PROCEEDINGS
CARIBBEAN WORKSHOP ON THE ORGANISATION AND ADMINISTRATION OF AGRICULTURAL RESEARCH

**Dover Convention Centre, St. Lawrence,
Christ Church, Barbados**

February 22-27, 1981

**Ministry of Agriculture, Food and
Consumer Affairs, Barbados
Inter-American Institute for Cooperation on Agriculture (IICA)**

**Edited by
Warren M. Forsythe
Antonio M. Pinchinat
Lyndon McLaren**

IICA
OFFICE OF THE ASSOCIATE DEPUTY DIRECTOR GENERAL
FOR RURAL DEVELOPMENT

San José, Costa Rica
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INTRODUCTION

Following up on the Regional Technical Meeting on Agricultural Research Systems in the Antilles, organised by IICA and held in Port-an-Prince, Haiti in 1977, under the auspices of the Ministry of Agriculture (DARNDR) of Haiti, a "Caribbean Workshop on the Organisation and Administration of Agricultural Research," was programmed. The workshop was mounted by IICA in cooperation with the Ministry of Agriculture of Barbados (MAFCA) and was scheduled to be held in Bridgetown, Barbados in October, 1980. However, due to circumstances beyond our control, it was postponed to February of 1981 but held at the original venue. It was primarily addressed to agricultural research leaders and administrators in the Caribbean, and had inputs from special consultants.

Many weaknesses were diagnosed in the organisation and administration of agricultural research in the national institutions which were represented at the Haiti meeting. The main objective of the workshop was to facilitate the exchange of views and experiences on the appropriate organisation and management of agricultural research. Its principal goal was to contribute to the improvement of agricultural research in the Caribbean.

To ensure that the workshop focused on the organisational and administrative problems which were regarded the most important in the agricultural research systems of participating countries, a list of issues and sub-issues, in question form, was circulated. Participating countries were asked to review the issues presented and to rate them in order of importance for the improvement of their national research systems. It was suggested that the broadest participation of individuals and institutions be obtained in the exercise.

Technical responsibility for the organisation of the workshop was assigned to Mr. J. P. W. Jeffers, Deputy Chief Agricultural Officer (Research) of MAFCA, Dr. Antonio M. Pinchinat, Agricultural Research Specialist of IICA, and Dr. Warren Forsythe, Director of IICA Office in Barbados. They were assisted by Dr. Eslie H. Alleyne of MAFCA, and Mr. Victor Ojeda of the IICA Office in Barbados.

Organising Committee,

P. J. W. Jeffers,
A. M. Pinchinat,
W. M. Forsythe.

PROGRAMME

Sunday February 22nd	
07:30 – 20:00	Arrival of Participants
16:00 – 19:00	Registration of Participants
Monday Februay 23rd	
08:30 – 09:30	Registration of Participants
09:30 – 10:00	**Inauguration Ceremony** Session Chairman: *J.P.W. Jeffers*, Deputy Chief Agricultural Officer – MAFCA Barbados.
10:00 – 10:30	Coffee Break
10:30 – 11:00	Agriresearch Issues in the Caribbean, *A.M. Pinchinat*, Research Specialist – IICA
11:30 – 12:00	Discussion
12:30 – 14:00	Lunch Session Chairman: *Warren Forsythe*, Research Specialist – IICA
14:00 – 15:30	Agriresearch Policy and Organisational Issues, *E. Trigo*, Research Specialist – IICA
15:30 – 16:00	Coffee Break
16:00 – 17:00	Discussion
19:00 – 21:00	Cocktails – Courtesy of Ministry of Agriculture, Food and Consumer Affairs, Barbados.
Tuesday February 24th	
	Session Chairman: *Ronald Barrow*, Director of Research – Ministry of Agriculture, Lands & Fisheries Trinidad & Tobago

08:30 – 09:30	Agrisearch Administration, *R.E. Pierre,* Director – IICA Office, Guyana
09:30 – 10:00	Discussion
10:00 – 10:30	Coffee Break
10:30 – 11:30	Agriresearch Programming and Project Management, *H. Stagno,* Agricultural Economist – IICA
11:30 – 12:00	Discussion
12:00 – 14:00	Lunch Session Chairman: *V.A.L. Sargeant* – CARDI, Barbados
14:00 – 15:00	Panel Discussion on Social and Economic Considerations in Agricultural Research in the Caribbean, *J. Spence* – UWI, *C. Applewhite* – UNDP, *H. Stagno* –IICA, *E. Trigo* – IICA *H. Barreyro* – IICA, and *V.A.L. Sargeant* CARDI (moderator)
15:00 – 15:30	Discussion
15:30 – 16:00	Coffee Break
16:00 – 17:00	Discussion

Wednesday February 25th

	Session Chairman: *K. Wellington,* Director of Research Department – Ministry of Agriculture, Jamaica
08:30 – 09:00	UWI's Role in Agriresearch in the Caribbean, *J. Spence,* Dean, Faculty of Agriculture– University of the West Indies
09:00 – 09:15	Discussion
09:15 – 09:45	CARDI's Role in Agriresearch in the Caribbean, *J. Bergasse,* Director – CARDI
09:45 – 10:00	Discussion
10:00 – 10:30	Coffee Break
10:30 – 11:00	CFC's Role in Agriresearch in the Caribbean, *H. A. D. Chesney* – Caribbean Food Corporation
11:00 – 11:15	Discussion
11:15 – 11:45	Proposal for Agriresearch support Projects in the Caribbean, *L. McLaren,* Director of Support and Follow-up – IICA Antillean Zone

11:45 – 12:30	Discussion
12:30 – 14:00	Lunch
14:00 – 17:30	Field Visit, *E. Alleyne* – Ministry of Agriculture, Food and Consumer Affairs, Barbados
Thursday February 26th	
	Simultaneous Working Group Sessions, Chairman: *A.M. Pinchinat* – IICA
08:30 – 12:00	Discussions Group 1: Agriresearch Organisation and Administration, Leader: *R. Pierre* – IICA Group 2: Regional Agriresearch Cooperation, Leader: *L. McLaren* – IICA Session Chairman: *E. Trigo* – IICA
12:00 – 13:00	Presentation and Discussion of Group Reports
Closing Session	Chairman: *J.P.W. Jeffers* – Deputy Chief Agricultural Officer (Research) – MAFCA, Barbados
13:00 – 13:10	Synthesis of Workshop, *A.M. Pinchinat* – IICA
13:10 – 13:25	Workshop Follow-up in the Caribbean *L. McLaren* – IICA
13:25 – 13:45	Remarks from the floor
13:45 – 14:00	Closing Remarks *J.W.P. Jeffers* – MAFCA, Barbados
19:30 – 21:30	Reception – Courtesy of IICA, Barbados Office.
Friday February 27th	
06:00 – 18:00	Departure of Participants.

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INAUGURATION CEREMONY

OPENING REMARKS

J. P. W. Jeffers

Deputy Chief Agricultural Officer (Research), Ministry of Agriculture, Food and Consumer Affairs, Barbados.

Mr. Parliamentary Secretary, Distinguished Guests, Ladies and Gentlemen, first of all, allow me to welcome you to Barbados.

This meeting is the second on Research in the region. I believe that there should be an intimate association between the researchers and their clients, the farmers. This association is necessary if farmers are to derive full benefit of our research.

It is therefore necessary for us to take a hard look at our Research Management and Evaluation methods, and this Workshop is designed to help us in doing just this.

I would like to take this opportunity to express our appreciation to Dr. Forsythe, the first IICA Director, and to welcome Dr. Barreyro, the new IICA Director, and hope that he will have a happy and successful stay in Barbados.

I would like to introduce Dr. Barreyro, the IICA Director, and ask him to address you.

WELCOMING REMARKS

Hector R. Barreyro
Director IICA Barbados Office

Ladies and Gentlemen, Dear Colleagues:

In March 1978, the IICA Barbados Office received from the Ministry of Agriculture, Food and Consumer Affairs (MAFCA) of this country a proposal to hold a **Workshop on Research Management and Administration** (1).

The proposal was based on the common observation that most Agricultural Research Administrators in the Caribbean were acting by instinct or personal reasoning, but lacked a solid orientation in management. Furthermore, most agriresearch institutions were not structured to effectively and efficiently support the national socio-economic development plans.

The proposal was readily accepted by IICA and later endorsed by interested national agriresearch institutions in the region. It received financial backing from the United Nations Development Programme (UNDP).

Representatives from the National Agriresearch Systems in the Caribbean were kindly asked to guide us in selecting and rating relevant topics to be covered by the Workshop (2). They generously responded to the request.

The purpose of this forum is thus to:

1. Fully discuss the selected topics and
2. Propose optional mechanisms and means to **improve the organization, administration and socio-economic impact** of agricultural research in the Caribbean (3).

To achieve these objectives, we have set up the following programme:

1. Presentation of background papers by leading professionals in agricultural research organization and administration.
2. Comprehensive discussion of the papers and exchange of views and experiences among the participants in the Workshop.
3. Formation of two (2) Working Groups to discuss and propose optional procedural models for the organization and administration of agricultural research.
4. Identification, discussion and formulation of project profiles aimed at attracting external financial and technical resources to strengthen the national agricultural research systems, in their capacity to significantly contribute to agricultural development in the Caribbean.

The real success of this meeting depends on the active and unselfish participation of everyone in the analysis of the topics, the exchange of information, and the establishment of viable strategies and means to make agricultural research a useful and potent tool for:

1. the planning of national agricultural development and
2. the effective and efficient implementation of agricultural development programmes in the Caribbean.

REFERENCES:

1. BARBADOS, MINISTRY OF AGRICULTURE, FOOD AND CONSUMER AFFAIRS.
   Letter to Dr. Warren Forsythe, Director, Inter-American Institute for Cooperation on Agriculture from J.P.W. Jeffers, Deputy Chief Agricultural Officer (Research). March 16, 1978. 1p.

2. INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS. Letter ZL/D–120 from A.M. Pinchinat, Agricultural Research Specialist (to concerned Caribbean Agricultural Research Institutions) February 12, 1980. 1p.

3. INSTITUT INTERAMERICAIN DES SCIENCES AGRICOLES-OEA. Letter ZL/H–1136 from A.M. Pinchinat, Coordinator (to concerned Caribbean Agricultural Institutions), October 31, 1980.

OPENING ADDRESS

Leroy Sisnett, M. P.
Parliamentary Secretary, Ministry of Agriculture,
Food and Consumer Affairs, Barbados

Mr. Chairman, Participants, Ladies and Gentlemen.

I wish first of all to extend a very warm welcome to all of you who are visiting Barbados, particularly those who are visiting for the first time.

We in Barbados are very pleased to be associated with the initiative of the IICA, to be known in future as Inter–American Institute for Cooperation on Agriculture, in arranging this Workshop. We are also happy that Barbados has been chosen as the venue. I sincerely hope that the Workshop will be a successful one and that your deliberations will be inspired by a spirit that is truly Barbadian.

The choice of topic "Organization and Aministration of Agricultural Research" is a most appropriate one at this time. We are aware that many useful discoveries have resulted from the efforts of persons who have painstakingly and single mindedly pursued their ideas both in the laboratory and in the field. Such a process has its value. But, in my view it is not enough that a body of appropriately qualified persons go out into the field or into their laboratories to work out their pet theories. Whatever be its inspiration, research must pay due regard to the over-riding national interests.

Recent authoritative assessments of the world food outlook give no grounds for complacency. We in Barbados who are net importers of foodstuffs are particulary conscious of the need to produce as

much of our own food requirements as we can. Our agricultural policies take this requirement firmly into account. We recognise the significance of research in supporting and promoting innovations so necessary for increasing the output of food by the most economical means at our disposal and firmly support the objectives of the Workshop.

I note Mr. Chairman, that this Workshop is a follow-up to one held in Haiti in 1977. The fact that it has been a follow-up indicates to me that there is a regional recognition of the need to strengthen the regional research effort and to harness it in the service of a more productive agriculture.

As I recall it, several priority technical areas were identified in your meeting in Haiti; however, it seems clear to me that these technical goals can never be achieved efficiently, economically and expeditiously unless the research effort is appropriately organised, demonstrated, coordinated and evaluated.

I would commend to you the special need for evaluating the research product; for in the early stages even simple improvements in techniques may show almost immediate large beneficial results; with time and with the utilisation of more advanced techniques the increments of improvement get smaller and smaller and it becomes increasingly urgent for us to evaluate the improvements, if any. Otherwise we run the risk of fruitlessly dissipating our scarce human and financial resources.

But these concerns, Mr. Chairman, together with others such as the selection of personnel and priority areas of work, will, I am sure, be part of your deliberations, over the next few days. You have a full agenda and will be anxious to get on with the task. I simply want to remind you of the old saying that all work and no play make Jack a dull boy. None of you can be accused of being dull boys. I am sure you will find time to explore our island and to make your own assessment of our island's hospitality.

Before closing I want to take this opportunity to publicly express the appreciation of my Ministry and of the Government of Barbados for the cooperation and assistance we have received from the Inter-American Institute for Cooperation on Agriculture in such areas as marketing, irrigation, animal health and plant quarantine. This cooperation is all the more noteworthy since we have had a local office of IICA with us for just about three years.

Once again let me wish you success in your deliberations.

It now gives me great pleasure in declaring the Workshop open.

WORKSHOP PAPERS

AGRICULTURAL RESEARCH ISSUES IN THE CARIBBEAN

Antonio M. Pinchinat
IICA

INTRODUCTION

The country reports presented at a Caribbean meeting organised by IICA and held in Haiti at the end of 1977 (1) showed that the national agricultural research systems (NARS) were suffering from serious organisational and administrative weaknesses, restricting contribution to regional agricultural productivity. This moved the Ministry of Agriculture, Food and Consumer Affairs (MAFCA) of Barbados to propose to the Inter-American Institute for Cooperation on Agriculture (IICA) the convening of a forum to discuss the fundamental aspects of that institutional problem and suggest ways and means to overcome them.

The proposal received regional support and IICA sent to fifteen interested NARS a questionnaire intended to identify and rate the relevant issues concerning the institutional improvement of their organisation and administration. The questionnaire contained nine broad issues divided into more specific sub-issues. The NARS were requested to rate both issues and sub-issues on a scale of 5 (extremely important) down to 1 (irrelevant) regarding their immediate needs for organisational and administrative improvement (Annex 1).

This paper presents their responses to the questionnaire.

RESPONDENTS

The questionnaire was filled up and returned to IICA by eleven countries (Table 1). These make up a very broad cross-section of NARS in the Caribbean, involving some of the least and some of the

most indigenous research institutions in the region. The response represented the views of leading and experienced professionals in the agricultural sector of those countries; therefore, they serve as valid indicators of the state of the organisation and administration at the NARS and as an authoritative basis for their improvement.

Table 1: RESPONDENTS TO THE QUESTIONNAIRE

COUNTRY	OFFICIAL	INSTITUTION AND ADDRESS
1. Antigua	Roberta Anthony Research Officer	Ministry of Agriculture Antigua
2. Barbados	E. A. Alleyne Senior Agric. Officer	Ministry of Agriculture, Graeme Hall, Christ Church, Barbados
3. Belize	Rodney Neal Principal Agric. Officer	Ministry of Natural Resources Belize
4. Dominica	Colin Bully Chief Agric. Officer	Ministry of Agriculture Government Headquarters, Roseau
5. Dominican Republic	Guillermo Villanueva Head of Department	Secretariat of Agriculture, Santo Domingo, Rep. Dominicana
6. Grenada	N. D. Need Agric. Project Officer	Planning Division Ministry of Agriculture, C/O IICA Office, St. George's GRENADA
7. Haiti	Julio Barthelemy Director SERA	Ministry of Agriculture Damien, Port-au-Prince, Haiti
8. Jamaica	K. E. Wellington Director of Research	Ministry of Agriculture Research and Development Dept Hope Gardens, Kingston 6, Jamaica
9. Montserrat	F. Margetson Minister of Agric.	Ministry of Agriculture Plymouth, Montserrat.
10. St. Lucia	C. G. Michel Research Officer	Ministry of Agriculture, Castries, St. Lucia
11. Suriname	R. R. Huiswoud Agronomist	Agric. Expt. Station P. O. Box 160, Paramaribo, Suriname.

RESULTS

The NARS were invited to review and change, if needed, the list of issues and sub-issues proposed in the questionnaire. Only four

countries (Dominican Republic, Grenada, Haiti and Suriname) added some points to the list. But upon examination it was found that these were already contained in the proposed issues and sub-issues, although less explicitly. Therefore the original set of issues and sub-issues was maintained.

The overall independent rating was about 3.8 points (Table 2), showing that the issues and sub-issues raised were judged to be definitely important by the NARS. The average rating from Antigua (about 2.5 points) and Dominica (2.4 points) were the lowest, possibly because in both countries a good share of the local agriresearch is carried out by nonindigenous structures, alleviating some of the organisation and administrative shortcomings commonly observed in the Caribbean NARS where the role of such structures is less prominent.

Table 2. Country Overall Issue Rating

COUNTRY	RATING	
	TOTAL	MEAN 1/
1. Antigua	94	2.47
2. Barbados	146	3.94
3. Belize	164	4.32
4. Dominica	92	2.42
5. Dominican Republic	178	4.68
6. Grenada	145	3.82
7. Haiti	151	3.97
8. Jamaica	187	4.92
9. Montserrat	126	3.32
10. St. Lucia	176	4.63
11. Suriname	137	3.61
TOTAL	1596	3.82

1/ Scale:

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

The ratings by group of issues and sub-issues are summarised as follows.

1. Research and National Development

The relationship between national agri-research planning and national development policies was a very important cause of concern (4.0 points) to the NARS (Table 3). That relationship has generated interesting but inconclusive debates in the region regarding the way it should be dealt with. A balance between the dependency of agri-research on current national development policies and plans on the one hand and its flexibility in anticipation of future national needs on the other, must be struck. The distance between dependency and flexibility admittedly is proportional to the technological level of the agricultural sector and the amount of available institutional resources (human, physical and financial).

Table 3: Research and National Development Rating 1/

COUNTRY	ISSUE AND SUB-ISSUE		
	1	1.1	1.2
1. Antigua	2	2	2
2. Barbados	4	4	4
3. Belize	3	5	4
4. Dominica	2	2	2
5. Dominican Republic	5	5	5
6. Grenada	5	5	3
7. Haiti	5	3	4
8. Jamaica	5	5	5
9. Montserrat	4	4	3
10. St. Lucia	5	4	4
11. Suriname	4	4	4
MEAN	4.00	3.90	3.64

1/ Scale:

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

2. Research System Structure

The NARS considered highly relevant the discussion of this issue on a regional level. The area of major concern (4.0 points) was the internal arrangement of the research institutions (Table 4). This varies greatly within the Caribbean, reflecting the socio-political heritage of the different groups of countries (Dutch, English, French and Spanish).

Table 4: National Research System Structure Rating 1/

COUNTRY	ISSUE AND SUB-ISSUE					
	2	2.1	2.2	2.3	2.4	2.5
1. Antigua	2	2	2	2	2	2
2. Barbados	4	4	4	5	4	3
3. Belize	4	4	3	3	3	5
4. Dominica	3	2	3	3	4	4
5. Dominican Republic	5	5	5	5	5	5
6. Grenada	4	4	3	3	4	3
7. Haiti	4	3	4	5	–	3
8. Jamaica	5	5	5	5	5	5
9. Montserrat	3	3	3	3	3	3
10. St. Lucia	4	5	5	5	5	4
11. Suriname	5	5	5	5	3	4
MEAN	3.90	3.82	3.82	4.00	3.45	3.72

1/ Scale:

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

3. Institutional Research Planning

Research planning has been one of the weakest features of the NARS in the region, due mainly to the lack of proper orientation and divergent views on the very functions of the research structures.

This is shown by the high rating (approximately 4.1 points) assigned by the NARS to the discussion of the planning process *per se* (Table 5).

Table 5: Institutional Research Planning Rating 1/

COUNTRY	ISSUE AND SUB-ISSUE		
	3	3.1	3.2
1. Antigua	2	3	3
2. Barbados	5	4	4
3. Belize	4	3	5
4. Dominica	2	3	3
5. Dominican Republic	5	5	5
6. Grenada	3	3	4
7. Haiti	4	3	4
8. Jamaica	4	4	4
9. Montserrat	3	4	4
10. St. Lucia	5	4	5
11. Suriname	4	4	4
MEAN	3.72	3.64	4.09

1/: Scale

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

4. Research Programme Management

Agricultural research programmes are intended to correspond to broad problem areas relevant to the development sector. They usually match the commodity targets in the national development plans. Thus they may be identified as the traditional food crop, export crop, and livestock programmes, or the more recent aquaculture and agro-energy programmes. Their management, and especially their

evaluation, were rated by the NARS as very important subjects (4.0 points) for regional discussion (Table 6).

Table 6: Research Programme Management Rating 1/

COUNTRY	ISSUE AND SUB-ISSUE			
	4	4.1	4.2	4.3
1. Antigua	3	3	3	3
2; Barbados	4	3	3	4
3. Belize	5	4	4	5
4. Dominica	3	3	3	3
5. Dominican Republic	5	5	5	5
6. Grenada	4	3	3	4
7. Haiti	4	4	3	5
8. Jamaica	5	5	5	5
9. Montserrat	3	3	2	2
10. St. Lucia	5	4	4	5
11. Suriname	3	3	3	3
MEAN	4.00	3.64	3.45	4.00

1/: Scale

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

5. Research Project Management

The implementation of research programmes through relevant projects is a complex management problem that most of the NARS have been unable to handle satisfactorily. This aspect was scored on the whole as very important (about 4.1 points) for regional discussion and action (Table 7).

Table 7: Research Project Management Rating 1/

COUNTRY	ISSUE AND SUB-ISSUE					
	5	5.1	5.2	5.3	5.4	5.5
1. Antigua	3	3	3	3	3	3
2. Barbados	4	5	4	4	4	5
3. Belize	5	5	4	4	5	5
4. Dominica	2	2	3	3	2	2
5. Dominican Republic	5	5	5	5	5	5
6. Grenada	5	4	4	4	4	3
7. Haiti	4	3	3	4	5	3
8. Jamaica	5	5	5	5	5	5
9. Montserrat	4	4	4	4	4	3
10. St. Lucia	5	5	5	5	5	5
11. Suriname	3	3	5	5	3	3
MEAN	4.09	4.00	4.09	4.18	4.09	3.82

1/: Scale

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

6. Technology Transfer

The average rating for the different aspects of technology transfer proposed for discussion (Table 8) was uniform (about 3.7 points). The high importance conferred on the issue could have been expected since in all of the Caribbean countries the level of adopted technology is usually a dismal portion of that produced by the NARS. This arouses a legitimate concern since the true value of agricultural research is measured by its actual contribution to the productivity of the farming systems.

Table 8: Technology Transfer Rating 1/

COUNTRY	ISSUE AND SUB-ISSUE			
	6	6.1	6.2	6.3
1. Antigua	3	3	3	3
2. Barbados	3	3	3	3
3. Belize	4	5	5	5
4. Dominica	2	2	2	2
5. Dominican Republic	5	5	5	5
6. Grenada	3	3	4	3
7. Haiti	5	5	4	5
8. Jamaica	5	5	5	5
9. Montserrat	4	3	3	3
10. St. Lucia	4	4	4	4
11. Suriname	3	3	3	3
MEAN	3.72	3.72	3.72	3.72

1/: Scale

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

7. Research Impact Evaluation

The need to devote special attention to the impact of agriresearch was strongly recognised by the NARS. The importance of the economic and social returns was rated even higher (3.6 points) than that of the technological changes as such (3.5 points), usually expressed in mere biological yields (Table 9).

Table 9: Research Impact Evaluation Rating 1/

COUNTRY	ISSUE AND SUB-ISSUE		
	7	7.1	7.2
1. Antigua	2	2	3
2. Barbados	3	3	3
3. Belize	4	4	4
4. Dominica	2	2	2
5. Dominican Republic	5	5	5
6. Grenada	3	4	3
7. Haiti	5	4	5
8. Jamaica	5	5	5
9. Montserrat	4	3	3
10. St. Lucia	4	4	4
11. Suriname	3	3	3
MEAN	3.64	3.54	3.64

1/: Scale

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

8. Research Physical Resources

Most agriresearch institutions in the Caribbean work on limited budgets and with meagre physical facilities of all sorts. Yet financial resources needed to improve this situation would be found if investments in the NARS could be demonstrated to be highly profitable economically and socially. The respondents felt that the examination of this problem at the regional level is quite important (Table 10).

Table 10: Research Physical Resources Rating 1/

COUNTRY	ISSUE AND SUB-ISSUE				
	8	8.1	8.2	8.3	8.4
1. Antigua	2	2	2	2	2
2. Barbados	3	4	4	4	4
3. Belize	5	5	4	5	5
4. Dominica	3	2	3	2	1
5. Dominican Republic	3	3	3	3	5
6. Grenada	5	5	4	4	4
7. Haiti	5	5	4	4	4
8. Jamaica	5	5	5	5	5
9. Montserrat	4	3	4	3	3
10. St. Lucia	5	5	5	5	5
11. Suriname	3	3	3	3	3
MEAN	3.91	3.82	3.73	3.64	3.73

1/: Scale

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

9. Research Personnel

The NARS rated the research personnel issue as very important (about 4.3 points) for regional attention (Table 11). As observed for physical resources, the human resources of the NARS are limited both in quantity and quality. One major area of weakness is precisely the unavailability of trained professionals in agriresearch organisation and administration.

Table 11: Research Personnel Rating 1/

COUNTRY	ISSUE AND SUB-ISSUE			
	9	9.1	9.2	9.3
1. Antigua	2	2	2	3
2. Barbados	5	4	4	4
3. Belize	5	3	4	5
4. Dominica	2	2	2	2
5. Dominican Republic	4	4	4	4
6. Grenada	5	5	4	4
7. Haiti	5	4	3	4
8. Jamaica	5	5	5	5
9. Montserrat	4	3	3	3
10. St. Lucia	5	5	5	5
11. Suriname	5	5	3	3
MEAN	4.27	3.82	3.54	3.82

1/: Scale

1 Irrelevant
2 Scarcely important
3 Important
4 Very Important
5 Extremely important

CONCLUSION

Following the 1977 regional meeting (1) several countries of the Caribbean have reviewed the performance of the local research institutions, and aimed at increasing their contribution to the national agricultural development goals. With IICA's assistance this led to the preparation of updated diagnostic documents on the agricultural research systems in Guyana (2), Jamaica (3), Haiti (4, 5), the Dominican Republic (6, 7) and Barbados (8, 9, 10).

The issues raised in the questionnaire were found by the NARS to be highly relevant to the diagnosis, and sufficient for a regional discussion on the institutional improvement of their organisational and administrative procedures.

The expected result of the discussions is the formulation of strategies and the identification of practical means capable of strengthening the organisation and managerial capacity of the NARS to plan, program, implement and evaluate agricultural research

activities consonant with the national agricultural development plans, in support of the socio-economic advancement of the Caribbean farmer and consumer.

REFERENCES

1. DARNDR/IICA. Reunion technique regionale sur les systèmes de recherche agricole dans les Antilles. Port-au-Prince (Haiti). 1977. irreg. pag. (Provisional).
2. FLETCHER, R., MACKENZIE, P., MCLEAN, F., CHIN, V., and DOWNER, A.V. Agricultural research in Guyana, Georgetown 1978. 56p.
3. BARKER, G.H., WAHAB, A.H., and BELL, L.A. Agricultural research in Jamaica. Kingston. 1977. 81p.
4. HAITI DEPARTEMENT DE L' AGRICULTURE, DES RESSOURCES NATURELLES ET DU DEVELOPPEMENT RURAL. Rapport sur la situation du systeme de recherche agricole en Haiti. DARNDR. Port-au-Prince. 1977. 25p. (and two annexes).
5. HAITI. DEPARTMENT OF AGRICULTURE, NATURAL RESOURCES AND RURAL DEVELOPMENT. Diagnosis of the situation of the agricultural research and extension system in Haiti (a summary). DARNDR. Agricultural Research Service, Damien, January, 1981. 1p.
6. SECRETARIO DE ESTADO DE AGRICULTURA/INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS. Diagnostico de la Investigación Agropecuaria en la República Dominicana. SEA-DIA/IICA. Santo Domingo. 1977. 55p. (and three annexes).
7. STAGNO, H. and PINEDA, R.A. Situación actual del sistema nacional de investigación y extensión y descripción de los programas principales en cultivos alimentícios. Santo Domingo, República Dominicana (IICA/SEA). Diciembre 1980. 96p.
8. JEFFERS, J. W. P. Agricultural Research Systems in the Caribbean. Barbados country report. 1979. (Bridgetown). 12p. (and one appendix).
9. INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS. Barbados Agricultural Research System. A condensed report (by A. M. Pinchinat) Santo Domingo, Dominican Republic. December, 1980. 7p.
10. BARBADOS. MINISTRY OF AGRICULTURE. Interim progress report on the work of the agricultural research committee to cater to the needs of farmers. (Bridgetown) 1979 11p. (and seven appendices).

ANNEX 1

CARIBBEAN WORKSHOP ON THE ORGANISATION AND ADMINISTRATION OF AGRICULTURAL RESEARCH

In Table 1, please rate the proposed issues and sub-issues according to the following scale of relative importance for the national agricultural research system in your country.

SCALE	MEANING
5	Extremely Important
4	Very Important
3	Important
2	Scarcely important
1	Irrelevant

In Table 2, please identify the individuals who participated in the selection and rating of the issues.

Table 1: Priority issues for the agricultural research system of (Country): _____

Nº	ISSUE AND SUB–ISSUE	SCALE
1.	Research and National Development	☐
1.1	National Research Policy	☐
1.2	National Research Planning	☐
2.	National Research System Structure	☐
2.1	System Composition, Leadership and Doctrine	☐
2.2	Internal System Coordination	☐

No		ISSUE AND SUB–ISSUE	SCALE
	2.3	Internal Institutional Structure	☐
	2.4	National Linkages	☐
	2.5	International Cooperation	☐
3.		Institutional Research Planning	☐
	3.1	Research Plans	☐
	3.2	Research Planning	☐
4.		Research Programme Management	☐
	4.1	Programmes	☐
	4.2	Programming Process	☐
	4.3	Programme Evaluation	☐
5.		Research Project Management	☐
	5.1	Project Identification and Selection	☐
	5.2	Project Preparation	☐
	5.3	Project Implementation	☐
	5.4	Project Monitoring and Evaluation	☐
	5.5	Reporting and Publication	☐

NO	ISSUE AND SUB–ISSUE	SCALE
6.	Technology Transfer	
6.1	Research Validation	
6.2	Feed-Back Mechanisms	
6.3	Transfer Processes	
7.	Research Impact Evaluation	
7.1	Technological Changes	
7.2	Research Returns (economic-social)	
8.	Research Physical Resources	
8.1	Research Funding	
8.2	Financial Resource Allocation	
8.3	Physical Facilities	
8.4	Documentation and Information Resources	
9.	Research Personnel	
9.1	Research Staffing Policy	
9.2	Personnel Management	
9.3	Technical and Administrative Personnel Upgrading	

No	ISSUE AND SUB–ISSUE	SCALE
10.	Other	☐
10.1	_____	☐
10.2	_____	☐
10.3	_____	☐
10.4	_____	☐
10.5	_____	☐

Table 2: Identification of the individuals who participated in the selection and rating of issues for the agricultural research system of (Country): _____

NAME	Academic Degree	Position	Institution
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

INSTITUTIONAL ASPECTS OF AGRICULTURAL RESEARCH ORGANISATION IN LATIN AMERICA, PROBLEMS, PERSPECTIVES AND POLICY ISSUES

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INTRODUCTION

This paper presents ideas and questions about the problems facing the National Agricultural Research Systems in Latin America, and it is intended as a basis for a more general discussion on future actions in the area of Science and Technology for the agricultural sector.

During the last two decades, the technological question in Latin America focused primarily on creating, developing and operating National Agricultural Research Centers. These were and still are the principal centers for agricultural research at the national level; they absorb the bulk of human and financial resources available for this type of activity, and consequently are representative of the national capabilities in agricultural science and technology.

In response to its basic strategy of institution-building, IICA concentrated its efforts on developing these public organisations by providing technical assistance and cooperation.

The fundamental point made here is that the economic and institutional development that took place during the last two decades introduced transformations in the institutional context where technology generation and transfer take place. These transformations need to be incorporated into the strategies for support and technical

cooperation for the technological component of rural development.

These transformations refer primarily to the private and semi-public organisations that operate in specific aspects of technology generation and transfer. Together with the National Institutes, these organisations now form a multi-organisational system replacing the (de-facto) State monopoly which existed at the beginning of the sixties when the latter were being developed.

These developments are inevitable in the evolution of the market economies which characterise most of the Latin American societies. They are considered positive factors in as much as the participation of different economic and social sectors in the technological process increases the amount of resources available. In a significant number of countries, however, the emergence of these new institutions caused the National Research Centers – once their initial stages of territorial occupation and institutional consolidation were completed – to suffer increasing conflict and contradictions in defining their objectives and their organisational structure.

Partly as a result of these conflicts, the Institutes appeared to lose political support. This affected their performance and consequently, their competence vis-a-vis the new agencies operating in the system. The crisis situation gave rise to a number of questions which must be resolved because of the central role the Institutes should play in the process of generating and transferring technology.

It is important to emphasise that although the Institutes are only one of the components of the national technology generation and transfer system, they play a major role in this field. This is due to some of the characteristics of the physical-biological research process and the organisation of the agricultural sector which demand State participation, and by extension that of the Institutes which represent the State infrastructure in the field. Unless this role is performed effectively, the remaining components of the system will have difficulty in achieving their specific objectives. This indicates the importance of making a correct description of the nature and origins of the current institutional situation before attempting to implement actions in an effort to curb this process.

The progressive development of a multi-organisational system in which member organisations simultaneously complement and compete with each other requires that the element of complementarity be highly developed in order for the system to operate effectively. The functions of each component and the operative mechanisms tying them together must therefore be clearly and precisely defined. Likewise, the fact that the State has lost the monopoly on research and transfer indicates the need to develop institutional mechanisms to ensure that the countries preserve their capability to determine and orient their own technological process.

Following this, is an analysis of the evolution of the National Research Institutes, the principal dimensions of their current problems and the principal factors determining this evolutionary process. This will support the assertion that the above mentioned institutional developments – creation of a multi-organisational system and crisis in the national agencies – are not isolated factors but rather are parallel manifestations of phenomena specific to Latin American agricultural development.

The third section describes the emergence of the new organisational components and of some of the relationships between the process and the performance of the National Institutes. Finally, the elements that should be considered for implementing action in the area of agricultural science and technology are presented.

NATIONAL AGRICULTURAL RESEARCH INSTITUTES IN LATIN AMERICA

Origin and Development of the National Institutes

The institutional development of technology generation and transference activities in Latin America, particularly in the countries of South America, is characterised by two well-defined stages. They are distinguished by the magnitude of the research effort and by the degree and form of public sector participation. The first of these stages starts with the initiation of research activities during the second half of the past century, and lasts until the mid-1950's. This is characterised by a low level of research activity carried out under *ad-hoc* and generally unstable institutional mechanisms.

Towards the end of this stage (the thirties and forties) the first experiment stations were organised. The situation, however, continued to be unstable because of the dependent nature of the experiment stations. Funding sources for research changed frequently, and the universities and schools of agriculture progressively became less important than the institutions directly dependent on administrative power. As a result of this process research activities were almost completely centralised in the Ministries of Agriculture.

The institutional format suffered from a number of limitations generally due to the bureaucratic nature of the Ministries. The most important of these were: unreliable budgetary support; inability to target the problems and priorities of farmers; fragmentation of efforts; inadequate ties between research, technical assistance and extension; and lack of coordination between the research organisation and those implementing the other components of agricultural policy

required for the effective development of the productive process (prices, credit, services, etc.) (PROTAAL, 1977; Samper, 1977).

During the mid-fifties, certain factors substantially changed the situation, giving rise to the second stage of the process, characterised primarily by the decentralisation of research and, in some cases, technology transfer (extension activities). These activities were shifted to decentralised, autonomous institutes generally patterned after the Experimental Station System of the United States.

The new institutional model was chosen to reflect the concept that technology is central to agricultural development, and the conviction that a broad range of potentially useful technology was available at the international level for the productive sector of Latin America. The problem, then, was to transfer this knowledge from the developed countries to the developing countries. It would be necessary to develop adaptable and flexible research infrastructure linking recipient countries with generating centers, a task which the Research Offices of the Ministries of Agriculture could not perform effectively because of the above mentioned problems. This concept is summarised in T. W. Schultz's book, "Transforming Traditional Agriculture", upon which the United States' Point IV Foreign Aid Programme (initiated in 1951) was based.

This idea was reinforced by a significant amount of financial and technical foreign aid, which was used to develop new institutes by building physical infrastructure and training research staff.

Thus, with some variations between organisations, but always within the same general framework, INTA was created in Argentina in 1957, INIAP in Ecuador in 1959, INIA in Mexico in 1961, ICA in Colombia 1962, and INIA in Chile in 1964. The trend towards decentralisation was not limited to the technological institutions; it also affected other service areas such as marketing, credit, etc., complemented by sectoral planning offices responsible for coordinating overall sectoral policy.

In the seventies, EMBRAPA was created in Brazil, FONAIAP in Venezuela, IBTA in Bolivia, ICTA in Guatemala, INTA in Nicaragua and INIA in Peru. During this period, Venezuela and Peru departed significantly from the general model. In the first case, the private sector participates intensely through foundations like FUSAGRI. In the second, the innovation appears through the active participation of the University (the Agrarian University of La Molina).

From the point of view of organisation, the Research Institutes, which became the basic elements of the systems in 1960, were decentralised, autonomous, and covered a broad range of products, regions and farmers. Functionally, they integrated research, especially applied research, with transfer activities, including, in some cases, post-graduate education (INTA and ICA). Slight differences in the

integration of functions show up at INIAP in Ecuador and INIA in Mexico. At INIAP, technology transfer is not a formal function of the Institution, and in the case of INIA, the Institution does not conduct livestock research.

In most cases, the Institutes were administratively organised to include National Research Centers for subject areas or products which were responsible for developing basic research, and experiment stations and extension agencies which performed applied and adaptive research and transferred new technological knowledge. This structure aimed to institutionally integrate the different stages of the technology generation and transfer process, and to tie the process directly to the production problems of the different regions and types of farmers.

From the operational point of view, programs by discipline and product were superimposed upon this decentralised structure. They provided a basis for priorities selection, resource allocation, activities programming, and coordinating the national programmes.

Within this context in the early sixties a strong emphasis was placed on expanding research and technology transfer activities in the agricultural sector. Note that this stage grew out of the developments taking place within the Ministries which were receiving significant support from international agencies, who were following the United States policy summarised in Point IV of its foreign aid legislation. From this time on, and because of continued and increasing financial support from international sources, and larger national budgets, the stage known as "territorial occupation" was developed, with the creation of new experiment stations and extension agency networks. At the same time, broad programs were begun for training staff researchers; these in some cases included the development of national infrastructure for post-graduate education (ICA, INTA and La Molina).

In the early seventies, this sustained growth and ensuing consolidation began to create problems in a significant number of countries, particularly in those where national research agencies had been created in the early sixties (Argentina, Colombia, Chile and Peru). Mexico was an exception to this process, and Brazil and Venezuela cannot be evaluated yet, as their research organisations were created only in the early seventies. In 1973 EMBRAPA replaced the Department of Agricultural Research and Experimentation, and FONAIAP was transformed into an autonomous state service in 1975.

The remaining sections of this paper present an analysis and description of these problems, attempting to identify some of the causes of this institutional situation and to highlight the policy measures required for the national institutions to recover and completely fulfill their central role in the technological process.

The Conceptual Base of the Model: The State and its relationship with social groups involved in the technological process

One of the primary assumptions for an adequate performance of the type of research organisation adopted in Latin American countries is related to the nature of the State's pattern of administration, and its ability to implement technological policies which will stimulate technological change. 1/

The technological agencies are decentralised public entities from the point of view of implementation, linked to state policy-setting agencies (ministries, planning offices, etc.) for their general orientation. They specialise in generating and, in some cases, transferring technology, which means that the policy-setting agencies must coordinate the tasks of different executing agencies to achieve the common objectives of agricultural policies. That is, aside from generation and dissemination of new technologies, price, marketing, credit, and other policies must also be developed and implemented to facilitate the adoption of new technology by the producing sector.

Furthermore, technological institutions must serve a broad range of products and recipients. The comprehensive scope of their action obliges them to respond to considerably disparate interests and problems which could lead to an internalization, at the level of operational decisions, of conflicts arising from the diversity of interests manifested by the different target social groups.

In order for an institutional model with these characteristics to operate effectively, the state must be highly coordinated and powerful, in relation to the civilian society from which it emerges, and thus capable of defining a given strategy and implementing it through state agencies. In the developed countries the political supremacy of the industrial sector following the Second World War led to the implementation of a strategy for modernising agricultural production, which significantly increased yields. On the contrary in Latin America the situation has been characterised by the absence of a preponderant social group, and thus by the permanent presence of unresolved conflicts at the state level in regard to the overall strategies of agricultural development and modernisation.

This is reflected in state activity as a whole, and has implications for the technological question. Unresolved conflicts at the state level reveal inconsistencies in the different policy measures implemented for different regions and products, and they hinder the effective incorporation of technology into these productive processes. Likewise, the various needs and requirements of the highly differentiated agricultural sectors are reflected in the technological institutions.

Because no scheme existed for developing priorities among beneficiaries, products or regions, institutions underwent a progressive breakdown in their ability to define operational priorities and effective relationships with their clientele.

In this line two matters of singular importance are worth noting. In the first place the productive structure of the Latin American agricultural sector is characterised by a great diversity of situations and the predominance of small farms. This creates serious limitations on the productive sector's ability to adequately express its technological demands. In the second place the socioeconomic conditions within which small-scale farmers develop their productive activities make the technological variable only one of the many components needed for the improvement of their production performance. Thus, because they also lack trade or other organisations of small-scale farmers, their demands for technology are expressed only partially, and the research organisations themselves must seek to fill existing needs by using mechanisms created for "reading" the requirements of these sectors. These mechanisms, however, face the additional difficulty of having to decipher very different contexts of design and operation which has further detracted from their effectiveness.

The presence of commercial sectors which can adequately express their demands has caused most research activities to concentrate excessively on the problems of commercial agriculture. This is due to the fact that the technological variable is more critical to this sector's activities. As a group they are better equipped to express their needs, and the research apparatus is more experienced and better adapted to dealing with their problems.

This fragmentation of research centers is one of their main limitations. As soon as it occured, they abandoned their original mandate, thus losing a good part of their connections and the political support they needed for maintaining the flow of resources required for developing and strengthening their activities.

Principal Indicators of Current Institutional Problems

An indicator of the status of research agencies at the regional level is the magnitude of resources allocated for research and technology transfer throughout the continent (Ardila, Trigo and Piñeiro, 1980). An analysis of this kind, however, must be carefully qualified since general figures for the region as a whole do not reflect differences in institutional situations, particularly in terms of the size of the countries and their potential for investing in technology.

A brief analysis of the evolution of expenditures for research from 1951 to the present, based on information gathered by Boyce

and Evenson (1975) shows increases from US$30 million in 1951 (1971 dollars) to approximately US$115 million in 1974, and to more than US$180 million in 1979 (Schultz, 1979). These estimates suggest an optimistic future for the region, but upon consideration of the significant growth of resource allocation in Brazil and Mexico —around US$25 million annually between 1971 and 1974 alone — and the initiation of activities in some of the countries, particularly those in Central America, it becomes evident that general budgetary increases reflect primarily the relative weight of the different countries and not a regional trend. The analysis of some cases in particular tends to provide more evidence of this.

Similarly, the study of the evolution of research expenditures in each country as an indicator of the institutional status of research activities also requires a certain degree of qualification for correct interpretation. This evolution alone may not faithfully reflect the institutional status or the support that research activities receive at a given moment, since the origin and mechanisms, through which budgetary allocations move, act to subordinate the significance of a given budgetary figure. Only if the funds come directly from the national budget does their evolution accurately indicate state support of these activities. This analysis should also be completed with information of the country's overall budgetary situation, in order to determine how assigned funds indirectly determine research activities. In instances where the research budget is independent of the national budget and is tied to other specific sources, as in the case of INTA in Argentina where resources reflect a fixed percentage of agricultural exports, the evolution of the budget is not a satisfactory indicator of the State's priority for research efforts.

Having clarified the validity of the budgetary analysis as an indicator of the institutional situation we can now briefly summarise the evolution of the budgets of the most important research institutions in Argentina, Peru and Colombia.

Table 1 presents the budgets of INTA, ICA and the Agrarian University of La Molina. In general both INTA and ICA received similar budgetary support showing steady increases during the sixties and a dramatic reversal in 1970/72. The case of the Agrarian University is quite different since the cyclical nature of the budget makes it impossible to pick out any clear trend. In Colombia where research funds come from the national budget the decline coincides with a time of certain budgetary affluence which resulted from the "coffee boom" of 1974–75.

The case of INTA requires greater qualification since its budget is tied to the volume of exports. At the beginning of the decade, the budget was reduced after a severe drop in the value of the exports. In 1970–73, expenses (approved budget) required practically 100%

of the income. A political-institutional movement ensued climaxing in 1973, when an increase was approved for the percentage of the value of agricultural exports destined for INTA, which went from 1.5 to 2%. From that time on the situation changed substantially and except for the initial increase registered in 1973 and 1974, the real amount of the annually approved budget declined for the institution. Between 1960 and 1975 the minimum value of the expenditure: income ratio was 77%, normally running greater than 85%. Subsequently, this relationship decreased to 63% in 1976, 51% in 1977 and 67% (Ardila, Trigo and Pineiro, 1980). These figures indicate that both institutions suffered a clear loss of institutional support (Table 1).

TABLE 1: BUDGETS ALLOCATED TO THE PRINCIPAL AGRICULTURAL RESEARCH INSTITUTES IN ARGENTINA, COLOMBIA AND PERU.

YEAR	INTA (Argentina) Millions of 1977 pesos	ICA (Colombia) Thousands of 1970 pesos	LA MOLINA (Peru) Thousands of 1974 soles
1965	10,33	–	218.111
1966	11,71	61.250	325.888
1967	15,00	152,604	410.943
1968	16,18	155.617	293.581
1969	15,49	231.381	168.167
1970	17,84	294.921	282.675
1971	14,80	290.875	281.726
1972	14,28	378.603	285.176
1973	19,62	167.491	246.240
1974	23,36	290.559	194.856
1975	18,24	314.212	341.071
1976	15,51	301.818	438.998
1977	17,48	306.558	385.786
1978	20,48	257.273	391.137

Source: Ardila, Trigo and Piñeiro, 1980.

It is important to note that the above occurred within a regional context of a general restriction in resources for agricultural research. If the percentages of agricultural produce invested in research in Latin America are compared with figures for other regions this becomes quite clear. Boyce and Evenson (1975) report that the percentage in Latin American amounted to a mere 1.21o/o in 1974, compared with 1.40o/o in Africa; 1.85o/o in Asia; 2.91o/o in Western Europe and 2.79o/o in North America and Oceania. Expenditures for technology transfer present a similar picture. Although Latin America surpassed Western Europe, North America and Oceania with its 0.87o/o, it still fell behind other regions of the developing world where, for example, Africa spent 2.20o/o of the value of its agricultural production on technology transfer.

As a complement to the resources and budget situation three additional elements can be considered in describing the institutional problems noted:

(1) the failure to fulfill certain basic aspects of the original model;
(2) the condition of the organisational and operative structures of the agencies; and
(3) the evolution of their training programs and their resulting capability to retain trained personnel.

The effective development of a technology generation process requires access to basic knowledge which serves as a point of departure and as a frame of reference. In most developed countries this basic knowledge comes from research activities perfomed by universities and advanced research centers.

Research centers in Latin America were created basically as "mission oriented" organisations and relied on the assumption that basic research would be performed at the country level by other institutions or would be obtained through institutional mechanisms linking them to other national or international technology generation centers. None of these assumptions proved to be valid. The Universities in general do not have sufficiently sophisticated programs and the mechanisms linking programs with research centres in other countries are not formally operative; they function on the basis of special situations or personal relationships between researchers. Although a number of international centres operate in the region, institutional channels do not exist through which national agencies can elucidate their specific needs and requirements. Likewise, given the mandate of the international centres (specific products or ecological regions), the support they could provide to national level activities was limited.

The larger organisations like INTA or ICA were thus forced to attempt to fulfil their own basic research needs which further aggravated the agencies' resource situation and caused internal conflicts

as a result of their inability to adapt functionally and doctrinally to these types of activities.

On the second point the seventies were characterised by constant changes in the organisation and operation of the agencies and their duties. Perhaps ICA in Colombia illustrates this point most clearly. The other two institutions underwent processes that, to different degrees, brought out the discrepancy between the original model and present conditions or demands. Functional difficulties arose because of the constant changes introduced into the organisational charts but probably the most noteworthy and important fact about this process was that these changes were attempting to establish better ties between research activities and the concrete problems of the farming sector. Examples are the creation of planning units and the efforts made to regionalise and integrate research and technology transfer activities. It also placed in question, both at home and abroad, the agencies' ability to achieve objectives and contribute to increasing agricultural production and productivity and improving the standards of living of the rural population.

The last set of indicators regarding the institutional status of the research and technology transfer institutes involves the evolution of highly trained human resources (critical mass) that can perhaps be considered the most important necessary condition for developing an effective research programme. The research organisations in the region and the international agencies that supported their creation and development are in agreement with this. Proof of this are the important training programs that were implemented prior to and following the creation of the national institutes. 2/

In general these programs were developed within a strategy that included strong external support during the initial stage,later replaced by national support as institutional coordination progressed. The plan initially envisioned sending scholarship holders to study centres abroad while a national infrastructure for post-graduate training, at least to the master's level, was simultaneously being developed for eventually satisfying most of the country's training needs.

Table 2 describes the evolution of the training programs in Argentina, Colombia and Peru, overall as well as within national programs. Note that the training programs follow the same general trends as overall institute budgets.

Following an initial stage of sustained growth during the late sixties and early seventies an abrupt decline occurred which culminated in the closure of the programs towards the end of the decade. This closely follows the movement of external funding for training activities. In Colombia, Argentina and Peru international support for training in the agricultural sciences grew until 1969–1973 when it declined, almost disappearing in 1978. This indicates inability or

disinterest on the part of national agencies to substitute international funds with their own, as set forth in the original strategy (Ardila, Trigo and Piñeiro, 1980).

An increasingly severe institutional crisis grew out of this situation and the agencies were apparently unable to retain trained personnel on staff. As a result, once training programs were no longer available the number of trained personnel progressively declined.

This process is clearly reflected in the information found in Tables 3 and 4 on the withdrawal of personnel and the total number of staff with post-graduate training at the end of each year. The migration process which has its own serious implications diminished the operative capability of the agencies by draining their technical teams and by upsetting their programs. Similarly, considering that the productive capabilities of researchers increase in proportion to their work experience, the relatively high rates of staff turnover decrease the average work experience of any level of staff and markedly decrease their productive potential. According to estimates for 1960–1978 (Ardila, Trigo and Piñeiro, 1980) turnover rates were 74.4% for INTA, 181.8% for ICA and 105.5% for the Agrarian University of La Molina. The turnover rates although calculated for 1960–1978 primarily reflect the events of the seventies since the flight of personnel was practically non-existent between 1960-1970.

Preliminary results of a study on the evolution of the national post-graduate program in Chile (Contreras, 1979), indicate conditions very similar to those in Argentina, Colombia and Peru. A total of 53 professionals were trained by INIA in Chile – 41 abroad and 12 in Chile – of whom 36 withdrew from the institution; 20 going to the private sector in Chile and 16 abroad. This is perhaps the most dramatic case of all in terms of current availability of research personnel.

The evidence submitted on budgets, the evolution of training programs and staff turnover, as well as that of the successive changes affecting operative functions and structures are all part of the institutional crisis. Its magnitude, especially in those institutions which were created in the early sixties, indicates the necessity of analysing this subject further, discussing some hypotheses and determining the origins of these situations. The following sections set forth some ideas that can serve as a basis for the discussion.

Elements for Interpreting the Problems of National Research Institutes

These problems can be interpreted with a two-part hypothesis:

(1) the national research institutes were perhaps an appropriate

institutional response to the conditions of the late fifties;

(2) the profund changes which have taken place during the past two decades in the agricultural sector of these countries, the international scientific community and the non-public technological institutions changed these conditions substantially, creating a series of conflicts between the agencies and the environments in which they operate. Left unresolved, these conflicts generated the institutional problems herein described.

Within this general hypothesis it would seem appropriate to begin the analysis by attempting to reconstruct the conditions of the fifties, and analyse the characteristics of the organisational model proposed at that time. In this regard three important elements should be noted.

In the first place, the creation and dissemination of new technology was the foremost component in the strategy for agricultural development at the time. Consequently, a favourable "environment" existed at the national and international levels for institutional development in this area. This took the form of significant support not only in financial terms, but also for the political decisions needed to create and develop the agencies.

Secondly a general consensus existed about the need to incorporate technology for increasing production in agriculture. This consensus was supported by the availability of new knowledge (e.g. hybrid seeds) which is essentially neutral in its distributive effects. Developing technological institutes thus received the support of different agrarian sectors without generating explicit attacks from the remaining groups. Support was also forthcoming as a consequence of the processes of industrialisation and urbanisation taking place during the fifties. This is summarised in ECLA's doctrinal position, in which technological modernisation of the agricultural sector played a central role.

Finally, during the initial period the rate at which basic knowledge was generated was insufficient for evolving field technology and the unavailability of research personnel created low levels of interest and few opportunities for the private sector to develop activities.

Because of these elements the model of decentralised public agencies (which replaced Ministry research structures that had complained of bureaucratic, administrative obstacles to their effectiveness) appeared as a natural and effective response to current needs.

Furthermore, these characteristics create the classic situation where the state must assume the responsibility of developing technology. Thus, the state's quasi-monopoly which is implied in the

TABLE 2: INTA, ICA AND THE LA MOLINA AGRARIAN UNIVERSITY: PERSONNEL ENTERING POST-GRADUATE STUDIES. TOTAL AND IN NATIONAL PROGRAMS (1965 – 1978).

	INTA		ICA		LA MOLINA	
Year	Began Studies	National Program	Began Studies	National Program	Began Studies	National Program
1965	15	2	11	–	15	2
1966	22	3	22	–	13	2
1967	34	–	24	8	27	1
1968	28	10	35	7	24	6
1969	23	2	40	8	16	2
1970	21	5	51	15	20	4
1971	39	21	37	8	10	3
1972	24	8	110	59	10	1
1973	24	16	96	52	11	5
1974	4	–	57	40	13	5
1975	1	–	53	51	7	1
1976	2	–	28	23	6	2
1977	1	–	7	–	1	–
1978	–	–	4	3	–	–

Source: Ardila, Trigo and Piñero, 1980

concept of national institutes is a result of prevailing "contextual conditions" rather than a concrete definition of the role they should play in the technology generation and transfer process. Note however, that this situation arose as part of a number of institutional developments with more than just the technological question. A case in point is the creation of comprehensive and sectorial planning mechanisms that complement and strengthen the state's quasi-monopoly over technology and that include technology management in addition to other instruments traditionally managed within agricultural policy.

This initial situation changed during the last 15 years as a result of certain institutional developments, occuring within and external to the national institutes, directly related to the three elements described as characteristic of the sixties.

The first significant development took place in response to changes in the emphasis on the importance of technology as a variable

TABLE 3: INTA, ICA AND THE AGRARIAN UNIVERSITY OF LA MOLINA: STAFF WITH POST–GRADUATE TRAINING WHO WITHDREW FROM THE INSTITUTION. (1965 – 1978)

YEAR	INTA	ICA	LA MOLINA
1965	–	1	–
1966	2	1	–
1967	1	–	2
1968	1	4	2
1969	4	4	1
1970	7	3	4
1971	9	12	4
1972	2	9	12
1973	4	15	6
1974	3	27	14
1975	4	45	9
1976	30	28	9
1977	3	16	8
1978	7	19	14
TOTAL	77	181	85

Source: Ardila, Trigo and Piñeiro, 1980

to the development process. During the fifties, the incorporation of new technology was viewed as the key element of agricultural development. Later, more comprehensive actions like agrarian reform, and then rural development received the spotlight. In these, technology still figured as an important variable but it now became subject to specific requirements, having to do with ecological conditions, types of users, and other factors which characterised each situation. 3/

This change in the outlook and significance of the technological variable within the development process appears to have involved the progressive appearance of an inability in the institutes' model to adapt to Latin American reality. This poor adjustment, present since the beginning, was unnoticeable as long as the institutes set their own general technological objectives, and their actions primarily served commercial agriculture whose characteristics had more in common with the contexts held as a frame of reference for the adopted model.

As previously noted, the national research and extension institutes were modeled primarily after the experiment station

TABLE 4: INTA, ICA AND THE AGRARIAN UNIVERSITY OF LA MOLINA: TOTAL STAFF WITH POST-GRADUATE TRAINING (M. S. OR Ph. D) 1965—1978

YEAR	INTA	ICA	LA MOLINA
1965	56	47	49
1966	70	60	68
1967	87	90	70
1968	105	100	77
1969	120	107	90
1970	133	123	104
1971	141	142	123
1972	169	163	124
1973	193	192	126
1974	209	256	128
1975	221	311	127
1976	197	336	120
1977	195	371	117
1978	189	382	102

Source: Ardila, Trigo and Piñeiro, 1980

system of the United States of America which provided not only the general principles but also such operative guidelines as research by discipline and products, extension methods and others. This model was originally developed in response to commercial agriculture and quasi-competitive markets for inputs and products. Researchers selected their research priorities based on market signals —the induction mechanism— that reflected the relative scarcity of factors, and the farmers made their decisions to adopt new technology on the basis of their profitability, also defined by these same market signals. Within this context the traditional research and extension systems had proved their effectiveness and this was implicit in the Latin American technological institutes.

Similarly, this change of emphasis on the priorities of the technological institutions required corresponding organisational change like the creation of mechanisms for providing an appropriate selection of research priorities in line with the needs of the new clientele (hitherto uninvolved in the technological process) and transfer techniques that effectively alter the market limitations which had inhibited the adoption of technology by small-scale farmers.

This situation produced two converging phenomena. On the one hand, the institutes went through a process of discussion and internal reorganisation in order to adjust to their new duties. Changes had to be made in the organisation of research and greater emphasis had to be placed on transfer activities and boosting production at the expense of research work.

ICA in Colombia illustrates this process. Between 1969 and 1975 the percentage of total institute resources allocated for research decreased from 44.5o/o to 27.9o/o, while funds for rural development activities (for technical assistance to small-scale farmers) rose from 13.7o/o to 27.7o/o.

This change in emphasis caused considerable problems in doctrines, which reflected institutional traditions and assigned great weight and importance to research and consequently, to the composition of their teams which were made up primarily of research staff. 4/

The reorientation also implied the gradual abandonment of commercial agriculture as the priority target, and the institutes thus lost the support of the strongest political groups in the agricultural sector.

The second important development occured as a result of increasingly intense conflict over the non-neutral nature of technology. Here it is important to consider three matters directly related to the development of the agricultural sector and the general economy, which had a great impact on the emergence of these conflicts.

(a) the industrialisation that accompanied the development process increased the demand for food products and gave rise to new social sectors affected directly by the intensity and nature of the technological process, and consequently interested in being able to influence it. In particular, the urban-industrial and food marketing sectors were both interested in increasing production as a means of decreasing the prices of agricultural products;

(b) some conflicts arose as a consequence of the implicit "biases" inherent in the new technology. This had to do with the relative intensity of the use of production factors and was always present, but its impact was of lesser importance as long as the incorporation of new land into production, usually with the use of the same technology, was the primary source of production increases; and

(c) the growing ties between the agricultural and industrial sectors, as a consequence of increases in the use of industrial

inputs in agricultural production and the development of agroindustry schemes for processing production, involved two new social sectors with clearly defined interests in the technological discussion. These were concerned primarily with adapting technology to the requirements of their processing systems.

A third and last development which should be mentioned is the appearance of alternative sources of technology at the national level through farmers' organisations, the activities of input industries, and agribusiness. This was a result of the greater accumulation of basic knowledge and trained staff. The appearance of these technology generating mechanisms reveals the consolidation of a new institutional model better adapted to the emerging "market conditions". The state's quasi-monopolistic position in technology generation and transfer changed to a structure of responsibilities shared by itself, through the national institutes, and the private and international sectors, which not only reflected the natural evolution of the technology generation and transfer system in market economies, but also the lack of a clear state position on protecting its monopoly in the area.

These three points indicate that an altogether different context had developed from the time the first national institutes were created. They consequently were obliged to readjust their mode of operation in terms of specific objectives and support apparatus. Examples are the importance given by ICA to rural development, INTA's efforts to regionalise its activities in Argentina and the growing importance of farm system, programs in a number of centers (EMBRAPA in Brazil, INIAP in Ecuador, etc.). These gestures emerge as agency initiatives within their existing doctrinal and organisation framework, that is, without a formal recognition of the need to develop new organisational structures defining the objectives and goals of each component based on the needs and limitations of the context. 5/

This is the framework within which the institutional problems of the national institutes developed and is characterised by reduced budgets, staff migration and questions regarding their effectiveness. However, it is noteworthy that technology generation and transfer activities in the countries in the region did not diminish, but on the contrary they increased as a result of the activities of the components of the emerging regional system of science and technology.

The next section deals with the make-up of this regional system . This is an important subject requiring additional clarification, particularly regarding the nature of the new institutional developments and their impact on the performance of the national research and extension institutes.

PRINCIPAL INSTITUTIONAL DEVELOPMENTS OF THE LAST TWO DECADES

It was noted that one of the most critical factors pertaining to the development of the current institutional problems of the national research institutes was the appearance of new organisations that competed with them in the generation and transfer of new technological knowledge.

This section deals with the principal institutional developments of recent years and briefly analyses their impact on the performance of the national institutes.

The Agricultural Inputs Industry

State activity for generating agricultural technology was justified by certain characteristics of the agricultural sector that provided no major incentives for the private sector. These are:

1. the smallness of agricultural enterprises which makes it difficult for them to undertake research activities;

2. the high risk of biological research; and

3. the limited possibilities for private enterprise to appropriate the benefits of these activities.

This undoubtedly influenced the model of the decentralised national institutes which flourished in the late fifties and the following two decades. However, the increased demand for technological inputs spurred by the agricultural expansion of the sixties and seventies, the progress that took place in the sciences and the basic knowledge produced as a consequence of the support provided to research during this same period, as well as the simultaneous development of legal mechanisms protecting the copyrights for certain intellectual innovations, increased the interest (profitability) of the private sector in undertaking certain types of research and technology transfer.

Initially, knowledge of certain basic matters like soil maps, working methods, and germplasm banks was extremely limited. As research programs developed these were the first problems to be tackled and the profitability of research for the private sector consequently changed. This was not the result exclusively of the actions of the national institutes but of the impact of international development and multinational enterprises as well. The contribution

of the national institutes which included training staff for private industry, was one of the most important aspects, however. Evenson (1977) identified this initial stage as creating "technological potential" (groundwork) followed by the stage for making use of the potential (this is where private activity enters) until a point is reached where a new effort is needed for creating additional groundwork. Dynamically speaking, the ability to generate technological potential became the system's critical element.

The development of the seed industry during the sixties is a clear example of how public investment (in the form of new knowledge and information as well as staff training) changed the conditions of profitability, enabling the private sector to acquire an increasingly important role in the generation and transfer of technology. This is particularly true in certain stages of the process such as developing new varieties, experimental testing and technology packaging, where it is possible to predict the results accurately and thus to reduce the risk of the investment. This type of participation is usually absorbed by the technical services departments of the ag-input industries or even private research and experimentation centres operating independently of the enterprises.

The case of the agrochemical industry in general and the poultry industries of Venezuela and Argentina in particular are examples of direct participation. FUSAGRI (Farmer's Service Foundation) in Venezuela is a prime example of a successful Centre financed by private industry but operationally independent. 6/

Technology Generation and Transfer by Farmers' Organisations

The same factors mentioned for the inputs industry, that is, the development of the agricultural sector and the possibilities generated by the new methodological knowledge and staff training carried out by the research institutes during their initial stages, set the scene in the late sixties, and more intensely in early 1970, for two types of institutional development, through which farmers' organisations began to participate in generating and transferring technology. Once again, the groundwork generated by the centres acted as a catalyst for the participation of certain farming sectors in generating and transfering technology.

The first of these was the development of farmers' organisations for transferring technology following the format of the Consortia of French Agricultural Technology Experimentation (CETA). These attempted to replace the extension systems of the research institutes, and created farmers' groups for the purpose of contracting private technical assistance. The first of these was created in Argentina in the

late fifties, under the name of Regional Consortia of Agricultural Experimentation (CREA). These became more popular during the next decade and particularly during the 1970's. They have extended to other countries especially Chile and Uruguay.

The second development is more complex and farther-reaching. In it research and technology transfer activities are directly undertaken by the pooled efforts of farmers of specific crops. 7/

The late sixties, and particularly the seventies, saw this type of activity increase markedly producing progressively more "separation by product" in research. The cases of rice and sugar cane in Colombia are interesting illustrations of this phenomenon.

Although research and transfer activities on rice began at ICA, they were gradually taken over by the technical services of the National Federation of Rice Growers (FEDEARROZ) especially in the area of technical assistance. The presence of the International Tropical Centre (CIAT) as a centre providing new varieties and technological resources apparently played an important role in how this process developed and consolidated.

The case of sugar cane differs somewhat from that of rice but from the point of view of the national institutes it is of similar impact.

Most important among the differences was the creation of a research centre (CENICAÑA) having ties with the public system (participation of state representatives on its board) but absolutely independent in its funding and decision making process from the state and the trade organisation which created it (ASOCAÑA).

Finally, we should point out some particular characteristics of the legal status of the agencies created and their relationship with the state structure, especially in terms of funding which enables them to anticipate their expansion to other products and countries.

First of all, these developments took place in highly homogeneous situations vis-a-vis the productive structures and the territorial concentration of productive units, and consequently, the consistence of technological interests. This is also the case for the CREA groups.

Secondly, and perhaps most importantly, these activities took place where it was possible to redirect public funds previously allocated to a public research agency (as in the case of rice) or to create new sources of public funding (sugar cane).

This indicates that these developments, although significant, will never substitute public activity. They are possible only in specific situations characterised by certain forms of productive structure and corporate organisation. Furthermore, the fact that they were financed with public funds usually siphoned from a

specific allocation suggests that mechanisms must be developed for orienting and controlling their use.

International Centers

The third element of context we wish to discuss is the appearance and rapid growth during the last 20 years of the model of international agricultural research centres.

The development of this new institutional component was directly related to the successful efforts of the Rockefeller Foundation in agricultural research and productivity programs conducted in Asia and Latin America in the forties and fifties. The model is also based on the research centres operating during the colonial period which obtained significant results especially with tropical products such as sugar cane, cotton, pineapples and others.

The rapid growth of the system can be noted in the remarkable growth of its budget: from US$ 1.1 million in 1965 to over US$100 million at the present time. This is related to two main factors that are closely tied to the evolution of the national research institutes. 8/

The first factor was the awareness that, given the importance of technology for the development process, it was possible to obtain high rates of return on research investment. Note, for example, the rapid dissemination of Mexican varieties of wheat and the strains of rice produced by the IRRI in the Philippines. The second factor involves the growing interest of multilateral agencies in finding alternatives to the model of inter-institutional contracts with counterparts through which international technical assistance had been channeled for research and rural development. These had proven to be effective mechanisms for developing institutional skills (institution building) but not for effectively developing more productive technologies.

The model of the International Centers was as a more effective mechanism for developing certain kinds of research based on their greater stability and broader geographic range.

This new format took shape in Latin America in the International Center for the Improvement of Corn and Wheat (CIMMYT) in 1966 as a continuation of the Rockefeller Foundation program in Mexico; the International Tropical Agriculture Center (CIAT) in Colombia (1967) with the mandate for the humid American tropics; and the International Potato Center (CIP) in Peru in 1971.

The development of the International Centers, and particularly of those operating in this region, significantly contributed to techno-

logy generating activities. Examples of these contributions are the dissemination of Mexican varieties of wheat; the important increases in the production and productivity of rice in Colombia and Central American countries with the CICA varieties; the improvements in beans and cassava obtained by CIAT and their work on pastures for the subtropical flat lands. The development of the centers however, also had parallel consequences not necessarily beneficial to the national institutes.

The creation of the agencies in itself meant a change in emphasis of the support provided by bilateral and multilateral institutions through the mid-sixties to the national institutes.

It is unclear whether the appearance of the centers caused a reduction in this type of support to national agencies. Several sources (Evenson, 1977 and 1978; Schultz, 1979) however, assure us that the growth of the centers was paralleled by a reduction of support to the national agencies. Ruttan (1979) declares emphatically that this is so. At the same time he calls attention to the urgent need to support these agencies as they are the key link in the international chain of technology generation and transfer.

Also, these centers offered the institutional beneficiaries of technology (such as farmers' associations, manufacturers of production factors and others) an alternative source of knowledge and may have contributed to isolating the national research agencies and reducing their political support. This may have played an important role in the development of FEDEARROZ in Colombia which would have had great difficulty in getting off the ground without its realtionship with CIAT. Certain developments in seed production in the private sector are also linked to the possibilities that opened up as a consequence of basic work performed by the centers.

This impact was heightened by the fact that, at least initially, and perhaps as a result of the need to provide results to their community of donors the centers sometimes established competitive rather than collaborative relationships with the national institutes.

Another point worth noting is that the international centers were created as "interest groups" vis-a-vis the national institutes, and consequently their pressure to keep national activities consistent with their own programs was not necessarily in line with the priority objectives of the national agencies. This phenomenon of penetration is a consequence of the important role played by the national institutes regarding the productivity of investments in the international system, since they serve as natural links between the centers and the productive system.

SUMMARY AND CONCLUSIONS: RECOMMENDATIONS FOR THE DEVELOPMENT OF AN INSTITUTIONAL SYSTEM FOR SCIENCE AND TECHNOLOGY IN THE AGRICULTURAL SECTOR.

The above sections have discussed ideas and evidence concerning two fundamental aspects of the problems of agricultural technology in Latin America. These problems have been articulated to initiate a discussion of research organisation policy issues and related alternatives for technical cooperation.

First, the region has a rapidly growing system for the generation and transfer of technology. It includes international agricultural research centers, national institutes and finally, a number of private and semi-public institutions oriented toward specific aspects of the process. Second, emphasis has been placed on the deterioration of the primary component of this system, the national institutes for research and extension, a phenomenon particularly evident in the most longstanding institutes which can be seen as pioneers of the model that spread through the region beginning in the late fifties.

This last point is of special importance since, in spite of the appearance of other components in the so called regional system, the national institutes are still the central link of the technological process and concentrate most of the investments in agricultural research in each country. This is supported by three major factors: first, although private efforts to generate and disseminate technology have grown considerably, they concentrate primarily on transferring a certain type of technology selected because of its potential for private appropriation of the benefits – and therefore its ability to make the investments profitable – or as part of the new inputs marketing programs. This type of activity does not cover:

1. the functions for developing the groundwork without which the private sector's capability to create new technology will soon be depleted;

2. other very specific activities which, because of their generic nature (methodological research for example) and the low probability of immediate results, are not likely to be assumed by the private sector; and

3. the development of certain types of technology not associated with the use of physical inputs, such as cropping practices, herd management, and others. The private sector has no interest in such technology as there is no possibility of private appropriation of the benefits. This is true in general

terms, but it must be qualified in view of certain developments such as the CREA groups, which clearly enunciate the possibility of effective private participation in developing this type of technology also.

In the second place, the international centers are not an alternative to the national institutes. Their mandate is highly specific and complementary, and it is physically impossible for them to achieve the kind of territorial coverage available to the national institutes.

Finally, most of the new institutional developments are highly specific in their coverage and, in general, they are associated with the products and conditions of commercial agriculture and particular forms of corporate organisations. 9/ This means that a broad spectrum of users is not being served by the new organisations, and therefore becomes the major responsibility of the national institutes.

All this highlights the importance of the national institutes not only because of the scope of national and international efforts for development, but also — and perhaps more importantly — because they affect the potential effectiveness of the operations of the overall system.

A key element in any discussion of the dynamics of research organisation and particularly the national institutes model is to determine whether or not the situation described above stems from the very nature of the institutional model involved. If it is a part of the normal life cycle of the organisations, the situation can be expected to appear in other countries as their organisations continue to develop. Otherwise, the situation could be stemming from institutional problems characteristic of the countries in which it is occurring.

In regard to the evolving policy issues — and related areas for technical cooperation — two factors defined in terms of the development of a regional system for science and technology for the agricultural sector should be discussed. The first is the need to maximise the potential of each component of the system by defining its role and functions. The second involves the nature and characteristics of the mechanisms that interrelate the various components in order to make better use of their complementary nature and to avoid duplications that prevent the effective use of scarce resources.

The Organisation of the Regional System

The scope of this topic is very broad, and it is difficult to discuss in general terms. We must first understand the special characteristics of each national system and the relative degree of

development of private and semi-public alternatives for the generation and transfer of technology. Nevertheless, certain general comments can be made concerning the international centres, and the placement and comparative advantages of each type of organisation should not be overlooked.

The international centres were developed in order to guarantee the continuous flow of highly productive biological technologies and became necessary when early efforts failed to strengthen national research organisation (Ruttan, 1979). However, pressure has recently been mounting for these organisations to expand their activities beyond the improvement of varieties and development of related technologies to become true rural development institutes. This is seen as a way of giving farmers the greatest impact of the investments being channeled through them. If this trend continues, it will be safe to say that the comparative advantages of the international centres are being underused.

It is now understood that productivity increases do not depend totally on the presence of new technological knowledge. Institutional and political factors, such policies for intervention in the factor and product markets, investments in infrastructure, etc., restrict any efforts to make real increases in productivity through the use of available technology. These factors lie outside the area of influence of the international centers. Even the discussion and analysis of such matters is the exclusive prerogative of national organisations in charge of policy implementation. This is not meant to imply that, as an ongoing part of their programs, the centers should not be developing an understanding of these restrictions as an input to their priority setting and resource allocation processes.

International centers, which give a high rate of return on investments, are a very effective mechanism for the development of genetic resources. In the future, it may be necessary to expand the range of topics they study. In such a case, the criterion for expansion should be to incorporate those areas in which they offer comparative advantages. These advantages would go to waste if attemps were made to limit the centers and focus their attention on problems of economic roadblocks to the producers' adoption of new knowledge. Given the centers' institutional nature and the origin of their funding, attempts to move into these areas could lead to conflict situations from the political standpoint.

Mosher (1977) discusses several possibilities for future functions of the international institutes, and lists three options:

1. continue exclusively as research institutes;
2. expand outreach activities toward national research insitutes and to cover national production programs; and

3. become service centers for national centers and programs, de-emphasising direct research and concentrating on assisting national institutes to be more productive.

The first option would mean maintaining the present role and characteristics whose effectiveness has already been shown. The other two options would mean entering into the general technical assistance field for which the centers, given their organisation and governance system, seem to have no comparative advantages. For some situations — regions — these two latter functions may be in deep need. If that is the case a more sensible alternative would be to create or use regional centers or organisations with formal linkages to the countries so as to assure a proper identification of necessities at this level.

As for the national institutes, it is very important to state clearly that the outcome of research, and consequently the top priority responsibility, is to create new technological knowledge. This must be fully understood. The ability to use the resulting knowledge to bring about increases in agricultural production and productivity is limited by a series of institutional and political factors beyond the control of technological organisations which cannot and should not have to assume institutional responsibilities.

Therefore, technological organisations must be required to provide technology appropiate for each particular context and they should be judged by their effectiveness in this effort. To this end, they need to develop appropriate mechanisms for identifying their clientele and their specific problem areas in order to guarantee the efficient allocation of priorities and resources. This does not mean they should cut off all transfer activities, but perhaps they should establish a conceptual difference between these activities and technology generation both of which confront different constraints.

Mechanisms of Institutional Interrelationships

The mechanisms that interrelate various components of the system should be approached on two levels: the relationships between regional components (international centers) and national components, and the relationships among the various national components.

The first type has been discussed implicitly in the above paragraphs and it can be summarised as the need to establish effective channels for transmitting the information generated by the international centers to the national institutes. It also includes feedback mechanisms by which the national institutes inform the international centers of the results of applying new technology

to the various production situations in each country. This information should also serve in the progressive effort to adapt center programs to the different sets of national problems.

In turn, the relationships among national components of the system occupy two different levels. First, it is necessary to establish operational mechanisms linking public, semi-public and private components, enabling them to complement each other. Second the existence of many organisations of different types requires a certain ability to orient all the various activities of the system. As long as national institutes monopolised all work on the national level this need went unnoticed. The orientation of technological variables as an element of the development strategy adopted was assured through the decisions on resource allocation inside the organisations themselves.

These factors, for defining the roles and functions of the system's components and the mechanisms of interrelationship and orientation of their activities, stress the importance of a science and technology policy for the agricultural sector. This should be the primary element of technological efforts on the national level. It also suggests the high priority need to consider technical cooperation activities in this area and to redefine them for the overall technological system.

FOOTNOTES

1 In this context, technological policy involves scientific policy, aimed specifically at regulating innovative activity; and socio-economic policy, which has broader objectives than the technological question, as it affects the manner in which agricultural enterprises adopt new technology.

2 Estimates place the amount that went into training programs in Colombia, Peru and Argentina at US$30 million with approximately 50o/o coming from external sources and the rest from national funds. (Ardila, Trigo and Piñeiro, 1980).

3 INTA's idea as a variable of economic policy, is clearly documented in the overall reorganization of the public sector. In the case of ICA several similar references exist in different policy documents dating from the early sixties. (Piñeiro, et al, 1979).

4 The results of an opinion poll on the causes of the migration of technical specialists from the National Centres indicate the lessening importance given to research activities as one of the major factors affecting the decisions of individual technical experts. (Ardila, Trigo and Piñeiro, 1980).

5 An exception to this may be the case of ICTA in Guatemala where many of these aspects were formally recognised and used as a basis for a new organisational structure.

6 For a more extended discussion of the role of private and multinational enterprises in the creation and dissemination of agricultural technology, see Marcano (1979).

7 This type of institutional organisation is not new. The Colombian National Federation of Coffee-Growers, for example, has run the Chinchina Coffee Research Station for generating and transferring technology since the thirties. It began operations in 1932 and has been operating until the present as the only centre conducting research on coffee in that country.

8 Ruttan (1978) discusses these matters in greater depth.

9 It is to be noted that the agricultural associations in Argentina, in spite of the fact that they are very powerful, have no active participation in the technological process, except as members of the Directors' Council of INTA. This contrasts significantly with experience in Colombia, where the associations appear to play a role of growing importance. There, the origin and certain characteristics of the organisations assume a special significance. The associations in Colombia are product-specific and in the countryside there is a long standing tradition of providing users with services and of making their interests heard in political circles. However, the Argentine associations cover a wide range of products and even of kinds of producers, and their actions have never extended beyond the simple expression of political and sectoral interests. These differences are important because the product and farmer homogenity in Colombia enables the associations to take a stand on the orientation of the technological process without generating serious conflicts inside the association. The diversity of interests in the Argentine associations would make it difficult to produce a uniform technological platform for a Rural Society or for the Agrarian Federation.

BIBLIOGRAPHY

ARDILA, J., TRIGO, E. and PIÑEIRO, M. Sistemas nacionales de investigación agropecuaria en America Latina: Análisis comparativo de los recursos humanos en paises seleccionados. Los casos de Colombia, Argentina y Perú. Colombia, Instituto Interamericano de Ciencias Agrícolas.
Documento PROTAAL No. 50. 1980. 61p.

BOYCE, J. and EVENSON, R. National and international agricultural research and extension programs. New York, Agricultural Development Council Inc., 1975. s.p.

CONTRERAS, D. Numero y ubicación de profesionales chilenos con grados avanzados en ciencias agrícolas obtenidos durante 1960–1979. Santiago de Chile, 1979. s.p. Mimeo.

EVENSON, R. Comparative Evidence on Returns to Investments in National and International Research Institutions. In Arndt, T., Darlymple, D. and Ruttan, V. ed. Resource allocation and productivity in national and international agricultural research. Minneapolis, University of Minnesota Press, 1977. s.p.

EVENSON, R. The organisation of crop and animal improvement research in the low income countries. In Schultz, T. W., ed. Distortions of agricultural incentives. Bloomington, Indiana University Press, 1978. s. p.

MARCANO, L. Rol de las empresas privadas y multinacionales en la creacion y difusión de la tecnología agrícola. In Seminario sobre

los aspectos socio-economicos de la investigacion agricola en los paises en desarrollo. Santiago de Chile, mayo 7—11, 1979. 18p.

MOSHER, A. Unresolved issues in the evolution of the international system. In Arndt, T., Darlymple, D. and Ruttan, V., ed. Resource allocation and productivity in national and international agricultural research. Minneapolis, University of Minnesota Press, 1977. s.p.

PIÑEIRO, M. et al. El proceso de generacion, difusion y adopcion de tecnologia en la produccion azucarera de Colombia. Costa Rica, Instituto Interamericano de Ciencias Agricolas. Documento PROTAAL No. 37. 1979. s. p.

PROTAAL. Sistemas nacionales de investigacion agricola en America Latina. Colombia, Instituto Interamericano de Ciencias Agricolas, 1977. s. p. (Serie Informes de Conferencias, Cursos y Reuniones No. 138)

RUTTAN, V. Institutional innovations. In Schultz, T. W., ed. Distortions of agriculture. Bloomington, Indiana University Press, 1978. s. p.

RUTTAN, V. The International Center of Agricultural Research and modification of comparative advantages. In Seminario sobre los aspectos socio-economicos de la investigacion agricola en los paises en desarrollo. Santiago de Chile, mayo 7—11, 1979.

SAMPER, A. National systems of agricultural research in Latin America. In Potentials for cooperation among national agricultural research systems. Bellagio, Italy, October 17—21,

SCHULTZ, T. Research in rural development. In Seminario sobre los Aspectos Socio-economicos de la investigación Agricola en los Paises en Desarrollo. Santiago, Chile, May 7—11, 1979.

SCHULTZ, T. Transforming traditional agriculture. New Haven, Yale University Press, 1964. 183p.

ADMINISTRATION OF AGRICULTURAL RESEARCH IN THE CARIBBEAN

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INTRODUCTION

The topic on which I have been asked to speak is "Administration of Agricultural Research". When I examined the tentative programme, however, I found that there were several topics listed which for all practical purposes, would overlap with my topic and this created some measure of confusion in my mind.

Administration is essentially 'management of affairs'. However, Ulbricht (1) makes what he describes as an exaggerated distinction between administration and management as follows: In administration one is concerned essentially with maintaining what exists already whereas in management one strives to have a clear aim and allied operational objectives. He suggests that in the former case, often the main aim is not to make mistakes,and this implies not taking risks, reluctance in decision making and delegation of work but not responsibility. But in the latter case decisions are essential and both work and responsibility have to delegated.

Agricultural research concerns the application of the principles of the basic sciences to the solution of problems of immediate or potential usefulness in agricultural production. To do this it draws heavily on a very wide range of scientific disciplines in the biological, physical and social sciences. It, therefore, involves people (executors and beneficiaries), finance (budget, allocation and control), physical infrastructure (buildings, laboratory and field equipment, field facilities) and materials of various kinds (fertilisers, pesticides, chemicals).

A good administrator of agricultural research must have knowledge and understanding of the principles of management planning, organising, human behaviour especially motivating factors, personnel management techniques etc., all this in addition to, at least, a general knowledge of agriculture to enable him to coordinate the work of specialists in a wide range of scientific disciplines and understand the peculiarities of agricultural research.

SOME CHARACTERISTICS OF AGRICULTURAL RESEARCH

Agriculture, the art and science of crop and livestock production, is a very complex subject and it is reasonable to expect agricultural research also to be complex. In agricultural research, one strives to apply all possible sources of scientific discovery to the solution of the technical and practical problems of agriculture. But there are some peculiar characteristics of agricultural research which may impede progress.

- Agricultural research is dependent on a wide range of scientific disciplines. Practically every scientific discipline impinges on it in one way or another. The biological sciences predominate (Breeding, Physiology, Microbiology, Entomology, Virology etc.) but the physical sciences (Soil chemistry, Soil physics, Meteorology, Engineering etc.) and social sciences (Economics, Human behaviour) are very much involved. The interdependence of the various fields is a source of organisational difficulty which can be only partially overcome by team work.

- Agricultural research is susceptible to the environment which is very variable (soil, climate) and some aspects are beyond predictability with a high degree of accuracy (rainfall). This makes it necessary to investigate basic research findings under a wide variety of ecological conditions. Sometimes it is even necessary to carry out both basic and adaptive research in order to resolve problems in specific locations. These lead to fragmentation and dispersal of resources into small units (experiment stations and sub-stations) and the attendant managerial difficulties.

- Agricultural research is international in character and it virtually thrives on exchange of ideas, information, expertise, germplasm etc. Attendance at conferences, workshops, seminars etc. is a necessary adjunct to implementing agricultural research.

— Although agricultural research results are freely available to the farming community unlike say industrial research, one often is faced with the problem of **farmer acceptance.** Since research findings are useless if not utilised in the productive process, an agricultural research administrator should be aware of the need for **transfer of technology** and the relatively recent concept of farmer participation in development of research programmes.

KINDS OF RESEARCH

A problem often faced by research administrators is the question of **balance** between what is known as **basic research** and **applied** or **adaptive research.** Basic research is here described as investigations that extend scientific knowledge by the search for new principles and the understanding of underlying processes, whereas applied or adaptive research is the adapting of these new principles and techniques to specific environments and problems. The two are complementary. The kind of research to be adopted in relation to a specific problem should be dictated by what will achieve the best results both qualitatively and quantitatively, in relation to the available time and the effort and money applied to it.

ORGANISATIONAL STRUCTURE

A logical and effective organisational structure is essential if one is to assign specific duties to individual units and maintain a coordinated effort. The organisational structure should be as simple and as flexible as is compatible with the fulfilment of its functions and should ensure the following:

— good communication flow along clearly defined lines

— efficient use of manpower and resources

— minimun of routine work by researchers

— minimun overlapping between different fields

— an environment that is conducive to research

Research organisations can be divided and sub-divided either on the basis of scientific disciplines or into inter-disciplinary groups which may or may not be commodity oriented. Before deciding on an organisational structure, consideration should be given to the

characteristics and comparative advantages and disadvantages of each form, based on:

- effectiveness in solving research problems and achieving goals
- efficiency in administration
- effect on research workers

Regardless of the structure there is generally need for some form of adjustment. Often this is due to personality problems. A good research administrator should not adhere tenaciously to rigid patterns but instead should be sufficiently flexible and should attempt to find individual solutions when necessary.

Because of the complexity and quantity of decisions involved in the administration of agricultural research it is essential that administrative functions be divided and a certain amount of **authority** and **responsibility** be delegated, In a large research organisation this often is divided into Administrative and Technical Divisions with a Research Director at the head.

The Administrative Division generally has responsibility for routine administration – personnel, discipline, finance, physical plant maintenance and development, procurement etc. whereas the Technical Division generally is concerned with scientific matters.

The area of finance sometimes is a source of conflict between administration and scientist because of the ability of the former to exert some measure of control over the activities of the latter through budget allocations. This can be obviated to a large extent if the scientists have responsibility for planned budgets with the administration ensuring that the expenditures are in keeping with existing rules and regulations. In short, administration should be used to **facilitate** rather than **control** research.

THE AGRICULTURAL RESEARCH SYSTEMS IN THE COMMONWEALTH CARIBBEAN

Davis (2) in a relatively recent study of the agricultural research systems in the Commonwealth Caribbean has classified them into three administrative **forms** based upon source of funding i.e. public, private or quasi-public. He has further grouped them on the basis of function in terms of adaptive vs. fundamental (basic) research and commodity vs. non-commodity orientation. Of 27 systems studied, 11 were classified as public, 6 as quasi-public and 10 as private

agencies at that time. Now, at least 3 of the private agencies have become quasi-public.

Seemingly, most of the agencies that are involved in agricultural research in the region are state financed. They either operate in the general stream of the public service e. g. ministries of agriculture, or with various degrees of autonomy e.g. state corporations, commodity associations etc.

The high level of government support is typical of the situation in developing countries and may be considered justificable in view of the role of agriculture in the economy of these countries. In more developed countries many of the agriculturally related industries e. g. fertilisers, pesticides, agricultural machinery and equipment, make significant contributions to agricultural research.

OTHER SYSTEMS

Other agencies concerned with agricultural research in the region include the University of the West Indies and its associated Units that are largely concerned with basic research, and the Caribbean Agricultural Research and Development Institute which is largely involved in adaptive research and development promotion regionally.

In addition, there are various commodity-oriented research groups including:

Banana Board Research Department,	Jamaica
Banana Breeding Research Scheme,	Jamaica
Windward Islands Banana Research Department,	St. Lucia
Coconut Industry Board Research Department	Jamaica
Trinidad and Tobago Coconut Research Ltd.	Trinidad
Guyana Rice Board Research Department	Guyana
Central Sugar—Cane Breeding Station	Barbados
Sugar Manufacturers Association Research Department	Jamaica
Caroni Agricultural Research Station	Trinidad
Sugar Experiment Station, Guyana Sugar Corporation	Guyana

However, attention will be focused on the research systems in the public service because of their overall importance in national agricultural development.

The research systems in the public sector in the Commonwealth Caribbean all lie within the main stream of the public service. The organisation charts for Barbados and Guyana are shown in Annexes 1 and II. In the public service systems, the administrative head of the Ministry is the Permanent Secretary whereas the responsibility for technical matters rests with the Chief Agricultural Officer (CAO).

In Barbados, the Ministry is divided into two sections: **Research** and **Extension and Development** each of which is headed by a Deputy (DCAO). The Research section is further divided into three divisions: **Crop Protection, Agronomy** and **Engineering**, each division with the appropriate specialist researchers.

In the case of Guyana the CAO is assisted by one Deputy (DCAO). At the next level comes the five Principal Agricultural Officers each heading a section as follows:

- Crop Science
- Soil Science
- Extension and Education
- Veterinary and Livestock
- Fisheries

Each section is further sub-divided mainly according to disciplines. **Crop Science**, for example, is divided into **Crop Production, Crop Protection, Farm Machinery, Seed Processing** and **Stations.**

In other territories there may be minor differences in the divisional grouping of disciplines. In Jamaica, for example, Crop Protection and Crop Agronomy are separate divisions whereas they are merged into Crop Science in Guyana. The systems are not dissimilar in the smaller territories but because of more limited manpower and resources they are even less sophisticated.

Downer (4) has noted the striking similarity of the constraints to effective research in Guyana to those which obtained in Brazil prior to the establishment of the Brazilian Public Corporation for Agricultural Research (EMBRAPA), and it is believed that this is true in many if not all of the Caribbean territories.

In a recent paper on "Rationalising Research within the Ministry of Agriculture" in Guyana, Granger (6) states that: "During the last decade the Ministry of Agriculture has experienced a decline in the quality of its research, the cost effectiveness of its research, the viability of its research, and the degree of professionalism needed to be associated with a vibrant and dynamic research programme. Evidence of this decline is manifested in several ways in the major lag or absence of properly documented research findings and projects and even in the day to day activities of the Ministry".

Fletcher (5) also has identified some major limiting factors and states that "there is an alarmingly high rate of staff turn over in the Ministry of Agriculture (Guyana) and new staff are nearly always recent graduates. This has resulted in a staff composition that is young and markedly deficient in experience".

Among the constraints identified were the following:

- lack of knowledge among research personnel of basic national

needs in respect to agriculture

- little interaction between research personnel and farmers
- an administrative structure which inhibited recruitment and promotion
- insufficient internal communication among units and individual researchers
- lack of adequate promoting and evaluating mechanisms thus permitting individuals to undertake activities of doubtful value
- insufficient guidance to young researchers many of whom are recent first degree graduates with very limited experience
- insufficient national, regional and international exposure of research personnel
- lack of a well defined mechanism for systematically upgrading staff both through in-service training and post-graduate studies
- lack of proper documentation of research plans and programmes in relation to the agricultural development goals
- lack of an effective system to ensure proper documentation of research results
- inadequacies in facilities for research (machinery and equipment, materials, transportation) and supporting services e.g. biometrics, library facilities.

These constraints cover a wide range of matters with which management ought to be concerned. They include policy definition, priority identification, farmer involvement, coordination and linkage, guidance and supervision, planning, review and evaluation, documentation and reporting, accountability, individualism, manpower development adequacy of physical plant and supporting services.

It is believed that many of these constraints are common to the agricultural research systems in the Caribbean, the majority of

which are in the administrative system of the public service. These systems suffer not so much because of the administrative structure of the public service, but perhaps more so because of insufficient accountability.

It is true that with their procedures, rules and regulations they tend to lack flexibility. Promotion is based on seniority rather than competence; the decision making process is slow and cumbersome; budgeting is incremental rather than planned, etc. Because of these difficulties there are many who advocate a more autonomous system for agricultural research and there is some merit in that. But in spite of these difficulties agricultural research could be made more productive even within the framework of the public service. The problems are not unknown and one does not necessarily need a new institutional framework to resolve at least some of them.

One of the main pre-requisites for increased productivity in agricultural research is better and more dedicated leadership particulary at the level of technical officer who, for all practical purposes is the "research director" in the public service system.

One approach toward resolving some of the existing constraints to increased productivity in agricultural research is through the system of coordinated, multidisciplinary research projects. But there are certain elements for success which must be incorporated into the system. These include:

- definition of research in terms of specific projects based on identified priorities in keeping with national goals, and with clearly defined objectives

- introduction of project costing and planned budgeting

- a strategy for the systematic review and evaluation of research projects.

Not only is this system compatible with the very multi–disciplinary nature of agricultural research but it tends to make much better use of manpower and resources, and reduces the tendency towards individualism and isolation in agricultural research.

There are two additional points which I would like to make before closing. The first is more of an appeal for greater collaboration within the region. One should recognise the scarcity of resources, and greater efforts should be made to avoid duplication and unnecessary repetition of research wherever possible. This can be achieved through:

- more effective communication and linkage between research agencies through the timely exchange or reports, programmes

etc., possibly coordinated by one of the regional agencies involved in agricultural research, and increased interaction among research directors;

— reciprocal technical cooperation; and

— standardisation of research methodology where possible.

The second point deals with the relevance of research. In the Caribbean, one often hears of the need for research to be relevant. In fact, this supposedly is one of the main reasons for separating the former Regional Research Centre from the University of the West Indies and the establishment of the Caribbean Agricultural Research and Development Institute.

Practically, all agricultural research is relevant, the question is whether it is immediately relevant or otherwise. What is really required are clear guidelines in terms of policy and priorities at both the national and regional levels and the appropriate vehicle to demonstrate relevance. That vehicle can be provided through planned linkage of research to production projects of some magnitude, either current or proposed.

REFERENCES

1 ARNDT, T.M. et al (Eds.) (1977) Resource Allocation and Productivity in National and International Agricultural Research. University Minnesota Press, Minneapolis, 617p.

2 ARNON, I. (1968) Organisation and Administration of Agricultural Research Elsevier Pub. Co. Ltd., New York, 342p.

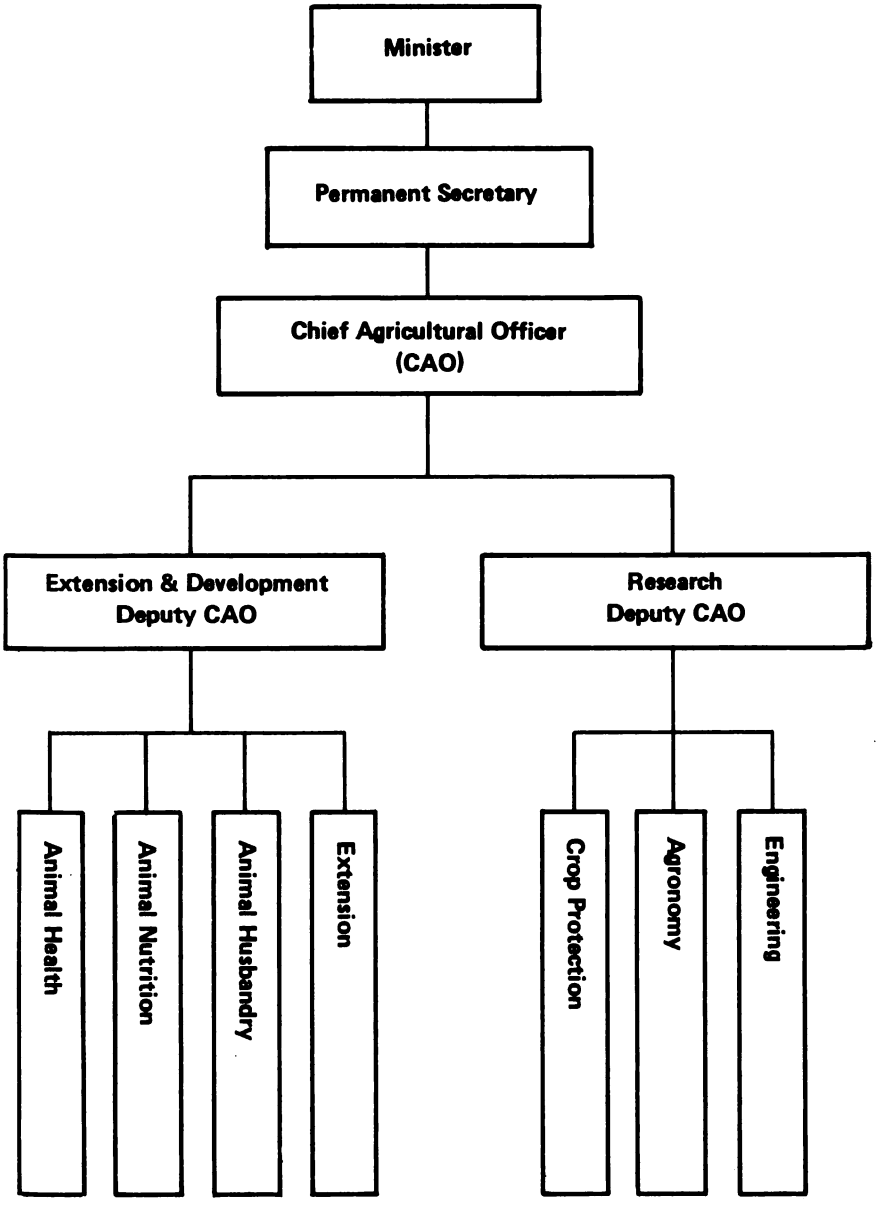
3 DAVIS, C.G. (1975) Agricultural Research and Agricultural Development in small Plantation Economics: The Case of the West Indies. Social and Economic Studies 24: 117–149

4 DOWNER, A. V. (1977) A Rationale for the Organisation of a National Agricultural Research Institute in Guyana. Mimeo.

5 FLETCHER, R.E. et al. (1977) Agricultural Research in Guyana. In Prelim. Proc. Regional Tech. Meeting Agric. Res. Sys. Antilles

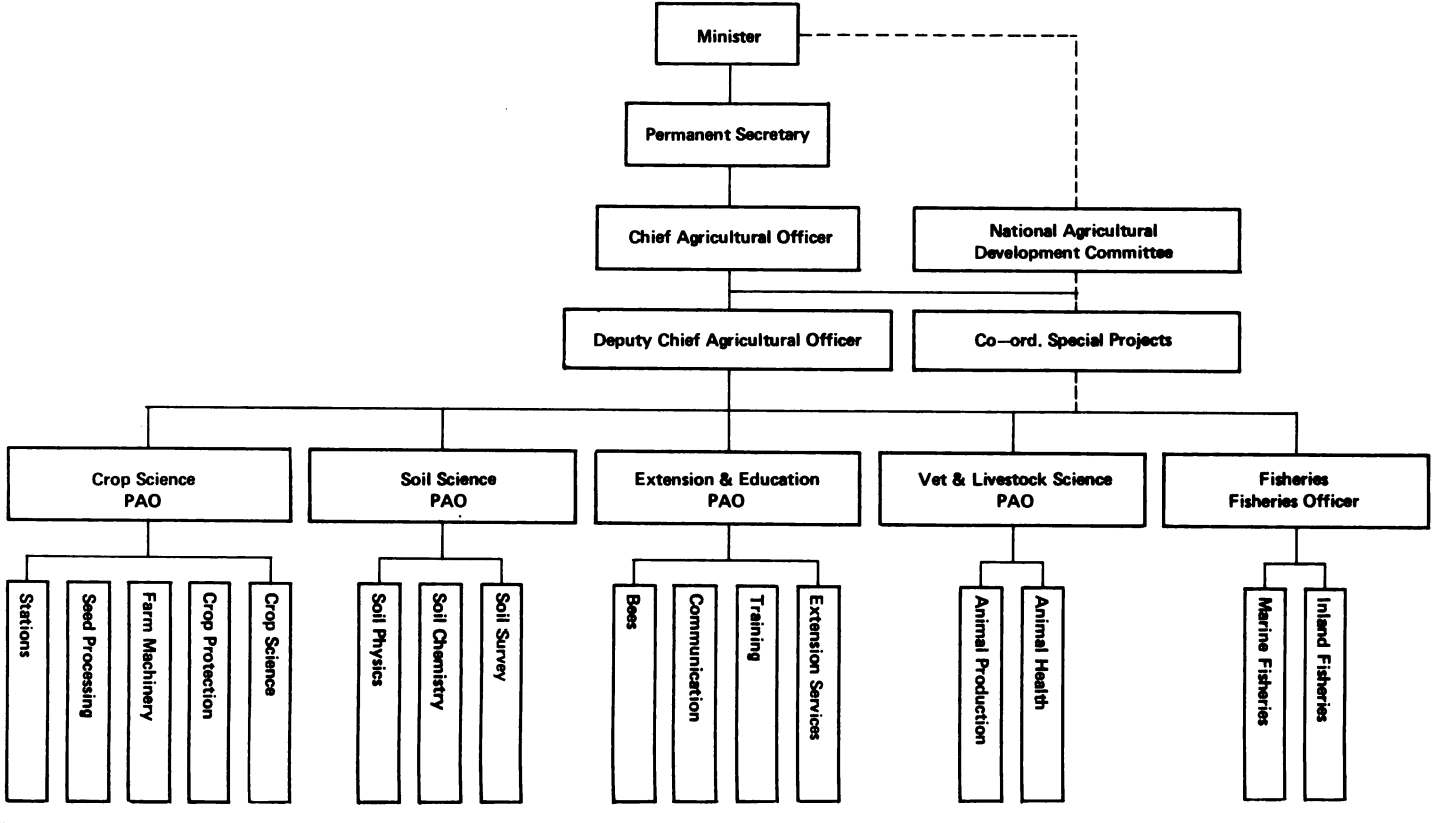
6 GRANGER, M.A. (1980) Rationalising research within the Ministry of Agriculture. Mimeo.

ANNEX 1 – Organisational Chart – Ministry of Agriculture, Barbados



Adapted from J.P.W. Jeffers (1977) In preliminary Proc. Reg. Tech. Meeting Agric. Res. Sys. Antilles

ANNEX II – Organisational Chart – Ministry of Agriculture, Guyana



PAO–Principal Agricultural Officer

PROJECT PLANNING AND MANAGEMENT IN AGRICULTURAL RESEARCH

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INTRODUCTION

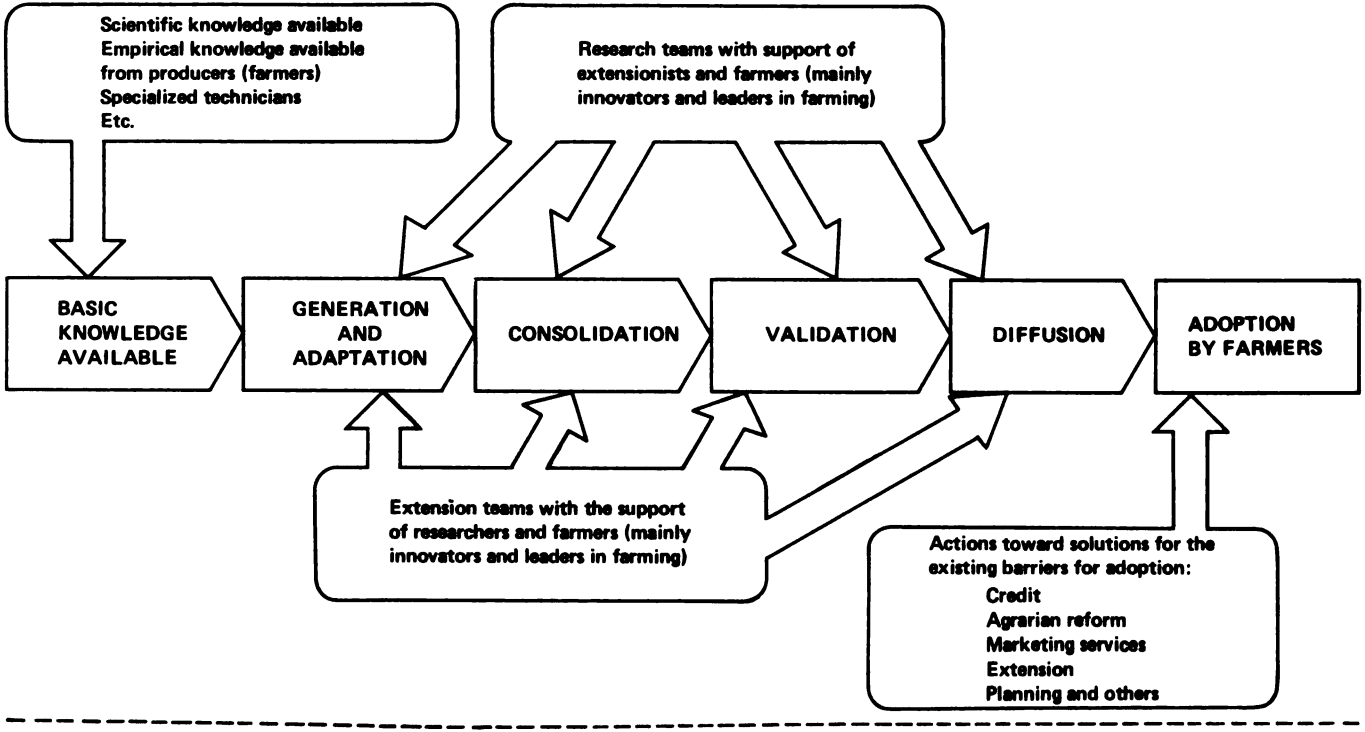
There are so many differences between **planning** and **management** of agricultural research that they could be treated as separate processes; nonetheless they are but two faces of the same coin. This paper will restrict its scope to the experiences we have shared within a national research system in its initial stages of development, and the problems typical to these early stages such as scarcity of human, physical and financial resources and organisational inadequacies (4).

GENERATION, TRANSFER AND ADOPTION OF TECHNOLOGY

Although it is customary to speak of the process of technology generation, transfer, and adoption, many people think of this process as if it were composed of isolated stages or phases. In fact, rather than stages these are aspects of the process whose differentiation is merely heuristic, emanating from the need to assign functions to the Government services between which, by their nature, resources and direct beneficiaries, it is useful to distinguish. In practice what is aimed at, by this differentiation of a continous process into phases, is improvement of separate decision taking in research, extension, and input provision, with the objective of raising the technological level of agriculture and, as a consequence, fostering rural development.

In the schematic representation of the generation and transfer process, the starting point is the **potential** to obtain technological innovation, and the terminal point is its adoption by farmers. This process occurs as a continuum. In this process (see Fig. 1) the stages of technology **generation** and **adaptation, consolidation, validation** and **diffusion** are distinguished.

FIGURE 1. TECHNOLOGY GENERATION AND TRANSFER PROCESS



From the viewpoint of institutional functions, specialisation tends to isolate the organisations devoted to research, extension, etc. emphasizing the differences among these stages, and this is oftentimes the main cause of technological transfer failure. On the other hand, if the existing barriers to adoption and the ways technological innovations could overcome them are not analysed beforehand, adoption could not be expected to occur. Sometimes the barriers are not removable within a reasonable margin of available time and resources. If this is the case, it is useless to produce the technological innovation which will not be adopted anyway. The art of good programming is then to determine –before it is produced – the technology that will have real possibilities of being adopted. In this way, sterile results can be avoided and resources may be assigned instead to the production of that technology that will be effectively utilised.

Very often agricultural research does not go further than the obtaining of a new plant variety or the publication of the results produced for the benefit of a given public. 1/ In a few cases actions are considered to facilitate transfer, but the researcher almost never takes the time to formulate concrete plans to overcome the barriers that may hinder permanent adoption. This failure in most cases has its cause in the narrow range of analysis that impedes the recognition of the factors acting on the three aspects mentioned (generation, transfer and adoption) which are equally important. In this paper we shall attempt to illustrate how those factors affecting each one of these aspects in the technological change process have been taken into account.

CURRENT APPROACHES TO RESEARCH PROGRAMMING

At present there is a tendency to differentiate in a somewhat simplistic fashion, inasmuch as the differences are not sharp and clearcut, between research programmed by product and research planned by the production system approach.

When agricultural research is programmed having in mind the importance of the value of the products as a means to relate the goals of socio-economic development to the establishment of research priorities, the impression is given that an effective contribution is being made to the achievement of the goals of national programs of product promotion and development, as well as of rural development. In underdeveloped market economies, however, research planned with this approach fails to take into account (3) that:

– The structural rigidities and the irrelevance of market prices offset usefulness of product value to establish priorities.

Frequently in these countries other factors must also be considered, such as the ability of the new technology to generate or replace employment to improve income distribution, or simply the new potential agricultural products whose market value is not yet known.

- **Technology is not neutral**, which means that it produces important impact according to the social group to which it is related, insofar as it not only increases the productivity of one factor (mainly land), but at the same time if affects the productive structure and the distribution of income.
- **Regional dualities** in the economy of these countries determine specific needs for regional development with the support of technology adequate to each region.
- **The diversity of types of farming enterprises** does not permit in all cases the proper use of the factors required by technological innovation.

This approach to research programming generally results in the generation of what is usually called **technological packages.** In theory, these packages, developed either separately or globally, supply the technical innovations for production in such a manner as to make various combinations possible. This would allow one, also in theory, to put together the pieces of the puzzle of the technological package, adequate to each zone and each group. In practice, however, the model followed is that of temperate zone monoculture on large farms endowed with an abundance of production factors.

Researchers in developing countries have had to confront the fact of non-adoption of new technology when they realise that their results have not reached the farmers. Faced with this situation, they have begun to think of the production systems approach to orient the generation of technical innovations within a more realistic context.

Although there exists a diversity of criteria in regard to what is meant by the term "production system", it is acknowledged that it represents a forward step over the previous tendency to use product or thematic programming. With the systems approach the researcher begins, usually, by studying the barriers to adoption, then he studies the possibilities of transfer and finally he determines the basic knowledge available and the knowledge missing, so as to base the research program on these premises. Yet the model sometimes presents complications for the development of new technology, because it requires so many new studies that one or other resource is always lacking. Because of the complexity and diversity of agricultural research, the matrix organisation in the structure of a research team is not appropriate simply due to the lack of resources. This can limit the possibilities of the systems approach in programming choice.

The study of systems, in effect, has its strength in the action of interdisciplinary teams; yet each micro-region, each typical enterprise, and the market perspectives and the service structure in each country combine to present areas for which the interdisciplinary teams are unprepared. For this reason implementing this approach for the introduction of new technology is so costly that only few countries can utilise it on a large scale. In the experience to be reported here it will be shown how programming by product will be gradually changed, within certain limits, toward the production systems approach, while striving to maintain a reasonable equilibrium between the country's needs, the possibilities to obtain saleable products and availability of resources.

THE PROGRAMMING MODEL IN THE PRESENT CASE

The situation faced in the present case required adapting the system of decision-taking on research programming and also introducing changes in the organisational structure, if institutional effectiveness and efficiency were to be raised. The problem then consisted in passing from a programming system almost entirely product-focused to one centered on production systems. Nevertheless, during the transition period both approaches were to overlap temporarily for two main reasons:

a. the need to avoid interrupting the already ongoing development of technological packages and, at the same time, the wish to integrate them into production structures specifically defined in terms of type of farmers.
b. the need to experiment to find out whether the change of focus would really give good results.

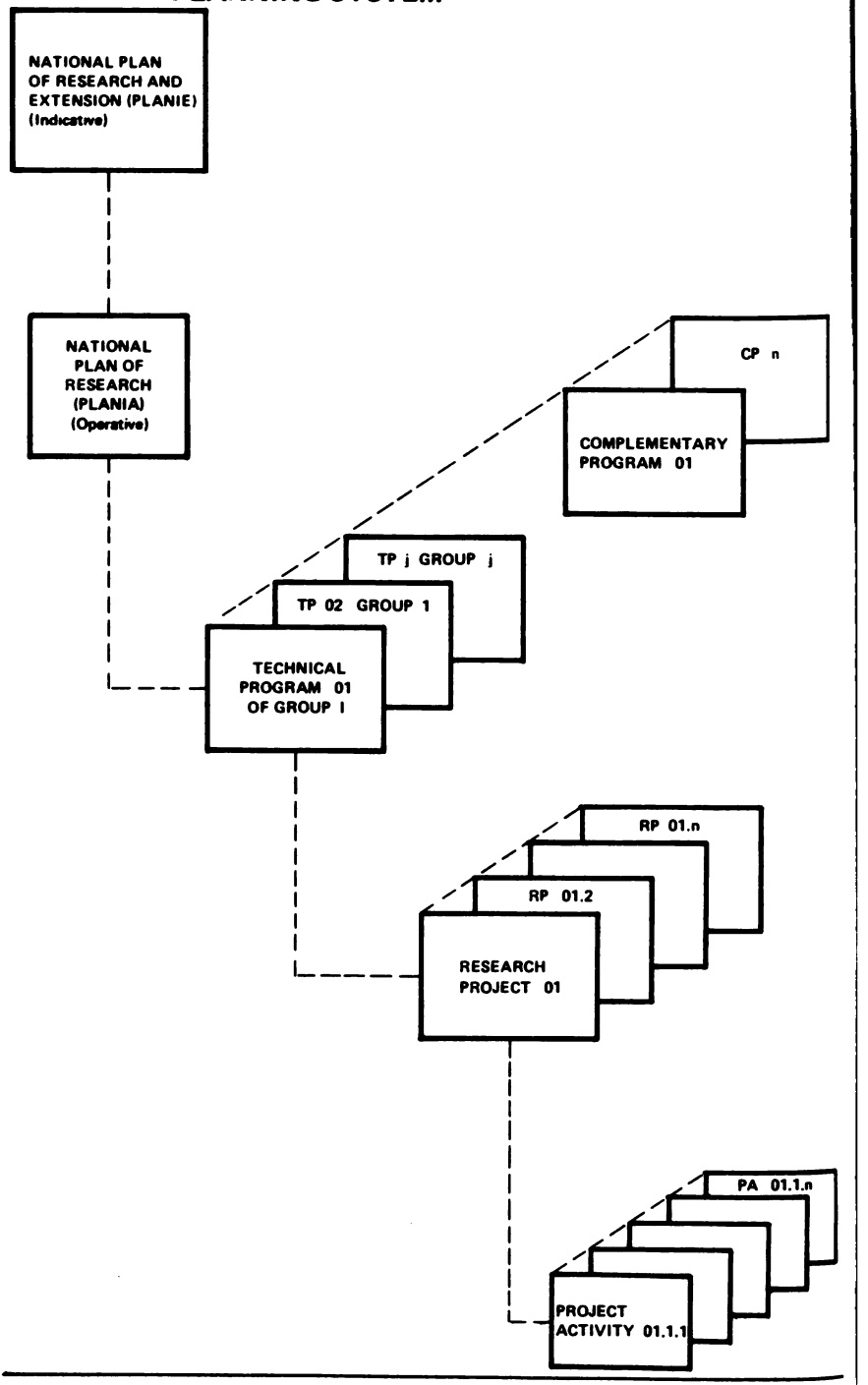
It was assumed that the progressive transition between the approaches would result in a better equilibrium between the research activities and the use of resources. Insofar as the experiment is still in process, it is not possible to assert that the change will prove to be beneficial, although this is expected.

The instruments employed are: The National Plan, the Programs, the Projects and the Activities of Research (Fig. 2) in the order they are listed (5).

In order to facilitate the allocation of resources, Programs were classificed in two types: **Technical** Programs and **Complementary** Programs.

The Technical Programs include 5 groups: Basic Crops, Animal Production, Intermediate Technology Transfer 2/ , Production Systems and Resources for the Future.

FIGURE 2: INSTRUMENTS OF THE ILLUSTRATED RESEARCH PLANNING SYSTEM



The Complementary Programs are aimed at the expansion and conservation of the physical inventory and human resources. They are concerned with the resources that to a certain extent are not totally programmable because they consist largely of fixed expenditure supporting the functioning of the whole research structure.

The above-mentioned set of programs helps to distinguish the efforts being made to change the research approach, and at the same time serves the purpose of facilitating the analysis of the allocation of resources to those activities that should be strengthened in accordance with the demand for technological information and available resources. The established mechanism is of course more complex than the description hereby presented, but for the goals of this paper it is less important to enter into details than to describe the general pattern of programming.

The information required for programming

Besides the existing information on technology, two significant groups of informational material have been considered for the purpose of programming:

a. the situation of agriculture and the rural sector

b. the country level situation of each product 3/

In order to provide coherence in the formulation of the (indicative) National Plan of Research and Extension, PLANIE (7), a procedure was developed that would ensure that the plan would serve as a basis for the elaboration of the National Research Plan, PLANIA (6), specifically directed to the orientation of research and intermediate transfer activities. Its purpose is especially operational, covering a three year period. The different research programs are adjusted according to its directives.

The information supplied by the planning instruments then cover two large areas separately identifiable: **general information** which orients the basic lines of research and the **product-specific information** which orients the programming activity.

The ganeral information contained in the National Plan

The following basic information is contained in the various chapters of the plan for the elaboration of the component programs:

I. Introductory information
   Explanation of the plan's content
   Objectives, principal and secondary

Socio-economics and political justification
Relation of the plan to the government strategy for the development of the agricultural sector.

II. Synopsis of the country's agriculture
Description of the main problems
Characteristics of the resources devoted to agriculture
—Soils and eco-systems
—Enterprises and producers
—Production
—Technical inputs: machinery, agrochemicals, irrigation and others
—Agriculture as employment generator: supply and demand of farm labour
Role of agriculture in the satisfaction of national needs
—Satisfaction of the internal demand of goods
—Import substitution, present and potential
—Generation of exportable surplus
—Agriculture as income multiplier
Institutions having to do with agriculture and their operational capacity

III Diagnosis of the present situation of research and extension
Resources: human and material; physical and financial (including national and external resources):

IV Beneficiaries to the plan
Determination and quantification of beneficiaries
Justification of the exclusion of certain sectors and strategies to include them in the future

V Priorities by products and by subjects plus bases for program elaboration
Synthesis of problems
Objectives of the program
Profiles of programs and of their projects

VI Recommendations about necessary institutional adjustments for plan implementation

The function of the national plan is to orient the long range actions, subject to periodic updating to secure effectiveness.

The elaboration of programs by product

This paper will not detail the information required to formulate programs by subject (examples: soil management and conservation, bio-climatology) but only for programs by product, inasmuch as these are the ones that present the greatest difficulties in the determination of approach, when making the choice of research priorities. The formulation of programs by product can be made in two stages: the first one consists in gathering information on the principal problems (present and potential) and the second relates to the decision as to problems to be attacked.

First stage: As a basis for the formulation of programs by product, problems were considered from several viewpoints, taking into account the institutional possibilities to solve them. It is important, in our case, to clearly define the institutional responsibility for research and for extension in the process of technological change that is oriented to socio-economic development in the rural enviroment. This information is contained in the "basic document" of the program and includes the following aspects:

I Problems related to production
Areas of present and potential production (known)
Comparative advantanges among the production areas
Varieties used and recommended
Seed availability
Crop mechanisation
Utilisation of labour
Utilisation of irrigation
Utilisation of fertilisers
Pest and disease control

II Problems related to the production system
Dispersion of the cultivated area (homogenous zones)
Types of enterprises

III Marketing problems
The marketing system at the farmers' level
—Production and organisation scale
—Producers' dependency
—Product marketing norms
—Product losses at the farm level

—Losses due to the centralisation of the marketing system
—Consequences of the lack of State participation
The marketing system at the intermediary level
—Degree of concentration of the economic activity
—Problems of the marketing infrastructure

IV Socio-economic importance of the product
Aggregate value
Contribution to the balance of payment (export, import substitution)
Direct and indirect generation of employment
Quantity of production units
Input demand

Second stage: In regard to the decision on what research to undertake, an analysis is made of the problems on the basis of the information contained in the basic document, with consideration given to two principal aspects:

Whether the problem is related to productivity, to production or to the farmers' income

What institution has the responsibility and realistic possibility to solve the problem

The first analysis helps to recognise the factors causing the problem as well as of the means available to solve it; it allows a comparison of the alternative solutions from various angles (national, regional, type of enterprise, etc.) and finally, it permits the identification of those aspects in which the research will produce effective results. This analysis facilitates the evaluation and decision as to which institution has the greatest possibilities to solve the problem. In this way it will be possible to identify problems that can be solved by research, by extension, by input provision, by research extension with other agencies such as credit, agrarian reform, etc., and by organisations not related to research and extension. This will make it possible to decide whether the "barriers" to the adoption of technical innovation can be effectively overcome and even more importantly, whom the new technology will benefit.

The next step of program formulation consists in the establishment of principal profiles for the projects. Project elaboration has a more technical context, adjusted to the socio-political framework supplied by the program. 4/ Evaluation and decisions as to the

technological segment (ought the "package" to be elaborated?) rest now on the interdisciplinary teams which compare the possible innovations among themselves and adopt the decision that would have greatest probability of success in the shortest period, given the available resources.

THE MANAGEMENT OF RESEARCH PROJECTS

Within the context of the planning instruments, research is actually managed or administrated through the Project. The project constitutes the Programming and Administration Unit of research as a function making inasmuch as the Project Leader is the main decision, component, responsible both for its execution and for its technical soundness.

Once the project has been approved as part of the program, its hierarchical linkage with the latter is secondary and the relationship between the Program Coordinator and the Project Leader is more one of collaboration than of authority. However, as for the Activities that compose the Project, the relationship is somewhat different: the Project Leader must have authority to influence the Activity Leader in those cases in which the activity being executed does not comply with what has been programmed, as well as in the technical aspects. This difference in "from the top down and from the bottom up" treatment stems from the fact that generally the person in charge of a project is a good specialist in the principal field of the project. Therefore he masters the project subject technically better than the Program Coordinator and probably has more experience (or with similar experience, greater responsibility) than his colleague in the position of Activity Leader.

For these reasons the formulation phase is very important and in it the project must be thoroughly debated and analysed so as to obtain sufficient legitimation for the validity and effectiveness of the project. Naturally, the objectives of the project must agree with the objectives of the program, and the objectives of the activities must agree with objectives of the project.

When saying that the programming unit is the project, it is understood that it carries the responsibility for the execution of the allocated budget. The sum of the budgets of projects is the budget of the program. The normal decisions of the program as far as objectives, resources, etc., are concerned, constitute the framework against which the recommendable projects are to be chosen. The selection of projects is done in group meetings by the program technicians. This manner of programming is one of the more practical means to avoid biases in the thematic content of the project toward certain fields or specialisations.

In the phase of project execution, and depending upon its complexity, several control techniques can be applied 5/ all of these are based on a good description of activities and of the sequence in which they will take place. This operational ordering favors good performance in project operation and insures the timely knowledge of future problems during execution. Progress reports are part of the execution itself and serve not only to advance the dissemination of valid information but also to take operational decisions unforeseen at the programming stage.

Evaluation is one of the most important aspects in the management of research projects. Evaluation is carried out in the first place in terms of achievement of the project objectives and, in the second place, in terms of its technical, methodological and executive aspects. From these analyses emerge the modifications of the project; however, if modifications are very important a new project must be formulated and developed.

The responsibility of operational units (experimental stations) in the execution of projects is very clear, since they must make available to the executors the basic resources and structure for the normal development of the research. The fixed expenditures (based on the provision of this "service" to the projects) are as important a determinant of success as the variable expenditures (project's own costs). On the adequate balance of both will depend the output of the research organisation.

TOWARDS AGRICULTURAL RESEARCH FOR DEVELOPMENT

In the developing countries there exists a tendency to interpret the problems of rural poverty as a problem peculiar to agriculture.

Whether this judgement is valid or not is of little consequence in view of the fact that rural poverty does exist and is associated with a broad complex of problems. Precisely because it concerns a complex of problems the solution is not simple. From the point of view of agricultural research, the professional obligation of researchers is to analyse in what manner technology may be transformed into an effective instrument for changing this state of affairs.

The study of production systems is a promising way in which to move with greater confidence toward the objective of rural development, but the scope should be widened somewhat by including two areas which are not usually taken into account by those who use this approach. These two areas are:

Research in agricultural market planning for the development of regional production resources;

Institutional analysis of organisations operating in the region.

This first permits the evaluation of the potential for agricultural development based upon market development. Generally, the recommended strategy is to indicate the change process by the improvement of the "principal" product from the point of view of the efficiency of the existing regional market. This is followed by the diversification of the production by incorporation of "secondary" products, which are also determined from the point of view of market development potential (1). In the latter case other aspects related to rural development are also taken into account, such as improvement of food supply in the region, balancing of rural labour supply and demand, adequate management of natural resources through community action, and so forth. In other words, the regional problems should be studied as if the region were in itself a transformer of a macro-system of production. Within this macro-system, typical farms are studied as principal transforming elements from the point of view of agriculturists. It follows, then, that this is the point of primary interest of the agricultural researcher, leaving to other services those actions which fall outside the area of the farm production and resource use.

The second, the institutional analysis of organisations operating in the region, which includes both public and private, has the purpose of evaluating their capabilities to overcome the barriers which block transfer of technology. Institutional analysis includes the components of leadership, doctrine, resources, programs, internal structure, connections and internal products (2). This permits the selection of those organisations with which the research and development program can operate successfully.

The above mentioned areas of analysis should be incorporated into the study of production systems, giving special attention to a priority analysis of the existing barriers that impede technology adoption and of those means which are available to remove these barriers within the particular region. From that base agricultural research will provide the technological elements for improving production systems.

It is important to point out that, even though the farm is the place where decisions are made on the use of resources, rural development will be achieved only when the region is taken into account as a unit (macro-transformer). Thus, to achieve rural development a group of technologies (in marketing, communications, etc.) should be introduced by the institutions which operate together within the region, based upon the possibilities developed by the agriculturists.

FOOTNOTES

1/ As an example it may be mentioned that extension workers sometimes do not understand the papers published by research and consequently they find it difficult to incorporate this language into a communication system for the farmers. Our position is that the researcher himself should choose the methods and means appropriate to the beneficiary of the technical innovation; that will facilitate communication and accelerate the transfer.

2/ Intermediate Transfer was defined as the transfer of technology from research to the extension service. Due to the fact that innovations do not easily leave the research unit, the Transfer Program is designed to operate through Trial Farms and Demonstration Farms. Both researchers and extension workers participate; the agricultural economists and farmers with certain characteristics (innovative farmers) employed as "linkages" by the current extension system .

3/ For the intermediate Transfer Program, Production System Analysis Program and Resources for the Future Program, each particular project requires a diagnosis because of the micro-environment in which each of them will operate. The sectorial diagnosis is useful to identify groups of projects that can be included in these three program types.

4/ For example, if the country needs to increase exports of one product there are many ways of doing it. Assuming the decision is to increase production, it must be analysed if expansion would be horizontal (increasing production area), vertical (increasing yields) or both, and from there, formulating appropriate projects.

5/ Among them the Critical Path Method.

REFERENCES

1. HILL, LOWELL D. Agricultural market planning in resource development. University of Illinois College of Agriculture. Special Publication No. 9 Urbana, Illinois. 1965

2. INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS. Problematica de la gestion institutional, segunda parte, esquema de analisis. Rio de Janiero. 1975 (Mimeo)

3. PIÑEIRO, M. y TRIGO, E. Planificacion de la investigacion agricola a partir de programas por productos: algunos comentarios criticos. Instituto Interamericano de Ciencias Agricolas. Serie PROTAAL Documento No. 4, Publicacion miscelánea No. 150. Bogota. 1977

4. SECRETARIA DE ESTADO DE AGRICULTURA, DEPARTAMENTO DE INVESTIGACIONES AGROPECUARIAS. Bases que fundamentan la reestructuracion del Departamento de Investigaciones Agropecuarias. Santo Domingo. 1978

5. SECRETARIA DE ESTADO DE AGRICULTURA, DEPARTAMENTO DE INVESTIGACIONES AGROPECUARIAS. Manual de organización. Santo Domingo. 1978

6. SECRETARIA DE ESTADO DE AGRICULTURA, DEPARTAMENTO DE INVESTIGACIONES AGROPECUARIAS. Plan nacional de investigaciones agropecuarias (PLANIA). Publicaciones oficiales No. 5. Santo Domingo 1979.

7. SECRETARIA DE ESTADO DE AGRICULTURA, SUBSECRETARIA DE ESTADO DE INVESTIGACION, EXTENSION Y CAPACITACION AGROPECUARIA. Plan nacional de investigacion y extension (PLANIE). Santo Domingo. 1977. 3v.

PANEL DISCUSSION ON SOCIAL & ECONOMIC CONSIDERATIONS IN AGRICULTURAL RESEARCH IN THE CARIBBEAN

J. Spence	*UWI*
H. Barreyro	*IICA*
V.A.L. Sargeant	*CARDI (Moderator)*
E. Trigo	*IICA*
C. Applewhite	*UNDP*
H. Stagno	*IICA*

The panel focused on the influences of socio-economic issues on agricultural research, financing of research, and social and economic consequences of research.

The relations among the agriresearch system, financing institutions for research and research results and society are strong, and develop into a complex system in which socio-economic issues play an important role as a decision making tool.

Under the point of view of social and economic consequences of research on the society as a whole, the main social and economic aspects to be taken into consideration in generation and transfer of technology, are the following:

A. In the short and Intermediate run

i. Added values (by product and subsectors) at the rural level as well as at downstream enterprises.

ii. Type of clientele or potential users of the new technologies generated, considering the production unit resources and management ability.

iii. The impact of new technologies on employment, particularly in what concerns labor-saving technologies and their influence on job opportunities at the rural level and rural-urban migration rates.

iv. Impact of new technologies on cultural and traditional values, specially in relation to the changing participation of men/women in the production process.

v. Rural change resulting from new technology which influences farm and area adjustment to the economic and social development.

vi. Potential contributions of the new technologies to import substitution or increassed exports and an improved balance of payment situation.

vii. Farmers' income, considering capital accumulation and capital structure changes, provided by and arising from technology changes, including enterprise risk and uncertainties of technology packages and production systems offered to farmers.

viii. Farm management and micro-regional development information for planning and operating different types of production units.

B. In the long term.

ix. The effect of present and new technologies on natural resources, particularly in reference to their management implications and future conservation costs.

x. Ecological impact of production practices promoted by new technologies and physical development (infrastructure) of rural areas, producing undesirable changes in the environment.

xi. Energy balance influenced by technology through energy saving production systems at the farm level, as well as technology for developing new sources of energy from agriculture and farm by-products.

THE FACULTY OF AGRICULTURE, UNIVERSITY OF THE WEST INDIES AND ITS ROLE IN REGIONAL AGRICULTURAL RESEARCH AND DEVELOPMENT

J. Spence

UWI

SUMMARY

1. The Faculty of Agriculture with 40 professional staff and 80 postgraduate students in disciplines ranging from pure and applied sciences to social sciences provides a resources base which should be fully utilised for regional agricultural research and development.

2. National Research Institutions in MDCs of Jamaica, and Trinidad and Tobago are now being reorganised and in this process the University Faculty of Agriculture is giving substantial assistance. It is likely that renewed development will take place in Guyana and Barbados and the Faculty of Agriculture is also available for assistance with these developments. In this regard it may be noted that the Faculty of Agriculture played a substantial role in the development of the Faculty of Natural Resources (including Agriculture) in Suriname.

3. The development role of the Faculty can be enhanced by its use in consultancies in agricultural development sponsored by the Caribbean Development Bank and similar agencies. This, in addition to the role already played by involvement in Government Boards, Committees, Commissions of Enquiry and consultancies by individual staff members. Further, the important

USAID funded project in which the Faculty of Agriculture will develop and implement plans for the improvement of the extension services in the LDCs will allow major Faculty involvement with an important instrument of development.

4. In the developments envisaged in the 1980's, it is important that the Regional character of the UWI Faculty of Agriculture should be maintained.

INTRODUCTION

Role and Function of Universities

Traditionally universities have two main functions: Teaching and Research. With respect to teaching, most modern universities have arrived at programmes which are geared to the functions which graduates may be required to perform in their later careers, this being particularly true in the professional faculties, for example, in Law, Medicine, Agriculture and Engineering. With respect to research, there has been a stronger tradition of "academic freedom" which allows choice on the part of individual members of the university as to the nature and subject of their research, the general concept being that by this approach the frontiers of knowledge will be more likely to be advanced. The high cost of research in science and technology has led to modification of the concept of academic freedom since the provision of funds for particular studies now frequently dictates the subject (if not always the nature) of the research. The best example of universities being managed as instruments of development has been the very successful Land Grant College System in the United States, where teaching, research and extension are centered in State Colleges (particularly of Agriculture) sometimes integrated with independent universities such as Cornell University in New York State. Developing countries of the former British Empire have followed a path, set in the Colonial era, of agricultural research being conducted in government departments and in government controlled institutes, rather than at universities, in large measure due to adherence to the British University System which traditionally did not become involved in development. It is clear that the situation in developing countries is much more akin to that in the U.S.A. where the Land Grant Colleges were set up to respond to the need for a rapid development of the agricultural sector.

Role of the University of the West Indies (UWI)

There is general agreement that UWI should play a role in development, but not infrequently the traditional concept of academic freedom persists as an impediment to the realisation of this goal. In the professional faculties there is strong support for the concept of a major role in development but this is not always recognised by persons and institutions outside of the University who persist with the false notion that UWI isolates itself in an "ivory tower". Sometimes institutional arrangements act as impediments to the involvement or participation of the University. Examples of

this bias will be given later and proposals will be made for positive action to remedy this situation.

In assessing the possible role of UWI in development the following characteristics may be noted which will affect this issue:

1. The University by its nature, is part of an international community of scholars and as such maintains an international reputation thereby gaining ready access to, and assocation with, a larger pool of knowledge and expertise.

2. Because of the multidisciplinary nature of many of the teaching programmes, specialists are provided at the University for teaching purposes, who must, nevertheless, pursue research and so the infrastructure already exists for the assembling of multidisciplinary teams.

3. The University is likely to attract the most enquiring of the young graduates, either as permanent staff members, or even for a time as postgraduate students, and this will keep up the flow of new ideas necessary to tackle the complex development issues.

4. The professional staff of the various institutions for development will come from the University and so the teaching and research programmes at the University must exert an indirect influence on the work of such institutions.

5. The relative autonomy of the University allows its use by differing political systems, particularly in the case of the faculties for Science and Technology.

6. Funds for research provided by the University are hopelessly inadequate particularly in Science and Technology and so there is a strong possibility of influencing the research to be undertaken by the provision of funds on a contract basis.

7. Because University staff have teaching commitments their movement is restricted. This has advantages and disadvantages; the major disadvantage is that their research activity must be very largely at the site of the location of the faculty; however in view of the experience of some regional institutions in the Caribbean, where each country may insist on a local presence thus leading to a fragmentation of the regional institution, so that each unit is below critical mass, the relative immobility

of the University staff may indeed be an asset. In the agricultural sector, an example of such fragmentation may be seen in the Citrus Research Scheme which collapsed after the multidisciplinary team based in Trinidad was dispersed to satisfy the demands of the contributing countries, one scientist then being stationed in Belize, one in Jamaica and two in Trinidad and Tobago. It should be noted that the Caribbean Agricultural Research and Development Institute (CARDI) is now undergoing a similar process of dispersal of staff.

ROLE OF THE FACULTY OF AGRICULTURE

Background

The Faculty of Agriculture possesses many of the characteristics referred to above which argue for its use as a major development instrument.

There are now 40 full-time permanent staff teachers in the Faculty of Agriculture (see Appendix I for Staff List), in the various specialisations required for the teaching of the many faceted subject of agriculture. In addition there are some 80 postgraduate students at M.Sc. and Ph. D. levels. This provides the largest single collection of professional agriculturalists at one site in the region, or indeed in any one institution.

The 40 professional staff have a varied background of training and experience. Some have been trained in pure science, others in agricultural programmes starting at technological level (at farm institutes), through to university degrees; some have been trained in the social sciences (economics and sociology); some have studies in the British University system and others in the North American system and still others in Asia; many have worked in ministries of agriculture and some in regional agencies such as the Caribbean Development Bank; many of the staff originate from, or have worked in, nearly all of the countries of the CARICOM region.

The Faculty of Agriculture has over the last 20 years maintained the international reputation in Tropical Agriculture held by its predecessor (the Imperial College of Tropical Agriculture) and has received research grants from a number of international agencies, for example, Ford and Rockefeller Foundations, International Development Research Centre (of Canada), International Foundation for Science (Sweden), Swedish Research Centre (SAREC), German Government, USAID, CIDIA, ODA (UK): in addition staff members sit on the boards of international institutes for agricultural research and act as consultants for aid agencies, and are invited to contribute in many international fora.

Most of these grants for research are given on the basis of contracts and regular reporting of the progress of the research (and of expenditures) are required. Further the work must be integrated even though the funding comes from the many sources indicated. In response to this circumstance the Faculty has developed over the last ten years a capability in research management which does not exist in any other national or regional organisation in the CARICOM region. More details of this system is given in Appendix II and in a Compendium of Research published by the Faculty of Agriculture. This management system is based on the need for coordinated research programmes on agricultural commodities which relate to the problems of the farmer, while maintaining the initiative of individual scientists for creative work without which progress cannot be made. Failure to recognise the importance of the right mores of scientific institutes has led to unproductive research in most of the countries in the region. The substantial expenditures on such research with little return has led to serious questioning of the need for research.

It should also be noted that the Faculty of Agriculture has had substantial involvement of economists and sociologists in research programmes.

The system of research contracts with accountability which the Faculty of Agriculture has had to manage has led to steady progress in a number of areas of research and the renewal of such contracts from international funding agencies is indicative of the successes.

At least one Government (Trinidad and Tobago) is now using the research contract system with the Faculty of Agriculture and a two million dollar TT contract for a two year period (renewable depending on performance) for research on specific agricultural projects was entered into in December 1979, between UWI and the Government of Trinidad Tobago. The first annual report on this contract has just been presented to the Government of Trinidad and Tobago.

Future Role of the Faculty of Agriculture in Research

To achieve a suitable structure there is urgent need for the reorganisation of the national research systems in the MDC's (Trinidad and Tobago, Jamaica, Guyana and Barbados) to make them effective in providing solutions to the farmer's problems. In Trinidad and Tobago the Government and Parliament have agreed to the establishment of an autonomous National Institute of Higher Education, Research, Science and Technology, NIHERST, into which will be absorbed the research division of the Ministry of Agriculture. In Jamaica an FAO/IDB Mission (which included the Dean of the

Faculty of Agriculture of UWI) has made recommendations which are now being implemented with an IDB loan for the complete reorganisation of the agricultural research institutions in that country.

With the establishment of a Faculty of Agriculture in the University of Guyana, and the creation of institutions for scientific research, there is every likelihood that agricultural research will be reorganised in that country. This leaves Barbados and the LDC's, the latter being too small to support individual national research systems. It is quite possible that Barbados with its University Campus and strong tradition for sugar cane breeding will develop a new system for agricultural research.

With respect to the LDC's the Caribbean Agricultural Research and Development Institute (CARDI) would undertake research for those countries and would collaborate with the Windward Islands (WINBAN) Banana Research Institute in St. Lucia.

In addressing the issue of the role of the Faculty of Agriculture in research, the following points need to be considered:

1. The national institutes will be occupied with short-term applied problems and while they will have particular areas of excellence (sugar cane breeding in Barbados; coconut and banana breeding in Jamaica; cocoa research in Trinidad and Tobago; rice breeding in Guyana; and banana research in the LDCs at the WINBAN Research Station in St. Lucia) there will be many areas in which multidisciplinary programmes would be difficult to mount.

2. There will be need for basic, long-term research and particularly for the development of new commodities and systems.

3. The national systems should be linked in a network of collaborating institutions with their differing areas of excellence, with mechanisms for new technology developed at one centre to become available to others for local adaptation and adoption.

4. The Faculty of Agriculture, as indicated earlier, possesses substantial manpower resources and would only be reduced in capacity, or removed, if under-graduate or post-graduate teaching were to cease. It should therefore be utilised to the best advantage for the region.

The Faculty of Agriculture could then be developed as a regional organisation to undertake basic and applied research (multi-disciplinary where required) in agricultural crops and livestock of importance to the region and relating to the tropical international agricultural research system, (in this context it should be noted that some 20%/o of the postgraduate students come from other developing countries, particularly in Africa) the results being passed to the national systems.

The Faculty of Agriculture could also act as the coordinating agency for a network of national institutes. It would be an important resource base for strengthening the national systems and in this context it should be noted that the staff of such national systems will in large measure be trained at under-graduate and post-graduate levels in this Faculty. Once the national research institutions have been improved, post-graduate students may then be placed in such institutions under joint supervision of staff of the Faculty and of the institution.

Future Role in Development

The Faculty has been involved in development at four levels:

1. Training of personnel.

2. Providing solutions to problems by relevant research see list of some current research student projects in Appendix III.

3. Involvement with the Agricultural Extension Services, particularly in the LDC's.

4. By membership of national and regional instruments for development.

With respect to Agricultural Extension, activities have been limited to research into extension methods and annual short-courses in the LDCs for extension workers and selected farmers. However, in a recently signed two million US dollar USAID contract, the Faculty of Agriculture has undertaken to plan the reorganisation of the agricultural extension services in the Leeward and Windward Islands, Belize and possibly Barbados. The Faculty has subcontracted a group of US Universities to provide expertise in particular extension disciplines as required. This first contract will cover a period of not more than two (2) years, but the project envisages a second of five million US dollars to implement the approved development plans for the agricultural extension services over a further three-year period.

This project will allow substantial and direct involvement of the Faculty of Agriculture in an important instrument for development to the LDC's. It is expected that the implementation phase will include pilot projects in which Technology developed by the Faculty (and other agencies) will be transferred directly to farmers. This will allow the Faculty to address a criticism that worthwhile research results do not reach the farmer.

The Faculty also becomes involved in development by the utilisation of individual staff members in short-term consultancies, on commissions of enquiry; on boards and committees; and on public corporations. Because of its geographic location many of these activities are in Trinidad and Tobago. However, the capability exists for group and multidisciplinary consultancies and it is to be regretted that the Faculty has not been used in this way by the Caribbean Development Bank (CDB). It is interesting to note that not infrequently consultants of consultant firms appointed by the CDB call on the Faculty staff for assistance. Over the last four years the CARICOM Secretariat has involved the Faculty of Agriculture at various levels in the development of the Regional Food and Nutrition Plan.

Future Developments in Teaching

With respect to teaching, this Faculty is responsive to the needs of 14 countries served by the University within the resources provided. The under-graduate degree, which is a general honours degree, was modified a few years ago to include a Pre-Agriculture Year which allows an 'O' level entry to cater for those countries in the LDC group that might not have a sufficient number of 'A' level students. This development has led to a very marked increase in the number of students graduating from the Faculty but, unfortunately, the LDCs have not taken advantage of this facility due to inability to pay the "economic cost" per student. In 1980 a specialised degree in Agronomy has been introduced to cater for anticipated needs of the Regional Food and Nutrition Plan. However, a proposal for a degree in Livestock Production, also needed for this Plan, has not come to fruition since the University Grants Committee did not agree to this proposal made in 1978.

A one year diploma in Extension will be introduced in 1981 to cater for the training needs of the USAID Agricultural Extension Project, which will provide financial support for the course including funding of the economic costs of students attending from the LDC's Entry to this diploma course will be open both to holders of a university degree and to holders of two or three year diplomas from

the Jamaica School of Agriculture and the Eastern Caribbean Institute for Agriculture and Forestry, followed by field experience in agriculture.

Conclusions

The Govenments of the Region, while recognising the role of the University in teaching and research, have urged a greater role in development for the University; this includes the Faculty of Agriculture which is making every effort to respond. The Faculty of Agriculture would also coordinate a network of national institutions for which it would train personnel and act as a resource base for specialists and advise in research management.

In the context of regional integration the re-affirmation of a regional mandate for the Faculty of Agriculture is extremely important at this time. It is clear that an active and vibrant Faculty consisting of 40 professionals, and 80 graduate students, with associated disciplines of Food Technology and Agricultural Engineering (in the Faculty of Engineering) and with an excellent record for attracting research funds, is an important resource which can be utilised for regional agricultural development.

APPENDIX I

THE UNIVERSITY OF THE WEST INDIES, FACULTY OF AGRICULTURE, ST. AUGUSTINE, TRINIDAD, WEST INDIES.

STAFF LIST (Academic Staff)

Dean of Agriculture

Prof. J. A. Spence, B. Sc., Ph. D. (Brist.), Dip. Agric. Sci. (Cantab.), DTA.

Faculty of Agriculture Representative (Jamaica) — vacant

Associate Dean (Academic Affairs)

R. F. Barnes, B. Sc. (Lond.), A.R.C.S.

Associate Dean (Research)

C.W.D. Brathwaite, B.Sc. (UWI), M.Sc., Ph.D. (Cornell)

Department of Agricultural Economics and Farm Management

Professor of Agricultural Economics — vacant

L.B. Rankine, B.Sc. (North Carolina), M.Sc., Ph.D. (Hawaii) — Senior Lecturer and Head of Department.

G.O'G. Alleyne, M.A. (Cantab.), Dip. Agric. Econ. (Oxon), Ph.D. (UCLA) — Lecturer

S.C. Birla, B.Sc., M.Sc. (Agra), M.S. (Illin.), Ph.D. (Illin.) — Senior Lecturer (on 2 years leave).

C.A. Pemberton, B.Sc, MSc. (UWI) Ph.D. (Manitoba) — Lecturer.

R.H. Singh, B.Sc., M.Sc., Ph.D. (Manitoba) — Research Fellow

Department of Agricultural Extension

T.H. Henderson, DICTA.; M.Sc. (Cornell), Ph.D. (Wis.) — Director and Head of Department

P.I. Gomes, M.A. Soc., Ph.D. (Fordham) — Lecturer in Agricultural Sociology

J. Seepersad, B.Sc, MSc. (UWI) — Lecturer in Agricultural Extension

Department of Biological Sciences

R.F. Barnes, B.Sc. (Lond), A.R.C.S. — Head of Department and Senior Lecturer in Botany

C.D. Adams, B.Sc. (Lond.), B.Sc. (Spec. Bot.), Ph.D. (Lond.) – Reader in Botany (retired 30/9/80)

R.P. Ariyanayagam, B.Sc. (Univ. of Poona), M.S. (Univ. of Philippines), Ph.D. (Cornell) – Senior Lecturer in Botany

C.W.D. Brathwaite, B.Sc. (UWI), M.Sc., Ph.D. (Cornell), – Senior Lecturer in Botany

G. Charran (Mrs.), B.Sc. (UWI) Ph.D. (UWI) – Lecturer in Botany

F.W. Cope, B.Sc., Ph.D. (Lond.), A.R.C.S. – Emeritus Professor of Botany and Plant Pathology

J.B. Davidson, B.Sc. (Dalhousie), M.Sc., Ph.D. (Toronto) – Lecturer in Biochemistry

E.J. Duncan, B.Sc. (Lond–UCWI), Ph.D. (St. Andrews) – Senior Lecturer in Botany

D.G. Hughes, B.A., D. Phil (University of York) – Lecturer in Biometrics

L. Marin P. B.Sc. (McGill), M.Sc., Ph.D. (Tor) – Lecturer in Botany (on 1 year's leave)

C.R. McDavid, B.Sc., Ph.D. (Wales) – Lecturer in Botany

G.V. Pollard, B.Sc., Ph.D. (UWI) – Lecturer in Biological Sciences

V. Scoon, B.A. (York) Ph.D. (Shef.) – Lecturer in Biochemistry (resigned 30/9/80)

K. Wignarajah, B.Sc. (Univ. of Ceylon), Ph.D. (Univ. of Liverpool) – Temporary Lecturer in Botany

J.A. Spence, B.Sc., Ph.D. (Brist.), Dip. Agric. Sci. (Cantab.), D.T.A. – Professor of Botany

M. Wilson, B.Sc., (Lond-UCWI), Ph.D. (Lond.) – Lecturer in Biochemistry

Department of Crop Science

L.A. Wilson, B.Sc., M.Sc. (Lond.), Ph.D. (Brist.) — Head of Department and Professor of Crop Science

R.A.I. Brathwaite, B.Sc. (Poona), Ph.D. (UWI) — Lecturer in Crop Production

T.U. Ferguson, B.Sc., Ph.D. (UWI) — Lecturer in Crop Production

W.O'N Harvey, B.Sc. (UWI), M. Agric. Eng. (Reading) — Lecturer in Agricultural Engineering (on Scholarship in the USA for two years)

D. Rajkumar, B.Sc., M.Sc. (UWI), Ph.D. (Adelaide) — Lecturer in Crop Production

S. Redman, DICTA. (ICTA), B.Sc. (McGill), MSA (Univ. Toronto) — Visiting Lecturer in Agricultural Engineering.

Department of Livestock Science

H.E. Williams, DVM. (Tor.) M.Sc. (Wis.), Ph.D. (Edin.), M.R.C. V.S. — Head of Department & Professor of Livestock Science

F.G. Youssef, B.Sc. Hons. (A'IN SHAMS), Ph.D. (Reading) — Senior Lecturer in Animal Nutrition

K.A.E. Archibald, DICTA, M.Sc. (UWI), Ph.D. (Lond.) — Lecturer in Animal Production

R.K. Rastogi, B.V.Sc. & AH., M.V.Sc. (U.P. Agric. Univ.), Ph.D., (Minnesota) — Lecturer in Animal Science

Department of Soil Science

N. Ahmad, AICTA: M.Sc. (UBC), Ph.D. (Nott.), — Head of Department and Professor of Soil Science

A.L. Donowa, B.Sc., M.Sc., (Manit.), Ph.D. (Waterloo) — Lecturer in Soil Microbiology

S. Griffith, B.Sc., M.Sc. (Guelp), Ph.D. (UWI) — Lecturer in Soil Chemistry

F.A. Gumbs, B.Sc. (Reading), M.Sc., Ph.D. (McGill) — Senior Lecturer in Soil Physics

C.C. Weir, B.S.A., (Tor.), Ph.D. (Manit.) — Honorary Lecturer in Soil Science

G. Holder, B.Sc. (UWI), M.Sc. (McGill), Assistant Lecturer in Soil Physics

J. Lindsay, B.Sc., M.Sc. (UWI), Junior Research Fellow

S.K. Mughogho, B.Sc. (Mass.), M.Sc., Ph.D. (Cornell), Research Scientist

University Field Station

W.N. Prendergast, Dip. Agric. (J.S.A.), DICTA., M.Sc. (UWI), Manager

APPENDIX II

Research Organisation

The Faculty of Agriculture has nine (9) research programmes in progress. Most of these are crop or livestock oriented while some are in disciplines. Details of these programmes and of the facilities available for research are given in a Compendium of Research, published by the Faculty of Agriculture.

Some of the programmes are well developed and have been funded for some years (e.g., Grain Legume, Root Crop, Soils); others have only recently received significant funding.

The organisation of the programmes is designed to achieve coordination while allowing initiative on the part of individual researchers.

Programmes and projects are approved by the Faculty Research Advisory Committee (FRAC) which advises the Dean (Prof. J. Spence) and is comprised of the Associate Dean (Research), Programme Leaders, Associate Programme Leaders, Heads of Departments and Subject Leaders.

The present programme with Programme Leaders are given below:

Research Programmes	Programme Leaders
Root Crop	Dr. C.R. McDavid
Livestock	Prof. H.E. Williams
Soils	Prof. N. Ahmad
Agricultural Extension	Dr. T.H. Henderson
Grain Legume	Dr. T.U. Ferguson
Horticulture	Prof. L.A. Wilson
Cereal	Dr. R. Brathwaite
Agricultural Economics	Dr. L.B. Rankie
Land & Water Management	Dr. F. Gumbs

A central computerised project registration system, Faculty of Agriculture Research Monitor (FARM) is being put into operation.

Funding for the individual programmes may come from more than one source often by way of contract for particular projects within a programme. An example is the Grain Legume Programme which has existed in this from for some 12 years, and which is described below.

This system of research programming has been successful both in terms of research results and in contracting for funding from international sources, and more recently from local sources.

The major advantages of the system are:

i. Wide choice in the appointing of programme leaders since a leader may be selected from any member of staff. The choice is made on interest in the programme, competence as a scientist, and ability to get on with colleagues and to organise the separate projects into a coherent programme. The responsibilities also involve taking the initiative in preparing proposals for funding.
The appointment is made by the Dean on the advice of the Faculty Research Advisory Committee.

ii. Possibility of changing the programme leadership periodically as circumstances dictate and without any great upheaval since no loss of salaried appointment is involved. Once it is accepted as a normal occurrence that there will be periodic reviews of the leadership with a view to change, then any change can be smoothly accomplished.

iii. It allows for development of leadership qualities in younger members of staff who may start as associate leaders and it encourages the inflow of new ideas which is vital for a viable research programme.

iv. Central monitoring of progress, and allocation of resources is carried out by the Office of the Dean with the advice of the Faculty Research Advisory Committee.

The basic objective of the research programmes is to increase regional food production. Research is also conducted on Cocoa, but in a Cocoa Research Unit which at present operates with its own Advisory Committee.

The Research Programmes have been aimed at developing systems of crop and livestock production that are economically viable for adoption by farmers in the countries which contribute to the cost of the University.

Collaboration is established with the local Ministries of Agriculture particularly where research in extension methods, or into the process of adoption of new technology, is involved.

An example may be given from the Grain Legume Programme to illustrate the way in which the research is structured and the relevance to agricultural and rural development.

The Grain Legume Programme has concentrated mainly on Pigeon Peas (Gungo peas) *(Cajanus cajan)* which is an important protein source throughout the West Indian region. The currently available varieties have a long growing season of some 6 months

and crop only during the shorter days from December to March when they have become large shrubs. The central thrust of the programme has therefore been a plant breeding project to produce a short-season pigeon pea plant which will crop over a longer period of the year. This would have the advantage of making the crop available in the fresh state for a long period of the year and reduce the inputs in weed and pest control needed between planting and harvest.

The breeding programme has been backed up by a number of studies in plant physiology, plant pathology, entomology, nitrogen fixation, agronomy, economics and farmer adoption as a new technology was developed. Thus the characteristics needed in the new variety are designated by the ancillary studies and the final package of practices is assessed in cost of production studies as well as being tested in farmers' fields for suitability for adoption. These latter studies on adoption include assessment on how the new variety would fit into different cropping systems that might be used by the farmer.

In three years from the inception of the breeding programme two new varieties have been produced which are short season (cropping time reduced from 6 months to 3 months) and which are capable, at least under Trinidad conditions, of cropping at any time of year. These results have the potential for a tremendous impact on production of pigeon peas at both small and medium size farmer level as well as opening up the possibility of large scale production.

Major New Developments

A major project recently funded by USAID involves an Extension oriented but multidisciplinary rural development project in the Leeward and Windward Islands, Belize and Barbados. The Mid-Western Universities Consortium for International Agriculture (MUCIA) has been sub-contracted by U.W.I. to provide technical assistance in the form of relevant expertise from U.S. Universities of the MUCIA group.

The main object of the project is to improve the Extension Services and to develop a model for a technology transfer system designed to make the greatest impact on rural development. The project will be based in three sites in the LDCs but will include back-up training in the Faculty of Agriculture in Trinidad. As far as it is practical, under-graduate students may be involved but more particularly post-graduate students. In both cases there will be the advantage that students will be in close touch with the farming community, as well as staff in the more academic disciplines who might not otherwise have had the opportunity for such contact.

This study will have direct relevance to rural development as well as serving as a training process for future professional agriculturists in the region.

Post-graduate Studies

Post-graduate studies projects are integrated into the research programmes where appropriate and so provide an important resource to the total research effort.

During the six-year period 1971 to 1976, 60 M.Sc. and Ph.D. students graduated from the Faculty of Agriculture. The number graduating has now doubled and in the 1978 to 1979 academic year 19 students graduated,9 with Ph.D. and 10 with M.Sc. There are now 80 post-graduate students registered in the Faculty and their studies have relevance for agricultural development in the region (Henderson, T. Abstracts of Graduate Students' Research in Agriculture — Research Summaries No. 1 (1973) and No. 2 (1977) Abstract.)

Some current post-graduate student projects are listed in Appendix III.

Publications

Apart from periodic reporting to funding agencies, and the production of annual reports, staff of the Faculty publish in a wide range of international journals. Thus in the five year period of 1974 to 1979, 141 such publications were produced by the 40 members of staff.

In addition a number of reports and departmental bulletins are produced as a result of special studies and the Department of Agricultural Extension publishes advisory bulletins.

The Faculty of Agriculture continues to sponsor the journal "Tropical Agriculture" which has a world-wide circulation.

APPENDIX III

Post-graduate Students' Projects

Agricultural Economics and Farm Management

Evaluation of Diversification Programme at Orange Grove National Company.

Resource Productivity in Cassava Production in Jamaica.

Financing Agricultural Development in the Caribbean with Special Reference to Barbados.

Development of an Appropriate Framework for the Allocation of Loanable Funds to the Agricultural Sector.

Impact of the Subsidy Programme on the Broiler Industry in Trinidad and Tobago.

Studies on Resource Economics.

A Simple Model for Planning Agricultural Development in the Caribbean.

An Economic Evaluation of the U.W. 17 Pigeon Pea Variety under Small Farm Conditions.

The Economic Impact of the Reorganisation of the Marine Fishery Industry in Suriname.

Agricultural Extension

A Study of the Attitudes towards Agriculture of Primary and Secondary School Students in North Eastern Trinidad.

Role and Function of Farmers' Organisations in Agricultural Development.

Assessment of the Adoption and Impact of Controlled Droplet Application (CDA) on Disease and Pest Control by Farmers in the Aranguez Area.

The Organisation and Administration of Agricultural Extension Services in Tanzania.

A Study of the Role of the Agricultural Extension Worker in Trinidad: The Farmer's Perception.

A Comparison between the Farming Methods and Innovative Practices of Traditional and Scientific Peasant Farmers in Caroni County, Trinidad.

Factors affecting the Adoption of Recommended Smut Control Practices by Sugarcane Farmers in South Trinidad.

Biological Sciences

Seed Borne Pathogens of Legumes and Their Control.

Studies on the Resistance of Pigeon Pea to *Sclerotium rolfsii*

A study of Factors influencing Flower and Fruit Abscission in Pigeon Pea.

Pedigree Selection for Earliness and Uniformity of Harvest in Pigeon Pea.

A Floral History Study of the Nariva Swamp, Trinidad.

Biological and Ecological Studies of *Frankliniella insularis* (Franklin) on Pigeon Pea (*Cajanus cajan* (L) Mills) with Investigations of its Pest Status.

Studies on Pyo-cynamide and Other Phenazine Compounds for Plant Disease Control.

A Study of the Resistance of Sugarcane Varieties to *Ustilago scitaminea.*

Comparisons of Methods of Plant Growth Analysis.

Studies on the Effect of Some Chemical Plant Defense Mechanisms against Leaf Cutting Ant Attack.

Ecological Studies of Salvinia and its Natural Enemies.

Cytological Studies on Pigeon Pea Atylosia Crosses.

A Study of the Effects of Sugarcane Ripeners on Photosynthesis, Translocation, Sucrose Content and Growth in High and Low Quality Clones.

Crop Science

Physiological Determinants of Sugar Productivity in Selected Sugarcane Cultivars.

Comparative Assessment of Growth and Yield in two Cassava Cultivars.

Evaluation of Selected Sweet Potato Seedling Lines for Tuber Yield and Yield Components.

Agronomic Studies on Grain Sorghum in Trinidad.

Studies on the Epidemiology and Control of Cowpea Mosaic Virus in *Vigna unguiculata* (L) Walp.

The Response of Selected Vegetables to Trickle Irrigation.

Studies on Storage Dormancy and Sprouting of Tubers of Selected *Dioscorea spp.*

A Study on Vegetative Growth in Mangoes and Avocadoes.

Agronomic Studies on Winged Bean.

A Study of the Performance of Sweet Potato in Cropping Systems with Corn.

Post-Harvest Studies on Prolonging the Shelf Life of Cassava Tubers.

A Study of Soil Compaction and its Effects under Mechanical Land Cultivation and Sugarcane Harvesting Equipment on Two Soils at Caroni.

Livestock Science

The Feeding of the Dairy Goat

The Utilisation of Some Agricultural By-Products in Livestock Feeding.

The Effect of the Stage of Maturity and Season on the Chemical Composition and Nutritional Value of Sugarcane as Livestock Feed.

Studies on Feeding Dairy Cattle.

Forage Sorghum Production.

A Study of Protein-Rich Forages as Complementary Feeding-Stuff for Ruminants on Sugarcane Diets.

Soil Science

Evaluation of the Bacteriological, Chemical and Physical Pollution of the Caroni River.

Evaluation of *Rhizobium japonicum* Strains for Ability to Increase Nitrogen Fixation and Yield of Soybean Varieties in Trinidad.

A Study of Nitrogen Fixation in Ground Nuts.

A Study of Water Runoff, Soil Losses and the Yield of Corn on the Maracas Soil in the Northern Range, Trinidad.

A Study of the Amounts of Water Runoff and Nitrogen Losses in Water Runoff and eroded Sediments from Crops grown on Sloping Land.

Prediction of the Irrigation Requirement of Crops grown in Trinidad using Climatic Data.

The Irrigation Needs of Sugarcane at Monymusk, Jamaica and the Associated Soil Salinity Problems.

Heterogenesis of Soils Developed from Shales in Jamaica.

Reclamation of Salt-affected Scotland Clays in the Scotland District of Barbados.

Soil Factors affecting Growth of Sorghum in Dry Salt-affected Soils of Jamaica.

The Reactions and Transformation of Ammonium Nitrogen using N15

Nitrogen Fixation in the Rhizosphere of Swamp Rice differentiating between Algal and Bacterial Fixation.

Productivity of Grass/Legume Mixtures under Antigua Conditions.

A Study of Rainfall Erosivity, Soil Erodibility and Soil Losses from Two Soils in the Northern Range, Trinidad, under Different Managements.

Soil Fertility Requirements of Pigeon Pea.

A Study of Soil Management for the Wet and Dry Season Production of Cabbages.

The Effect of Different Methods of Land Preparation on the Soil Physical Properties and the Growth and Yield of Sorghum on a Clay Soil in Jamaica.

Management of Cunupia Silt/Clay Soil for the Wet and Dry Season Production of Corn and Cowpea.

Studies on Organic Fertilisers.

Studies on the Movement of Nitrogen in the Soil.

Interaction of Metal Ions and Organic Matter in Drained and Flooded Tropical Soils.

Organic Matter in Vertisols.

THE CARIBBEAN AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTE AND ITS ROLE IN THE REGIONAL AGRICULTURAL RESEARCH

Joe Bergasse

CARDI

INTRODUCTORY INFORMATION

1.1 Historical Background

The Caribbean Agricultural Research and Development Institute (CARDI) was established in 1975 as an autonomous regional organisation to serve the agricultural research and development needs of the 12 member countries of the Commonwealth Caribbean Community; viz.

Antigua	Grenada	St. Kitts-Nevis
Barbados	Guyana	St. Lucia
Belize	Jamaica	St. Vincent
Dominica	Montserrat	Trinidad and Tobago

The Institute was founded in 1975 as the succesor organisation of the Regional Research Centre (RRC) of the Faculty of Agriculture, University of the West Indies (UWI) to meet the changing needs in agricultural research and development in the Region.

Thus, the Institute by virtue of its linkages with the RRC has a history dating back to 1955 when the RRC executed regional research programmes which were part of the responsibilities of the Imperial College for Tropical Agriculture (ICTA).

CARDI continues to be affiliated with the University of the West Indies with Headquartes at the St. Augustine Campus, Trinidad, but is a fully autonomous regional organisation.

1.2 Objectives and Functions

The broad objectives set out in the articles of agreement establishing CARDI include:

a. to provide for the research and development needs of the agriculture of the Region as identified in national plans and policies;

b. to provide an appropriate research and development service to the agricultural sector of member countries;

c. to provide and extend the application of new technologies in production, processing, storage and distribution of agricultural products of member countries;

d. to pursue for specified periods long-term research in pertinent areas;

e. to provide for the coordination and integration of the research and development efforts of member countries where this is possible and desirable;

f. to undertake teaching functions normally at the post-graduate level, limited to the development of the relevant research by any member country.

1.3 Formal Organisation

CARDI is governed by the Standing Committee of Ministers responsible for Agriculture in the Caribbean Community. The Committee meets annually to consider the annual report of the Institute along with budgetary and other policy matters. The decisions of this Committee are implemented by a Board of Directors consisting of ten (10) voting members and four (4) non-voting members. Of the voting members six (6) represent individual territories, one (1) represents the University of Guyana and three (3) represent the University of the West Indies. The non-voting members on the Board are the Chairman, the Executive Director, a representative of the Caribbean Community Secretariat and a representative of the Caribbean Development Bank.

The Executive Director is responsible for the day-to-day control and management of the Institute. He has delegated authority to the Chiefs of Programmes and Research, and Heads of Planning, and Administration Units and the Financial Comptroller for the management and administration within their respective spheres of operations.

1.4 Human, Physical and Financial Resources

The Institute currently has 75 professional staff and approximately 90 supporting, technical and clerical staff distributed in the 12 countries. This functional presence in all countries establishes the basic framework in which the Institute's programmes can be initiated and implemented.

The main areas of expertise include agricultural economics and farm management, agronomy, analytical chemistry, animal nutrition, animal production, biometrics, cultural anthropology, entomology, forage production, nematology, plant pathology, soil chemistry and fertility and virology.

Facilities at Headquarters include several well equipped laboratories capable of carrying out a wide range of chemical and physical analyses on an assortment of agricultural materials.

Funding for the Institute's core budget comes from Member States on an agreed formula, while project funds come from many donor agencies.

2. DEVELOPMENT OF WORK PROGRAMME

2.1 General Approach

The Institute has sought to ensure that proper dialogue and consultation take place at all levels at which government representatives meet with CARDI to review and decide on research and development priorities. There is therefore adequate machinery for representation and participation of member governments in the decision making process relative to the Institute's programmes.

2.2 Work Programme Development

The Work Programme is dynamic and is developed in consultation with the ministries of agriculture and commodity organisations of the member countries as well as with regional institutions. It is particularly concerned with advancing regional integration of agricultural research and development while meeting the individual needs of the member countries.

It is reviewed and revised on a continuing basis as needs and priorities change, as projects are completed and as additional funds become available. The process usually involves discussions between CARDI Field Units and senior officers of the ministries of agriculture on projects designed to meet expressed needs. Priorities are established and projects move forward into a draft of the Work Programme which is reviewed by a meeting of Senior CARDI Staff and the Chief

Agricultural Officers of the LDC's. At this meeting efforts are made at rationalising the programme to meet regional requirements. This leads to maximising of financial and human resources and the development of regional programmes where several countries have similar problems.

Finally, the modified draft is discussed by the CARDI Board of Directors. This forum which includes the chief technical officers in the ministries of agriculture, and other regional agencies allow for a critical examination of the programme and ensures that it is designed to meet national and regional needs.

3. THE ROLE OF CARDI

3.1 Background

In keeping with the general policy of Caricom Governments aimed at increasing regional domestic food production, it is critical that the necessary research inputs and other supporting services are available at the appropriate level and time if success is to be assured.

The Region has a serious shortage of agricultural scientists and technicians and it would be difficult for each government to employ all the essential specialists and other staff necessary to manage such services. Even if they were available the cost of the full complement of research and development scientists in each would be prohibitive.

It is obvious that there is a role for a regional organisation which can play a vital part in the development of national as well as regional agriculture.

3.2 Role in the MDC's

In Barbados, Guyana, Jamaica and Trinidad and Tobago, the national agricultural research systems are more developed and provide services to national projects. The various ministries are staffed with varying degrees of expertise.

Therefore, the Institute's role is aimed at complementing and supplementing the programmes of these states. This is done through joint or collaborative programmes in which both technical staff and resources from CARDI and the ministries are brought together for project execution.

In such cases the research work is organised on a multi-disciplinary basis and directed at positive and terminal goals and include development studies, which result in practical and economic packages which can readily be taken by the extension services for dissemination to farm producers and ultimate users.

3.3 Role in the LDC's

The role of CARDI in the LDC's is similar to that in the MDC's. However, these countries are not endowed with the same levels of staffing and expertise available to the MDC's. The Institute therefore assumes a lead rather than a supporting role in the identification of useful and meaningful areas for development.

3.4 Working Agreements

From the above it can be seen that the Institute works quite closely on a collaborative basis with ministries of agriculture and or other national agencies, such as commodity associations or statutory boards. The support of the ministries, other organisations or private farmers usually consists of providing land, equipment and other facilities as appropriate.

It has been observed that even in the case of the RRC, the conduct of research with ministry of agriculture personnel, as described above, has usually had very successful results emanating from these combined efforts. However, such arrangements were normally undertaken on a personal basis and on the initiative of the individuals concerned.

By and large, CARDI's cooperative work with national governments and agencies takes place in the absence of formalised agreements. However, as part of its work on farming systems research, Memoranda of Agreement between CARDI and the host country have been entered into. Under these 'Host-Country Agreements', the organisation of the project, its goal, purpose and strategy, inputs required by the government and CARDI and the project outputs, are detailed.

It is envisaged that this type of formal agreement could be used to advantage in other projects.

3.5 Linkages with other Regional Agencies

CARDI works in close cooperation with regional agencies and organisations engaged in agriculture and development in the Region. Consequently, the Institute has entered into cooperative agreements with the University of the West Indies, the Windward Islands Banana Growers' Association (WINBAN), the Centre for Research and Training in Tropical Agriculture (CATIE), the Inter-American Institute for Cooperation on Agriculture (IICA) and the Asian Vegetable Research and Development Institute (AVRDC).

Under the terms of these agreements provisions are made for the furtherance among other things of:

1. the development of cooperation and collaborative activities of mutually reinforcing interests of the two Institutions

2. the enlargement and strengthening of the capabilities and capacities of each institution through the cooperative use of materials and facilities which are supportive to mutually agreed programmes.

Within the region, the Institute recognises the presence of another resource group in the Faculty of Agriculture, UWI, and endeavours to involve this resource in the implementation of its programmes. Further, the Institute in keeping with its objectives, has made available members of its Senior Staff for the supervision of post-graduate research students working in areas allied to the Institute's Work Programme.

With the signing in September, 1976 of the Agreement Establishing the Caribbean Food Corporation (CFC) the institutional framework and operational system were put in place for the promotion of the Regional Food Plan and complementary activities relative to the overall objective of increasing food production.

Although working relationships are still to be established, CARDI sees itself as the main research consultant of the CFC. This does not mean however, that the CFC would be without freedom to draw on other appropriate agencies when such is desirable. Within the framework of this relationship, CARDI would be able to respond in terms of finding solutions to problems identified by CFC as constraints to project implementation.

3.6 Coordination of Regional Research

At the recent meeting of agricultural planners held in Guyana on 29th January, 1981, a paper was presented on 'The Relationship between Regional and National Organisations.'

The point was made that there was a need to obtain some measure of coordination between the large number of regional, bilateral and multi-lateral organisations operating in the Region.

The areas requiring Institutional Coordination were:

1. Regional Agricultural Projects
2. Pilot Project Activities
3. Regional Agricultural Services
   - Trade Information
   - Management Data Bank and Delivery
   - Technology Storage and Delivery
   - Research

- Extension
- Training

4. Agricultural Planning and Programming
5. Regional Legislation

The Institute saw itself as having along with other agencies prime or complementary responsibility in a number of activities. In so far as Pilot Projects are concerned, there would be involvement at the project identification and selection stages, as well as in project preparation, implementation, monitoring and evaluation. The implementation of pilot projects is seen as the main responsibility of CFC with CARDI and UWI being contracted to implement or provide assistance in implementation.

Within the activities of regional agricultural services, the main role of the Institute would be in technology delivery and developmental research. The Institute would also be involved in agricultural planning and programming at the regional level by participation in resource surveys, sector and subsector studies, and the development of projects within the Regional Food and Nutrition Strategy.

Also, emanating from a FAO Study conducted in 1980 on improving agricultural research in the Caribbean was the recommendation that a Caribbean Agricultural Research Coordinating Committee (CARCC) be established. It was the consensus of the Agricultural Planners meeting that there was no need to set up a new organisation and that the functions of CARCC should be placed in CARDI.

CARDI sees no difficulty in carrying out the functions that were envisaged for the Coordinating Committee, provided that the financing arrangements could be put in place.

CFC's ROLE IN THE ORGANISATION AND ADMINISTRATION OF AGRICULTURAL RESEARCH

H. A. D. Chesney

CFC

The Caribbean Food Corporation was recently established specifically to promote and implement the development of the Regional Food Plan. Because of this implementation and production orientation a superficial mind may want to question any significant role for CFC, in the planning, design, organisation, and administration of research in the Region taking into account the presence of so many specialised research institutions in the Region. The Corporation is, however, of the strong opinion that it has a major role to play in at least the design, planning and organisation of regional research (at least some components of it) and is pleased to have this opportunity to share these views with this celebrated group of researchers.

Traditionally, research in the Region has been executed by either commodity associations, e.g. sugar, rice, bananas; specialist regional organisations, e.g. CARDI, U.W.I., governmental agencies, e.g. ministries of agriculture; and, more recently, research institutes and international institutions, e.g. IICA, CIAT and USAID sponsored universities singularly or in consortia. The preamble to most of these activities generally suggests that they are aimed towards the improvement of agricultural production in the Region. An examination of available data 1/ shows that agricultural production has not increased. For example, during the period 1976 – 1978, the following are instructive:

1. the total value of exports from the Region decreased from EC$ 1,105.6 to $ 1,023.7 million despite increases in prices;

2. the value of imports increased from EC$ 1,317.3 to $ 1,543.3 million; in per capita terms this represented an increase from EC$ 298.4 to $ 347.8; and

3. the food trade balance showed a widening deficit from EC$ 211.7 to $ 519.6 million.

What is evident from the data is that research activity *per se* did and will not ensure agricultural development. The applicability and efficient application of the results, within an acceptable production environment, is of utmost importance. It is here that CFC feels that it has a major role to play.

Taking a closer look at the state of the Region's agriculture, it is seen that the negative trend was more pronounced with respect to the value of food imported as compared to exports. This may be due, *inter alia*, to either the research done by the commodity associations being of direct applicability to the industry since the industry pays for the research; or, conversely, there is the infrastructure within which the results could be used in the short and/or medium term. It may be suggested that in the food industry in the Region, which to a large extent is carried out by the peasant farmer, the latter situation is not readily found. In other words, the food production sector has not been "geared up" or "tooled up" to accept, much less adopt, research findings. This must not be taken to be an overly harsh criticism, for even in moderately developed and traditionally scientifically oriented Britain, it is estimated that only approximately eleven (11) percent of research and development findings is translated into productive use. 2/

However, it makes it necessary for questions to be asked. Firstly, can the Region afford this "wasted" research, i.e. wasted in the sense that it is of very limited immediate use? The answer is obviously no.

Secondly, should not the means of making the research beneficial be given highest priority in terms of human, financial and other resource allocation and utilisation?

The answer should be an unqualified yes, perhaps even at the expense of ongoing research.

Thirdly, what are the means required? To answer this question it would be necessary to subdivide the food production sub-sector into the existent "peasant oriented" system and, (if production rates are to be accelerated), the needed bv not commonly found, large scale commercial system. In the former system the more important of the means may be identified as institutional, e.g. land reform, production incentives, ready availability of inputs and markets; financial, e.g. provision of credit at acceptable conditions; educational, e.g. better extension services.

In the second system more important is the establishment/ strengthening of organisations to implement the production programmes. Secondly, the packaging of the individually recommended production coefficients into scientifically sound but manageable and economic systems. In other words, I am suggesting that data for large scale agricultural production are not nearly adequate, to ensure the accelerated rate of production that is necessary to significantly help reduce the Region's dependence on imported food.

The establishment of CFC is a manifestation of the need for a regional commercial organisation that has the power to spawn subsidiary entities. It therefore has a role, like the commodity associations, in the planning of research, to ensure that results are translatable in the short and medium term into increased economic production. The Corporation is convinced that if research results are transferable through project activities into improved economic conditions then the prospects of obtaining additional research funding (specially from extra-regional sources) are vastly improved. CFC pledges its support – directly and indirectly – for the provision of funding for such project oriented research.

In this respect, it has already funded some research activities primarily through the UNDP/OPEC/CFC supported project. For example, the production of corn and soya in the Intermediate Savanahs of Guyana by CARDI: the assessment of warehousing facilities in Trinidad and Tobago by Faculty of Agriculture, UWI, and the assessment of regional shipping facilities for the movement of regionally produced food commodities, by private regional consultants. The implication here, which needs to be brought out, is that CFC will contract out its research activities to competent national, e.g. CARIRI, regional, e.g. CARDI and UWI, and international organisations.

In another sense, CFC hopes to be a source of ideas and research needs.

In a related sense, CFC sees itself as an implementer of research findings, directly, or with appropriate modifications within its projects. For example, it nas pioneered the idea of the use of tissue culture practices for the propagation of fruit and floral crops in the Region. To this end, it is proposed to establish, within the next two years, a Technology Adaptation Unit. Assistance has been promised in principle from the grouping of large European and North American commercial private sector companies for this undertaking.

It is to be gathered from the above that CFC has no intention to execute research. It however wishes to be associated with and to influence it. The Corporation would therefore urge that research for

large scale commercial production activities has the following characteristics:

i. project oriented, i.e. with specific objective (s) and time frame and terminates when its specific objective (s) has (have) been achieved;

ii. the general objective should be the substantially increased availability of basic nutritional food items, e.g. cereals, vegetable protein, milk and milk products, vegetables, fruits, and fish. With these major groupings there is also need to specialise in the commodities for which there is adequate base information to suggest a good chance of some early results. Going hand in hand with this it must be accepted that the Region must give more (if not exclusive) priority to the cultivation of commodities that are best suited to our ecological conditions. That is, our demand must be for what we can produce.

It is to be noted that the investment programme of the corporation reflects these principles;

iii. economic production system(s) oriented;

iv. of short and medium term benefit to the regional economy. It should however not result in foreseeable long-term damage to the environment. This suggests that the approach must be short or medium term, with foreseeable long term activities only being considered when absolutely necessary to clarify problems arising out of the short and medium term aligned activities.

The research emphasis suggested is therefore one of production rather than social, ecological and natural resource.

In this short paper, I hope that I have been able to share with you CFC's thoughts on its role in the organisation and administration of agricultural research. In summary, this role is in the identification of research ideas; the planning and design of the ensuing research; the utilisation of the data coming from these results, in production activities, especially where these are technology innovative; and assisting in the mobilisation of funding for project oriented research activities. CFC sees no role for itself in the direct execution or implementation of research activities.

I have not dealt with CFC's production projects, but I would be happy to answer any question on this topic.

Mr. Chairman, it was a pleasure to have had this opportunity to have made this presentation on behalf of CFC.

1/ Agriculture and Food in the Caribbean Region – CARICOM Secretariat Paper, January 1981.

2/ Statement by Sir Allen Cottnell, former Chief Scientific Adviser to the British Government; the Economist 17 Jan., 1981.

PROPOSALS FOR TECHNICAL AND FINANCIAL SUPPORT TO AGRICULTURAL RESEARCH IN THE CARIBBEAN

L. E. McLaren
IICA

During the last decade there have been several meetings and workshops which have focused on the problems of agricultural research in Latin America and the Caribbean –its organisation and execution, and its application (1,2,3). Here in the Caribbean, in the latter portion of this same period a number of missions have reviewed agricultural research and research systems at both the national and regional levels (4). The FAO/UNDP Preparatory Assistance Project Mission (5) of 1979 has been the most recent of these.

The present paper seeks to outline the purpose of that project and the proposals which have derived from it. The main objective of the presentation is to secure an objective feedback from the representatives of the institutions which are potential beneficiaries of this assistance. This should be invaluable in ensuring that the project assistance focuses on priority needs and attempts to respond to these.

The project is seeking to achieve "better coordination of agricultural research activities in the Caribbean Zone" in the long term. As such it tends to focus on action at the regional level. However, experience indicates that a group of weak programs coordinated at the regional level are not mutually strengthening. To achieve some synergistic effect "good scientific strength in at least some of the component programs is essential." So, in as much as the project will aim at the improvement of coordination, it should also provide for strengthening national systems. In these circumstances a brief review of national systems is being included in this paper, as these represent components of the regional composite, coordination which is being attempted.

In Trinidad and Tobago when the organisation of science and technology and their application to development of this country was critically examined some few years ago, recommendations were presented for reorganisation of the research and development system. These appear in the White Paper on National Institute of Higher Education, Research, Science and Technology (NIHERST) (1977) in which the establishment of a National Institute of that name was proposed. In respect of research and development for the agricultural sector, these would be the responsibility of two Sections/Bureaux within the Division of Research and Development, and Extension Services and Continuing Education. The proposed sections were the Centre for Agricultural Research and the Extension Services for Industrial and Agricultural Development, respectively.

Since then some progress has been made towards the establishment of the Institute. The specific time frame for the organisation and its components to become operational is not yet available. It is, however, assumed for purposes of the present discussion, that a functional Centre for Agricultural Research will service the needs of the agricultural sector in the not distant future.

In respect of Jamaica, the agricultural research system is in process of reorganisation and restructuring, with financial and technical assistance being supplied with resources provided by the Interamerican Development Bank. Total project investment is US$ 9.4 million (Loan Component $ 6.0 million) over a four-year period.

These activities represent part of a series of processes designed to achieve rational organisation of Jamaica's agricultural research system and establishment of reasonable capacity and capability.

The programs for agricultural research in Barbados in both crops and livestock are now undertaken by the Ministry of Agriculture. However, agronomic research for the Sugar Industry is done by the Barbados Sugar Producer's Association. And at the present time, although integration of Research Services has been discussed no plans towards this end have been accepted for execution.

In the case of Guyana, agricultural research is the responsibility of a number of public sector agencies. The Ministry of Agriculture pursues investigations in crop and soil sciences, the Guyana Rice Board in rice production, the Guyana Sugar Corporation in sugar production and the Livestock Development Company in livestock husbandry, especially forage production and management. Although the Ministry has overall responsibility for the formulation of policy, execution of research remains uncoordinated. The National Science Research Council has on occasion been mooted as an appropriate body to assume overall responsibility for agricultural research. More recently, at the request of the Government, USAID has under-

taken a comprehensive review of Agricultural Research, Extension, and Education in the country, with a view to formulating proposals for reorganisation and improvement.

In Haiti the overall responsibility for agricultural research rests with the Ministry of Agriculture, Natural Resources and Rural Development. But, some research activities are carried out in the Faculty of Agronomy and Veterinary Medicine (FAMV), and the Organisation for the Development of the North (ODN).

There has been little organised agricultural research in recent times. Government has therefore sought external assistance and has concluded a technical assistance project agreement with USAID for assistance in crop research. Total value is US$ 6.4 million with the USAID component being US$ 4.047 million, extending over four years.

Progress on the execution of this project has been negligible. In an effort to secure some action in this important area, IICA has recently been requested to assist in the preparation of a national plan for agricultural research, based upon the plan for agricultural development over the coming five years, which is in process of elaboration.

The current situation in the neighbouring Dominican Republic is substantially better. Following on the creation of a Division of Agricultural Research in 1964, a Subsecretariat for Agricultural Research and Extension was established a year later. Despite this and the later creation of a National Centre for Agricultural Research it was not until 1971 that this Centre began to acquire the character of an agency with national responsibility for agricultural research. But, progress towards the reorganisation of a truly national system has been considerable in the last three years. This has resulted in the delegation of full responsibility for all Government financed agricultural research to the Director-of the Department of Agricultural Research, and the development of a national plan for this research. The total cost of the programs over the 1980–1982 period has been estimated at RD$ 14 million (US$ 14 million).

As the situation in countries of the ECCM is reviewed, it becomes apparent that the relatively small ministries of agriculture do not have established units with responsibility for agricultural research. However, in nearly all of these , there is a handful of professionals undertaking a modicum of investigation, and in the Windward Islands, as is well known, WINBAN's Agricultural Research and Development Division provides a research service to the banana industry of this area.

In this brief review, which in essence provides a background against which the UNDP/FAO preparatory assistance project must be seen and its conclusions and proposals examined, what is the general picture which has emerged? Essentially, it is that, overall, agricultural research and research systems in the area have come under scrutiny and are undergoing reorganisation.

In the two countries of Hispaniola, restructuring of research institutions is in train or is contemplated; while in the MDC States of the CARICOM region a process of reorganisation and strengthening of agricultural research is in its early stages.

As a regional institution CARDI is providing the LDC's with some research capability in specific areas. Additionally, in the MDCs the Institute is complementing national programs in a few selected areas. The Faculty of Agriculture at the U.W.I. with its not inconsiderable capacity and potential in this field is greatly restricted by the very limited resources available to it, but seeks to undertake research in support of its teaching programs, and is a actively attempting to expand its "contract" research activities.

It is on this background that the major initiative to provide technical and financial aid to agricultural research in the Caribbean has been organised — the FAO/UNDP preparatory assistance project for "Improving Agricultural Research in the Caribbean."

"Immediate objectives of the project were

i. To draw conclusions on the quality and relevance of research programmes of the zone.

ii. To make recommendations on ways and means of expanding research, improving its effective use, and

iii To indicate how various recommendations could be implemented and the various institutional linkages which would need to be developed for effective implementation."

Arising from the activities of the mission which undertook execution of the project have come a number of recommendations and proposals. However, additional work has now to be undertaken, after study and acceptance and/or modification of these, in the preparation of projects for technical and financial aid requests.

The project noted the ongoing action to reorganise and improve the national agricultural research systems in the larger islands of the zone, and has recommended that the possibility of establishing a National Agricultural Research Institute in Barbados be explored; an Institute with an autonomous organisation, separate career structure, with financing from Government and other sources.

CARDI has been seen as having a two fold rule. Firstly,in continuation of its research and development activities in the region, it should develop specialist capability in farm systems development and management, and strategic planning of resource use. Secondly, the Institute would provide research capability to the LDCs.

The Faculty of Agriculture of the UWI "should continue to be recognised as having a strong complementary role in regional research and be funded to continue in this role."

As regards CARDATS, coordination of the planning and implementation of its work with that of CARDI should be improved.

Establishment of the proposed regional Agricultural Information and Documentation Service should be accelerated.

But the most far-reaching proposal which has been made, however, is for the establishment of a "Caribbean Agricultural Research Coordinating Committee" (CARCC) – Its proposed functions are–

a) To assist in the formulation of programmes of national agricultural research;

b) To establish priorities for cooperative programmes of agricultural research;

c) To develop cooperative programmes of agricultural research;

d) To stimulate and facilitate links with the international research centres; and

e) Help mobilise resources for the implementation of these national and cooperative programmes on a coordinated basis."

Membership of CARCC would be
– National Directors of Agricultural Research
– Representatives of CARDI, CARIBSEC, IICA and UWI

With observers from
CATIE, CIAT, CIMMYT, CIP, FAO, IBRD
(The International Agricultural Research Insitute, in the region and potential international donors)

The Committee would be serviced by a Secretariat staffed with an Executive Secretary of high calibre and considerable experience in research, with appropriate support staff. Technical support to the Secretariat would come from CARDI, UWI, and IICA.

It has been estimated that funding for establishment and operation of the Secretariat and the Committee would be about US$ 130,000/year for two years, in the first instance.

The establishment and effective functioning of CARCC is seen as the key mechanism in

a. Securing the much needed systematic and coordinated assessment of the overall financing needs of national and regional agricultural research.

b. Seeking the necessary funding.

c. Attempting to secure greater support in research and training from International Research Centres serving the Region (CIAT, CIMMYT, and CATIE)

d. Facilitating and expanding cooperative research between national agricultural research institutions.

Indeed the proposal has now to receive the most careful consideration from the senior research administrators in the Region who must ultimately advise the policy makers in their own countries. In deliberating upon this it is important to recognise that while emphasizing cooperative research activity, the committee is likely to facilitate strengthening of the national institutions. This process, the importance of which I have emphasized, can receive direct assistance from the ISNAR —International Service for National Agricultural Research, which was established in 1980. Its services are provided to any developing country, but these are given only on request.

Should these proposals for establisment of CARCC find favour, IICA has indicated willingness to work in collaboration with the UNDP and CARIBSEC for preparation and presentation of an appropriate proposal to a funding agency. Thereafter IICA assistance to the Committee, once established, would continue alongside cooperation with national agricultural research institutions and through IICA's regional research specialist and other research specialists working in selected member countries such as the Dominican Republic, Guyana and Jamaica.

Even before CARCC becomes fully operational, there will be urgent need to prepare detailed proposals for financing collaborative/cooperative research projects already identified for priority attention. These include sugar cane and coconut research, banana and plantain breeding, the organisation of regular courses for training experiment station managers and the establishment of arrangements for periodic reviews of agricultural research manpower needs.

In summary, the support which national and regional agricultural institutions in the Caribbean could therefore expect to mobilise in the medium term could include:

a) Technical and financial aid for national and cooperative research projects (resulting from the work of CARCC)

b) Assistance provided to national systems by ISNAR, on request.

c) Assistance to national systems from bilateral sources.

d) Technical cooperation inputs from international agencies specifically UNDP, FAO and IICA.

e) Aid from non-profit organisations.

REFERENCES

1. FAO The Contribution of Technology to Agricultural Development in Latin America LARC/70/5.Eleventh FAO Regional Conference for Latin America, 1970.

2. UNDP Proceedings UNDP Workshop on The Application of Agricultural Research in Latin America, 1974.

3. FAO Report on FAO Expert Consultation on Agricultural Research in Latin America, 1976.

4. CARICOM Campbell Report on Agricultural Research in the Caribbean Community Region, 1973.

5. UNDP—FAO Project Findings and Recommendations UNDP/FAO Preparatory Assistance Mission for "Improving Agricultural Research in the Caribbean". Terminal Report. AG: DP/RLA/79/011, 1980.

WORKING GROUP REPORTS

GROUP I – AGRIRESEARCH ORGANISATION AND ADMINISTRATION IN THE CARIBBEAN

The working group recommends that in the Public Service Systems of Agriresearch the following areas of priority require urgent attention:

1. Planning and Programming System

2. Personnel Management

3. Reporting, validation and application of research results

4. Supporting Services

5. Evaluation.

1. Planning and Programming

The agricultural research systems operating in the Caribbean include national and external organisations.

The national organisations, focus their activities on agricultural products and production systems.

The external organisations include institutions that are region specific to the Caribbean as well as other international institutions.

It is necessary to build a national planning system for the generation and transfer of technology, as well as the regional system in order to fit better the available resources. The regional system should support the national systems, complementing their efforts as required.

It is only by planning that areas of needs can be identified, priorities established, and short to long term strategies employed towards a balanced development for the individual countries and the region as a whole.

As understood in this context, programming includes the formulation, execution, control and evaluation of planning tools such as plans, programmes, projects and activities.

The programming system will identify problems and provide alternative solutions at both national and regional levels, making best use of available resources such as personnel, financial support, physical facilities and avoiding planning beyond the capability for success.

It is important that flexibility be maintained in planning and programming, allowing adjustment to the existing structural organisation and administrative procedures within the countries.

2. Personnel Management

Personnel Management has to be developed and improved to retain talent and make best use of the available personnel. To achieve this objective the following considerations must be taken into account:

2.1 To Develop the Research Coverage by Specific Training

2.1.1. Formal in-service training

2.1.2. Exposure to international fora such as seminars, meetings, workshop, and others

2.1.3. Development of skills for the management of research as well as the decision making process

2.1.4. Organisation of work on the basis of multidisciplinary groups to develop skills and leadership.

2.2 Provision of Incentives for Researchers

2.2.1. Development of a career path within the national and/or regional institutions

2.2.2. Development of a flexible system to allow for accelerated promotion and appropriate levels of remuneration

2.2.3. Establishment of mechanisms for public recognition of outstanding service either on an individual or group basis.

2.3 Improvement of Human Relationships

2.3.1. Internal Communication

2.3.2. Relationships between researchers, from national, regional and international organisations.

2.3.3. Relationships between researchers and administrators.

3. Reporting, Validation and Application of Research Results

3.1 Consider agronomic, economic and social implications

3.2 Focus on uses of research findings by farmers, extension agents, administrators and national planners

3.3 Strengthen research, development and extension linkages.

4. Supporting Services

4.1 Need for decentralisation to ensure timely field operations

4.2 Proper management of support services vital to successful execution of research programmes and application of results.

5. Evaluation

5.1 Continuous evaluation for the betterment of performance of project and personnel development

5.2 Multi-disciplinary groups doing research, providing a system that is self-evaluating

5.3 Performance evaluation of research staff to replace the more antiquated systems that obtain in most Caribbean Countries.

GROUP II – REGIONAL AGRIRESEARCH COOPERATION IN THE CARIBBEAN

1. Agricultural Communication

It is recognised that lack of professional interaction and communication or exchange of information is a serious constraint within the Caribbean. It is also recognised that as a result there is a lack of understanding and awareness of what material or technical resources are existing and available within the region.

It is therefore being proposed that a mechanism be devised to allow formal and informal interaction among professionals within the region.

There exists at this point in time, several "specialised groups" as it were, attempting to enhance the level of agricultural communication.

1.1 There is Caribbean Food Crops Society (CFCS) that promotes an annual interchange between farmers and professionals at an intermediate level. This group provides an appropriate forum for the ultimate target group or users of research information. However, it requires additional financial support to up-grade its effectiveness, organise the meetings, provide some travel support and publish the proceedings of the meetings.

1.2 There is also the Caribbean Livestock Association (CALA) that functions at a more professional (or technical) level under the aegis of Caricom. It is being proposed that a recommendation be made to include or invite non-Caricom countries to participate in the Technical Sessions.

1.3 Presently the University of the West Indies (UWI) Livestock Department is mandated with the Secretariat responsibilities and formal meetings are biennal. It is felt that a recommenda-

tion should be made to hold such meetings on an annual basis and that additional funds be identified to assist the Secretariat.

1.4 Other specialised groups that exist include those that are in other specialised areas such as Integrated Pest Management, Agricultural Economics, Sugar Technology, and others.

1.5 The group felt that an Annual Symposium at a scientific level embracing the wider Caribbean and broader aspects of agricultural research be convened. However, it was decided that it would be best to maintain the *status quo* of CFCS because of its direct linkage with at least part of the research target group, and as such some consideration should then be given to holding of annual alternating meetings between CFCS and the proposed Caribbean Agronomy Society.

1.6 It is further recommended that most of the groups in existence can be invited to hold their meetings within the scope of the proposed Society. However, being fully cognizant of the general social aspects prevailing within the Caribbean, some lobbying should be undertaken in order to encourage an active cooperation with this new society. Some consideration must be given to the specialised areas, as to whether sessions will be held parallely or sequentially.

1.7 It is further recommended that funds be sought to fully sponsor the annual symposium in its early stage,to allow proper development and inspire governmental confidence as to the impact directly or indirectly that such a meeting will have on national agricultural development.

1.8 The need to have an effective professional journal was emphasised. The group felt it best that the existing journal, "Tropical Agriculture", be expanded through broadening its base to include both technical and general papers well as notes or briefs. However, it is expected that the publication of the proceedings of the "Caribbean Agronomy Society (CAS)" will remain the mandate of the Society.

2. Regional Information & Documentation Center

It is recognised that there is a need for an efficient communication network and that ECLA should be urged to use their best efforts to ensure the implementation of an appropriate regional information and documentation system.

3. Extension

There is a need for researchers to indicate to the public or consumer sector the benefits derived from research, and recommend where efforts are being made in member countries and made available to other countries.

4. Germplasm Banks

Preservation and exchange or dissemination of material should be encouraged.

5. Collaborating in Research

The CAS annual symposium should be so structured that it will encourage development and cooperation in research among countries.

CLOSING CEREMONY

CLOSING REMARKS

J.P.W. Jeffers
MAFCA

Mr. Chairman, Distinguished Guests, Participants:

It is indeed a pleasure for me to address you again at this Closing Ceremony of the Caribbean Workshop on the Organisation and Administration of Agricultural Research.

Discussions have been intense and the results encouraging. The views expressed and exchanged on research management and evaluation as well as the constructive criticisms voiced have been enlightening and helpful.

I sincerely hope that this meeting will result in cooperation among us and will provide the direction for technical exchange in the field of research management and evaluation.

Funds for Research and Development are a very scarce commodity and researchers at management level must, among other things, be cost conscious of this.

I believe this Workshop has brought more sharply into focus issues pertaining to the subject in question, and I hope that you have benefitted as I have from this Workshop. I for one, am now even more aware of many of the issues, and as a result feel better able to face them more confidently in the future.

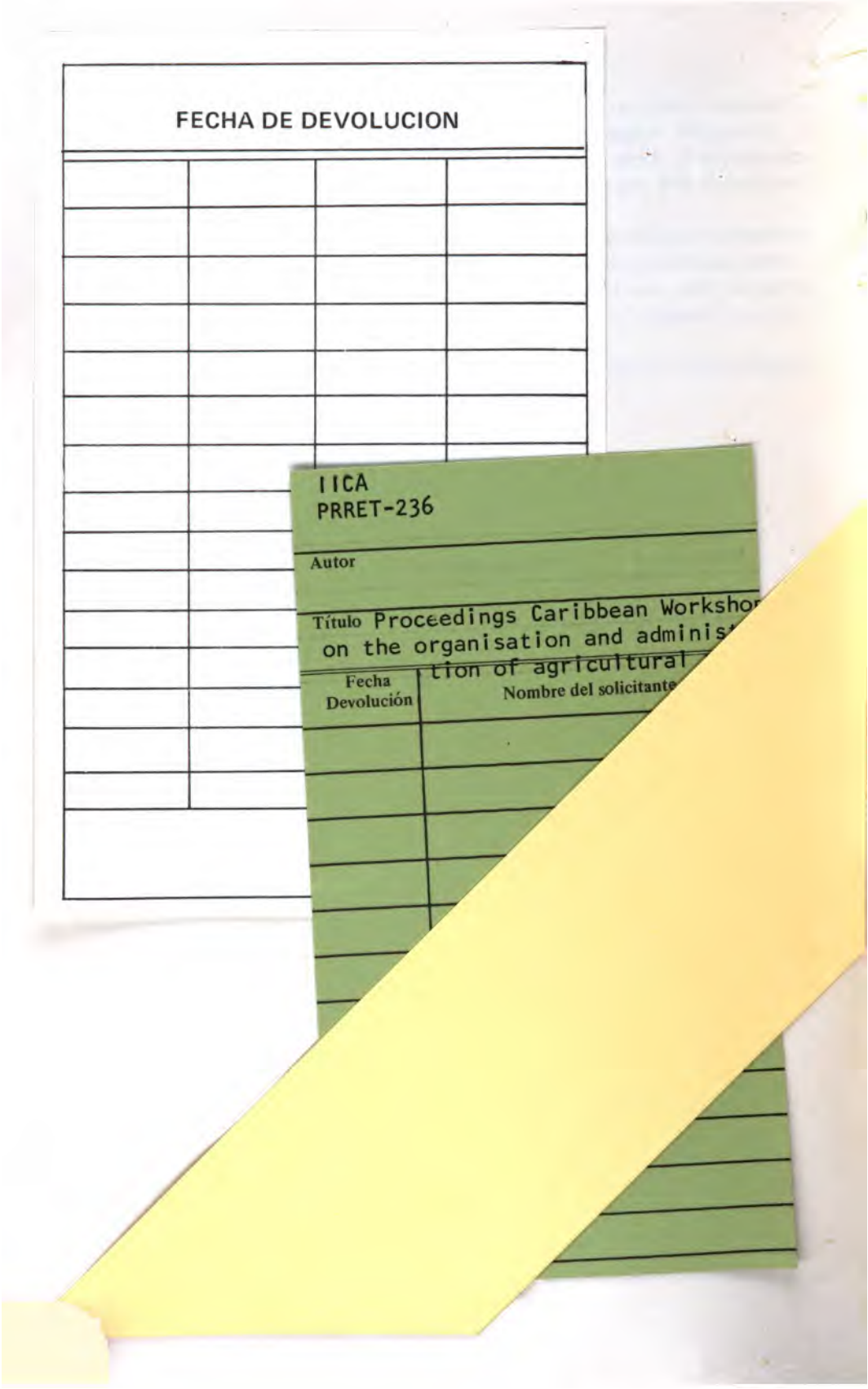
IICA's part in this Workshop has been invaluable. They have successfully brought together for this Workshop French, Spanish, Dutch and English speaking people and have nonetheless had a most free, frank and comradely meeting. We owe them a great debt for organising and to a large extent funding this Workshop.

I would also like at this time to express my appreciation to the Organising Committee. Between the 18th of December and last

Monday they were able to find the time to carry out their substantive duties and yet arrange what has been a successful Workshop. I would also like to express our appreciation of the work of secretaries and all those other persons whose efforts have made this Workshop possible.

Last, but not least, I wish to thank each participant, resource person and chairman who has come to this meeting and has contributed so substantially to its success. To those of you who have to leave, I bid you farewell and wish you a safe and pleasant journey home.

I now declare this Workshop on the Organisation and Administration of Agricultural Research, closed.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