs the mother's protecting care: the man may care himself.

A FEW OF MY EXPERIENCES.

It may not be out of place here to relate some of my experiences in forming the company. After my friends and I had put our ideas into practical form I asked some of the gentlemen in the district to attend a meeting. The result of that meeting was an agreement that something should be done, but that no further steps should be taken until a certain amount of money had been realized. Well, the money was collected to the surprise of many, my company was legally formed and I was commissioned to canvas for shares, and my experience in doing so is amusing, surprising and gratifying. One gentleman in this city of the highest social standing, famed for his humour and wit, listened to what I had to say. "I hope," said he, "that it is not one of those things that will twist and turn and will ultimately get in the pockets of one man." On telling him that we will deal honestly, "Oh," said he, "I know it is called by that name among the one family that is generally benefited, and who by some happy coincidence happens to be Father, Chairman; Brother, Vice-Chairman; Son, Secretary; and Uncle, Treasurer." I perceived of course what was his opinion with regard these local societies, a good many of which I am sorry to say were conducted in such a manner as to justify his not very favourable opinion of them. I however succeeded in getting his earnest attention, and when he had seen what was the object of the company his manner was at once changed and in quite a serious tone, said: "Nobody will respect you, Mr. Wyatt, unless you respect yourself, and one of the evidences of self-respect is self-help. I am glad to see your people in Savana Grande are trying to help themselves, and I will do all I can to assist you. I'll take ten shares in your company and will be pleased to advise you at any time." Another gentleman of high social status also, but in a different walk of life,

and who is said to be unsympathetic to our labouring population, treated me courteously and listened attentively. After reading our prospectus to him which contains the following paragraph: "We are of opinion that in seeking evidence of a country's prosperity it is more accurate to note the paupers in its hospitals, thieves in its jails, than cash in its bank, and as poverty is the greatest incentive in the breeding of these undesirables, let us do all we can to lessen their number." "That's very well," said he, "but in Trinidad the thieves are not always in jail." I thought that was the fault everywhere, but of course, said nothing; he, however, to my surprise took shares, remarking at the same time: "This is a movement in the right direction; it will help the working man, and I respect that man for he is worthy of respect." My experience among my own people is also amusing. I'll relate one incident. One farmer who manifested great joy when I told him that I would buy all and whatever he would grow, inquired how I would get the money to purchase. I told him it was a company, and that I would like him to take shares. His manner was at once changed, and with a shaking of the head said: "No me fren,' niggers' ting can't las" "But," said I, "a good many white folks are in it, and great ones too." "Oh! in that case," said he, "it will succeed, but the white people will get all, and nigger nutting; if you would buy my provision I satisfy, but fu' take shares, no." I am glad to say, yet, a good many of my people are taking shares. Finally, gentlemen, it remains for me to thank you for the patient way you have listened to me, and if I have not impressed you with the worthiness of the cause, blame my ability, but help the movement. The sum of $ 1,000, as has already been said, is yet to be realised to carry out our aims, and I again make the appeal to this audience to lend us its aid. We ask one and all with money and influence to identify themselves with the movement so that in this direction we may have a fair and reasonable trial, the result of which, I hope, will help us to contribute to the prosperity of this beautiful island, Trinidad.

Before taking my seat I must say "God bless Mr. Chamberlain for the result of Monday night's meeting in the House of Commons, which means the improved condition of these hitherto handicapped islands of the West." (Cheers).

NOTE.—Since the above paper was read this Company has unfortunately suspended operations—it is to be hoped temporarily.

Notes on the Local Cultivation of Tobacco.

By JOHN PHILLIPS.

In any consideration of the cultivation of Tobacco in Trinidad, in order to arrive at a correct estimate of its present position and probable success in the future, it is necessary to consider it from the different standpoints of the ultimate use to which the cured product will be put. Owing to the extreme humidity of the atmosphere here, it is not at all likely that it will ever be possible to produce the bright yellow tobaccos suitable for cigarettes and the finer grade of smoking tobaccos, peculiar to Virginia and the Carolinas in America and Turkey and Persia in the East. This being so, it remains only to consider the two classes, which are used for cigars and the commoner grade of smoking tobaccos. As these constitute the bulk of the consumption of the world, the demand for which is a constantly growing one and the prices of which are always remunerative, and at times very profitable, there is no question but that the successful grower will be able to find a ready market for his produce.

In Trinidad there has long been grown a small amount of Tobacco from Cuban seed, but only within the last ten years, when an experienced grower was employed by the Government to teach the people the best methods of cultivating cigar tobaccos, has there grown up in the southern district of the island, where the Government experiments were carried out, any considerable cultivation. There are no accurate statistics, but probably the output is now somewhere near 50,000 lbs. per annum, and increasing a little every year. The greater part of this is grown on new lands which are being cleared for cacao, but no grower cultivates tobacco with a view to getting the very best possible results, his sole object being to produce something easily converted into money to enable him to carry on his cacao planting. The consequence is that the tobacco produced is of a very inferior quality and of no value as compared with the carefully grown tobacco of Cuba and Jamaica. The whole of this tobacco is bought and consumed locally, being made

into very cheap cigars. As the demand for these cigars is limited it follows that there can never be a large increase in this production as it is at present handled, for the simple reason that it could not come into competition either with Cuba or Jamaica. Experiments with selected samples of tobacco grown in this district, however, indicate that with careful cultivation a very fine grade of cigar tobacco can be produced; for these samples show the characteristics of silkiness and aroma which are of prime importance in the production of good cigars.

In many points the methods in use here are not calculated to obtain the best possible results. Instead of putting the seed bed anywhere that happens to be convenient, it is important to select a good spot in the woods, preferably on a hillside.

It is of very great advantage to burn the ground selected so as to insure the killing out of the seeds of injurious weeds and the larvæ of insects likely to be in it. On no account, however, should it be burned unless the surface is thoroughly dry. As experience proves that 15th October to 15th November is the best time here for sowing plant beds, the dry weather which is usual in September should be taken advantage of to do this burning. The ground should then be well forked up and pulverised and made into beds 3 feet wide by 20 feet long. A bed this size sown with two level teaspoonfuls of seed mixed thoroughly with a quart of dry wood-ash will furnish plants to set out two acres, but it is always wise to sow twice the number of beds likely to be required. They should be set across the slope of the hill parallel to one another with a path two feet wide between each. On three sides of the beds a good drain 12 inches by 12 inches should be made to protect them from washing, and the paths between must be sunk at least 6 inches to 8 inches below the level of the beds and led into the side drains. When made, they should be sown broadcast on a dry day when there is no wind, with the seed and ashes mixed, and carefully pushed down with the hands or with a board lightly pressed on the surface, but on no account should the seeds be raked into the ground. When possible, it is strongly recommended to cover the beds after they are sown, with a light covering of palms to break the heavy rainfall. This should be light enough to allow the rain to pass through in a fine spray. At the same time

there must be sufficient slope to prevent any drips. The best way is to build a light frame around each bed 30 inches high at the upper side and 20 inches at the lower, projecting slightly over each end, and to lay the palm branches on this lightly yet thick enough to break the force of the rain and not so thick as to make a heavy shade, as the young plants require plenty of air and light, but are injured by the direct rays of the sun. Owing to our very heavy rains it has not been found practical to use the method of canvassing which is now generally used with such great success in the tobacco growing countries of the North.

As the success of the whole crop depends on the plant beds it is absolutely necessary to use every care in this preparation, and they should be very carefully watched and looked after until the crop is out. The time of year most suitable for the maturing of the crop regulates the time when these beds are sown. Here in Trinidad the crop must mature in the dry season which can usually be counted on to begin near the 15th February. The whole of the crop should be brought by that time to top, that is, it should be so far developed as to begin to show the button which is to produce the flowers and seeds. As it requires from 17 to 20 weeks from the time the seed is sown until the crop matures, beds sown between October 15th and November 15th would have ample time in which to get their growth, and still have dry weather in which to mature. It is not wise to sow before October 15th, as tobacco is likely to be injured by maturing while the rains are still on, nor later than November 15th, as probably it would not have sufficient growing weather. In 7 or 8 weeks after the beds are sown the plants should be 5″ or 6″ high with at least four well developed leaves, and are then ready to set out; but as long as the stalk remains brittle the plant can be used. Large plants are less likely to be affected by heavy showers, and when they start will come on much faster than smaller ones. The present practice is to set the plants far too small. This has been very notably illustrated this season, a great many plants being killed by the heavy rains of December.

Two weeks before the plants are ready to be put out the covering should gradually be moved off the beds, every day allowing them to take more of the direct rays of the sun until they are properly hardened, so that the sun at

midday will not wilt them. The coverings should always be ready to put on in case of a heavy dashing shower. When the plants are ready to be put out they should be drawn in the morning as early as possible and packed in shallow baskets lined with green grass or soft leaves, and put away in a cool, shady place until ready to be set in the field, which should not begin until 3 p.m. A day after a heavy shower when the surface is full of moisture should be chosen.

The selection of the land in which to grow tobacco is of first importance, and at present, as a rule, the best lands are not utilised. It is the usual thing to plant tobacco on hillsides, some of which are very steep and should never be put to any cultivation which requires the land to be kept as clean as tobacco does. The fine vegas of this district are rarely put in tobacco, as no attention is paid to drainage; but with proper drainage and cultivation the light, loamy soils of these vegas would produce a very high grade cigar tobacco. All the best samples from this district have come from lands of this kind.

It is very expensive to prepare new lands by ploughing and harrowing, yet it is only by very thorough tilling before the plants are put in, that the best results in yield and quality are obtained. In view of this and of the fact that these lands in the southern district are open and fertile, it has been suggested that almost equally good results might be obtained by forking up the ground where the plants are to grow. For cigar tobaccos the plants should be set 24 inches apart in rows at intervals of three feet three inches. It is important that the roots should go in straight and the plants should be put far enough down to get a good hold, but not so far that the bud is likely to be covered by washing. Unless the weather is unusually dry, in three or four days it should have recovered from the shock of transplanting. From the time tobacco is set it requires constant attention. The field should be kept perfectly free from weeds and grass which besides spoiling the body of the leaf, afford a hiding-place for insects. The two most dangerous are the bud-worm and horn-worm, both produced by moths, the former by a small, white moth and the latter by the Gipsy-moth. The only sure way to protect tobacco from these two worms is to go over each plant every morning early and kill them when they are small. This is not such a difficult task as it

would seem, as one soon gets to know where to look for them. Bud-worms attack the small bud of the plant and it is most important to examine young plants for, should they eat the bud, the plant will not put out new leaves and is practically destroyed. Horn-worms, not so numerous in the dry season, are always found on the under side of the leaf, and of the two worms are the more dangerous-looking, a full sized worm often being six inches long by half inch in diameter. Bud-worms are really, however, the more dangerous, as they multiply very rapidly and are never out of season.

The seed button should appear from 4 to 6 weeks after the plants have been set, and when this is fully developed it should be taken out carefully so as not to injure the small leaves that are around it. This is called "topping the plant." No plants except those intended for seed should be allowed to flower, as the developing of flowers takes away a very large part of the body of the leaf and makes the tobacco thin and trashy and without flavour when cured. A few days after the buds have been taken out the plant, in its effort to reproduce itself, will begin to throw out shoots from the base of each leaf. These suckers, as they are called, should be pulled off, otherwise they will produce flowers and seed the same as the parent plant. About two weeks after the plant is topped the leaves will commence to ripen from the bottom. Ripe leaves can easily be told by their mottled appearance and by being very brittle. As soon as ripe they should be taken off and collected in flat baskets and carried to the curing house. Great care should be used in handling these leaves. They should not be exposed to the direct rays of the sun any longer than is possible. When they have wilted thoroughly, which will be in about an hour after they have been pulled, they should be pierced through the butt of the stem and strung in pairs with the backs together, 40 to 50 leaves on a string. They should then be fastened to a stick made of any light wood about 1 inch in diameter and 5 feet long, the leaves kept well separated. This stick is then hung in the racks of the curing-house.

The building of a curing-house is a very simple method. A shed roof with the ridge running north and south thatched with palms and running down within 2 feet of the ground to prevent the rain from blowing in makes a first-class

curing-house. The building of these houses is well understood here, but a good curing-house should have as little light in it as possible and the gable ends should be shut up. As soon as the tobacco is cured, which should be in about 6 or 8 weeks from the time it is cut, it should be taken down and bulked, care being taken that all the stems are thoroughly cured and dry. The body of the leaf should not be too soft. If it is taken down when the leaf is supple and will not stick together when crumpled in the hand it will be right.

It is a very difficult matter to lay down any definite rules for the fermentation of tobacco. There are, however, a few things to be avoided if the tobacco is to be kept from rotting. It must never be put down without an air space of at least four inches from the floor; if a dirt floor this space should be 6 or 8 inches at least. The tobacco should be rolled up on the strings in bundles and laid straight in a bulk well covered over and weighted. This will begin to ferment in 3 or 4 days. It should then be carefully watched and allowed to get to a high temperature, but not so high as to make the leaf tender. When sufficiently high the bulk should be changed and allowed to come up into another sweat. This rebulking should continue until the temperature does not rise sufficiently high to be dangerous. The tobacco can then be taken off the strings, tied into bundles of 15 to 20 leaves and put into tight bales ready for market.

This fermentation process brings out the aroma of the tobacco and on the result depends the whole value of the crop. Tobacco that has been well grown and matured and harvested in good dry weather, will be of good body and will not give so much trouble in fermentation as the thin-bodied tobacco matured in wet weather, and the aroma will be in every way superior. The main object in producing a cigar tobacco is to get a leaf of good body and very fine fibres. Tobacco that grows coarse and rank is not good cigar stock. These are merely the most essential points to be observed by the planter in the growing and handling of the crop. The grading of fermented tobacco requires expert knowledge and is hardly within the province of the grower.

Within the past two years efforts have been made to produce the heavier bodied tobaccos suitable for the pipe. While the results obtained can hardly be said to be successful so far, they show that this tobacco can be produced here.

The experiments have been made in heavy clay soil, similar to that in which this class of tobacco is grown in America. The difficulty with clay soil here is found to be its great liability to bind. Where there is sufficient sand mixed with the clay to prevent binding the plants come on well and make good useful tobacco. The preparation of the seed beds and the planting is the same as for cigar tobacco, except that the plants should be set in rows 4 feet apart at intervals of three feet in the row. When, however, they come to top no more than 10 to 12 leaves should be allowed to grow on each plant. After topping they should be allowed to stand as long as possible so that all the leaves will thoroughly ripen. The whole plant should then be cut down within two inches of the ground, and carefully laid down with the cut end facing the sun and allowed to wilt, after which they must at once be brought into the shade. They can then be hung on sticks and put in the curing-house. There are several ways of doing this: the simplest is to loop a bit of string or bark over the end of the stalk where it has been cut and to slip the loops over the sticks. From five to seven plants, according to their size, can be hung on a five feet stick. As soon as cured the tobacco must be taken down and the leaves stripped from the stalks and tied in neat bundles of eight to ten leaves of the same length using a leaf to tie the bundles with. Damaged and light, trashy leaves should not be mixed with the perfect ones.

The fermentation of this tobacco should not be so heavy as in cigar tobaccos. As soon as the bulks begin to get warm they should be changed. When the fermentation is finished the tobacco should not show the strong ammonia smell that well fermented cigar tobacco has, but should have a sweeter odor. The object of this fermentation is to get rid of the green sap in the tobacco and at the same time preserve its gum.

If the cultivation of cigar tobaccos in the southern district were taken up seriously, there is every indication to suppose that a high class wrapper tobacco could be produced. Sumatra tobacco which on account of its extreme fineness and elasticity, now ranks first in that class, lacks aroma. Havana wrappers, on the other hand, while they have the aroma, are of a much heavier texture. If a wrapper combining the desired characteristics of each could be produced it would find a ready market at highly remunerative prices. Forty

years ago Sumatra tobaccos were totally undeveloped. Now there is exported annually about 40 millions of pounds all used for cigar wrappers and mainly sold in Amsterdam. In the past 32 years the value of Sumatra tobacco sold on the Amsterdam market has amounted to 280 million dollars.

The best samples of Trinidad tobacco even now show to a certain extent both fineness of texture and delicacy of aroma. Could these be still further developed, there would be produced the high grade wrapper so long wanted, and tobacco cultivation in Trinidad would then no longer be classed as a minor industry.

RICE.

By W. GREIG.

THIS product forms the staple food of India, China and Japan, where enormous populations are dependent for food upon an annual crop, and it is estimated that over 400,000,000 inhabitants of those countries, or about half of the total population are dependent entirely upon rice for food. Although for many years past, about one-third of our population in Trinidad has been East Indian and of the rice-consuming class, only a small proportion of our requirements is grown here, although one would imagine that the protection afforded by our import duty would be a sufficient inducement. The reason is not far to seek. High cost and scarcity of labour in conjunction with the fact that until recently our rice growers have been entirely of a class which for generations has been wedded to manual labour, and has no knowledge of implements or machinery. For those reasons rice has not been grown in Trinidad to any extent as a commercial undertaking, although it has been grown in considerable quantities, and as it is consumed largely by the growers and passes through no market, only a rough estimate of our production can be arrived at indirectly, by gauging the effect of the increased production in recent years, on the imports. This I would place at about 45,000 bags at a value of over $200,000. The principal rice-growing districts are Caroni, Oropuche, Cedros, and Mayaro, where the lagoons and lowlying wet lands are particularly suited to its growth under present conditions of cultivation. To a lesser extent the Savana Grande and other drier districts contribute to the production a dry land rice, which under present conditions cannot compete on favourable terms with the wet land or swamp rice. In addition to what is commonly known as the hillside rice and swamp rice, grown in Trinidad, there are many other varieties known to science, differing in size, shape, and colour of grain, in length of time required to mature and yield; but our creole rice like our creole dog is best named just "plain rice," being a mixture of many kinds. In Ceylon, 161 varieties are known to be grown, and in India, China and Japan, where great

care is exercised in selection, over 1,400 kinds of rice are cultivated. This opens up a large field for investigation to the Trinidad growers.

CULTIVATION.

The method of cultivation in Trinidad is most primitive and expensive, having been imported by the East Indian from India where labour is plentiful and cheap, and is quite unsuited to existing conditions here, and the only reason of its survival is the love of independence of the East Indian who would rather live as his own master on five cents than work for another at twenty-five cents per day. Swampy, wet land or land on which water can be retained during the wet months is generally chosen; this is hoe-ploughed to remove weeds and grass which are banked around the plot to keep the rain on the land when it falls. The rice plants which have been grown from seed in a nursery plot are then carried and transplanted into the larger plot by hand. If rain falls, the rice plants grow as also do weeds, and with suitable weather, generally two or three weedings are necessary before the crop matures. This method is general and succeeds in China, Japan and India, where the annual agricultural labourer's wage does not exceed $15, but here an agricultural labourer earns $60 per annum. Owing to the entire dependence upon weather there must always be great uncertainty as to yield. Another very serious disadvantage is that increased area under this system would mean increased proportionate expense, so that as at present generally cultivated, rice can only be grown on the kitchen garden scale, and owing to the large supply of labour necessary, at a great disadvantage to the other agricultural industries of the island and without any compensating advantage to the island generally. All credit, however, is due to the East Indian pioneer who has proved conclusively at his own cost, and in spite of many difficulties, that as good rice with as high a yield can be grown in Trinidad as anywhere, and it is only because he knew no better that he is not to-day growing all the rice we require. Within the past two years some valuable experiments have been carried out by more intelligent growers than the East Indian to determine what reduction could be made in the cost of producing rice by new and improved methods as compared with the East Indian method. The plough, disc-harrow and roller were used to prepare the seed bed, and the seed was sown broad-

cast and harrowed and rolled into the land. This was simply following out the usual routine of every farmer who plants cereals in the old country, where labour conditions are similar. Irrigation was resorted to when the rainfall failed. The result of two seasons' experiments shows that a reduction of fifty-nine cents per barrel paddy can be made in the cost of growing, the cost being by East Indian method $2 39 per barrel and new method $1 80 per barrel, and the new method has the further advantage, that increased area will reduce cost whereas the reverse is the case with the East Indian method. It has also been found that irrigation is necessary and rice can be grown on land on which when the water is drained off, implements can be used to cultivate, and carts and harvesting machines used to reap the crop. Elsewhere the use of implements has reduced the cost of growing rice enormously of late years, and to-day the cheapest rice is grown in those countries where labour is scarcest and most expensive. In the East Indies where the labourer costs on the average $20 per annum, he cultivates two acres at a cost of $10 per acre, whereas in the United States where the labourer costs $100 to $150 per annum, he cultivates with the aid of implements from thirty to forty acres, at the cost of a little over $3 50 per acre.

REAPING.

The method of harvesting as employed in Trinidad is as primitive and wasteful as that of cultivating. The crop is cut with the sickle when fully mature and carried in bundles to a shed where by knocking the heads against a board the grain is detached and falls to the ground. Much grain is lost and falls before a crop of any size can be reaped owing to the impossibility of getting sufficient labour just at the proper time, and from the primitive method of threshing. This can be avoided by the use of proper reaping and threshing machines.

CLEANING.

Before the rice in husk or paddy can be consumed it has to be cleaned or have the husk removed. Creole rice is generally bought and sold as paddy and the consumer removes the husk as he requires the rice for his use, just as in the West Indies we roast and grind our coffee. This is done by pounding in a mortar, after which the husk is separated from the grain by winnowing in a very simple

and effective way, the contents of the mortar being poured from a height in a breeze. The breeze carries away the lighter chaff and dust and the heavier grain falls into a receptacle below. By this method the grain is much broken and the smaller particles are lost in the winnowing with the result that only fifty per cent. of clean rice is recovered from the paddy. No attempt is made to polish or clean the grain which, perhaps, is as it should be, as the outer skin which is removed to give rice its white and pearly lustre is the most nutritious portion. In the flour obtained from polishing rice 7·2 per cent. fats are found, whereas polished rice only contains ·38 per cent. However, apart from the appearance of the final product which is a matter of taste which must be taken into account in a commercial undertaking whether good or bad, the loss by the mortar hulling is great and very costly and unworkable if undertaken on a large scale, and owing to the large proportion of broken rice the product is unmarketable. This method being quite unworkable on a large scale, some experiments were made by rice-growers with imported machines with such satisfactory results that a complete rice factory is now at work in Trinidad which has a capacity of twenty bags of cleaned rice per day and can turn out any quality of rice from the commonest to the best white table. Initial difficulties were met with as was to have been expected, and have been overcome, and the promoters of this enterprise now expect to reap the fruits of their labours. After three years of careful experiments in cultivating and milling creole rice I am assured by those interested in this new industry that creole rice can be placed on the market to compete on favourable terms with the imported article and leave a considerable margin of profit. The conclusions I have come to from all the information I have been able to collect with regard to rice-growing in Trinidad are:—(*a.*) That under existing methods no great increase in production can be looked for, or is to be desired. (*b.*) That under improved methods of cultivation and milling the production of rice will increase, slowly at first, as capital is necessary, and capitalists generally lack confidence in new industries, but more quickly as the results become better known and appreciated. That the cheapening of a foodstuff, which is the staple nourishment of the large proportion of our agricultural labourers, would be of advantage in an agricultural colony cannot be denied, and yet I do not think any industry has been allowed

to suffer so much from the want of roads as the rice industry. I am intimately acquainted with the Caroni Savannah where there must be 3,000 acres of land under rice cultivation, and yet not one gravel road taps this cultivation. The crop being reaped during the wet season, ungravelled roads and reserve traces are worse than useless, as the traffic is concentrated on them and they become impassable, and the result is that almost the entire crop has to be carried by the half bag on men's heads for miles. There are only two things necessary to make the rice industry a success in Trinidad—capital and roads. Since writing the above, I see from the Official Gazette that application has been made by the Tacarigua Local Board to the Central Road Board for permission to extend three roads in Caroni Savannah district.

COCONUT OIL.

By W. GREIG.

THE Coconut Oil industry has until recently been little known to the general public, but owing to the proposed changes in our fiscal arrangements to meet the proposed Reciprocal Treaty with the United States which might affect it, it has come in for a good deal of attention. For many years past coconut oil has been made in Trinidad in small quantities principally by small peasant proprietors who had difficulty in disposing locally of their produce in the shape of coconuts, and not having the facilities of the larger proprietors for shipping. So long as the larger proprietors realized remunerative prices they shipped their nuts, but with a gradually declining market for nuts they have had to turn their attention to the oil. Fifteen years ago coconut oil was imported into Trinidad, but since then this has ceased altogether and we now export coconut oil to the annual value of £2,500. The growth of this industry has been slow, as by the ordinary local method of extracting the oil from the nut, there was not a very high margin between the relative values of nuts and oil, and it must always take time before a purely agricultural industry will adopt machinery. By the most primitive method of extracting the oil, the kernel of the nut was grated on a cassava grater and boiled with water. The oil which on boiling became separated and floated on the surface, was skimmed off. As the industry advanced and a larger output was necessitated, rotary graters took the place of the cassava grater, and "teachers" or "steam pans" were used for boiling, and in some cases old scum presses from the sugar estates were used to press the water from the resulting meal and render it available as a stock feed. The objections to this method were high cost in labour charges, inferior extraction and low value of the by-product—oil meal. Some enterprising capitalists not directly connected with the growing of coconuts and without the prejudices of the agriculturist against machinery, some years ago erected modern oil-extracting machinery in Port-of-Spain. They evidently overlooked the very serious disadvantages of high cost of transporting the nuts from where they grow, or

if transported in shell, to reduce this cost the loss of the husk as fuel which necessitates the use of expensive coal. It is only since modern machinery has been erected at Mayaro and Cedros that the advantages of this industry have become apparent, and when those advantages are more generally known I am satisfied that our export of coconut oil will entirely take the place of the coconuts exported now with considerable advantage to the colony. The average price realized for nuts during the past two years has been from $7 to $8 per 1,000; if made into oil by the most modern machinery after deducting the cost and value of residual cake, the oil would cost 40 cents per gallon. The difference between that price and 50 cents, the average price oil has been sold at during the past two years would be the profit to the manufacturer, or if manufactured by the owner of the nuts it would increase the proceeds of his nuts by $2 45 per 1,000. There is therefore a loss to the colony of almost $2 50 per 1,000 on the 12½ million nuts we now annually export, or over $40,000. The most modern process of extracting oil from the coconut is by hydraulic presses. Before pressing, the kernel of the nut must be broken up into as fine a meal as possible, and as this can only be done with the dry kernel, it is therefore necessary to make copra first. This can be done without the aid of artificial heat at Cedros or Mayaro, but not on our west coast or at Port-of-Spain. The copra is ground into as fine a meal as possible in a disintegrator, after which it is warmed and packed in small bags and is then subjected to a pressure of 2 tons to the square inch in the hydraulic press. An extraction of 48 per cent. from the copra is obtained by this first pressing. The cake from the first pressing being comparatively dry can now be ground a second time in the disintegrator into a very fine meal after which it is again warmed and pressed when a further extraction of 10 per cent. from the copra is obtained, making 58 per cent. in all. The residual meal amounting to 38 per cent. of the weight of copra is a first-class stock feed containing 11·50 per cent. fatty matter and 10 50 per cent. moisture, for which there is an ample demand in the local market at 1½ cents per lb. By this process a relatively high extraction of oil is obtained at a low cost, and the residual meal is of high commercial value. The cost per gallon of oil extracted does not exceed 10 cents, in a small plant capable of an output of 100 gallons per day, including capital and depreciation charges as well as labour

and supplies. The skill required to work oil presses is not beyond the intelligence of our ordinary mechanic, and for the following reasons the oil should be extracted as near where the nuts grow as possible:—(*a.*) To avoid heavy freight or transport charges—1 puncheon of oil being equal to 400 nuts. (*b.*) Where husks and branches can be obtained no other fuel is necessary to work the factory. (*c.*) Copra can only be made without the aid of artificial heat on the east and south coasts, where most of our nuts grow. The cost of putting down a modern oil extracting plant capable of an output of 100 gallons per day, or of working up a crop of 1,250,000 nuts would be about £1,000 to £1,200, and the following relative value of nuts, copra and oil, worked out from the results of such a plant may be useful to any who propose going into this industry.

Nuts per 1,000.	Copra per ton.	Oil per gallon.	
$10	$67 86	50 cents.	
9	61 73	46 ,,	After allowing
8	55 61	42 ,,	for value of
7	49 48	38 ,,	5·6 lbs. meal
6	43 36	34 ,,	per gallon
5	37 23	30 ,,	oil.

Meat, Milk and Butter Supply.

By C. W. MEADEN, Manager Government Farm.

Meeting held on 14th March, 1903.

THE PRESIDENT (PROFESSOR CARMODY) IN THE CHAIR.

I HAVE been requested by Professor Carmody to say something on the question of our Meat, Milk and Butter supply. It is a subject that has little attraction for an audience, but has practical solid interest to the general householder and the public in particular. In touching upon the question of our meat supply, comment may not be accepted with favour, as the supply is practically a monopoly, and the purveyors raise or lower the price of meat in what may be called a combine, as there is no trade competition existing. If the supply of animals from Venezuela is uninterrupted then the price of beef is brought down to a certain level; if the trade is erratic then the price to the consumer follows in a like manner. The fact is obvious, that depending as we do entirely upon Venezuela for our beef, we are at their mercy both as regards supply, quality and retail price. We get absolutely what they like to send us; they never make any attempt to improve their stock, and the consequence is that we get the worst class of meat that can possibly be supplied, only fit, if I may say so, for converting into tabloids for Tommy Atkins when on his next campaign, and if he had not much chewing to do he would know that he has been saved a great deal of trouble which falls to our lot. In times of scarcity no neighbouring island could provision us to any extent so that we are left to the tender mercies of a neighbouring State to supply us at their own sweet will. This is an important and desirable factor in our means of living, and should prove a strong incentive to induce us to help ourselves and place the colony in a less dependent position.

Live stock generally in most countries is considered an important asset in their wealth, but here with us it finds no place, and is a lost quantity. The object of this paper is humbly to endeavour to show that the business of stock raising in Trinidad and Tobago should, if conducted on practical lines, prove a lucrative industry quite sufficient to encounter competition from abroad. This later on. The price and quantity of meat affects our labouring population to a great extent. The well-to-do man can obtain his cold storage joint or a fine cut from what is going, but it is different for the poor man. Good food and plenty should be brought within his power of purchasing. It is a principle laid down that the cheaper a people can be fed, cheaper labour follows—whether this applies here is of course another story, but the first is that a well fed labourer is better for work than an ill fed one. Taking the average wages of ordinary labourers to be 40 cents a day, and beef selling at 15 cents, if a pound is bought for himself and family there is not a large margin left for other necessities and it is a fact that meat is selling at this price which has to be paid, or gone without. I believe that if our people had the opportunity of buying fresh meat within their means they would be all the better for it as the constant use of salt meats and starchy vegetables is not altogether invigorating. A new source of meat supply has come as cold storage and is a welcome change to many as the quality is excellent, and thanks are due to the enterprise of those engaged in the business for having placed an enjoyable class of beef before the public, but this class of meat would not fulfil the wants of our poor population. There is not a great demand for joints as generally understood, the prevailing custom being to go in for steaks, under many names, but unfortunately never a satisfactory grilled one. In this way as much bone is worked off as possible and it is often wonderful how the amount of bone can be contained in a given quantity of meat. In advocating that we should help ourselves in the production of meat, the prime factor is whether it is worth doing, or would it pay, for there are several obvious points to consider. (1st.) The amount of capital required to be invested in stock, buildings, fencing and general upkeep until a return was made. (2nd.) The market for disposal of produce, and another consideration is the competition to be encountered, also whether we can raise animals cheap enough to face this. These are the

chief points; minor ones are difficulty of stocking a place on a large scale and many other difficulties incident to such an occupation. To start with, it may be asserted that at least £30,000 is spent annually on fresh meat, the greater part of which sum goes out of the colony. Another £12,000 departs for sheep, pigs, goats, &c. This approximately is the money value of the industry. The capital needed for, say, a 1,000 acre estate would not be less than £8,000, or £8 per acre, £5,000 would be required for breeding animals, say 500, the fencing and a balance in hand for general expenses to be met with on first establishment. The return from this in 3-4 years would be roughly 300 animals for the market at $30 each or about £2,000, so that in 4-5 years the outlay should practically be recovered. Of course there would be in the meantime the upkeep until the animals were ready for the market, but bye products might be available to meet this. I cannot do better than include here the result of experiments made in the interest of producing our own meat. Though not on a large scale, they afford sufficient evidence that there are possibilities in stock rearing in the colony, and I venture to think that our local purveyors would gladly accept and encourage the production of our own cattle for their purposes. The first experiment recorded, was as follows: "During the last year an experiment in breeding for beef was brought to a satisfactory conclusion, although only carried out in a small way. The subject of the experiment was a cross between a red poll sire and an ordinary creole cow. This steer when turned out to grass at fourteen months old weighed 465lbs. He was kept under conditions, such as might be expected would be given in the general way in the colony to test the value of grass feeding. The season proved exceedingly severe and grass was scarce. At two years old he had gained only 83lbs. As grass became more plentiful a rapid increase of growth ensued and at the end of his third year he scaled 773lbs., showing a gain of 222lbs. for the latter period. This rate of gain would probably have continued so that at four years old he would, in all likelihood, have scaled 1,100lbs., the weight of a prime beast in Trinidad. The cost of rearing this animal amounted to $4 80 including milk and feed. The gain in weight during the last year cost two shillings—one shilling land tax and one for upkeep of fences and land, calculated on the average cost of the herd of oxen running together." The dead weight of the

steer was 384lbs. He was in a perfectly healthy condition, every organ sound, and, to use a butcher's term, cleaned well. The meat was tender, sweet, and altogether superior to what is generally obtainable and realized in the open market, sold under the same conditions as any other beef, $32 28, which after paying for slaughtering, market dues and commission, left a profit of $27 48 or $9 16 per annum. With a large herd, sufficient working capital and sound management, such returns indicate the possibility of a lucrative industry. The second experiment was taken up during the recent famine in cattle, and following on the suggestion that Jamaica should cater for our market we should have heartily welcomed friends from there supplying us, but there were apparently too many obstacles in starting, and not sufficient security that if once started the demand would be maintained or go back to our old source. However, Jamaicans must be credited with doing their best to produce the best article, and it would certainly have been to our advantage if a trade could have been established with them. Coming back to the experiment, the following was stated: "But why not set to work to produce our own meat?" When this observation is made it is always met by the statement that we could not do so: our grasses were not sufficiently nutritious, that it would never pay in competition with imported cattle, etc. Now, this may confidently be set aside, and every effort should be made to place ourselves in a more independent position with regard to our meat supply of all classes. To bear out the assertion made, a lot of young steers (20) were sold this week to Messrs. E. Grell & Co. The live weight of the lot was 11,410 lbs. at 6 cents per lb., equal to $684 60; average price per head, $34 23, average weight of each, 570 lbs., average age, 2 years, ages ranged from 1 year 8 months to 2 years 9 months. The animals were in very good condition, and had they been kept on for a couple of years longer showed promise of scaling well over 1,000 lbs. As it was, considering that the animals sold were growing, their condition and weight may be considered most satisfactory, and, financially, equally so. Now these particular steers with a number of others were brought up entirely on abandoned cane lands. They had only the usual grasses and scrub which follows abandonment for their daily fare, and it may be remarked that they considerably helped to clear the

ground to form pastures, so practically the cost of production was nil as far as food was concerned. What might be a useful help to increase the number of animals would be the establishment of public pastures in each district where practicable and convenient. In addition these pastures might form recreation grounds. The fee for right of grazing would provide sufficient funds to pay for upkeep' but should be as low as possible and include the free service of bulls provided by Government. This plan has been successfully adopted at St. Augustin estate, and since the opening of the savannah upwards of 100 cows are daily pastured thereon, and, as suggested, it includes a pleasant recreation ground. Then it might be possible for our cocoa planters to accommodate more stock. There is generally a lot of rough feed in the way of bananas and other vegetables, which have very little money value, and would certainly be worth as much if fed to animals, and the residual manure would always be acceptable on the estate. Our peasantry outside the East Indian do not seem to have much interest in the care or rearing of cattle. It is regrettable, for every ten-acre lot might well include a cow. This would be to the advantage of the owner and certainly to the colony at large. If this was so, we should not feel the pinch of scarcity and could view with equanimity any disturbance in what has hitherto been our source of meat supply.

BREEDING FOR BEEF.

This question is frequently asked, for if we are to produce beef it is of course desirable that the best basis should be found to stand upon. This will be met, I think, in starting with half or three-part bred zebu females that have good size. The zebu is healthy, free from attacks of parasites, thrive well and quickly on very little; I do not mean that these give the best class of meat, for the character of the zebu is to develop muscle under all conditions. But the cross derived from the zebu foundation with a sire of such breeds as the Shorthorn, Hereford, Red Poll or similar classes, would give the desired result. The photograph here shows what might be taken as the typical result of such crossing. The cow shown contains three-part zebu and one-part shorthorn: she weighs over 1,100 lbs., and gave 5,550 lbs. of milk last year, and kept in the pink of condition. If such

a type is bred it is not too much to assert that profitable results will ensue. Horned cattle brought from temperate climes are extremely susceptible to the effects of a climate such as that of Trinidad. It is advisable that they be introduced as young as possible, and though time may be lost to the purchaser much less risk is run, but it is only by considerable care that they become acclimatised; when they do, very little further trouble is given, except grooming and clipping; artificial feeding should be given with caution. Stud bulls might be fed with a mixture of crushed oats, dried grains and coconut cake about 5lbs. daily. The cost of bringing animals here from England no doubt affects their more frequent introduction. The Royal Mail do not touch live stock. The Direct London Line charges £20 passage for an adult animal, probably as much as a decent bull would first cost. The freight on a similar animal from Halifax, N.S., is $20, a ram $1 75, pig the same. The difference is so striking that no wonder breeders will look to Canada in future for their stock animals, and as regards class there is very little to choose between the English and Canadian bred, at least for all useful purposes here.

With regard to our meat supply as contributed to by sheep, goats, pigs, &c., there was imported last year 25,000 head, and taking their all-round value at ten shillings each, means that another £12,000 departs. Perhaps their is not much against this, as the smaller neighbouring islands benefitted, whose incomes are not on so broad a scale as ours, but the figures show that there is ample scope for helping ourselves, and peasant proprietors should be especially interested in them. Mutton does not enter largely into our dietary, due absolutely to the price charged for it, from one shilling to one shilling and sixpence per pound, and it does not matter whether the meat is imported American or from Tobago, the carcass weighing in the first case 130 pounds, the other 20 pounds; the charge is the same. Sheep-breeding is not popular, it is thought that the climate is adverse to successful rearing, but I do not think that sufficient trial has been given to accurately pronounce this. Some very nice sheep have been reared in certain localities, quite good enough for the market and to be continued in with profit. With regard to goats, from the considerable numbers imported they must enter the bill of fare to a considerable extent, helped out by the

demand there is for them amongst the East Indians. Pigs: We do not consider the pig and his ways, but the fact is that there is nothing lost about him except his squeal, from the bristles on his back to his trotters he is valuable and you have to go back on certain parts of his anatomy to extract that active principle known as pepsin, which is a preparation containing properties that enable one suffering from that distressing malady, indigestion, to partake of crab backs and rum punch at will in the morning. I do not say that the pork usually supplied in the market is the best of its kind; far from it, but there is no reason why it should be so. A well fed cleanly kept pig would give just as good meat here as in any other part of the world, and cost less to produce. I have often considered why our peasantry and contractors do not invest more in pigs. Supposing they were living in remote districts with bad roads. The provisions they grow would pay them much better to convert into pork than drag them wearily to market with so little return for the trouble. Their donkey could as well crook 200 lbs. of pig as the same weight of provisions and with much better financial results. An experiment has been made in bacon-curing, but no great success was achieved consequent on insufficient accommodation for the process. The result, however, was good enough to justify further trial. If the meat is suitable a very sweet class of pickled or corned pork can be made for quick consumption and should find a place in our meat supply. Poultry enters so largely in our meat supply that it may be considered equal in quantity to the consumption of beef; so important was it at one time that our Medical Institutions' bill for poultry was nearly £1,000 per annum The price of common fowls is on a par with other animal food, and altogether beyond their nutritive value for food. As is the case with all other food products, we depend entirely upon outside for supplies of poultry. What we can procure at home is vastly superior to any imported. An excellent class of fowl is raised in the districts of Claxton Bay, Princes Town, &c., and the prices recently realized at auction for them from these places indicate that their value is appreciated. It is hoped later to distribute eggs from improved poultry to the school-masters in the different districts to be given to the scholars to encourage them to take an interest in the production of poultry, because the country people ought to raise a much greater number of poultry than they do,

If they find that an interest is taken in any endeavour they may make. it will be the means of encouraging them to continue. In concluding this part of the paper, I would like to draw attention to the quantity of small live-stock, etc., which entered Port-of-Spain on one day. Goats 120, pigs 64, sheep 15, fowls 20–30 dozen, eggs 120 dozen and turkeys 10, This is all very well for the adjacent islands and such imports are very acceptable to us, but it proves how insufficiently we are supplied from our own resources and what a serious position we should be in if such supplies were shut out from us by war or pestilence. It is a serious matter indeed, for the stoppage of such supplies would be keenly felt by our large population whose occupations make them dependent upon what is brought in and which is not or cannot be produced locally.

MILK AND BUTTER.

Our milk supply, taken from Professor Carmody's wide knowledge of the question, is that it commences with the cow and ends with the pump, but on this point it is not wise to discuss such a detail. Coming to facts, condensed milk to the value of over £20,000 was bought by Trinidad last year and it seems that the imports are steadily on the increase. Milk in this form may thus be taken as our supply, and given a good quality there is nothing to be said against it for ordinary purposes. But milk as thus supplied cannot be said to contain all the constituents of the pure fresh article and cannot replace it in the treatment of many forms of tropical sickness. At Chaguanas some years ago, dysentery was always present in a severe form and difficult of treatment, but when cows were obtained and fresh milk issued it acted like a charm; so from such facts fresh milk is an absolute necessity here. Of course we all know how fresh milk is generally supplied. As a trade, if it may be so called, it is entirely in the hands of the East Indians and from their petty way of trading, their patient way of travelling miles to obtain so little, certainly influences the market for fresh milk to a considerable extent and this would have to be taken into consideration if a dairy business were to be established. Dairying on a large, up-to-date scale has frequently been advocated by Professor Carmody, and there is no hesitation in saying that with skilled management it would prove a boon to the public and a safe investment for capital.

Condensed milk costs 2d. per quart, so approximately for the £20,000 spent we get 2,500,000 quarts of milk annually, therefore a fair demand for it is evident. Fresh milk sells for 5c. per imperial quart and there is a sale for all that can be procured at this price. If a dairy could only supply one-tenth part of the condensed milk consumed there would be money in the business, giving a return of, say, £5,000 with 25 per cent. profit. I assert this from the fact that at St. Clair milk was produced for the hospitals at an expenditure of two pence per quart.

Butter making on a commercial scale is a new future for Trinidad. Last month 2½ cwt. was made at the Farm and found ready sale at 2s. per lb., and the demand for it was so keen that three times the quantity could have been sold if it were possible to make it; but as the quantity made depends upon the demand for milk the output is limited. Without fear of the statement, the butter produced is equal in all essentials to that imported from any part and superior in one particular point, *i.e.*, it will remain solid and can be cut and spread without the aid of ice. No butter imported will do this. The details of the process of manufacture are tedious to listen to, so, for the sake of brevity, the statement is curtailed, but full information of the work can always be obtained at the Farm. Briefly, the milk is first passed through a separator in the afternoon to obtain the cream, to this is added a given quantity of flavouring known as a "natural starter." This is prepared from separated milk. The addition of this flavouring to the cream hastens the development of lastic acid and influences the yield, flavour and keeping qualities of the butter. Churning is done as early as possible next morning. The churn used is known as a "Champion" generally used in the English dairy schools. The time taken in churning varies from 10 to 30 minutes, but depends considerably upon the weather. After churning, the butter is thoroughly washed and placed on a butter worker, where it is left for a while. Afterwards it is wrapped in butter paper and packed in cardboard boxes. During the whole process, the butter is not touched by the maker's hands. The quantity of butter obtained from the milk is equal to the English standard, viz., 10 per cent. or say 4 quarts of cream will yield from 4–5 lbs. of butter. Professor Carmody has thoroughly analyzed the whole process, from the milk to

the butter made, and the result is considered satisfactory and does not leave much room for improvement on the quality of material to work upon. The endeavour has been to produce a clean, pure, wholesome article and from the kind expressions of approval received this has been achieved. Financial results are the most interesting and conclusive test as to the value of the business and the following statement is given to show the position.

Made 130 lbs. butter—sold at 48c. per lb. ..		$ 72 40
5 cows milked	1,200 qts.	
Milker	$7.00	
Feed	7.50	
Woman and Boy	6.00	
Packing, delivery	1.60 ...	$ 22.10
		$ 50.30
Less 20 per cent. for supervision taxes, etc. ...		$ 10.00
Return, say		$ 40.00

Each cow's return was $8 per month. On a sufficiently large scale there is apparently money in making butter where there is no possibility of retailing the milk. Of course if the milk had been sold the return would be practically doubled. In butter-making there is always the value of separated and butter milk and calves to be included in the returns. In conclusion I have humbly tried to show as far as is possible within the limits of a paper like this the position we are in with regard to our meat, milk and butter supply, to call attention to the prospects and possibilities of supplying ourselves and the results of doing so. The amount of money *involved in supplying* the above necessaries approaches £130,000 annually. If their production were undertaken locally, employment would be found for many, and the great sum mentioned would be dispersed here and add to the wealth of the colony. We should be in an independent position as regards these particular food supplies and gain in having a superior quality to what is now obtainable, and cheaper.

Venezuelan Trade with Trinidad.

By R. H. McCARTHY, Collector of Customs.

GEORGE CANNING once in the House of Commons referred to Trinidad as the future Liverpool of the New World. In the despatches of Governors during the last hundred years—ever since Britain conquered the Island from Spain—and in books of travel the same idea constantly occurs. Its origin is obvious. Trinidad is at the mouth of the great river, Orinoco, which with its numerous tributaries, several of these great rivers in themselves, taps a very large part of South America, from the Brazilian frontier to near the Caribbean sea, and from the Atlantic to within a few hundred miles of the Pacific. Within that area there are many different elevations, and practically different climates, so that the range of products is extremely wide, from cotton, rice, and sugar cane in the lowlands, to cacao, coffee, and some of the grains of the temperate zone as the elevation increases. Many of the vegetable products are valuable, such as rubber, tonca beans, and several varieties of medicinal plants. Cattle breeding is a large business, but it might be greatly extended, excellent pasturage covering many millions of acres, where food is plentiful throughout the year. Gold has been found in large quantities in the Yuruari region, and beyond reasonable doubt vast supplies remain, though the annual output now is limited to from 5,000 to 10,000 ounces. On the Grand Boca, at Imataca, there is an almost limitless supply of iron of high quality, copper and amethysts have been found; but as much of the territory is unknown, and all of it is frequently disturbed by revolutions, information respecting its resources is scanty, and development has been slow. Sufficient, however, is known to show that these resources, and the possibilities of Orinoco trade, are enormous especially as the basin is in the main very healthy and suitable for immigration. In a word, it is difficult to speak of these possibilities without using language which would appear exaggerated.

Before entering into details of Orinoco trade, a few words may be said of other branches of the business done by Trinidad with Venezuela. The connection of the two has long been intimate, and to-day a large and influential section of the population of Trinidad is Spanish. For the whole of the East coast of Venezuela including a fine agricultural district, and the important towns of Maturin and Guiria, Trinidad is inevitably the market where European and American goods are bought, and cacao, coffee, cattle, maize and vegetables are sold. Many private families in Caracas make their purchases in Trinidad, where, too, travellers must stop on a journey between the capital and Bolivar, the chief town on the Orinoco. Venezuelan warships probably spend more time in Port-of-Spain than in any port of the Republic, and Trinidad shares with Curacao the favour of those Venezuelans driven from their country by political troubles. Very many companies engaged in Venezuela in trading, mining, or other industries have their head quarters in Trinidad. Therefore, owing to its position, and to the facilities it offers as regards steam and cable communication with the rest of the world, that island is, to apply a military term to trade, of great strategical importance with reference to Venezuela Especially is this the case respecting the Orinoco, since that river is, practically speaking, closed to ocean going vessels by its lack of depth, and the low-draught steamers which ply on it find a suitable place for transhipment at Port-of-Spain, which port is close to the mouth, and divided from it only by what is virtually an inland lake.

Political disturbance having been continuous for some years it is not easy to describe Orinoco trade in its normal state. It may be said, however, that two stern-wheel steamers ply as regularly as circumstances permit between Port-of-Spain and Ciudad Bolivar, which is 300 miles up the river, and the chief centre of trade in the region Five or six others go higher up, distributing and collecting on the main stream and some of the principal tributaries, in some cases to a distance of 1,000 miles above Bolivar. Still higher up, beyond the Maipure and Ature Rapids, a small steamer connects this fleet with San Carlos, on the frontier of Brazil, where the Orinoco joins the Rio Negro, and by it the Amazon. Roughly speaking, these steamers work above Bolivar only in the wet season, and while the river is low goods are allowed to accumulate at various up-river stations.

Throughout the year, however, trade is carried on by innumerable smaller craft, propelled by sails or paddles, some of which occupy months on the journey downward to Bolivar.

Following is an approximate account of the goods shipped from Bolivar to Trinidad in the year 1901. That year is selected, because though during it trade was disturbed, it was a fairly representative year, while for a great part of 1902 the river was blockaded. This account shows only the chief exports, and it represents but the labour of a very small population and the trade of a town of 10,000 inhabitants :—

Gold	oz.	6,000
Rubber	Kilos	163,000
Balata Gum	,,	1,186,000
Hides and skins (cattle, calf, deer & goat)	No.	160,000
Balsam (copaiba)	Kilos	16,300
Tonca beans	,,	*97,000
Coffee	,,	128,000
Cacao	,,	38,000
Plumes and feathers	,,	2,200
Tobacco	,,	77,000
Horns	,,	9,600
Live stock	No.	10,000

* Average of 1901 and 1902. The crop is not an annual one.

One of the most striking features of the Orinoco is the vast area which it renders accessible by water, its navigable tributaries being very numerous. Its connection with the Amazon has already been mentioned, and it may be added that a considerable proportion of the rubber, amounting to from 25,000 to 30,000 tons per year, which is now exported by the Amazon, and is therefore known in trade as Para rubber, is collected in the Orinoco basin, and would but for artificial obstacles be exported by that river. The tributary Portugueza and its branches are the natural outlet for a great part of the 30,000 tons of coffee now annually shipped at Maracaibo. The Meta is navigable to within 100 miles of the "Hermit City" of Bogotá, the rich capital of Colombia, perched with its 120,000 inhabitants 9,000 feet above the sea, and closed in on every side by mountains. At present the trade of Bogotá is monopolised by the port of Savanilla and the River Magdalena, water, rail, and mule carriage being all employed, and numerous transfers necessary. Further, the Magdalena is very rapid and landslips often interrupt navigation for prolonged periods; while the royal road constituting the old route from Honda by Facatativa is

also often interrupted by landslips. For these reasons alternative routes have long been sought. One is now used between Honda and Bogotá by Jirardot, the difficulties of which may be guessed by a bare enumeration of the successive means of transport employed from the seaboard:—rail, river-steamer; another river-steamer; rail; mule; rail. The Meta-Orinoco route naturally suggested itself, and it has been used to a limited extent, goods going by steamer from Trinidad to Oroené or Barrigon, and thence by mule; but they had to pass through Venezuelan waters, and that Republic, first by taxation and other restrictions, and finally by total prohibition, killed the trafic. For the development of that route a railway would be necessary, but it is an open question whether it should go all the way to Bogotá or stop at the foot of the *cordillera*, which is there 11,000 feet high. An English engineer who has actually surveyed the route, tells the writer that a railway over the mountain would be frightfully expensive. In passing it may be mentioned that Colombia is so eager for fresh outlets, eagerness explained by the fact that probably more than half of her territory is now completely shut in from the sea, that she is examining the possibility of utilizing the Amazon.

The causes of the slow development of the vast and varied resources of the Orinoco are apparent. Want of settled Government prevents immigration and discourages the investment of capital. Large profits are now made, but at the expense of constant anxiety and considerable risk. It may be hoped, however, that this state of things will not last. Then, with peace and security capital and population will flow into those fertile regions, and the Orinoco become what the Amazon now is, one of the great highways of the world's commerce—with this difference, that this highway will never be traversed by ocean-steamers. Transhipment will always be necessary, and so far as one can judge it will always be performed at Trinidad.

The Industrial Resources of Trinidad.

By Professor P. CARMODY, F.I.C., F.C.S.

IN 1895, after a residence of five years in the Colony, I recorded a few impressions on the above subject in a paper read at a meeting of the Institute; and at the end of a further period of eight years a comparison of the former and present positions of our main industries cannot fail to be instructive and useful. This comparison can be more conveniently made by retaining the previous subdivision of the subject under the heads of:—

Agriculture.
Mining.
Manufactures.
Other Industries.

AGRICULTURE.

The values of our principal agricultural exports then and now are:—

	1894.	1902–3.
Sugar and sugar products ...	£650,000	£427,000
Cacao	500,000	907,000
Cocoanuts	35,000	17,000
Coffee	1,000	500

The change that has taken place in the relative positions of Sugar and Cacao during this short but anxious period of eight years is most striking. In 1895 the market price of sugar had fallen to £8 10 and the sugar industry was in danger of extinction. Prices were then believed to have reached low water mark; but in 1902 they fell below £6. The causes are well known, and now that it is clearly seen that the effect of the bounties leads towards the gradual extinction of this industry, steps have been taken to equalize as far as possible the competition between cane and beet sugars in the British markets. On the other hand, although the price of Cacao has fluctuated considerably, the markets have not been controlled by any system of national interference with the natural course of trade, and the consequence has been that the extraordinary productiveness of our soil has placed cacao in the prominent position as regards value which sugar formerly occupied.

Sugar.—No better illustration of the injurious effect of Bounties could be given than the following figures taken from the report of the Collector of Customs showing the values of sugar (alone) exported during the past 25 years:—

1876—1880	...	Annual average values	... £800,000
1881—1885	...	,, ,,	750,000
1886—1890	...	,, ,,	700,000
1891—1895	...	,, ,,	650,000
1896—1900	...	,, ,,	620,000
1902-3	...	... ...	... 410,000

It is not difficult to see what might have been the position of the sugar industry in this Colony in the critical year just ended if the timely and rapid development of cane-farming had not come to its aid. In 1895, cane-farming was of so little importance that it was merely referred to in my paper; now it has assumed proportions that will be best appreciated from a study of the following figures:—

Year.	*Estate Canes.*	*Farmers' Canes.*
1899 ...	426,000 tons. ...	106,000 tons.
1900 ...	364,000 ,, ...	106,000 ,,
1901 ...	434,000 ,, ...	170,000 ,,
1902 ...	338,000 ,, ...	185,000 ,,

It will be seen that one-third of the total crop of 1902 was grown by cane-farmers, and this proportion is not likely to diminish in future years. Under conditions more favourable than the present, it might even be considerably augmented. In my former paper I pointed out the advantages that follow from the Central Factory system of specialising both the cultivation and the manufacture. Cane-farming has contributed to this result in a manner and to an extent not then anticipated. But Cane-farming, as at present practised, cannot receive unqualified approval. That it has materially assisted the sugar industry of this Colony in a crisis of unusual severity will readily be admitted; but it cannot become a permanent part of the sugar industry unless it is worked on sounder agricultural principles. The introduction of the present system of agricultural education into the primary schools may effect this.

This educational system was first proposed by me in 1890, as a member of a Committee on Agricultural Education, and though it was immediately approved by that Committee it was not adopted by the Government until ten years later. Favoured by the hearty co-operation of the Teachers, its success in this Colony is certain. It cannot fail to make education more interesting both to teachers

and students, or to convey to the children of the working classes a fair knowledge of the principles of agriculture which they in turn cannot avoid putting into practice in after life. It cannot fail to lead to a higher system of agricultural education, for the employer of labour must at least know as much of the principles of agriculture as his employees. And since Agricultural Science has become one of the subjects in the Cambridge Local Examinations the teaching of a higher course of agriculture in the Colleges need no longer be delayed. When this is accomplished, we may hope to see cane-farming established on a better and wider basis.

I regret that I am unable to record any advance in mechanical tillage in connection with cane cultivation. The inadequacy of the present tillage operations is manifest.

Cacao.—Fortunately for this Colony, the cacao industry presents a remarkable contrast to sugar. The value of the exports has risen enormously in eight years:—

1894	...	...	...	...	£500,000
1902-3	...	...	...	...	907,000

The market position of Trinidad cacao continues highly satisfactory, and planters are endeavouring not only to retain that position, but to improve it. The use of artificial drying is extending slowly but steadily, and, when its superiority to sun-drying both as regards quality and cost is clearly proved, further progress may be expected.

Not much progress has been made in the study of the fermentation of cacao. Good results are now produced by purely empirical methods; but the principles underlying these methods are not known. They should form the subject of an early investigation.

Cacao Planters should not forget that they will have to face increasing competition in the near future. Foreign Governments have recently sent official reporters to this Colony to study the growth and preparation of Cacao, and as a probable result the area of cultivation will increase, and the competition for quality and prices will be more keenly felt in the world's markets.

The manuring of cacao trees has received some attention. Lime in various forms has been tried with beneficial results. But beyond this very little has been done with artificial manures. No recorded experiments have been made to

ascertain the advantages of replacing the 300 tons of phosphates annually removed by the bean. A unique contribution to our knowledge of the utility of the shade tree, almost universally used on Trinidad cacao estates, has resulted from an analysis of the flowers which were found to return to the soil as much Nitrogen as is removed by the bean. This may prove of some value. It already supplies a good reason for retaining the immortelle tree in preference to other shade trees that have been suggested.

Coconuts.—The number of these exported has varied very little from 10 millions, but owing to a serious decline in prices the value has diminished from

£35,000 in 1895 to
17,000 in 1902–3.

New uses have been found for this already useful nut, but as yet growers have not benefited by these discoveries. Better results may soon be expected. Coconut butter, which has been a chemical curiosity for some time, has now become an article of commerce, and if it succeeds in obtaining that popularity it is said to deserve the future of the industry is bright. A large quantity of the oil is expressed locally, and a new factory has been started. The meal left after the oil is expressed is used as a cattle food.

Over 1¼ million pounds of Copra of a value of £7,000 are now exported and chiefly to the United Kingdom.

Coconut oil is now exported to the extent of 25,000 gallons.

Coffee.—At one time this appeared to be a promising minor industry. Owing to the fall in price, no efforts are now made to extend it.

Rice.—In 1895 very little rice was grown locally. Within the last few years the cultivation has extended rapidly. The growth is so profitable to cultivators, and so well suited to our soil and climate, that within a few years the Colony will probably produce the greater part of the rice it consumes. A factory for cleaning it has been established, and has to a great extent replaced the primitive methods previously employed.

Mr. Greig deals fully with the subject of Rice in his excellent paper.

Rubber.—Serious attempts at rubber cultivation have been made here and in Tobago. Strong hopes of establishing a profitable industry are entertained by those who have begun the cultivation; but some years must yet elapse before any definite opinion can be formed.

Tobacco.—This is grown to a limited extent and only for home consumption. The subject is fully dealt with in the paper by Mr. Phillips. Very good cigar leaf can be grown, and the soil in some districts is specially suited to this highly priced product. The efforts made by the Government to encourage this cultivation have produced no satisfactory results.

Maize.—Large quantities are grown locally, the soil and climate being well suited to its production.

Vegetables.—About £17,000 are annually spent in the purchase of vegetables which might easily be grown in the Colonv.

Pine Apples.—It is a matter of surprise and regret that pine apples are not grown on a large scale. So suitable is the soil that in some places pine apples grow wild, and yet nothing has been done to extend the cultivation I publish the following estimate given me by a planter of experience, and I hope that it will receive the attention of our capitalists:—

ESTIMATE TO CULTIVATE 25 ACRES OF LANDS IN PINE APPLES AND VALUE OF PRODUCE.

To clear and prepare lands at $15	$375 00	
To 5,000 plants to the acre, 12,500 at 25 cents per 100	312 50	
To planting same at $5 per acre	125 00	
2 weedings at $12 each per acre	600 00	
6 men for reaping 12 days at 40 cents ...	28 80	
2 men for carting same at 40 cents	9 60	
50,000 feet W. P. Boards at $30 for crates ...	1,500 00	
Sawing same into laths at $5 per 1,000 ...	250 00	
Making 3,500 crates at 6 cents	210 00	
200lbs. nails for same at $3 50 per 100 ...	7 00	
Carting crates to bay, 2 carts 12 days at 40 cents	9 60	
Freight to Port at 3 cents each	105 00	
Building for management and storage ...	1,000 00	
Barrack for Labourers	200 00	
2 mules and carts	350 00	
Management	600 00	
Miscellaneous expenditure	240 00	
TOTAL EXPENDITURE ...	5,922 50	
125,000 fruits at 9 cents each		$11,250 00
NET PROFIT	5,327 50	
	$11,250 00	$11,250 00

Fruit.—Immense quantities of fruit are allowed to rot annually. An export trade is badly needed to stimulate efforts in this direction; and it is to be hoped that Mr. Symington's scheme just started will effect this.

MINING.

Asphalt continues to be our most valuable mineral. The value of the exports has increased from

£112,000 in 1895 to
168,000 in 1902–3.

The industry has suffered to some extent from long and costly litigation, but a special Commission of enquiry has recently made recommendations which it is hoped will prevent such litigation in future.

Glance Pitch in 1895 appeared to have a promising future. The mine is now no longer worked.

Vistabella Coal—Under this name a variety of Pitch similar to manjac in chemical composition, but presenting slight differences in its physical properties has been known locally for many years. It is a brittle and nearly pure Bitumen, found almost on the surface of the ground, and in seams like Coal. It is now regularly exported.

Mineral Oil.—For many years the oil deposits of the Colony have attracted attention, but until recently explorations have been confined to the surface. Now, three or four borings of considerable depth have been made, and the project attempted on a commercial basis. Oil of first rate quality has been found, and as might have been expected, containing a much larger proportion of Naphtha than the oils found exposed on the surface. For analysis *see* supplement to Mr. Rust's paper on "Trinidad Petroleum."

Coal—For many years Coal has been known to occur rather widely distributed in Trinidad. In the Geological survey made by Wall and Sawkins in 1856, a good deal of attention was given to coal, and the results of the analysis of many samples will be found in their Report. No samples of Coal of first rate quality have yet been found, and no seams of any extent. So far as my experience goes, our coal deposits are principally of two classes: one lignitic, the other bitumenous. The calorific value of the first class is low, of the second class high. The results of analysis of the coals found in new deposits during recent years are given at the end of Mr. Guppy's paper on Coal and Gold.

MANUFACTURES.

The progress of new manufactures in the Colony is slow. This is mainly due to the exclusion of applied science, or any form of technical instruction, from the educational system of the Colony. The older manufactures are confined to the production of sugar, rum, and Angostura Bitters. The curing of cacao can hardly be claimed to be a manufacturing process, although if better understood it might be a most important one. Among recent manufactures are Soap, Matches, Beer, Ice, Biscuits, Cigars and Cigarettes; but the consumption of these is almost exclusively local, and therefore limited.

Sugar, Molasses and Rum.—So far as the manufacture of sugar is concerned, I am convinced that the future efforts of the manufacturer should be towards the production of sugar of the highest grades of quality. So long as refining sugars are produced, the price of cane sugar will always be regulated by the price of beet sugar. But a good cane sugar, such as can now be produced in every factory in this Colony, needs no refining. Our best sugars polarising 98 are already highly refined, and those polarising 95 contain none of the objectionable impurities always found in beet sugars of the same standard.

A great deal of molasses is produced as a bye-product of the manufacture of sugar, and although some is used as cattle food, and some is converted into rum, there is usually a surplus which is sometimes unsaleable at a profit. It was at one time exported largely, but the exports have fallen off very considerably since the Martiniquan distilleries ceased purchasing, and they are now less than 500,000 gallons annually, and £12,000 in value. The high cost of packages and freight is the chief barrier to profitable exportation. The local consumption of molasses as a cattle food is not large, and the world's consumption of rum has considerably diminished. A suitable outlet for the surplus stock of molasses is very much required. The introduction of a successful alcohol motor would be a boon to the owners of molasses

The consumption of rum in the Colony is limited to 300,000 gallons or thereabouts. One gallon per head of the population appears to be the normal consumption. This is sold in the Colony at a price which is fairly remunerative.

to the distiller. At present prices, rum from molasses should be able to compete successfully with potato spirit, but here again the cost of freight and package handicaps the local distiller.

Bitters.—The well known Angostura Bitters are made here, and besides the local consumption, which is large, are exported to the value of about £38,000 annually.

Beer.—Since 1895 a praiseworthy effort has been made to produce locally a Beer that would compete with the article imported annually to the extent of 250,000 gallons on an average. A well equipped Brewery was started and placed in charge of an English Brewer. It received a fair share of support from the Government, and at one time appeared to be very successful.

Soap.— 3½ million pounds of soap continue to be imported every year, and although we possess a soap factory and an abundance of coconut oil and other fats we have made no reduction in the imports.

Matches.—This industry supplies a part of the local consumption, but matches are imported in considerable quantities although taxed with a comparatively high import duty.

Paper Pulp.—An experiment is now being made to establish an industry for converting bamboo fibre into paper pulp. This should be an important local manufacture.

Biscuits.—The industry has only recently been started, and already the decline in imports is very considerable.

Tobacco.—The position of tobacco remains practically the same as in 1895, with the exception of cigars and cigarettes the importation of which has increased considerably. The following are the figures:—

	1895.	1902-3
Unmanufactured tobacco	... 550,000 lbs.	... 590,000 lbs.
Manufactured tobacco	... 50,000 ,,	... 56,000 ,,
Cigars and Cigarettes	... 8,000 ,,	... 20,000 ,,

The West Indian Cigarette Company has added the manufacture of cigars on a large scale.

Tobacco continues to be grown locally, but the curing of it does not appear to be a conspicuously successful process.

Ice and ærated waters.—The ice used in the Colony is now produced locally. There are two factories which have recently amalgamated, and since these were established ice has

been retailed usually at one cent per lb. The addition of cold storage chambers was made a few years ago, and has proved a great boon in connection with the importation of meat and other perishable goods. So successful has this been that another and larger chamber has just been erected by the Trinidad Shipping and Trading Company, and regular supplies of fresh meat and other delicacies from America will in future be conveyed in the Company's Steamers.

Aerated waters are made, but I regret to say with a diminishing regard for purity and quality on the part of some makers.

OTHER INDUSTRIES.

Meat and Milk.—I have frequently called attention to the almost entire dependence of this Colony on Venezuela for its meat supply, and to the inferior quality of the Beef, During the recent revolution, this supply was very irregular. and beef was at times exceedingly scarce.

The establishment of a Government Farm at Tobago a few years ago is expected to remedy this unsatisfactory state of the local market.

The establishment of a Dairy by private enterprise is a marked feature of the progress that is being made in this direction. For the first time in the history of the Capital it is now possible to obtain a glass of genuine milk as cleanly served as in the best London dairy shops which have done so much good there in the cause of Temperance.

Condensed milk continues to be imported in increasing quantities, and its value in 1902–3 amounted to £23,000.

Mr. Meaden's excellent paper on our "Meat, Milk and Butter Supply" shows that the industry is a profitable one, and much credit is due to him for his persevering efforts in producing fresh butter of a high standard of quality. His remarks on the want of shipping facilities for importing good breeds of cattle probably accounts for the backward condition of that industry in the Colony.

Fibres.—Very little progress has to be recorded in connection with fibrous materials which grow here in such abundance only to ripen and rot. And were it not for the attempts that are now being made to prepare paper pulp from bamboos, there would be none to record. A previous unsuccessful attempt was made many years ago. It is not

improbable that other fibrous substances will receive attention if bamboo fibre can be profitably made by the new process.

Starch.—Small quantities are made by primitive methods for local consumption. This could easily be made into a large industry.

Boat-Building.—The remarkable increase in Boat-building is said to be due to some extent to temporary causes, such as the seizure of many trading sloops by the Venezuelan Government during the recent blockade, and to an order for a fleet of boats for the Margarita pearl fishery. But previous to this there was a noticeable increase. The La Basse is now crowded with boats in various stages of construction. With an improved reputation for good design and workmanship Trinidad might hope to become the boat-building centre for the West Indies. In the technical books in the Institute Library will be found useful instruction in boat-building.

Brick-Making.—This has been recently re-introduced with much promise of permanent success. The clays of the Colony are well suited for this purpose. There is a large and regular demand, and the present maker understands the processes connected with brick-making and rough pottery.

GENERAL REMARKS ON AGRICULTURE.

Notwithstanding the falling off in sugar, the period has been one of marked agricultural progress among the labouring class. Cane-farming has given them an opportunity of working on better terms with the estate owners, and of ascertaining the real disposition of the latter towards labour. The feeling that the estate owner was always antagonistic to the labourer has disappeared among the Cane-farmers, for have they not seen that the estate owner has paid them a fair price for their canes and has advanced them money, or given them the free use of the land? And 8,500 satisfied Cane-farmers in a small community must have a beneficial influence on the whole labouring body, the majority of which is favourably disposed to work honestly and well.

In addition to the stimulus given by cane-farming, other influences have assisted. The attention given to agricultural education, the extension of roads and railways, the special reduced railway rates for agricultural produce,

the Royal Commission of Enquiry and subsequent establishment of the Imperial Department of Agriculture, have contributed to make agriculture more attractive and remunerative. And of the encouragement and support given by the present Governor to everything connected with agriculture, it is not too much to say that this predominant influence has made itself felt in every direction and has laid a firm foundation for future prosperity and progress.

An important omission in the cycle of agricultural industry still exists, viz.: the feeding of cattle for the production of meat *and manure*. Pen manure has a particular value for soils deficient in organic matter such as ours.

Poultry and eggs are also of importance. The former are in sufficient quantity for home consumption; but the latter are not and in consequence large numbers of eggs are imported from America. The local demand is steady and should be supplied locally.

Rotation of Crops.—There is much to be done in connection with this subject; and the abandonment of cane lands might be avoided if the necessary experiments were made to establish a suitable rotation with readily saleable crops.

* * * *

In the foregoing part the subject has been considered from a purely agricultural point of view; in the following from its trade aspects.

The statistical figures are from the Reports of the Collector of Customs.

Values of Imports and Exports 1898 to 1902-3.

For the past two years the statistics have been made up to March 31 ; previously the statistical year ended on December 31.

Countries.	Imports.					Exports.				
	1898.	1899.	1900.	1901–2.	1902–3.	1898.	1899.	1900.	1901–2.	1902–3.
	£	£	£	£	£	£	£	£	£	£
United Kingdom ...	796,359	949,685	881,894	920,509	983,216	713,211	889,665	983,055	706,173	626,194
Canada ...	73,053	62,629	66,245	98,958	132,962	21,645	25,534	29,380	47,098	31,545
Other Brit. Colonies ...	151,467	167,051	103,099	114,731	153,645	31,318	31,990	49,590	33,421	72,308
Foreign Countries ...	1,262,177	1,356,600	1,449,020	1,517,402	1,402,264	1,543,959	1,625,702	1,522,524	1,658,959	1,742,134

	1898.	1899.	1900.	1901–2.	1902–3.
Total Imports and Exports	£ 4,603,000	£ 5,108,000	£ 5,084,000	£ 4,514,553	£ 5,144,268
Population (Census 1901)	...	...	251,000	251,000	260,000
Trade per head	£ 18	£ 20	£ 20	£ 18	£ 20

IMPORTED GOODS.

CEREALS, &c.

	1901-2.	1902-3.
Biscuits	20,000 ...	10,700 brls.
Flour	200,000 ...	207,000 ,,
Meal (not wheaten) ...	96,000 ...	90,000 ,,
Rice	19,000,000 ...	21,000,000 lbs.
Dholl	2,700,000 ...	2,500,000 ,,
Potatoes	£12,000 ...	£13,500
Peas	£12,000 ...	£12,000

Cereals and Cattle Food.—With the exception of Rice none of the articles included under this head are grown in the Colony. The cultivation of Rice is capable of considerable extension; and the imports are likely to diminish.

The United States supplies nearly the whole of the Biscuits, Flour, Meal and Peas consumed here. Biscuit making is a new industry which has already reduced imports.

CATTLE FOODS.

Oil Meal	4,300,000 ...	3,700,000 lbs.
Oats	183,000 ...	175,000 bush.
Maize	45,000 ...	42,000 ,,
Hay	£3,445 ...	£3,551

Oil Meal.—Large quantities of Coconut-meal are produced here and sold for Cattle feeding. In addition, large quantities of Cotton-seed meal are imported from the United States.

Oats and Hay. — Canada has during recent years increased by nearly 100% the quantity of Oats supplied. For these two articles there will always be a constant demand since oats cannot be grown. As grass can be obtained nearly all the year round, local hay has not been prepared as a reserve food.

FATS, OILS, &c.

Butter	567,000 ...	802,000 lbs.
Oleomargarine ...	226,000 ...	196,000 ,,
Lard	1,380,000 ...	1,611,000 ,,
Cheese	262,000 ...	281,000 ,,
Edible Oil	42,000 ...	49,000 gals.
Milk (condensed) ...	£20,000 ...	£23,000
Ghee	54,000 ...	31,000 lbs.

Butter.—As yet only small quantities of fresh Butter are made in Trinidad. It retails at 2/- per lb. It is not likely that the Colony can in the near future produce sufficient butter for its own requirements.

Table Butter comes chiefly from Denmark, Canada and France in tins; the keg butter trade is chiefly with France; and while the quality of that imported in tins is satisfactory, much of the butter imported in kegs is of very inferior quality.

Oleomargarine and Lard.—The United States practically monopolises the supplies of these articles.

Cheese.—This comes chiefly from the States; but Canada has increased its trade in Cheese by about 50%. The English Cheese trade remains almost stationary.

Milk.—The Colony produces rich milk which is sold fresh at a retail price of 48 cents per gallon. Notwithstanding this high price, the milk supply is much adulterated and is in an unsatisfactory condition generally. For this reason, and also to a large extent, owing to the inaccessibility of fresh milk to remote districts, condensed milk is imported in large and increasing quantities.

All the fresh milk required for the Hospitals and other Government Institutions is supplied by the Government Farm.

Oil.— The imports are chiefly from France.

Ghee.—This is melted Butter used by East Indians.

MEAT AND FISH.

Meat (preserved)	... 6,000,000	...	6,300,000 lbs.
Fish Do.	... 7,490,000	...	9,611,000 ,,
Oxen ...	... 6,800	...	4,700 No.
Sheep, Goats, Pigs	... 25,000	...	26,000 ,,

Preserved Meat.—Owing to the difficulty of keeping fresh meat in this climate there will always be a large demand for preserved meat. Locally very little meat is preserved.

Fish.—Fresh fish can be obtained in great abundance; but none is preserved, notwithstanding the excellence of the local supply. The imports of preserved fish are large; and Canada has improved its trade in fish by 20%.

Oxen and Sheep.—Trinidad has depended on Venezuela for its supply of oxen. The meat from this source is remarkably tough, and the supply so uncertain (owing to the not infrequent Revolutions occurring there), that efforts are being made to combine tenderness and certainty in the meat supply of this Colony. Tobago is an ideal grazing Colony, and as it is now a dependency of Trinidad, the Government

has established a stock farm there. In Trinidad grass is so abundant and nutritious that stall-fed cattle are unknown.

Sheep are seldom raised here, and most of our supply of mutton comes alive from the United States and Canada, and a small portion in refrigerators from the United States.

FUEL AND LIGHT.

Coal and Coke	...	28,000	...	30,000 tons.
Patent Fuel	...	16,000	...	11,000 ,,
Kerosine Oil	...	480,000	...	526,000 galls.

Coal.—Coal has been found here, but has never hitherto been worked. Found on the surface it was mostly lignitic in character, and of low Calorific value. Recently larger deposits have been found on Government lands, and it is not improbable that the output may very soon be sufficient for the Colony's ordinary requirements. The recent large increase in the imports of Coal is probably due to the increased facilities for handling it which an improved harbour supplies and to a greater demand by calling steamers. The increase is altogether in American coal.

Patent Fuel is convenient and likely to retain its present popularity.

Wood Charcoal is made locally wherever forest trees are felled, and used in very large quantities. It does not compete with Coal or Patent Fuel to any extent.

Kerosine imported wholly from America. The imports have increased, notwithstanding the general use of the Electric Light in Port-of-Spain.

BUILDING MATERIALS, &c.

Timber	...	11,000,000	...	10,600,000 ft.
Bricks	...	374,000	...	465,000 No.
Slates	...	142,000	...	125,000 ,,
Cement	...	42,000	...	48,000 brls.
Furniture	...	£ 13,000	...	£ 14,900
Hardware and Ironwork		£ 146,000	...	£ 176,000

In a Colony undergoing rapid development, Building Materials are sure to be in demand. The buildings are mostly of wood, or partly of wood and cement; and usually of the fragile kind which is only possible in a Colony not visited by hurricanes. Local contributions to the articles required are very limited. Building Stone is almost unknown, Cement and Bricks are largely imported, and timber-trees are in the depths of the virgin forests and not easily

accessible. Slates are only used in the more solid class of buildings; galvanized iron being considered suitable for ordinary roofing. Large imports of lumber, cement, bricks, slates and galvanised iron are therefore made yearly.

Furniture.—Local timber is excellent for furniture, but local mechanics have a tendency to confine its use to fancy goods for which there is a very limited demand. Much furniture is therefore imported from England and the States in nearly equal quantities.

Hardware.—The imports are chiefly from Great Britain.

CLOTHING AND CLEANSING.

	1901-2.	1902-3.
Textiles	£308,000 ...	£404,000
Boots and Shoes ...	£43,000 ...	£69,000
Soap	2,500,000 ...	4,300,000 lbs.

Textiles.—For these there must always be a large demand as there is no local production. England is the chief source of supply; but recently the imports from the United States have largely increased.

Leather and Leather Goods.—Leather is made locally; but the bulk of the supply is imported. Cheap and smart looking boots and shoes are in demand, and quality and wear are points that receive less consideration. Increased imports from the States, and corresponding decreased imports from England are recorded in recent Statistics. Canadian firms have just begun to introduce Leather Goods.

Soap is manufactured locally but to a limited extent only. Blue Mottled Soap is the kind most in demand.

INTOXICANTS, &c.

Wine	173,000 ...	205,000 gals.
Spirits	39,000 ...	50,000 ,,
Malt Liquor	248,000 ...	200,000 ,,
Tobacco (leaf)	561,000 ...	592,000 lbs.
,, (manufactured) ...	69,000 ...	77,000 ,,

Wine is imported from France and Spain in nearly equal quantities.

Spirits.—These consist of Brandy imported from Great Britain and France in nearly equal quantities; gin chiefly from Holland; whisky from Great Britain.

Malt Liquor.—The bulk of this consists of heavy stout which is more popular than light beers.

The latter are likely to be imported more largely owing to an alteration in the Tariff by which they are favoured slightly.

Tobacco.—The leaf comes almost entirely from the United States; the manufactured chiefly from Great Britain; and the Cigars and Cigarettes chiefly from the United States.

The consumption per head is approximately Wine $\frac{3}{4}$ gal., Brandy $\frac{1}{30}$ gal., Gin $\frac{1}{30}$ gal, Whisky $\frac{1}{15}$ gal., Beer and Stout 1 gal., Tobacco $2\frac{1}{2}$ lbs. and local made Rum 1 gal.

EXPORTED PRODUCE.

CANE SUGAR PRODUCTS.

	1901–2.	1902–3.
Sugar	45,000 ...	47,000 tons.
Molasses	482,000 ...	301,000 gals.
Rum	178,000 ...	213,000 ,,
Bitters	32,000 ...	39,000 ,,

Sugar.—Prepared exclusively from the Sugar Cane in the large Central Factories of the Colony. In these factories, sugar can be produced polarising 98 to 99 per cent. of pure sugar, and is then equal to Refined Sugar. None of the yellow or white Crystals of similar quality require refining. The refining process removes the characteristic agreeable flavour of *Cane* Sugar. Beet sugar is not fit for consumption until the characteristic disagreeable flavour is removed by refining. Herein lies the chief difference between *Cane* and *Beet* sugars.

The superiority of Cane over Beet sugar is seen especially in :—

1. Sweetened Ærated drinks, Cordials, Liqueurs, &c.
2. Fruit preserving.
3. Brewing.
4. Cooking.

The present prices of sugar are so much below the cost of production that this industry is in a very precarious condition.

Molasses.—Large quantities of Molasses are produced as a bye-product in the manufacture of sugar. The molasses

from Cane Sugar is very superior to that from Beet, which contains an excessive quantity of alkaline salts.

Molasses is used for—

1. Making Rum.
2. Cattle feeding.
3. Making Golden Syrup, Treacle, &c.

Trinidad Molasses contains about 45% of Cane Sugar and 20% Glucose, and Vacuum Pan molasses can now be bought at very low rates. It should be useful in the manufacture of Beer and alcohol.

Rum.—This is made locally from molasses, and 300,000 gallons are consumed annually in Trinidad. Among the Liqueurs made from it Rum Shrub is the best known. The rum made here is of a strength of 40 o.p.: Present prices are very low.

Bitters.—The world-famed Angostura Bitters are made in Trinidad from Rum of the finest quality produced in the Colony. The other ingredients are a trade secret. These Bitters have been frequently imitated, but never successfully. It was originally made at Angostura by Dr Siegert as a medicine, but since 1830 has been used both medicinally and as a beverage. Since 1875 the Bitters have been manufactured in this Colony. It is one of the principal ingredients in the West Indian Swizzle or Cocktail.

CACAO AND COFFEE.

Cacao	...	30,100,000	... 37,500,000 lbs.
Coffee	...	26,000	... 35,000 ,,

Cacao.—Trinidad Cacao has a very high reputation in the world's markets. As exported, the beans have undergone a process of fermentation and subsequent drying in the scorching tropical sun. The keeping qualities of Trinidad-cured Cacao are remarkable. It undergoes a further process of manufacture in the importing countries, and is usually sold:—

1 With portion of the fat extracted,
2. With the addition of starch (prepared cacao),
3. With the addition of sugar (chocolate).

The sale of Chocolate Confectionery has increased enormously in recent years; and the general consumption of Cacao is increasing every year.

The Cacao and Chocolate made in the Colony contain all the fat (50%) natural to the Cacao Bean, and without any admixture of starch or sugar.

Cacao Butter.—This is not a local production, but a bye-product in the manufacture of the first type of Cacao referred to above.

Coffee.—At present prices it does not pay to collect the Coffee which readily grows in the Island. Trinidad Coffee of a standard nearly equal to that of the Blue Mountain Coffee of Jamaica can be produced. Good Coffee retails locally at 5d. per lb. The exports could be largely increased if the prices were remunerative.

COCONUTS.

	1901-2	1902-3
Coconuts ...	10,200,000 ...	10,400,000 No.
Copra ...	927,000 ...	1,325,000 lbs.
Coconut Oil ...	15,000 ...	25,000 gals.

Coconuts.—These are exported chiefly for the oil they contain, which is used largely in Soap making. The nuts are shipped in three forms, viz:—unhusked, husked, and (after being crushed and dried) as Copra.

Copra.—This is the dried white part of the ripe coconut. It is used for oil making, and is less bulky than nuts for export. It contains 65 to 70 per cent. of oil. It is also largely used in confectionery, to which it gives a characteristic agreeable flavour.

Coconut Oil.—The oil expressed locally has the advantage of being prepared from the fresh nuts, which are free from rancidity. The residual meal is used locally for cattle feeding. Recently a substitute for Butter has been successfully prepared from coconut oil.

LIMES.

Lime Juice ...	4,700 gals.

Limes.—These are produced in enormous quantities. and very often not collected. It could be made a very profitable industry if properly handled.

Lime Juice.— This is expressed from the above and concentrated for shipment. From it is made the Citric Acid of commerce now so largely used in making summer drinks.

Oil of Limes.—This is a volatile oil used for flavouring and perfumery. It is not systematically collected, and the quantity exported is consequently much less than it should be.

PAVING MATERIALS.

	1901-2	1902-3
Asphalt—Crude ...	127,000 ...	145,000 tons.
,, Epuree ...	15,000 ...	11,000 ,,
,, Liquid ...	20,000 gals.	

Asphalt.—As a paving material Trinidad Asphalt is unequalled. It is found in many parts of the Island, but the principal deposit is at La Brea where there is an almost inexhaustible supply. The Pitch Lake is 110 acres in extent, of unknown depth, and situated 130 feet above the level of the sea. The removal of 1,720,000 tons during the past 34 years has apparently made no impression on the Lake.

The Lake contains no liquid Asphalt, but in other parts of the island this kind is found widely distributed. From it illuminating and lubricating oils can be distilled. Large deposits of mineral oil containing Naphtha, Kerosine, and lubricating oils have recently been discovered, and are now being worked partly by the aid of Canadian capital and enterprise.

Glance Pitch, also found in the Island, is used for Electric Insulations and for Black Varnishes.

Manjak, a superior quality of Asphalt, has been found in a district about 10 miles north of the Pitch Lake, and in several large beds a short distance below the surface.

FOREST PRODUCTS.

	1901-2	1902-3
Timber (cedar)	£8,700 ...	£3,300
Balata Gum	£50,000 ...	£71,000

Timber.—The timber of the Island is best suited for decorative Cabinet making. The grain is exceptionally fine.

The Cedar exported is chiefly for Cigar box manufacture.

Balata.—The Rubber exported comes principally from South America.

HIDES.

	1901-2	1902-3
Hides ...	£ 12,000 ...	£ 22,000

Hides.—These come principally from South America; but the Island supplies on an average 2,000 a year.

GENERAL REMARKS.

Trinidad being almost exclusively an Agricultural Colony but with its agricultural advantages confined to a very limited number of tropical products, is consequently dependent upon other countries for many substances that could readily be produced in the Island; and others which for climatic and economic reasons cannot be produced. For manufactured goods, it almost entirely relies on external supplies. For these reasons it imports large quantities of :—

Cereals generally, including flour,
Cattle Foods,
Dairy Products,
Meat and Fish (preserved)
Cattle and Sheep,
Fuel and Oil,
Building Materials
Furniture,
Textiles,
Hardware and Machinery,
Boots and Shoes,
Soap,
Malt Liquor,
Whiskey, Brandy & Wines.

Its principal exports are :—

Sugar and its bye-products.
Cacao.
Asphalt.
Coconuts and Coconut Oil.

The progress and development of these industries can well be seen from a Return published in the Annual Report of the Collector of Customs, from which the following figures are taken :—

	Annual Average Values.		
	Sugar.	Cacao.	Asphalt.
5 years ending 1880 ...	£800,000	£307,000	£ 23,000
,, ,, 1885 ...	755,000	344,000	39,000
,, ,, 1890 ...	715,000	486,000	67,000
,, ,, 1895 ...	658,000	550,000	107,000
,, ,, 1900 ...	620,000	664,000	137,000
Year 1902-3 ...	410,000	907,000	168,000

The Sugar Exports have in 27 years decreased in value to one-half, while Cacao Exports have increased to three times, and Asphalt to seven times.

As regards *sugar*, the direction of trade has varied but very slightly during the 20 years, 1880–1900, a moiety of the crop (25,000 tons) going to Great Britain, the remaining moiety to the United States.

Cacao, on the contrary, has found new markets as the following Table will show :

	Annual Average Quantities Exported.		
	Great Britain.	United States.	Other Countries.
5 years ending 1885	7,300,000 lbs.	1,500,000 lbs.	3,100,000 lbs.
,, ,, 1890	8,500,000 ,,	3,400,000 ,,	5,700,000 ,,
,, ,, 1895	7,400,000 ,,	5,200,000 ,,	9,600,000 ,,
,, ,, 1900	9,200,000 ,,	6,700,000 ,,	10,200,000 ,,
Year 1901-2 ...	9,400,000 ,,	9,300,000 ,,	11,400,000 ,,
,, 1902-3 ...	8,500,000 ,,	12,500,000 ,,	16,500,000 ,,

Besides these large industries, the Colony is peculiarly suited for the production in very large quantities of the following substances:—

Starches : *e.g.*. Manioc, yam, sweet potato, tania, &c.

Fibres : *e.g.* Sisal, pine apple, banana, coconut, bamboo.

Fruit : *e.g.* Orange, lime, shaddock, pine apple, banana, plantain, mango.

Spices : *e.g.* Nutmeg, ginger, pepper, vanilla.

Tobacco : (of the Sumatra type for Cigar covers).

Kola : Castor Seeds.

Dyes : *e.g.* Annatto, Logwood.

Plants : Palms of all kinds.