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**PROCEEDINGS OF THE  
CARIBBEAN FOOD CROPS  
SOCIETY**



**SIXTH ANNUAL MEETING  
ST. AUGUSTINE, TRINIDAD  
JULY 7-13, 1968**

**VOLUME VI**

## FOREWORD

The Sixth Annual General Meeting was unique in the sense that it was the first time the Society attempted to hold their meetings in conjunction with another body of agricultural workers.

The meeting was held as a joint session between the Caribbean Foods Crops Society and the Tropical Region of the American Society for Horticultural Sciences.

The task of planning the sessions to accommodate the views and objectives of both societies proved difficult but not impossible. It is the hope of the Planning Committee of the C.F.C.S. that the members who attended the meetings benefited from the joint exercise and that the experiences gained and the contacts made would be of value to us in the future.

In this issue of the proceedings we present the contributions of members of our society. Other Technical papers which were presented at the sessions will be published in the proceedings of the American Society for Horticultural Science.

LAWRENCE CROSS  
*President*

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### Chairmen of Sessions

Session 1. Monday, 8th July	1000-1200	Dr. J. Carew—A.S.H.S.
2. Monday, 8th July	1330-1715	Mr. F. Del Prado—C.F.C.S.
3. Wednesday, 10th July	815-1000	Mr. J. Rapsey—A.S.H.S.
4. Wednesday, 10th July	1030-1230	Mr. F. Gabriel—C.F.C.S.
5. Wednesday, 10th July	1400-1715	Dr. Pito—A.S.H.S.
6. Thursday, 11th July	815-1000	Dr. V. C. R. Henry—C.F.C.S.
7. Thursday, 11th July	1015-1215	Dr. G. Samuels—C.F.C.S.
8. Friday, 12th July	815-1045	Mr. S. Colmenares—A.S.H.S.
9. Friday, 12th July	1100-1230	Business Sessions and Closing Remarks

## CARIBBEAN FOOD CROPS SOCIETY

### Officers of the Society for the year July, 1967-June, 1968

President	L. A. CROSS	Trinidad
Vice-President	V. A. L. SARGEANT	Trinidad
Secretary-Treasurer	G. SAMUELS	Puerto Rico

#### Board of Directors

Chairman	FRANK DEL PRADO	Surinam
Member	F. GABRIEL	Martinique
Member	A. G. NAYLOR	Jamaica
Member	V. ROYES	Jamaica
Member	A. SOTOMAYOR RIOS	Puerto Rico
Member	S. SONTAR	Jamaica
Member	A. WAN PING	Guyana

### MINUTES OF THE BUSINESS SESSION

12th July, 1968

#### Caribbean Food Crops Society

The Business Session of the Sixth Annual Meeting of the Caribbean Food Crops Society was held at the St. Augustine Campus of the University of the West Indies.

The meeting was called to order by the President, Mr. L. A. Cross. The minutes of the previous meeting were approved. The Secretary's Report was read and approved.

#### Treasurer's Report

1. Balance: Bank Statement, June 30, 1967	...	...	\$2,344.25
2. Receipts: July 1, 1967 to June 30, 1968	...	...	1,846.85
SUB-TOTAL	...	...	\$4,191.10
3. Expenses: July 1, 1967 to June 30, 1968:			
Travel grants, Surinam meeting	...	...	\$ 75.00
Travel expenses, Board of Directors	...	...	390.00
Surinam meeting expenses	...	...	441.40
Typing 1966 Proceedings	...	...	71.15
Printing 1966 Proceedings	...	...	425.50
Printing 1967 Proceedings	...	...	400.00
Newsletter, 1967-68	...	...	9.00
Secretarial work	...	...	145.00
Cables	...	...	6.60
Postage	...	...	46.30
Stationery	...	...	19.95
Trinidad Meeting, opening account	...	...	100.00
TOTAL EXPENSES	...	...	\$2,147.90
4. Balance June 30, 1968	...	...	\$2,043.20

## Board of Directors

A meeting of the Board of Directors was held on the evening prior to the Business meeting. The main items decided on were:—

1. Mr. L. A. Cross was elected Chairman of the Board for the year 1968-69.
2. The venue for the Seventh Annual General Meeting was decided upon. The meetings will be held in Martinique.
3. The Board agreed to have representatives of the society in each island to keep members informed of the society's activities and to help in the collection of dues. Each representative would be a member of the Board. In islands where there is no member of the Board, a member of the society will be appointed to act as representative.

## Election of Officers 1968-69

President	MR. F. GABRIEL	Martinique
Vice-President	MR. J. SALETTE	Guadeloupe
Secretary-Treasurer	DR. GEORGE SAMUELS	Puerto Rico

## Board of Directors

Chairman	MR. L. A. CROSS	Trinidad
Member	MR. E. G. GOODING	Barbados
Member	MR. C. P. KENNARD	Guyana
Member	MR. A. G. NAYLOR	Jamaica
Member	MR. V. ROYES	Jamaica
Member	MR. A. SOTOMAYOR RIOS	Puerto Rico
Member	DR. J. A. SPENCE	Trinidad

## Local Representatives

Barbados	E. G. GOODING	Jamaica	A. NAYLOR
Dominica	C. DUPIGNY	Martinique	F. GABRIEL
French Guyana	J. TURENNE	Puerto Rico	A. SOTOMAYOR
Guadeloupe	J. SALETTE	Surinam	F. DEL PRADO
Guyana	C. KENNARD	Trinidad	L. CROSS

## Seventh Annual Meeting

The General body agreed to have the Seventh Annual Meeting in Martinique in 1969. Dominican Republic or Guyana was suggested for 1970.

A session will be devoted exclusively to Corn (Maize) and papers will be invited on all phases of this crop.

Our annual proceedings of this meeting will also publish Research Notes of about 250 words submitted by members before the date of the meeting.

Papers on Forage Crops will be accepted where the subject matter of the paper is limited to the crop aspect only. Sustaining members shall be asked to nominate one non-voting advisory member to our board.

## Amendment to the Constitution

Article 5 section 5 of our By-Laws referring to the length of the term of members of the Board of Directors was changed from a period of three years to a term of two years.

**LIST OF PARTICIPANTS**  
**Sixth Annual General Meeting of C.F.C.S.**  
**Trinidad and Tobago**  
**7th-13th July, 1968**

- |   |  |
|---|--|
| 1. Mr. F. A. Henry—Antigua                  | 34. Mr. A. J. Bennett—St. Vincent          |
| 2. Mr. R. Baynes—Barbados                   | 35. Mr. H. V. D. Shortt—St. Vincent        |
| 3. Mr. A. G. Bryan—Barbados                 | 36. Dr. F. A. del Prado—Surinam            |
| 4. Mr. E. G. Gooding—Barbados               | 37. Mr. R. R. Huiswood—Surinam             |
| 5. Mr. de Courcey W. Jeffers—<br>Barbados   | 38. Miss Zita Allen—Trinidad               |
| 6. Mr. C. J. L. Dupigny—Dominica            | 39. Mr. P. Alleyne—Trinidad                |
| 7. Mr. G. Villanueva—Dominica<br>Republic   | 40. Mr. E. Au Young—Trinidad               |
| 8. Mr. Philippe Chartier—France             | 41. Mr. R. Barrow—Trinidad                 |
| 9. Mr. M. Delhumcan—F r e n c h<br>Guyana   | 42. Mr. F. Barsotti—Trinidad               |
| 10. Mr. J. H. Turenne—F r e n c h<br>Guyana | 43. Mr. P. M. Bharath—Trinidad             |
| 11. Mr. James Andrews—Grenada               | 44. Mr. S. Bharath—Trinidad                |
| 12. Mr. Arthur Donclan—Grenada              | 45. Mr. W. O. Bishop—Trinidad              |
| 13. Mr. Denis Noel—Grenada                  | 46. Dr. T. W. A. Carr—Trinidad             |
| 14. Dr. Bernard Digat—Guadeloupe            | 47. Mrs. C. Chin Chuck—Trinidad            |
| 15. Mr. J. Fougrouze—Guadeloupe             | 48. Mr. L. Cross—Trinidad                  |
| 16. Mr. J. S. Salette—Guadeloupe            | 49. Mr. C. Dindial—Trinidad                |
| 17. Mr. C. P. Kennard—Guyana                | 50. Mr. M. Dookeran—Trinidad               |
| 18. Mr. H. A. Beckford—Jamaica              | 51. Mr. V. Ferrer—Trinidad                 |
| 19. Mr. R. E. Osborne—Jamaica               | 52. Mr. R. Ganpat—Trinidad                 |
| 20. Dr. H. Payne—Jamaica                    | 53. Mr. J. Goellnicht—Trinidad             |
| 21. Dr. R. E. Pierre—Jamaica                | 54. Mr. R. Griffith—Trinidad               |
| 22. Mr. S. M. Sehgal—Jamaica                | 55. E. H. Hamilton—Trinidad                |
| 23. Mr. L. A. Jr. Walker—Jamaica            | 56. Dr. Fred Haworth—Trinidad              |
| 24. Mr. Gerard Desportes—Martinique         | 57. Mr. P. Haynes—Trinidad                 |
| 25. Mr. F. Gabriel—Martinique               | 58. Dr. V. C. R. Henry—Trinidad            |
| 26. Mr. G. Rimband—Martinique               | 59. Mr. V. Ho-A-Shu—Trinidad               |
| 27. Mr. Raul Abrams—Puerto Rico             | 60. Mr. L. James—Trinidad                  |
| 28. Mr. J. Cuevas-Ruiz—Puerto Rico          | 61. Mr. N. Khan—Trinidad                   |
| 29. Mr. M. Flores-Gonzales—Puerto<br>Rico   | 62. Mrs. S. Laurent—Trinidad               |
| 30. Mr. William Pennock—Puerto<br>Rico      | 63. Mr. Dindial Mahabir—Trinidad           |
| 31. Dr. George Samuels—Pnerto Rico          | 64. Dr. B. G. Montserin—Trinidad           |
| 32. Dr. F. P. Blair—St. Lucia               | 65. Mr. V. Sargeant—Trinidad               |
| 33. Mr. Calexte George—St. Lucia            | 66. Mr. W. Scarl—Trinidad                  |
|   | 67. Dr. M. P. Singh—Trinidad               |
|   | 68. Mr. T. Skinner—Trinidad                |
|   | 69. Dr. J. A. Spence—Trinidad              |
|   | 70. Professor E. A. Tai—Trinidad           |
|   | 71. Mr. R. Shalterbrandt—Virgin<br>Islands |

Seventy-six members of the Tropical Region of the American Society for Horticultural Science also attended the meetings.

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## CARIBBEAN FOOD CROPS SOCIETY

### Programme for Sixth Annual Meeting July, 1968, St. Augustine, Trinidad and Tobago

#### Saturday, 6th July

Arrival of delegates and Participants and transportation to Hotels.

#### Sunday, 7th July

1630-1800 Registration  
1800-2000 Rum Punch Party.

#### Monday, 8th July

830-900 Participants arrive at U.W.I.  
900-945 Opening Session  
945-1000 Coffee  
1000-1200 Presentation of Papers  
1200-1330 Lunch  
1330-1500 Presentation of Papers  
1500-1515 Coffee  
1515-1615 Presentation of Papers  
1830 Trinidad and Tobago Government Reception.

#### Tuesday, 9th July

815-16.30 Excursions to El Naranjo Flower Farm, Crescent Estate and  
Central Experiment Station  
2030-2200 Colloquium.

#### Wednesday, 10th July

815-1000 Presentation of Papers  
1000-1015 Coffee  
1015-1230 Presentation of Papers  
1230-1400 Lunch  
1400-1530 Presentation of Papers  
1530-1545 Coffee  
1545-1715 Presentation of Papers  
2030 Trip to a Steelband Yard or Floor Show at Scarlet Ibis Hotel.

#### Thursday, 11th July

815-1000 Presentation of Papers  
1000-1015 Coffee  
1015-1200 Presentation of Papers  
1200-1330 Lunch  
1330-1630 Excursion to one of the following places; Texaco Food Crops  
Demonstration Farm, the St. Augustine Nursery of the Ministry  
of Agriculture and the Citrus Research Unit of the Citrus  
Growers Association of Trinidad and Tobago.  
International Foods.  
Floral Gardens and Orchid collections  
2000-2200 Colloquium.

**Friday, 12th July**

815-1045	Presentation of Papers
1045-1100	Coffee
1100-1200	Business Session
1200-1230	Closing Remarks
1230-1600	Shopping
1900-	Banquet—Queen's Park Hotel.

**Saturday, 13th July**

7.00 a.m.	Excursion to Tobago.
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**Sunday, 14th July**

Departure of Delegates.

## PROGRAMME OF THE OPENING SESSION

Held at St. Augustine Campus,  
University of the West Indies,  
7th July, 1968

- 900 Opening Remarks by Professor E. A. Tai, Regional Chairman of the Tropical Region. American Society for Horticultural Science.
- 910 Opening Remarks by Mr. Lawrence Cross, President of the Caribbean Food Crops Society.
- 920 Feature Address and Official Opening of the Sessions by the Honourable Lionel Robinson, Minister of Agriculture, Lands and Fisheries of Trinidad and Tobago.
- 940 Meeting of Delegates with Official persons.

### Local Organizing Committee

Chairman	—	Mr. Lawrence Cross
Secretary	—	Dr. John Spence
Transport and Accommodation	—	Mr. W. Searl
Finance	—	Dr. L. Wilson
Proceedings	—	Mr. V. A. L. Sargeant
General	—	Dr. V. C. R. Henry
		Mr. M. Dookeran

The success achieved was partly due to the help and assistance rendered by members of the Ministry of Agriculture in general and particularly the staff at Central Experiment Station.

Special mention should also be given to the following firms and departments who contributed to the success of the meetings:—

Government Printery  
Mapping and Control  
Texaco Trinidad Inc.  
Shell Trinidad  
Néstles  
University of the West Indies  
Trinidad and Tobago Horticultural Society

The contributions of Professor Tai and the organizing committee of the Tropical Region of the American Society for Horticultural Science is acknowledged.

**ADDRESS BY THE HONOURABLE LIONEL ROBINSON, MINISTER  
OF AGRICULTURE, LANDS AND FISHERIES OF TRINIDAD AND  
TOBAGO AT OPENING SESSION**

I am deeply honoured to have been asked to open this Joint Meeting of the Tropical Region of the American Society for Horticultural Science and the Caribbean Food Crops Society. This historic occasion on which these two distinguished societies have assembled together to share and enrich each other's experiences must catch the imagination of all those interested in plants and plant sciences in the Caribbean area and my personal association with it is for me a very rare privilege indeed.

I should like at the outset on behalf of the Government and people of Trinidad and Tobago to extend a very warm welcome to all those who have come from overseas to take part in the deliberations of this assembly. And here I would say how very happy I am to greet M. Desportes, the President of the Chamber of Agriculture of the French Department of Martinique who comes to us as official representative of his country's government. To you all I say 'Welcome'. I trust that you will enjoy and profit by your stay here and that when you return to your homes once more you will carry pleasant memories of the people you meet in this country and the things you see and do.

As some of you know, it was my good fortune to attend the Fifth Meeting of the Caribbean Food Crops Society held last year in Surinam. I am very pleased this morning to see about me so many well-remembered faces and to have this opportunity of renewing the friendships formed at that very successful meeting.

The Caribbean Food Crops Society has a vital role to play in the agricultural development of our region and your presence in great numbers here at this Sixth Meeting demonstrates your readiness to meet the challenge.

I would also extend warm greetings to you the members of the Tropical Region of the American Society for Horticultural Science. The eminence of your branch as well as your parent body and the solid contributions to horticultural advancement over several years by your Society as a whole are well known to us and we are honoured by your presence. Permit me to make an observation. So many of the branches of horticulture are intimately concerned with food production that I tend in my own mind to identify most of the efforts of your society with those of the Caribbean Food Crops Society as being aimed at helping in the struggle to feed the exploding populations of the tropical world in general and the Caribbean region in particular. This being so, this joint exercise falls naturally into place and I congratulate the planners of the meeting on their perspicacity.

Esteemed delegates, your meeting at this time in this country is most opportune. Like many other developing countries, Trinidad and Tobago has embarked on important and, for us, costly programmes aimed at increased and more orderly production of food. It is the policy of my Government to substitute wherever possible local for imported foods and so improve our balance of payments. During your

stay here you will undoubtedly hear and perhaps see something of our overall agricultural development programme which aims at the establishment throughout the country of a number of specialized farms producing dairy, poultry and pig products, food and fruit crops. The success of this venture will depend in the long run on the efficiency of our farmers and this in turn will rest on the availability to the farmers of adequate knowledge about crops, livestock and effective farming techniques. To gain this knowledge the Research Division of my Ministry has oriented its efforts toward work on problems of food crop and livestock production.

Our studies on vegetables are progressing satisfactorily and modest claims can be made in respect of our improved ability to grow crops like onions and carrots—crops which are practically new to the Trinidad farming scene. Some advances have also been made in growing tomatoes during our difficult wet season and a number of edible legumes which perform well in this country have been selected for use by small farmers. But these improvements are all based on well-tried techniques and plant material developed in advanced countries.

What can we say about our work with tropical roots and fruits? With the exception of those species which have been exploited for years by metropolitan countries, studies on tropical crops have been meagre or non-existent. And so our efforts have been halting and slow. Take fruit crops! In Trinidad we like the soursop fruit. We make from it delicious drinks and ice creams. But a soursop orchard is not known anywhere and I am almost sure that sufficient information on which to base the establishment of commercial production can be found nowhere in the published literature. We must thus undertake the whole development process from the beginning: selection from volunteer plants, studies on propagation, development of agronomic practices, pest and disease control, &c., and the same is true for many others of our tropical species.

Notwithstanding all this we are making *some* progress. But we need help and encouragement. I expect that the series of discussions which will take place at this Meeting both inside and out of the conference room will provide the kind of help which is most useful at our particular stage in development. The exchange of ideas and the encouragement which scientists are able to give each other must result in benefits for this country and surely will be of value to the other countries represented here today.

I should like to wish the Meeting every success. I thank the visitors from abroad for all their valuable contributions and express the hope that in addition to your deliberations in conference you will all find your tours to institutions, gardens and homes throughout our country full of interest and enjoyment.

With very great pleasure, I declare officially your Meeting open.

## AGRICULTURAL DEVELOPMENT, GROWTH, AND CHANGE

F. M. Barsotti\*

I am privileged to have the opportunity to address this distinguished gathering of agricultural scientists at the opening session of this important and topical Conference, at which I am told there will be a great deal of discussion, and a free and frank exchange of ideas and information on the problems and prospects of horticultural science and the cultivation of food crops and vegetables.

It is interesting and especially gratifying to someone like myself to note that increasing emphasis is being placed on agriculture and agricultural development throughout the countries of the developing world. Many of the misconceptions and shibboleths about the role of agriculture in economic development have been swept away, and to a great extent it appears that the once popular but sterile arguments about agriculture versus industry have been replaced by the realization that agricultural development is an essential factor in the process of modernising and transforming the economics of the countries of the so-called Third World. A number of factors are responsible for this new sense and spirit of urgency about the agricultural sector, the most important of which are the aspirations of rural people and their desire to participate in and reap some of the rewards and benefits of economic growth.

The growing awareness of this section of the world's population brought about largely by the dramatic resolution in communications media is something which governments and politicians can only ignore at serious risk to stability and progress.

Moreover, in recent years the international community has become increasingly cognisant through the work of the Food and Agriculture Organization of the incipient if not real Malthusian crisis confronting the countries of the developing world and particularly those countries situated in Asia.

The articulation of the problems of the rural masses has triggered off a world wide interest in agriculture and led to the acceptance and endorsement of brave new policy recommendations such as the decision to formulate a World Indicative Plan for Agriculture in an attempt to identify and overcome the constraints to agriculture progress and productivity.

In addition the world has had tangible proof through the achievements of Japan before the turn of the century, and Mexico and Taiwan in more recent times, that agriculturally backward countries can with the right amount of investment, hard-work, and dedication achieve a breakthrough which can firmly set their agriculture on an expansion path which reduces rural destitution and stagnation, alleviates social tensions in the countryside and moderates the costly phenomenon of urban drift.

Despite the fact that the Malthusian crisis which I referred to earlier is not as imminent for Latin America and the Caribbean region as it possibly is for the countries of the Asian sub-continent, there is no room whatsoever for complacency

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\*Senior Economist, Ministry of Agriculture, Lands and Fisheries, Trinidad and Tobago.

about our agricultural situation, for rapid population growth, coupled with increasing urbanisation make it essential for Caribbean countries to formulate and implement policies and plans to increase both agricultural production and productivity.

Messrs. Brewster Thomas two U.W.I. economists in their study on "The Dynamics of West Indian Economic Integration" have referred in the opening paragraphs of the chapter on "Agriculture and the Economic Integration of the West Indies" to the complex economic, as well as historical, social, and political factors which affect Caribbean agriculture and which make the transformation and modernization of the sector a very difficult and a very arduous exercise. But this is not common to Caribbean agriculture alone, although certain of the historical and social factors may be considered unique in our particular case.

A glance of most of the literature on agriculture and agricultural development in the developing countries will reveal that the problems are immense and that as John de Wilde has mentioned in his study of "Agriculture in Tropical Africa", "a large number of factors—physical, biological, economic, and social—are involved in affecting improvements".

In spite of the magnitude of the task Caribbean Governments have no choice but to get down to the job of modernising and diversifying their agricultural economies. I am not in a position to speak authoritatively at this time about the plans and programmes of many of the Caribbean territories and countries, but a study of the five-year development plans of Jamaica and Trinidad and Tobago will reveal that agricultural diversification is a stated aim of economic policy.

I would like to emphasise at this point that modernisation does not necessarily mean mechanization, and should not also be construed as an indication of lack of interest in what are sometimes referred to as the old traditional export crops. It would be shortsighted indeed if these crops like sugar, cocoa, &c. were left to stagnate (sugar produces an income for Trinidad and Tobago of about \$35m.—\$40m.) and is still a considerable employer of labour—for there is room for modernisation and improvements in efficiency in this area as well, although market limitations, and restraints imposed through international commodity agreements effectively rule out expansion.

The point is, therefore, that given that the structural transformation of the economy has not reached the point at which surplus labour from the agricultural sector can be absorbed in the manufacturing and service sectors every effort must be made to obtain whatever benefits by way of employment and foreign exchange that may accrue from trade in the so-called traditional exports. After all I do not think that anyone can seriously object because efforts are made to have an efficient cocoa, sugar, coffee, or citrus industry, especially as a significant number of the rural population are still engaged in the cultivation of these crops.

On the whole, however, the export experience of primary producers, the steady deterioration of their terms of trade, the fact that they are price takers and not price makers plus in the case of the Caribbean countries the continuous rise in their food import bills (\$300 million for West Indies as a whole) is indicative of the logic behind the strategy of development for agriculture in their plan documents. Under the prevailing conditions a policy of diversification designed by and large to encourage and promote import substitution seems to be the obvious course to pursue.



This brings me to the problem raised by Johnston and Nielsen in their article on "Agricultural and Structural Transformation in a Developing Economy" where they state that—"in the agricultural sector, the level of productivity and output depends to an exceptional degree upon the interesting influence of two different types of factors referred to as "proximate" and "conditioning" factors. The "proximate" or farm level factors depend upon the decisions and performance of individual farm operations, where as the various "conditioning" factors are determined by government measures and other outside influences that affect to which they have the knowledge, desire, and command over resources to act upon the opportunities that exist."

We may, using the terminology of the authors, regard agricultural research in which you are interested and with which you are concerned as a "conditioning" factor while the action of the farmer in accepting your findings and recommendations would be regarded as a "proximate" or farm level factor. These factors interact and produce change, but there is always the very real possibility that the farmer will not accept the proffered advice, perhaps because of the way it is presented by extension people, or perhaps because it is too costly. Success in motivating the farmer seems then to depend on the adoption of an interdisciplinary approach to agricultural problems since as de Wilde has pointed out with reference to Africa that—"the orientation of research must be influenced strongly by not only the potential benefits to the farmer but by the possible repercussions on his whole method of farming. Experience has revealed that research has in many cases suffered from excessive technical bias and over simplification".

This observation has been backed up by the comments of three other authorities in the field. De graff who says that "applied research has above all been deficient." Schult who says that "to a considerable extent there has been a failure to develop new agricultural inputs which are rewarding to the farmer and McMechan whose remark is that research has been poorly tailored to actual development needs and has not effectively linked economics and technology".

If we examine the literature on the success story of Japanese agriculture, we repeatedly run across the expression that "agricultural science was tailored to solve the problems or to meet the felt needs of the farmers and we notice also that in the earlier period of advance increases in agricultural productivity were based largely on low-cost technical innovation. That is to say that in labour surplus,—capital scarce situation, serious attention was given to factor proportions problem and careful consideration was also given to the choice techniques employed.

I think that there are three factors of special interest for us here, the first is that research must have relevance, the second is that economic factors and the selection of techniques which make sense in the context of the factor proportions problem must be carefully considered, and third that we should, resources permitting attempt to adopt an interdisciplinary approach to agricultural problems.

I am not attempting here to make any special plea for economists, for they possess only one of the essential disciplines, but I do think that the economic implications of research advice and recommendations should be always carefully thought through.

A fact which I think may be of interest to a gathering such as this, is the point

made by Messrs. Brewster and Thomas in the publication already referred to that "West Indian Agriculture, including export crops, show increased output to be heavily, almost proportionately, dependent on increases in land". They go on to say, that the most striking example of this is rice cultivation, where the returns to land and labour have not altered since the inception of the industry in the nineteenth century. It follows therefore, that the region cannot understate the scope for economics in research and scientific studies.

If we contrast the level of performance referred to by the authors with the performance of the same industry in Japan, the United States of America and recently in the Philippines where better spacing and plant population per acre, and the judicious use of fertiliser with improved varieties has resulted in significantly increased yields we cannot but support the opinion of the authors that we need to get on with our research effort and that the development of a cadre of scientific personnel can best be done on a regional basis given our present levels of development.

The Caribbean countries are in the process of attempting to diversify their agriculture into areas in which largely speaking research has been minimal. Again, we are not unique, because both here and in tropical Africa more work has been done on the so-called traditional or export crops than on food crops, vegetables, grasses (pasture and fodder,) and livestock. This means, therefore, that we have to mount a massive effort to overcome the gaps and deficiencies in our knowledge. There is need for—and I think that this is an area in which your societies would accomplish a great deal—an attempt to be made to estimate our needs for agricultural scientists, so that the total research effort should not be held up because of failure to obtain the right man when he is required.

I intended to go into some detail about the specific areas in food crops and vegetables in which research would be necessary in Trinidad and Tobago, but I think that this will be much more ably dealt with by my scientific colleagues in the Ministry.

I think, too, that the coming into being of Carifta must of necessity result in a reappraisal of import substitution in the Caribbean territories and countries. Brewster and Thomas have pointed out that regional import substitution will make more sense than national import substitution since with the latter regional duplication is inevitable. This is a matter which will have to be carefully discussed by the units concerned and I would not at this time like to indulge in any value judgments or take up a definite position.

As a Society, however, your comments and observations based on the particular expertise which you possess should be of great benefit to the region as a whole on this question.

I would like to conclude by drawing to your attention the comment made on the requirements for research by John de Wilde in his book on Agriculture in Africa. Effective agricultural research can be developed only if—

1. it is based on a sound knowledge of local farming system;
2. more attention is paid to the improvement of food crops and of the general system of agriculture;
3. the economics of various innovations are more comprehensively appreciated;

4. sufficient trials and demonstrations are undertaken to test the practicability of recommendations;
5. staff is made available in adequate number and quality and for sufficiently long periods, and
6. there is greater international co-operation in the exchange and utilization of research results.

These emphasise the inter-disciplinary approach which I referred to earlier and in my judgment make a great deal of sense particularly in our situation in the Caribbean.

I think it was Bertrand Russel who remarked in a discussion on nuclear disarmament how difficult it was to get humanity to acquiesce in its own survival. I think that given the interest you have shown in the past and your dedication to your task that it will not be so very difficult to get the Caribbean peoples to acquiesce in re-orienting and organising their agricultural economics.