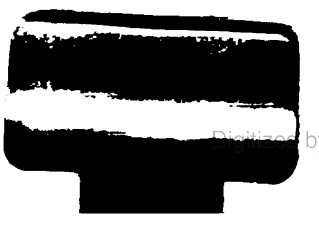
IICA

AGRICULTURAL TECHNOLOGY TRANSFER

BETWEEN

LATIN AMERICA AND THE CARIBBEAN

IICA Office in Saint Lucia



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IICA

AGRICULTURAL TECHNOLOGY TRANSFER BETWEEN LATIN AMERICA AND THE CARIBBEAN

Proceedings of a Meeting

May 18-20, 1993
Castries, Saint Lucia

Antonio M. Pinchinat
Enrique Alarcon
Reynaldo Perez

IICA Office in Saint Lucia

**The Meeting was hosted by the
Ministry of Agriculture, Lands, Fisheries and Forestry
of Saint Lucia**

REPORTS, RESULTS AND RECOMMENDATIONS FROM TECHNICAL EVENTS SERIES

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CONTENTS

Contents (cont.)

PREFACE

The need for closer linkages between Latin America and the Caribbean to speed up agricultural development has been addressed in many forums, several declarations and a few bilateral agreements. Yet the practical results of those means have been scarce, considering available opportunities to modernize agriculture in both regions, through horizontal reciprocal cooperation.

Consequently, at its Sixth regular meeting in Madrid, Spain in October 1991, the Inter-American Board of Agriculture (IABA) commissioned the Inter-American Institute for Cooperation on Agriculture (IICA), to address that shortcoming. IICA undertook the task through the Multinational Project **Facilitating Latin American/Caribbean Linkages and Transfer of Technology for Agricultural Development** (LACTTA), launched in May 1991, under the **Plan of Joint Action for Agricultural Reactivation in Latin America and the Caribbean** (PLANLAC)

To build consensus on cooperation needs, LACTTA convened a Workshop in December 1991, involving key regional and international institutions operating in the Caribbean. Workshop participants agreed on an agenda comprising eleven sets of specific areas for concentrated cooperation with Latin America.

The follow-up Meeting on **Agricultural Technology Transfer between Latin America and the Caribbean** aimed at laying the institutional basis to initiate formally a process for strengthening horizontal reciprocal cooperation between Latin America and the Caribbean in agriculture. Its results fulfilled that purpose. In particular, through the meeting:

- opportunities for inter-regional cooperation were jointly identified
- an immediate inter-regional cooperation agenda was devised, and
- a Technical Committee for Agricultural Technology Transfer between Latin America and the Caribbean (TECLAC) became operational.

These Proceedings, therefore, provide a valuable framework for undertaking reciprocal horizontal cooperation between the two regions and an inter-institutional mechanism to guide follow-up by LACTTA. This outcome conforms to PLANLAC's objective of fostering joint actions among Latin American and Caribbean countries to solve concrete problems facing agricultural development in both regions.

Eduardo J. Trigo
Director, Technology
Generation and Transfer Program
IICA

ABBREVIATIONS AND ACRONYMS

AJAX	:	AJAX Manufacturing and Fabricating Ltd.
CARDI	:	Caribbean Agricultural Research and Development Institute
CARICOM	:	Caribbean Community
CARIRI	:	Caribbean Industrial Research Institute
CATIE	:	Tropical Agricultural Research and Training Centre
CCST	:	Caribbean Council for Science and Technology
CDCC	:	Caribbean Development Cooperation Committee
CIAT	:	International Centre for Tropical Agriculture
CIP	:	International Potato Centre
CIRAD	:	Centre for International Cooperation in Agronomic Research for Development (French)
ECLAC	:	United Nations Economic Commission for Latin America and the Caribbean
ECS	:	Eastern Caribbean States
EMBRAPA	:	Brazilian Agricultural Research Corporation
FAO	:	United Nations Food and Agriculture Organization
FHIA	:	Honduran Agricultural Research Foundation
FONAIAP	:	National Agricultural Research Fund
IBPGR	:	International Board for Plant Genetic Resources
ICA	:	Colombian Agricultural Institute
ICTA	:	Agricultural Science and Technology Institute
IICA	:	Inter-American Institute for Cooperation on Agriculture
INIFAP	:	National Institute for Agricultural and Forestry Research (Mexico)
INIBAP	:	International Network for Improvement of Banana and Plantain
INRA	:	National Institute for Agronomic Research (French)
INRM	:	Integrated National Research Management
INTA	:	National Institute of Agricultural Technology (Argentina)
IRRI	:	International Rice Research Institute
LAC	:	Latin America and Caribbean
NARI	:	National Agricultural Research Institute
OAS	:	Organization of American States
PROCI	:	International Horizontal Reciprocal Cooperation Programme and Network
R/D	:	Research and Development
RISPAL	:	Latin American Research Network for Animal Product Systems
TECLAC	:	Technical Committee for Agricultural Technology Transfer Between Latin America and the Caribbean
TREDU	:	Training Research and Extension Development Unit
UK	:	United Kingdom
USAID	:	United States Agency for International Development
UWI	:	University of the West Indies
WINBAN	:	Windward Islands Banana Growers Association

1.0 RECOMMENDATIONS AND RESOLUTION

1.1 GENERAL RECOMMENDATIONS

1. Immediate cooperation between Latin America and the Caribbean should be undertaken through:

   - distribution of the list of participants from the Latin American and Caribbean institutions represented at the Meeting;
   - distribution of lists of research areas, programmes and projects underway at the participating institutions;
   - direct contact between professionals from the participating Latin American and Caribbean institutions.

2. Cooperation should be established laterally within each region and bilaterally between the regions, including principally:

   - scientific exchange;
   - information exchange;
   - other appropriate means.

3. Existing research projects in one region should explore additional cooperation from the other.

4. Through the current reciprocal international cooperative programmes and networks managed by IICA, inter-regional cooperation should be established, covering especially:

   - scientific data exchange;
   - germplasm exchange;
   - technical information exchange;
   - reciprocal exchange of researchers and other professional staff;
   - linkage with national or sub-regional technology research/development networks.

5. The Caribbean institutions should investigate resources (human, physical, financial) available within their region to determine technology research/development areas for immediate intra-regional cooperation.

6. Main modes of inter-regional cooperation for information exchange between entities from both the public and private sectors should encompass:

   - inclusion of abstract in Spanish/English in all technical papers;
   - distribution of Annual Reports from cooperating institutions;

- exchange of lists of scientific/technical professional staff;
- reciprocal participation in regional events;
- inclusion of all the institutions that participated in this meeting in future mailing lists of each cooperating institution.

7. Major modes of inter-regional cooperation in training should include:

- tailor-made short training courses, offered in English/Spanish at CATIE;
- sponsorship of visiting scientist exchange;
- sponsorship of Caribbean/Latin American technical seminars and workshops.

8. Sponsorship offered by IBPGR allowing students to pursue a post graduate course on Conservation of Plant Genetic Resources at the University of Birmingham, UK, should be noted.

9. A small group of persons (two from each region) should be selected to represent and articulate the areas of cooperation between Latin America and the Caribbean in future meetings in this series; coordinating and supporting institutions (IICA, ECLAC/CCST or both) should oversee the operations of that Representative Group.

10. The Coordinating and Supporting Institutions should note ECLAC/CCST's interest in promoting through them the following cooperation programmes:

- promotion of language training;
- expansion of data-base and information exchange between Latin America and the Caribbean, through a computerized network;
- provision of limited financial support to technology transfer between Latin America and the Caribbean.

11. The CARICOM Secretariat should continue to follow up the implementation of cooperation between the two regions; its main role would be that of co-sponsor, with the responsibility for providing from the Caribbean side, political legitimacy and support to the cooperation.

12. For the future enhancement of cooperation between the Caribbean and Latin America, efforts should be undertaken towards the ultimate development of a network of agricultural research activities as well as technology and information exchange (called PROCICARIB) led by CARDI and supported by IICA.

1.2 SPECIFIC RECOMMENDATIONS

Area and Sub-areas	Priority Problems per Area	Main Modes of Reciprocal Cooperation	Committed Institutions [1]	
			Caribbean	Latin America
1. CROPS				
1.1 Fruits				
1.1.1 Banana 1.1.2 Pine-apple 1.1.3 Mango 1.1.4 Citrus 1.1.5 Papaya 1.1.6 Avocado 1.1.7 Passion fruit 1.1.8 Plantain	- Use of narrow germplasm base - Inadequate pest/ disease control/ management - Use of low-production technologies - Use of inadequate post harvest technologies - Low productivity - Insufficient techno-logical advance in flower induction - Insufficient hybri-dization programmes	- In-service training - Formal training - Technology sharing - Joint under-taking of macro-technology research and development	- WINBAN/CARDI CIRAD (to liaise with INIBAP) . UWI . NARI . INRA . CARIRI	- FHIA/EMBRAPA . ICA . FONAIAP . INIFAP . ICTA . IBPGR . CATIE . INTA

Area and Sub-Areas	Priority Problems Per Area	Main Modes of Reciprocal Cooperation	Committed Institutions [1]	
			Caribbean	Latin America
1.2 Root and Tuber Crops	- Use of narrow germplasm base - Inadequate pest/ - disease control/ management - Use of inadequate post-harvest technology	- Information sharing - International networking	- CARDI . INRA (to liaise with CIP)	- EMBRAPA
1.3 Vegetables	- Insufficient socio-economic studies to guide domestic and export marketing - Use of inadequate post-harvest technology	. Technology sharing . Information exchange	- INRA	- INIFAP
1.4 Grains				
1.4.1 Rice 1.4.2 Food Legumes	- Insufficient availability of improved production/ processing technologies	- Information sharing - Technology sharing - Formal Training	- NARI . CIRAD . AJAX . CIRAD . AJAX . AJAX	- ICA (to liaise with CIAT and IRRI) . INTA . INTA . INIFAP

Area and Sub-Areas	Priority Problems Per Area	Main Modes of Reciprocal Cooperation	Committed Institutions [1]	
			Caribbean	Latin America
	- Use of narrow germplasm base			. FONAIAP . EMBRAPA
1.5 Ornamentals	- Use of inadequate marketing techniques - Insufficient accessibility of farmers to improved planting materials	- Joint undertaking of technology research/development activities	- CARDI . INRA . CIRAD	- PRIVATE SECTOR (IICA to serve as facilitator) . FHIA
2. LIVESTOCK				
2.1 Ruminants	- Low quality forages - Inadequate supply of indigenous protein sources - Insufficient supply of indigenous feeds - Precarious animal health (especially sickness caused by amblyoma ticks)	. Formal training in livestock management technology . Inservice training	- CARDI/UWI . INRA . NARI	- ICA . INTA . EMBRAPA . FONAIAP . CATIE . INIFAP

Area and Sub-Areas	Priority Problems Per Area	Main Modes of Reciprocal Cooperation	Committed Institutions [1]	
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1.3 Vegetables	- Insufficient socio-economic studies to guide domestic and export marketing - Use of inadequate post-harvest technology	. Technology sharing . Information exchange	- INRA	- INIFAP
1.4 Grains				
1.4.1 Rice 1.4.2 Food Legumes	- Insufficient availability of improved production/ processing technologies	- Information sharing - Technology sharing - Formal Training	- MARI . CIRAD . AJAX . CIRAD . AJAX . AJAX	- ICA (to liaise with CIAT and IRRI) . INTA . INTA . INIFAP

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Area and Sub-areas	Priority Problems per Area	Main Modes of Reciprocal Cooperation	Committed Institutions [1]	
			Caribbean	Latin America
	- Insufficient application of modern meat processing technology - Use of deficient production systems			
3. AGRO-FORESTRY	- Insufficient methodological knowledge to design sustainable agroforestry systems and watershed management	- Technology sharing - Diagnosis	- CARDI/UWI . CIRAD	- CATIE . EMBRAPA . INTA
4. STRATEGIC RESEARCH				
4.1 Biotechnology	- Insufficient institutional capabilities for undertaking activities in - . embryo transplant in livestock . gene transfer in plants and animals	- Technology sharing	- UWI CIRAD INRA	- EMBRAPA . INTA . ICA . CATIE . ICTA . FHIA

Area and Sub-Areas	Priority Problems	Main Modes of Reciprocal Cooperation	Committed Institutions [1]	
			Caribbean	Latin America
	. vaccines production in aminals . preparation of diagnostic kits . germplasm collection and characterization in plants and animals . tissue culturing in crops			
4.2 Agri-business Management	- Insufficient training opportunities	- Formal training - Informal training	- CIRAD	- IICA (to liaise with Central American Universities and specialised training centres)

Area and Sub-Areas	Priority Problems Per Area	Main Modes of Reciprocal Cooperation	Committed Institutions [1]	
			Caribbean	Latin American
4.3 **Impact of Agro-chemicals on the Environment (especially in banana production)**	- Insufficient sharing of research results	- Information exchange	- **CIRAD** (to liaise with INIBAP) . **WINBAN**	- **FHIA**
4.4 **Macro-economic Policies**	- Scarcity of sound methodologies to assess priorities and analyse impact of policies	- Information - sharing	- **CIRAD**	- **ICTA**
4.5 **Management Systems for Acid, Sandy Soils of the Savannahs**	- Insufficient institutional research capabilities	- Information sharing - Joint undertaking of R/D and networking	- **CIRAD/INRA**	- **EMBRAPA** . **ICA** . **INIFAP** - **FONAIAP**

[1] Lead institutions are listed in **bold letters**

1.3 ESTABLISHMENT OF THE TECHNICAL COMMITTEE FOR AGRICULTURAL TECHNOLOGY TRANSFER BETWEEN LATIN AMERICA AND THE CARIBBEAN

Based on the Work Group Recommendations and a proposal presented by IICA to plenary discussion, the participants passed the following Resolution.

1. To ensure institutionalization of agricultural technology transfer between Latin America and the Caribbean, a Technical Committee for Agricultural Technology Transfer between Latin America and the Caribbean (TECLAC) is established.

2. The initial membership of TECLAC comprises a representative of each of the following institutions:

Latin America
- EMBRAPA (Brazil)
- CATIE (Costa Rica)
- INIFAP (Mexico)

Caribbean
- CARDI (Trinidad & Tobago)
- UWI (Trinidad & Tobago)

3. The PROCIs, especially PROCIANDINO and PROCITROPICOS, represent the main mechanisms to channel cooperation between South America and the Caribbean

4. IICA will provide Executive Secretariat support to TECLAC.

2.0 ADDRESSES

2.1 REMARKS

R. E. Pierre, Director of Operations, Caribbean Area,
IICA, Barbados

Mr. Chairman; Hon. William George Mallet, Deputy Prime Minister, Minister for Foreign Affairs, Home Affairs, Trade, Industry and CARICOM Affairs; Dr. Leslie Simpson, CARICOM Representative; Dr. Antonio M. Pinchinat; Members of the Diplomatic Corps; distinguished guests; ladies and gentlemen.

It is my pleasure to welcome you on behalf of the Director General of IICA, Dr. Martin Pineiro, to this first meeting of Latin American and Caribbean Institutions which aims to:

- identify institutional capabilities and needs for the technological modernization of agriculture;

- define priority areas for inter-regional cooperation;

- define a joint agenda for such cooperation; and

- establish an institutional mechanism to facilitate inter-regional linkages and the transfer of technology in support of agricultural development.

Included among us are representatives from institutions as far south as INTA (Argentina), to INIFAP (Mexico) as well as ICTA (Guatemala), FHIA (Honduras), EMBRAPA (Brazil), FONAIAP (Venezuela), ICA (Colombia), and CATIE in Costa Rica.

From the Caribbean, there are CARDI, CARIRI, AJAX (Private Sector, Trinidad and Tobago), SRC (Jamaica), NARI (Guyana), UWI, WINBAN, CARICOM, ADCU/OECS, our friends from INRA and CIRAD in the French speaking islands of Guadeloupe and Martinique and the French Ministry of Foreign Affairs. We are also very pleased that representatives from USAID, FAO, ECLAC, and The World Bank have been able to join us and, of course, our IICA colleagues from Costa Rica and Trinidad and Tobago.

We at IICA are particularly pleased to collaborate with the Government of Saint Lucia in sponsoring this initiative, and I wish to assure you that we will be equally pleased to pursue with the institutions involved, all necessary actions to ensure that the activities which result from the deliberations at this meeting will be successfully implemented.

The high level at which institutions are represented at this meeting is particularly noteworthy, and I consider this to be truly indicative of the importance which the agencies attach to this initiative.

It is usual on occasions such as this to say that the initiative, whatever it may be, is "important and timely", but I think you will agree, Mr. Chairman, that this particular initiative is truly so. It is so because of the difficult circumstances in which Caribbean agriculture finds itself at this time, particularly in regard to our major export crops - banana and sugar.

These two commodities, which for a long time benefitted from preferential market access and favourable prices, are now faced with the prospect of losing these preferences and the consequent task of becoming internationally competitive - a task which is by no means easy, particularly in the light of the significant reduction in aid to the region and the difficult economic circumstances which many governments are facing.

The difficulties confronting Caribbean agriculture have been brought about, in part, by a number of global issues, among the most important of which are the formation of Mega Trading Blocks, particularly the European Common Market, and the trend towards trade liberalization. These two factors will, most certainly, lead to the eventual elimination of preferential market access and the favourable price structure from which Caribbean agriculture has benefitted over the years.

Some of my colleagues are of the view that the favourable treatment of our traditional agricultural exports in the past has led to the "underdevelopment" of Caribbean agriculture because we were not forced to be competitive. That may or may not be so, but the problem now is not to determine what caused Caribbean agriculture to be so uncompetitive but to find ways and means of making it competitive - competitive in terms of price of product, in terms of product quality, and in terms of reliability of supply.

I indicated earlier, Mr. Chairman, that the current problems of Caribbean agriculture have been brought about, in part, by global issues. Another part stems largely from domestic concerns related, for example, to the negative perception of agriculture and the apparent belief that agriculture should be for the least academically endowed; the tendency, in the past, to emphasize the technological rather than the business aspect of agriculture, the high degree of dependency on the public sector for agricultural support services, praedial larceny, and the underlying problem of low labour productivity. These are some of the main concerns which clearly warrant attention.

During the next few days, however, we will concern ourselves mainly with technological issues in relation to agricultural development. Mr. Chairman, just about six months ago, IICA had the opportunity of collaborating with your ministry and WINBAN in hosting a workshop here in Saint Lucia, on "Technological Modernization of the Banana Industry in the Caribbean" - a workshop in which representatives of all Caribbean banana producing countries, from Belize to Suriname participated together with the relevant agencies (CARDI, UWI, WINBAN, CDB).

While looking through the workshop proceedings, I was struck in particular by some comparative statistics on banana production between the Windward Islands and Central America, as follows:

	WINDWARDS	CENTRAL AMERICA
AVERAGE PRODUCTION (t/ac)	6-8	26
BUNCHES PRODUCED/ac/year	630	1006
BUNCHES HARVESTED/ac/year	440	906
FIELD LOSSES (%)	30	10
RATOON RATE (bunches/year)	0.7	1.4

This would seem to indicate, Mr. Chairman, that there are some technologies related to banana production in Central America from which Caribbean countries can benefit significantly. I am confident that this applies, also, to commodities other than banana and that there are areas in which Latin American countries can benefit from initiatives taken in these parts.

I hope that during the next few days, you will be able to identify many of these mutually beneficial areas which would impact positively on agricultural development and will put in place appropriate mechanisms to bring the expected collaborative efforts to fruition.

Thank you.

2.2 ADDRESS

L. Simpson, Agricultural Officer, CARICOM Secretariat, Guyana

Mr. Chairman; Deputy Prime Minister and Honourable Minister of Foreign Affairs, Home Affairs, Trade, Industry and CARICOM Affairs; Dr Reginald E.Pierre, IICA Director of Operations (Caribbean); Members of the Diplomatic Corps; Distinguished Guests; other members of the head table; colleagues; ladies and gentlemen.

1. The initiative by the Inter-American Institute for Cooperation on Agriculture (IICA) to convene this first meeting of the Technical Committee for Agricultural Transfer Between Latin America and the Caribbean, represents another fundamental and important achievement by IICA in its quest for the development of agriculture in the hemisphere. The initiative is also a further step in the path or trend which seems to be developing and which is designed to enhance and accelerate CARICOM/Latin American cooperation which has been the focus of increasing interest recently.

2. Mr. Chairman, it is becoming abundantly clear that in a world where there is an increasing trend towards the creation of hemispheric blocs (as can be seen through the discussions currently ongoing in relation to the North American Free Trade Area (NAFTA) and the single market in Europe). It becomes imperative if the Caribbean is to ensure that it is not marginalised, in fact, to ensure its very survival, that there are concrete and practical means which go beyond the formal and diplomatic relations which have already been established, to give practical meaning to the aspirations of the people of the Caribbean and Latin America, the southern part of this hemisphere.

3. In this regard, permit me to call attention to some examples which serve to illustrate the trend to which I have just alluded.

4. In 1992, CARICOM and Venezuela signed an agreement which allowed one-way duty-free access for certain CARICOM goods into the Venezuelan market once certain conditions were satisfied. The formalities for implementing this agreement have more or less been satisfied and CARICOM Member States are in the process of giving practical effect to this agreement. There have also been indicators that the Government of Chile is interested in establishing a formal relationship with the community and discussions are proceeding to finalise this desire. The Government of Argentina has expressed a similar interest.

5. In addition to these initiatives, which are essentially of a bi-lateral nature, the community has also been actively engaged in relations with the Rio Group, the Group of 3, and is in the process of negotiating a framework agreement with the Latin America Integration Association (ALADI) with a view to formalising and enhancing the relationship between CARICOM Member States and members of ALADI to enhance cooperation and cooperative activity.

6. Mr. Chairman, you will no doubt note that the initiatives which have been described above are, essentially, for want of a better term, piecemeal. However, I wish to refer to one initiative which is likely to be more long lasting and far reaching; this initiative emerged from the deliberations of the Conference of Heads of Government in 1989, when it was decided to establish the West India Commission (WIC) to provide a "blueprint" or framework for the development of the Caribbean Community to the 21st century.

Among the recommendations of the WIC which were accepted and endorsed by the Conference of Heads of Government at its special meeting in October 1992, was that for the creation of an Association of Caribbean States (ACS) which would embrace all the states in the Caribbean Basin Littoral.

The WIC considered that CARICOM's relations with the wider Caribbean should not be restricted to membership of, or association with, CARICOM itself which should be the core family of the Caribbean integration process; and that CARICOM should initiate proposals for the establishment of an Association of Caribbean States directed to both economic integration and functional cooperation with other Caribbean Basin countries.

It was envisaged that the ACS could bridge the division between its Member States and other states and territories of the Caribbean and Latin America, recognising the advent of an increasingly "Caribbean Basin" approach to international negotiations and developmental issues, as well as the changes within and among Latin American countries; and, in the context of a changing hemisphere, Caribbean countries should pursue, as a matter of high priority and with a sense of urgency, the possibility of negotiating as a group a common position for entry into NAFTA under arrangements whereby the benefits under the CBI are maintained.

Mr. Chairman, the Conference of Heads of Government has moved diligently in pursuit of the development of the ACS with the appointment of former Prime Minister of Jamaica, Mr. Michael Manley, as CARICOM Ambassador to probe the potential of ACS and determine their degree of interest being an important step. The Conference of Heads of Government at its meeting in July, 1993, is expected to note important decisions on the structure and formation of the ACS.

Thus, Mr. Chairman, it can be inferred that the Caribbean Community is fully committed to the development of relations with Latin America and that the vision which it has of the progress and course of these relations fits easily within the concepts which will be discussed here over the next three days.

On behalf of the CCS and myself, I, therefore, wish to commend IICA on this initiative in support of sustainable agricultural development in the hemisphere.

2.3 FEATURE ADDRESS

Hon. W. G. Mallet, Deputy Prime Minister;
Minister for Foreign Affairs, Home Affairs, Trade,
Industry and CARICOM Affairs, Saint Lucia

Mr Chairman; Dr Reginald E.Pierre, IICA's Director of Operation for the Caribbean; Dr Leslie Simpson, Representative of CARICOM; Distinguished Members of the Diplomatic Corps; Members of TECLAC; invited guests; Ladies and Gentlemen.

It gives me great pleasure to be provided with the opportunity of addressing such a distinguished gathering of agricultural scientists, agricultural researchers and persons involved in agricultural development work in the Caribbean and Latin America. Saint Lucia is indeed honoured to play host to this distinguished assembly of experts, your collective experience cannot but guarantee the success of this meeting in achieving its important objectives.

Mr Chairman, I wish on behalf of the Government and people of Saint Lucia, to extend a warm welcome to the participants attending this First Meeting of the Technical Committee for Agricultural Technology Transfer between Latin America and the Caribbean. Many of you are visiting our shores for the first time. I hope that you will take the opportunity whilst here, to learn more about us and about our country. It is through a closer knowledge of each other that a bridge of understanding can be forged to facilitate the flow of regional cooperative endeavour, which is so essential for mounting an effective response to the global changes that are overtaking us.

Those who historically were responsible for the divisions which exist between us today, have themselves cast aside their differences, in the interest of their own economic advancement. It is only sensible that we too, in this region, should ourselves seek to safeguard our own self-interests.

Herein lies the importance of the Inter-American Institute for Cooperation on Agriculture's programme of activities, and in particular, its initiative in bringing about the establishment of the Technical Committee for Agricultural Technology Transfer.

As I understand it, the Terms of Reference of the Committee include:

a) reviewing priority technology constraints of the Caribbean Area;

b) identifying sources of technologies in Latin America, capable of helping to remove these constraints;

c) recommending strategies and mechanisms which can facilitate linkages, and the transfer of technologies from Latin America to the Caribbean and vice versa, as well as to promote joint agriculture-based ventures;

d) identifying sources of funding for the implementation of the recommendations;

e) assisting in monitoring progress in implementing the recommendations, evaluating results, and planning follow-up activities.

The importance of this meeting is that it sets the stage for the work of the Committee, in addressing an area which is central to the development process - the process of sourcing, adapting, and employment of technology. The crucial nature of this process is evidenced by the close relationship which seems to exist between a country's access to and use of technology and the level of development achieved as a consequence.

The Inter-American Institute for Cooperation on Agriculture must therefore, be commended for its foresight in highlighting the role of technology in the process of transforming and modernizing agricultural and rural development, for selecting this area for inclusion in its five-pronged programme, and for recognizing the potential for its member countries to share development experiences and expertise.

The history of the region's Agriculture has been linked to production, based on the demand of the metropolis for primary products to meet the raw material requirements of its industry.

Production of these primary products was first facilitated by constitutional means and later by a system of preferential arrangements both of which have fostered a pattern of Trade, characterized by mono-cropping or a severely restricted range of production, and a dependence on restricted markets for disposal of output.

As constitutional changes have taken place and preferences eroded, so too has a decline in the share of Agricultural output as a percentage of Gross Domestic Product. The Caricom Region in 1972 changed from being a net exporter of Agricultural Products to the Net importer that it is today, and the share of agriculture in the Gross Domestic Product of Caricom States averages some 13%, - and is down to single figures in some states. These figures should however not be taken to imply a growing decrease in the importance of the role of agriculture in our economies, in terms of employment generation, the maintenance of food security, as an earner of

foreign exchange and at the same time a conserver of foreign exchange in its capacity to provide for import substitution.

The banana industry of the Windward Islands, for example, accounts for 52% of domestic exports and provides direct and indirect employment for over 50% of their work force.

Agriculture will also be required to fill a new role in the development process, that of providing links for the creation of regional industries and as a supplier for the growing Tourism Industry.

However, in order to fulfill its potential within an economy made less vulnerable through diversification, the Agricultural sector will of need to modernize its methods from the production to the marketing end, in order to cope with the challenges posed by the increasingly competitive global environment expected to emanate from the process of trade liberalization, which is the objective of the Uruguay Round. This process must involve the deployment of improved technology.

This first meeting of your group is not only timely, but critical, in the context of the urgent need which exists to come up with appropriate answers.

It must however here be noted, that variances of resources including land resources, serve to place our less developed countries on a playing field which is far from being level.

The Punta del Este declaration recognizes this in its reference to the needs of less developed states. We too must ensure that our endeavours and our actions reflect the fact, that variations also exist between us.

The difference of views held between us in the Caribbean Community and some of our neighbours on the question of the banana trade in the EEC market is perhaps a case in point. Cooperation can only proceed within an atmosphere of mutual understanding, and nothing can be gained by a confrontational approach, in which the survival interests of one of the parties involved, fails to receive its due consideration.

Mr Chairman, the current International situation coupled with the problems facing the agriculture sector pose many challenges. But amidst these challenges there are also opportunities. Perhaps the factor which will best determine the extent to which these opportunities can be translated into profitable ventures, is the level of access to new technology, and the ability to transfer that technology to the farm level for use by farmers.

Because this meeting focuses on mechanisms for the transfer of technology and on its adoption by farmers and because it deals with

issues of production efficiency and the role of technical and economic factors, its importance cannot be overstated.

I believe, that four areas are worthy of particular attention in your deliberations.

1. **DEFINITION OF THE OBJECTIVES OF TECHNOLOGY GENERATION AND TRANSFER.**

I am of the view that the ultimate objective of technology generation and transfer, should be to increase productivity per unit of area and per unit cost. This implies maximizing returns per acre/hectare, at least production cost.

The challenge will be to accomplish this within the physical and human limitations of the existing circumstances, and with measures which encourage sustainable development and incur minimum environmental risks.

2. **THE ESTABLISHMENT OF PRIORITY NEEDS OF AGRICULTURAL RESEARCH, AND RATIONALIZATION AMONG INSTITUTIONS.**

There are a number of organizations in Latin America and the Caribbean engaged in the conduct of agricultural research. At this meeting alone, I am informed, there are 12 organizations represented. The limited resources at national levels, would seem to indicate the need for institutions engaged in research to focus on high priority areas where the net returns can be maximized.

It is an absolute waste of time, energy and financial resources, for work to be duplicated by institutions. There is scope for a division of labour within which each institution seeks to concentrate its efforts in the areas where its comparative advantage lies.

In this part of the world, Agricultural Research has been largely left to the public sector, but attempts should also be made to attract private sector investment in research after all the benefits derived from such research fall directly to private sector advantage. Attracting private sector resources however will depend on the ability to better demonstrate that the returns justify the investment in research.

3. **THE ORGANIZATION OF COMPETENT EXTENSION SERVICES.**

The link between research and extension must be strengthened, and extension workers trained to communicate within the environment of their activities if research results are not to remain locked, within the ivory tower of their creation, providing costly pleasure for the researcher but doing little to satisfy the objectives.

4. INSTITUTIONAL LINKAGES.

The fourth area I wish to highlight is that of institutional linkages. This I believe will be an important focus of your meeting; and it is necessary that it should be so.

There are a range of crops which are common to Latin America as they are to the Caribbean. However, in many instances, when a problem arises in one country, there is a tendency to resort to the costly procedure of duplcating research, rather than seeking to determine what regional expertise exists, for dealing with the problem.

There is need for strengthening data bank resources, linking them and providing translation facilities, in order that recent developments in communications can be fully exploited in attempts to resolve this problem of duplication. If the only result coming from your discussions over the next few days is a decision on the means of achieving this central objective, then your deliberations here would have secured a signal success towards fulfilling the purpose of your meeting.

Mr Chairman it has been a privilege and an honour to address this august gathering. I trust that your deliberations at this your inaugural meeting will set the stage for a series of future similar gatherings, from which will evolve a blueprint for dealing with this most critical development issue.

I now have great pleasure in declaring open the First Meeting of the Technical Committee for Agricultural Technology Transfer between Latin America and the Caribbean.

2.4 CLOSING ADDRESS

Hon. Ira d'Auvergne, Minister of Agriculture,
Lands, Fisheries and Forestry, Saint Lucia

You have come to the end of the First Meeting of the Technical Committee on Agricultural Technology Transfer Between Latin America and the Caribbean, and no doubt, during the last three days, you have been engaged in intensive discussions on the issues before you. The importance of this First Meeting has been underscored by all the speakers at the opening ceremony, particularly by the distinguished Deputy Prime Minister. Nevertheless, I think it is important for me to reiterate this, yet again, at the closing of the meeting.

The issue of technology has long been recognised as a critical element in the development process. Countries, in particular developed countries, where the level of resources, both financial and human, are much greater than ours, spend millions of dollars on research and development of new technology. The benefits of such expenditure on research, are, generally, thought to be significant and there has been a positive correlation between levels of expenditure on research into new technology, and rates of economic growth.

Developing countries like ourselves, have not been able to spend on research to the same extent as our counterparts from the developed countries for obvious reasons. It is clear, however, that if we are to make maximum use of the technologies available to us, we have to gear ourselves to accept and utilize them where appropriate.

Agriculture in Latin America and the Caribbean is truly at the crossroads, facing strong competition from other producing areas, facing protective barriers in developed country markets and depressed prices for our major export commodities. Response in this situation cannot be piecemeal.

In the Caribbean, we have moved from net exporters to net importers of food over the last two decades, and the agricultural sector is in a state of relative decline. Our food import bill grows astronomically each year, as we use whatever foreign exchange reserves we have to purchase the basic food items to feed our population.

I believe that what is needed in this area, is a more focussed approach to agricultural development, and to regional agricultural sector planning and programming. We need to identify the major elements of the food import bill and devise strategies to progressively reduce them. These strategies must be technology led, for it is only through the efficient application of technology at

the farm level, that our agricultural productivity can be increased.

The present international scenario present major challenges and offers significant opportunities for mutually beneficial cooperation among the countries of Latin America and the Caribbean in the field of technology generation and transfer.

Some potential areas for collaboration are:

- the formulation and development of appropriate policies, particularly suited to developing country situations;
- sharing of material, technologies and experiences among member countries;
- training and manpower development in the generation, transfer and adoption of new technologies;
- acquisition of complementary capabilities and expertise;
- exchange of experiences in the regulation of new technologies;
- the question of intellectual property rights.

The world today is on the threshold of major changes in agriculture. Advances in new technologies, particularly biotechnology, can transform agriculture and have far-reaching consequences for both developed and developing countries which for the latter, could be enormous. Unless these countries adopt appropriate policy measures and work towards the creation of a suitable institutional framework to enable them to derive full benefit, they will be left behind with catastrophic consequences for the lives and well-being of rural people.

This meeting has afforded us an opportunity to begin to work towards the establishment of a regional institutional framework, so we may collectively share in the benefit of the technological revolution in agriculture. Through this effort should come an action plan that clearly spells out the steps that should be taken to ensure progress. The final output of the process which you have started should be a network that would ensure a cooperative effort in this area. I would like to urge that specific use be made of the advances in information technology in this exercise.

Mr Chairman, I would like to urge the donor agencies gathered here to support this process which we have began. Many of you have provided significant support to agriculture in this region, but I submit that this initiative is one which can have far-reaching implications in terms of placing our agriculture on a viable and sustainable footing.

I hope you have had a pleasant stay in Saint Lucia and will return in the future, perhaps in more relaxing circumstances.

I thank you.

3.0 STATEMENTS FROM THE CARIBBEAN

3.1 PERSPECTIVE FOR COOPERATION BETWEEN LATIN AMERICA AND THE CARIBBEAN

A. Ali, Director of Planning and Evaluation, CARDI, Trinidad and Tobago
and D. Demacque, Head of Unit, CARDI, Saint Lucia

1. BACKGROUND

The Caribbean Agricultural Research and Development Institute (CARDI) was established in 1975 as the successor organization of the Regional Research Centre (RRC) in the Faculty of Agriculture of the University of the West Indies. During its 20 years of existence the RRC had established itself as a centre of excellence in tropical agricultural research in the Caribbean but member states felt that there was need for an autonomous institution that could be more responsive to their needs.

CARDI replaced the RRC with an expanded mandate and a new financing arrangement. While funding of the RRC was shared between the British Government and the More Developed Countries (MDCs) of the region, the new arrangement involved a new formula for funding excluding the British Government and now including the Less Developed Countries (LDCs) of the region.

2. ORGANISATION AND MANAGEMENT STRUCTURE

The Governing Body of CARDI is the Standing Committee of the Ministers Responsible for Agriculture (SCMA) in the Caribbean Community. This body approves the budget and provides the Board of Directors with general guidelines concerning policy and programmes. The Board of Directors is composed of representatives of the member states of the University of the West Indies (UWI), the University of Guyana (UG), the Caribbean Development Bank (CDB), the Caribbean Food Corporation (CFC) and the CARICOM Secretariat, with IICA having observer status on the Board.

The organisational structure of the Institute now reflects a division of responsibility into two areas - scientific services and corporate services - headed by the two Deputy Executive Directors. Scientific services have the responsibility for implementation, monitoring and review of the programmes and projects in the Institute. Corporate services cover the areas of administration and finance, planning and evaluation, and information and communication.

The External Review in 1991 headed by Dr John Pino, recommended a merger of these two responsibilities under a single Deputy Executive Director and this recommendation has now been accepted by the Board of Directors.

3. BUDGET AND FUNDING SOURCES

There are two sources of funding available to CARDI:

1) Member governments which contribute to the core budget; and

2) The international donor community which provides funds, primarily directed to projects.

The core budget is funded according to a formula whereby member governments agree to contribute varying amounts between 0.7% to 29%. The current core annual budgetary contribution is EC$8.8 million. Four member countries are responsible for 85% of all current core contributions (Barbados 15%; Guyana 12%; Jamaica 29%; Trinidad and Tobago 29%).

4. HUMAN RESOURCES

As the demand for agricultural research and development increases so does the need for improved technical and administrative capability to service that demand. Since 1987, the Institute, in order to respond effectively to its clients, has had to expand its professional corps from 59 to 78, with 45 professionals paid by Core and 33 by Projects. Personnel costs now account for 66% of Core actual expenditure and this figure is expected to increase in the next two years as CARDI accepts more of its counterpart burden and as projects reach their completion dates.

5. TECHNICAL RESOURCES

Technical work in CARDI is carried out through its three basic programmes: Crop Production, Animal Production and Technology Adaptation and Transfer. Staff of these programmes are located within the member countries where economically viable technologies are adapted, tested, validated and transferred into production and marketing systems. This research requires investment in infrastructure at the field level and this has been provided by member governments making available to CARDI resources such as field stations and laboratories at several locations.

6. CHANGING OPERATING PHILOSOPHY

CARDI has moved from being a highly centralized institute in terms of the location of its research and development activities to one which has a presence in all its member countries with centre of focus in strategic locations. These changes also reflect the changes in the Institute's research strategy. A centralized critical mass of scientists was considered necessary and desirable

in the early life of the Institute. The decentralization of the late 1970s and early 1980s was achieved, principally, through the introduction of externally funded projects in the OECS and did not represent any substantial expansion of the Core outside of the headquarters in Trinidad.

Following the report of the Sorhaindo Review Committee 1986, CARDI was reorganized to achieve a higher level of decentralization. This included the dismantling of the `critical mass' of scientists at headquarters and the introduction of a new notion of the functioning of a critical mass - a departure from the traditional condition of single location. It was felt, then, that there could be a critical mass of scientists functioning in diverse locations utilizing a matrix management system.

Experience seems to now favour an intermediary position which promotes the idea of areas of focus with a minimum critical mass of scientists in each location and collaboration through internal networks.

7. WORK PROGRAMME IN AGRICULTURAL TECHNOLOGY RESEARCH AND DEVELOPMENT

The policies and guidelines for CARDI's Work Programme in agricultural technology research and development are contained in the Strategic Plan for 1988 - 1993. The research and development activities of the Institute's programmes are focused on achieving the following general objectives:

- increase agricultural diversification;
- improve productivity of basic food crops and animal production enterprises;
- lower costs and increase profitability of farm production;
- expand the products for utilization in agro-industries.

The Work-Plan of CARDI is organized into three programmes, supported by technical services in economics, biometrics, documentation and information services. The three programmes include:

1) Animal Production
2) Crop Production
3) Technology Adaptation and Transfer

The Animal Production Programme provides focus on:

- Forage Seed Production and Pasture Development;
- Improved dairy and beef production systems;
- Improved sheep and goat production systems;
- Development of feeding systems from local feeds.

The Crop Production Programme is divided into the following sub-programmes:

- **Fruit/tree crops**
- **Root crops**
- **Grain Legumes**
- **Vegetables**

The successful implementation of these programmes revolves around integrated pest management and the production of planting material and tissue culture.

The major focus of the fruit/tree crop sub-programme involved:

- **agronomic studies to increase yield and quality of mangoes and pest management studies to control anthracnose, gall midges and fruit flies on that crop;**

- **agronomic studies on growth and yield and rapid multiplication of plantain;**

- **studies on trellis material, pruning, hand pollination and germplasm in passion fruit;**

- **studies on height management and varietal characterization in breadfruit.**

The focus of research on root crops has involved:

- **post-harvest studies, epidemiology of anthracnose and virus indexing in yams;**

- **development of maturity studies and IPM of weevils on sweet potatoes.**

The focus of research in grain legumes has involved:

- **for soya-bean - evaluation of acid-tolerant varieties and development of soil management systems;**

- **for pigeon-pea - evaluation of varieties for dry grain and development of soil management systems.**

Research in vegetables has concentrated on hot-pepper - the development of systems to produce virus-tested seeds of suitable varieties.

The Technology Adaptation and Transfer Programme is the driving force of CARDI's programme system. It adopts a holistic multi-disciplinary approach which involved farmers, extension agents and researchers in the development process. Targeted activities of this programme have involved:

- development of improved economically - viable Production/ Marketing Systems: Systems for crops under the OECS Diversification - plantain, mango, pineapple, hot pepper, ginger;

- systems of crops which promote food security, linkages with the tourist sector and import substitution, e.g. onions, cole crops, white potato, yams, aroids and peanuts;

- systems that integrate with existing production and marketing systems;

- systems directed at improving the management of citrus;

- testing and validating improved production.

Practices at the Farm level included:

- Water management techniques for vegetable production;

- Technologies that reduce post-harvest losses in onions;

- Weed management;

- Integrated pest and disease management of coffee pests, diamond-back moth, fruit fly and anthracnose in mango, root rot in avocado;

- Improved cultural practices for fruits: pruning, fertilizing, induction of flowering and top working;

- Development and testing of production systems for specific agro-socio-economic environments, including:
  - Legume production systems for the Intermediate Savannahs in Guyana, and
  - Legume production systems in Belize.

Comparative Areas of Institutional Strength

Major strengths have developed within the Institute in the use of the farming system research methodology while maintaining the focus on the small farm target group. In its search for an effective technology transfer mechanism, CARDI has successfully developed a methodology which involved the researcher, the extension agent, the farmer, the marketing, credit and other support agents, in a concentrated effort to meet certain target objectives. This methodology, now referred to as a Task Force approach, has worked in a commodity systems approach and will be employed in CARDI's new programme thrusts.

The programme approach in CARDI has also brought into the Institute, a programme development and management culture which would enhance improvements in future programme strategies as well as provide a framework for promoting the achievement of excellence in research and development activities. The participative approach will continue to provide opportunity for effective research and development priority determination and collaboration in implementation between CARDI and the national systems.

The Programme Activity Record (PAR), which was introduced as the building block of the programme, provides for a systematic build-up of programmes. This instrument will remain as an excellent tool regardless of the programme strategy employed.

CARDI has now built up a store of knowledge and skills in all areas pertaining to ruminant production systems. Concentration of efforts in small ruminants has been among resource poor farmers, the most common group in the sub-sector. Dairy work has been among very small backyard-type operations using a cut-and-carry system in Dominica, as well as among medium-scale farmers operating on improved pastures in Guyana.

The Institute has built up a significant knowledge base in the areas of grain legume production (peanut, pigeon pea, cow pea, and soya bean) as well as in root crop production (aroids, dasheen, yam, sweet potato and ginger) and vegetables, particularly onion and hot pepper.

The diversification thrust of the OECS countries has created a demand for the introduction of a new capability in the area of fruit crops and ornamentals. Significant progress has been made towards establishment of these capabilities including the initiation of a centre for fruit crops research in Saint Lucia, and recruitment and training of staff to meet these new demands.

As a result of its presence in all member states, its wide range of expertise and its access to the other regional and international agencies, CARDI is strategically placed to provide or facilitate the provision of technical assistance to its member states. This has been a vital area of service as far as member states are concerned and CARDI will seek to improve and maintain its level and quality.

Considerable advances have been made in the area of technical support services. An information and documentation service is available and accessible to all staff. This service is very widely used not only by CARDI staff, but also by staff and students of the University of the West Indies, and research and development staff of some member states.

The Institute has benefitted significantly from its association with CTA with headquarters in Holland. CARDI was designated the Regional Branch Office (RB) of CTA in 1986//87 and serves the Caribbean through focal points located in ministries responsible for agriculture in all member countries (as well as Suriname, the Dominican Republic and the Bahamas). This function has, significantly, strengthened CARDI's capability in responding to the technical information needs of the region.

CARDI has established the nucleus of a Communication and Information Centre to further enhance the information delivery system and to provide for the needs of a wider clientele. The Institute has also upgraded its printing and publishing capability.

A biometrics service has been established. It responds in a timely and adequate fashion to the needs of CARDI's scientists spread over the region. This service operates out of three centres - headquarters, Saint Lucia and Jamaica - and is also available to the national R/D systems of member states.

Also installed in CARDI is a capability for germplasm management and development. A tissue culture laboratory with related facilities is located in Barbados with a similar but more limited capability in Dominica. These facilities are geared to the provision of `clean' planting material of selected species as well as to the research and development of planting material of superior varieties of priority crops. The maintenance of germplasm banks is also undertaken at the Barbados centre.

CARDI has also developed/adopted skills in rapid propagation of root crops material through methods other than tissue culture.

A seed production unit has been established in Antigua with capability in grass and forage legume seed production. The unit has also been active in the production of vegetable and food legume seeds. A similar facility is being developed in Guyana to cater for species adapted to acid soil conditions.

A germplasm programme has been developed to respond to regional needs for foundation material that is not easily accessed or not available to meet short-term needs, especially as it relates to the introduction of new production systems and new technology.

8. CURRENT INTERNATIONAL COOPERATION LINKAGES

CARDI has also exploited opportunities for collaboration which has improved its capability to meet its mandate:

- CARDI and the UWI have worked together in the Agricultural Research and Extension Project (AREP), funded by the United States Agency for International Development (USAID) in strengthening research and extension linkages at the national level in the OECS.

- CARDI, CFC/CATCO and Agricultural Diversification Coordinating Unit (ADCU) of the OECS are collaborating to improve systems of production and marketing of non-traditional crops in the OECS.

- CARDI and the Inter-American Institute for Cooperation on Agriculture (IICA) are collaborating in network promotion and in accessing technology from the Latin American region.

- CARDI and the International Service for National Agricultural Research (ISNAR) are collaborating in the strengthening, planning, monitoring and evaluation capability of the Institute.

- Strong linkages have been developed between CARDI and some International Agricultural Research Centres (IARCs) including the International Potato Centre (CIP) and the International Centre for Tropical Agriculture (CIAT) as well as with institutions such as the University of Reading, the University of Florida, the Institute National de la Recherche Agronomique (INRA) and the Centre de Cooperation Internationale en Recherche Agronomique pour le Development (CIRAD).

9. INSTITUTIONAL CONSTRAINTS

The need for impact is putting increased demands on CARDI to improve its capability in socio-economic analysis and to establish capability in quantitative priority setting and impact assessment. The integration of socio-economic input into all of CARDI's programmes is now receiving attention and a strategy for effective and efficient implementation will emerge.

The Planning and Evaluation Unit will be firmly established and provided with resources to undertake the functions of leadership in policy analysis for regional research and development. Provisions will also be made for installing capability for quantitative priority setting and impact assessment in the Unit.

The provision of information and documentation services to CARDI staff is an area of strength. However, CARDI needs to extend this service to include a broader service to a wider clientele including farmers, potential farmers and persons and firms who are interested in investing in agriculture. The Communications Centre already referred to will, therefore, need to be equipped and

staffed to achieve this new level of service.

Core funding of CARDI is an area that warrants attention. The core funding base is too restricted and frequently puts pressures on financial management. A strategy to achieve a satisfactory level of financial stability is essential to efficient planning and management of the Institute's finances. A major effort will be needed to secure a broader and more manageable core funding base.

CARDI has developed a very impressive collaborative/co-operative mode in its operations, linking with the UWI, the National R/D systems, the IARCs and regional and extra-regional institutions. The Institute recognizes that there will be an increasing demand for use of strategic alliances and partnerships if it must meet its mandate within its severely limited resources. Attempts have been made to rationalize these relationships through the establishment of a networking project that will bring together kindred actors in an effective and efficient relationship. Finding an interested donor has so far been elusive. However, the strong justification for this activity must lead to its fruition before long.

CARDI has had to depend very largely on externally funded projects to meet its capital development needs. This has worked relatively well except that the Institute lacks flexibility in planning the development and/or replacement of its capital stock. The Institute will need to identify an appropriate mechanism for improving and sustaining its capital stock to ensure no loss of capability to meet its increasing role in research and development in the region. The EDF supported a capital programme through the LOME I Convention funding agreement, and this may need to be pursued as a possible strategy for dealing with this area of deficiency.

10. SPECIFIC NEEDS FOR INTERNATIONAL COOPERATION[1]

	Theme	Area of Cooperation
1.	Sustainability	Natural Resource Management
2.	Fruit Crops	Production, Processing & Marketing
3.	Small Ruminants	Production Systems, Nutrition and Feed Development
4.	Macro Economic Policy	Impact on Agricultural Sustainability

1 Source: Agenda of Latin America/Caribbean Cooperation for Agricultural Development, IICA ISSN-0253-4746 Series A2/LC-92-001. 1992.

3.2 PERSPECTIVE FOR COOPERATION BETWEEN LATIN AMERICA AND THE CARIBBEAN

D. A. Ali, Director and Chief Executive Officer,
CARIRI, Trinidad and Tobago

1. CARIRI'S ORIGIN

The Caribbean Industrial Research Institute started life as a project of the Government of Trinidad and Tobago in conjunction with UNIDO with funding assistance from UNDP. The project opened its doors for business in the last quarter of 1970 in a 390m^2 building located on the St. Augustine Campus of the University of the West Indies. The first Director was provided by UNIDO and came from Norway. A local Co-Director was also appointed.

The Institute was incorporated under an Act of Parliament. The major expenditures to set up and run CARIRI (i.e. for operating expenses and for capital assets) were provided as annual grants by the Government of Trinidad and Tobago. The assistance from UNIDO continued until 1976 and included:

- provision of experts;
- training for local staff;
- some capital assets.

As defined under the Act of Incorporation, the objects included inter alia:

- to provide technical and industrial services to public and private industrial enterprises;
- to undertake chemical analytic work particularly in connection with quality control testing in food and other local industries;
- to provide physical measurements and materials testing services;
- to engage in industrial research programmes relevant to the needs of Trinidad and Tobago and the Caribbean region.

From the outset, CARIRI attempted to forge a close working relationship with industry in both the public and private sectors. The Institute also focused on building a strong laboratory-based organisation and capability in technical information services. A major component of the work programme was in agro-industry i.e. food technology and food processing, and equipment design.

2. CARIRI'S DEVELOPMENT YEARS

The period of CARIRI's development (in the 1970s and early 1980s) coincided with the oil boom. In Trinidad and Tobago, there were rapid rises in employment levels and in salaries and benefits. CARIRI was not immune to this. By 1987, it was clear that fundamental change in the economy of Trinidad and Tobago was inevitable. Structural adjustment imposed through the conditions of the World Bank and the IMF came to Trinidad and Tobago at that time. Institutional change became part of this adjustment process. The elements of this change included:

- reduced transfers from the Treasury to State organisations;
- greater focusing on core business;
- market sensitivity;
- increases in productivity and efficiency.

By 1987, CARIRI was mandated to change, reducing its dependence on the Treasury and earning more of its income from clients through the sale of services. A major part of this change process was the institution of planning and CARIRI began developing a Strategic Plan for the period 1990-94.

The Plan was implemented in 1990. Major elements of the Plan included:

- **A Mission Statement:**

  "To advance the economic and social development of Trinidad and Tobago and other countries in the Caribbean region by providing technical and technological support and creating and transferring technology to the producers of goods and services."

- **Strategic Directions**

  Services:

  - Laboratory-Based Testing and Consultancy
  - Technology Sourcing and Intelligence
  - Process and Product Research & Development

Sectors:

- Food and Beverage
- Chemicals
- Non-Metallic Minerals

- Focus on earning income and independence from the Treasury.
- Focus on core business with changes in staffing.

3. WORK PROGRAMMES IN AGRICULTURAL TECHNOLOGY

The focus is on:

- Agro-industrial Processing (i.e. improvement and development of products and processes at both laboratory and pilot plant levels);
- Quality Improvement;
- Use of Local Raw Materials;
- Design, Fabrication and Licensing of Equipment for SMEs; and
- Technical Information Services.

4. INSTITUTIONAL STRENGTHS

- Good laboratory infrastructure and human resources in:
  testing in analytical chemistry;
  testing in microbiology;
  fermentation technology;
  food product development.
- Well-developed technical information services including on-line access.
- Good facilities and people in equipment design, fabrication and testing.
- Good reputation.
- Good planning skills.

5. INSTITUTIONAL CONSTRAINTS

- Pilot plant needs to be upgraded;
- Development of specialist expertise and consultancy skills e.g. in packaging, energy efficiency;
- Quality improvement (TQM, ISO 9000, laboratory accreditation);
- Improved marketing;
- Development of strategic alliances outside Trinidad and Tobago and especially in Latin America;
- Excessive reliance on one language;
- Need to exploit international system better.

6. INTERNATIONAL COOPERATION LINKAGES

Caribbean linkages via

- CDB
- CARICOM Secretariat
- IICA.

Extra-Caribbean linkages via

- OAS
- UN System
- IDRC of Canada
- World Bank
- CDI
- WAITRO.

7. SPECIFIC NEEDS FOR INTER-REGIONAL COOPERATION

- Training, e.g.
  expertise in tropical fruits and vegetables;
  packaging;
  energy audits and efficiency;
  biotechnology for the food industry.
- Assistance in Quality Improvement.
- Strategic alliances to offer a wider base of service to our clients.
- Extension of information links.

3.3 PERSPECTIVE FOR COOPERATION BETWEEN LATIN AMERICA AND THE CARIBBEAN

M. A. Granger, Director, NARI, Guyana

1.0 BACKGROUND

The National Agricultural Research Institute of Guyana (NARI) was established by an Act of Parliament; Act No. 19 of 1984. It began functioning, as an autonomous body under the Ministry of Agriculture, on January 1st, 1985.

NARI now conducts research in two of five broad agro-ecozones - the Coastal Plains and the Intermediate Savannahs - while providing technical support for the Upland Rainforests, the Mountains and the Rupununi Savannahs.

The Coastal Plains Field Research Unit (CPFRU) is at Burma, Mahaicony. The major research emphasis is on Rice Improvement but research is also conducted on Root and Tuber Crops, Plantains, Vegetable Crops and Pasture Improvement. The Institute's Genetic Resource facility and germplasm collection are located at this Unit.

The Intermediate Savannahs Field Research Unit (ISFRU), located at Ebini in the Berbice river area, emphasizes research for the large-scale mechanized farming systems for such open-row crops as cotton, cowpea, soybean, peanut, pigeon pea, corn and sorghum along with research on pasture improvement, beef cattle, and on sheep and goat adaptability to the ecozone.

The Institute's Headquarters, General Administration, and Central Laboratories are located at Mon Repos, East Coast Demerara. The laboratories and greenhouses are moderately well equipped and provide diagnostic and advisory services in Entomology, Plant Pathology, Weed Science, Biotechnology (including Tissue Culture and Soil Microbiology), Soil and Tissue Analyses and Soil and Land Use Surveys. It also houses the National Agricultural Research Library and Documentation facilities.

NARI is governed by an Agricultural Research Committee (ARC) comprised of eminent local scientists and managers. The ARC interfaces with the Agricultural Research Advisory Council (ARAC) - a council of farmers that has been integrated into the research process. The Institute, currently, has a technical staff of about 28 scientists comprised of 4 PhD, 10 MSc and 14 BSc level graduates.

The Institute works closely with local agencies, the regional research agency (CARDI), and several International Agricultural Research Centers. NARI is funded primarily by Central Government

but some projects are supported by International Agencies. It is, presently, supported technically by FAO and UN specialists provided with funds from UNDP.

1.1 Mission Statement

"To advise on and develop technologies and systems for sustained agricultural development."

1.2 Development

The formative years of the Institute were primarily Institutional building, nurturing a scientific community, and creating an environment for a sustainable national agricultural research effort. A paucity of senior experienced scientists identified the priority-need for manpower development emphasis. Priority was also placed on refurbishing and re-equipping laboratories, providing field machines and equipment.

The paucity of skills within the Institute also dictated that NARI coordinates and encourages interagency collaboration and participation in research programmes with a central national focus. NARI has, from inception, instituted an Annual Review and Programme Planning Workshop in which research scientists and farmers throughout Guyana are invited to participate.

The focus of the Institute over the next quintennium is on consolidation and accelerated impact on production. Manpower development will be a continuous exercise until a critical mass of skills is stabilized in place.

1.3 Philosophical Approach

Given Guyana's high import-dependence for agricultural production, research efforts are geared to greater selectivity in technology application to enhance Guyana's competitiveness on international markets.

1.3.1 Crop Research

With regard to crop production it seems likely that the most logical approach is to emphasize environmental or ecological adaptability. Selection or development of better adapted crops will be the most economical pathway for crop production in the short and medium term. To this end, research on crop production is designed in four components:

1) Varietal improvement;
2) Technological development;
3) Seed production; and
4) Technology Transfer and Adaptation.

Varietal Improvement

The International Agricultural Research Centres (IARC'S), and bilateral agencies are the main sources of improved germplasm for evaluation for adaptability. Concomitantly, based on germplasm already in NARI's germplasm bank, a national hybridization programme is being accelerated in respect of rice improvement.

Advanced lines are subject to large-scale evaluation on farmers' fields and, in collaboration with the National Seed Committee, appropriate varieties recommended for release for commercial production will be subject to the National Performance Trials for comparative evaluation and generation of more unbiased final data.

For some crops NARI now has the capability to respond to international commodity trials, while in others, only selected germplasm is requested.

Technological Development

a) Plant Protection

This remains one of the more critical areas of crop production. Research is on Integrated Pest Management emphasizing biological pest control, and genetic resistance to pests. Screening and evaluation of chemicals must, of necessity, continue in collaboration with such chemical manufacturers as CIBA-GEIGY, ICI, BASF, etc. The Insectarium and Herbarium are emphasized as these play integral roles in taxonomy and, to some extent, ecology. Supporting services in quarantine, diagnostic and advisory services are also provided.

b) Soil Analyses and Fertility Research

Use and management of soil amendments (limestone and fertilizers) are being refined through definition of nutrient imbalances, soil chemical toxicities and nutrient sufficiency-deficiency levels. Nutrient levels in tissue are also used to define nutrient adequacy levels. Growth response-to-added-soil amendment curves for key crops are being generated. Diagnostic and advisory services in soil and tissue analysis are being made more efficient.

In addition, emphasis is placed on biological fertilizers through the work of the biotechnology programme.

c) **Soil and Water Management**

Water management falls into three distinct categories:

- Water management for rice;
- Water management for upland crops; and
- Internal soil moisture management.

These areas are now being seriously addressed although some inconclusive work was undertaken. Soil conservation, soil physical characteristics and agro-meteorological information are key factors in this effort.

d) **Tillage and Field Mechanization**

As Guyana becomes more mechanized the utilized technology must be refined. The high capital investment and comparatively high operating and maintenance costs dictate that NARI develops a capability for addressing problems of tillage and field mechanization. Included in this area are soil conservation techniques, the refinement of field mechanization operations, harvesting techniques, and the placement of soil ameliorants.

e) **Agrometeorology**

This area has not been addressed fully and the Institute, in collaboration with the National Hydrometeorological Division of the Ministry of Works, is developing systems to give a much higher predictability of the onset and cessation of major growth influencing climatic events, i.e. time of onset, duration and cessation of rains; develop water budgets and provide an advisory service as part of the technological package to farmers.

Seed Production

NARI has the mandate for the production of Pre-basic Seed. Production emanates from the purification of existing commercial varieties and from the selection or development of new varieties. NARI provides to the National Seed System such quantities of Basic Seed of rice, grain legumes and other cereal crops required. NARI assists the National Seed Programme in developing the capability for farmers to produce Certified Seed in the first instance. With regards to root and tuber crops and plantains, NARI provides, through Tissue Culture, adequate quantities of disease-free, homogeneous planting material to the national system for farmers.

1.3.2 Livestock and Pasture Research

The main problem affecting livestock development is the nature, quantity and quality of feed materials available. With regard to ruminants (small and large), the Institute, in

collaboration with CARDI, adopted a research approach to develop forage-based systems as the main nutritional sources for dairy and beef cattle, sheep and goats. While the emphasis on non-ruminant research has been on identification and production of carbohydrate and protein sources - i.e. sorghum, corn, soybean, cowpea and pigeon pea. In addition, management of ruminant herds is critical for optimizing the use-efficiency of forage-based systems. CARDI is the national lead Institution in Livestock and Pasture Research.

1.4 General Approach

The operational framework perceives the Institute, besides its active research, as coordinating, encouraging and pooling resources with other entities for a concentrated address of a focussed national research effort. It attempts to absorb and utilize funds, equipment and personnel directly into the national research programme to optimize the use efficiency of available resources. Of particular interest are the University of Guyana's Faculty of Agriculture, The Guyana School of Agriculture, the Regional Educational Programme for Animal Health Assistants, the Ministry of Agriculture and its Seed Technology Unit, Veterinary Diagnostic Laboratory, Livestock Farm and the Agricultural In-Service Training and Communication Centre, the Caribbean Agricultural Research and Development Institute and other agencies.

2.0 WORK PROGRAMME IN AGRICULTURAL TECHNOLOGY RESEARCH AND DEVELOPMENT

The Institute pursues both a multi-disciplinary commodity-oriented and a discipline-oriented research agenda along with two outreach programmes. The current work programme is comprised of the following:

Rice Improvement

This is a major commodity programme entailing selection, hybridization, technology development and seed production for large-scale mechanized production systems on the Coastal Plains.

Grain Legume

Developmental commodity programme for cowpea, soybean, peanuts and pigeon-pea entailing selection, technology development and seed production for large-scale, mechanized production systems in the Intermediate Savannahs.

Root and Tuber Crops, and Plantains

Developmental commodity programme of selection, characterization, technology development and production of planting

material (homogenous, disease-free material) for small-scale farmers on Riverain and Coastal areas.

Other Cereal Crops

Developmental commodity programme for sorghum and corn involving selection, technology development and seed production for large-scale mechanized farming systems in the Intermediate Savannahs.

Oil Seed Crops

Commodity programme for coconuts and oil palm. Research emphasizes selection, plant protection and fertilizer use and management on plantation-sized farms.

Vegetable Crops

Commodity programme for vegetables with research emphasis on plant protection.

Fibre Crops

Research is on cotton varietal selection and adaptability and on technology development for large-scale mechanized production systems in the Intermediate Savannahs.

Fruit and Orchard Crops

Research is emphasizing collection and characterization of locally grown fruit and orchard crops (both traditional and non-traditional), agronomic characteristics, plant protection and the Supply of bud-wood and other planting material.

Crop Related Projects

This is a complex of discipline-oriented research and service projects in soil and landuse surveys, soil fertility research, soil characterization, routine soil, plant tissue and water analyses, entomology, plant pathology and weed science. The plant protection research emphasizes integrated pest management with a significant component of biological control and cultural practices.

Soil Management Systems

Research is specific to two eco-zones (Coastal Plains and the Intermediate Savannahs) for developing appropriate technologies for sustainable crop production.

Farming Systems Research and Development

This is the application of a particular methodology for the

characterization and understanding of small farmer production systems. It considers the total farm enterprises and socio-economic nature of individual farms with the aim of improving the viability through interventions already known or by identifying areas of research needs.

Livestock and Pasture Research

A complex programme to address ruminant production on forage-based systems. Work emphasized selection of pasture grasses, and forage legumes for both intensive and extensive systems, herd health, management, and genetic improvement.

Non-ruminant research addresses the identification of local sources of carbohydrates and protein sources, formulation and sustainable production systems for adequate quantities of these commodities.

Biotechnology (research is conducted in two main areas)

i) Soil Microbiology: Emphasizing use of soil microbes in plant nutrient supply and in nutrient uptake - rhizobia and mycorrhizal fungal association in annual and perennial crops.

ii) Plant Tissue Culture: A technique used to produce homogeneous, disease-free planting material - sweet potato, yams, cassava, pineapples and plantains; and as a tool to assist the Rice Breeding Programme in anther culture and in inducing stress tolerance as an element of the Rice Breeding Programme.

Research-Extension Liaison

This is the Technology Transfer Unit that relates directly with the National Extension System and the farming community. The Unit also produces Audio-Visual materials, leaflets and booklets for farmers, organizes field demonstrations, training sessions and, in general, promotes the use of new innovations from research. It plays an integral role in the Farming System Research and Development methodology application.

3.0 COMPARATIVE AREAS OF INSTITUTIONAL STRENGTHS

Given the relative youthfulness of the Institute there are few areas of comparative strengths:

- **Rice Improvement:** This area is still maturing but the strength lies more in varietal improvement and Seed Production.

- **Pasture Forage Species:** considerable expertise and germplasm collection now exist.

- **Plant Protection:** Includes biological pest control and integrated pest management. Some taxonomic expertise in weed science and entomology, control of Acoushi (Leaf-cutting) Ant, Atta sp.

- **Plant Tissue Culture**

- **Seed Technology**

- **Soil Microbiology**

4.0 INSTITUTIONAL CONSTRAINTS

4.1 Manpower Development

Major among the constraints is paucity of skills. Manpower development can be addressed through inter-institutional cooperation. NARI cannot aim to have recruited on core staff all the skills required for a critical mass. It will depend also on:

- exchange of scientists to be trained in new techniques in specific disciplines or sub-disciplines, i.e. Bio-technology, Entomology, Plant Pathology, Soil Microbiology, etc.;

- access to specialist skills on a short-term advisory basis to address national needs:-Fruit and Orchard Crops, characterization, management germplasm selection, etc. (Examples: 1. NARI accesses CARDI's Biometrician. 2. NARI can access CARDI's and IICA's capability in the fruit and orchard crop research programmes).

4.2 Germplasm and Information Exchange

Access to these two commodities can be greatly enhanced through greater inter-institutional cooperation in terms of the development and/or use of appropriate technologies for sustainable development. The awareness of technology development or modification, i.e. EMBRAPA, has released results of studies using Casareep as a nematicide, insecticide and as a fertilizer.

5.0 CURRENT INTERNATIONAL COOPERATION LINKAGES

NARI has established links with several International Agricultural Research Centers primarily for germplasm and information on new innovation arising therefrom:

IRRI	-	Rice germplasm and information
CIAT	-	Rice, pasture (grasses and forage legumes) and information
ICRISAT	-	Pigeon pea, peanuts, sorghum, information
IITA	-	Soybean, Cowpea, information
FAO	-	Expertise, germplasm, information
CABI	-	Information, entomological and mycological taxonomy
CSC	-	Technical support
IICA	-	Information
CARDI	-	Expertise, germplasm, information technical support (CARDI plays an integral role in the National Agricultural Research Programme)

Bilateral links are weak and tend to be politically influenced but informal contacts are, relatively, more reliable on a personal basis.

6.0 SPECIFIC NEEDS FOR INTER-REGIONAL COOPERATION

It was most encouraging to see the initiative taken by IICA to create this link in horizontal reciprocal cooperation for technological advancement and the promotion of Agricultural Technology Transfer between Latin America and the Caribbean.

Perhaps the greatest need for inter-regional cooperation lies in overcoming an inability to communicate effectively and not by attempting to be specific as indicated in ANNEX I. More important is the need for a mechanism to create a forum or to allow an Annual Meeting of a "Technical Committee for Agricultural Technology Transfer Between Latin America and the Caribbean."

Within the Caricom "Caribbean" the dominant institutions, at least in principle, are UWI and CARDI. These institutions are accountable to the Heads-of-Government in the final analysis. A third major institution is CARIRI which has come into its own and impacts positively, regionally. Together, these three institutions should, in theory, form the first bridge to Latin America on behalf of the National Agricultural Research Systems. They are the "cutting edge" of Caricom agricultural development but they, themselves, must first accept their roles and responsibilities as Regional Institutions in support of NARS.

Consequently, the bridge or bridges for cooperation between Latin America and the Caribbean for the transfer of agricultural technology may best be constructed by determining a means for the strengthening of the University of the West Indies and Guyana, the Caribbean Agricultural Research and Development Institute, the Caribbean Industrial Research Institute and the Institute of Applied Science and Technology (Guyana). These, in turn, will be more competent to be promoters of the transfer of technology between the two sub-regions.

Notwithstanding the relative inexperience of Guyana's NARS, the rate of national agricultural development can be greatly enhanced by identifying and making effectively functional a technology transfer mechanism to permit Guyana to access relevant germplasm, technology and information from neighbouring countries such as Brazil, Venezuela, Colombia and Suriname.

3.4 AN OVERVIEW OF ACTIVITIES WITH SPECIFIC REFERENCE TO AGRICULTRAL TECHNOLOGY AND INTER-REGIONAL COOPERATION

G. V. Taylor, Executive Director, SRC, Jamaica

1.0 BACKGROUND

1.1 Mandate

The Scientific Research Council (SRC) was founded in 1960 "to undertake, foster and coordinate scientific research in the island and to encourage the application of the results of such research to the exploitation and development of the resources of this Island". [Scientific Research Council Act (1960)]. The mission of the SRC is threefold:

- **Information**, i.e., the collection, review and dissemination of information and research and technical knowledge of potential development value to Jamaica;

- **Coordination**, i.e., the coordination of scientific research programmes within the public sector (including statutory organizations) and, with their consent, of research schemes and projects undertaken by other organizations;

- **Research**, i.e., to undertake directly or to support the development and utilization of local natural resources, the improvement of existing technical processes and methods of or the expansion of local industry and the utilization of waste products.

1.2 Work Programme

The Council operates on a project basis in five selected areas of priority:

- Food Science and Technology;
- Biotechnology - Tissue Culture;
- Natural Products;
- Energy; and
- Information.

1.3 Criteria for Project Selection

In selecting projects the following criteria are applied:

- probability for early contribution to national development;
- development of infrastructure;
- impact on Science and Technology community;

- staff training;
- commercial viability; and
- use of indigenous raw materials.

The operations of the Council are flexible and are geared to respond to national demands and priorities. Research and Development emphasis in the Council will, therefore, change with perceived national imperatives and available resources.

1.4 Staffing

In the present organizational structure of the Council, there are 179 established posts of which 88 are technical.

1.5 Financing

The Council is, mostly, funded by Government subvention for the following specific areas as listed below:

- Compensation of Employees;
- Travel and Subsistence;
- Rental of Property;
- Purchase of Other Goods & Services;
- Grants and Contributions;
- Purchase of Equipment; and
- Purchase of Property.

1.6 Outputs

The outputs of the Council include:

- the development of indigenous capabilities;
- human resource development and utilization;
- technological contribution towards the activities of the priority sectors of socio-economic development; and
- strengthening the information base on technological requirements, natural resources and their exploitation.

2.0 MAJOR ACHIEVEMENTS IN TECHNOLOGICAL MODERNIZATION OF AGRICULTURE

The work of the Council in relation to agriculture and agro-processing is undertaken by the Food Technology Institute (FTI). The FTI is an agency of the SRC. Its mandate is to promote the growth of the local Food Industry primarily through the utilization of indigenous crops, the development of new food products and the provision of technical assistance. The major achievements are in the following areas:

- The development of Milk Quality Assurance Standards which include Standards for Raw Milk and a Certification Programme for Milk Receivers (Processing Plant) and Bulk Tanker Drivers;

- The introduction of Solar Drying Technology as a means to reduce the incidences of post harvest loss;

- The use of Hot Water Dip Treatment for export mangoes;

- The introduction of the Potato Hydrometer to determine the maturity of potatoes in the field;

- The production of an organic soil conditioner/fertilizer from agricultural wastes such as ackee pods, banana pseudostems, citrus waste and coffee pulp;

- The use of Tissue Culture Technology to produce disease-free planting material of several important crops; and

- The development of suitable Rhizobia inoculant associated with the roots of legumes for use in both cowpea and redpea production.

3.0 INTERNATIONAL COOPERATION LINKAGES

Presently, much of the funding for actual research and development activities and projects comes from international funding agencies such as CIDA, UNESCO, UNDP, OAS, UNIDO, IDRC UNU and the FAO, in addition to some non-government agencies such as Third World Academy of Science (TWAS), International Foundation for Science (IFS), as well as institutions and networks such as ITTA, IICA and ISONAR.

In addition, technical assistance is provided by institutions such as GTZ and UNDP.

4.0 POTENTIAL AREAS FOR REGIONAL COOPERATION

Areas for regional cooperation include research and development, information exchange and training workshops/ programmes in the following areas in which Jamaica is engaged:

1) Food Science and Technology;
2) Natural Products;
3) Crop Science;
4) Animal Production/Husbandry;
5) Aquatic Resources;
6) Forestry/Aquaforestry;

7) Sustainable Environmental Research;
8) Biotechnology;
9) Standardisation;
10) Extension Services; and
11) Education and Training.

At the level of the Institution, the SRC would seek regional collaboration in the R and D programmes presently being undertaken. These include :

- Artemia (brine shrimp) production;

- Biovegetal;

- Development of pesticides formulation for Jamaican Blue Mountain ecosystems;

- Development of a technology extension and advisory science capability;

- Food Technology;
  - wheat-less bread development;
  - low acid canned foods;
  - development of tropical fruits and vegetable puree technology;
  - dehydration of selected spices and herbs;
  - raw milk quality assurance programme;
  - food irradiation;
  - meat technology;
  - french fries production;
  - solid-liquid extraction of fruits solids and flavours for concentration by reverse osmosis; and
  - extrusion technology.

- Investigation of the pesticidal potential of some Jamaican plants;

- Investigation of the nematicidal potential in the extracts of some Jamaican plants;

- Microbial Nitrogen Fixation;

- Mushroom cultivation;

- Oyster culture;

- Plant tissue culture of selected root crops and ornamentals; and

- Rural Information Services.

3.5 PERSPECTIVE FOR COOPERATION BETWEEN LATIN AMERICA AND THE CARIBBEAN

L. A. Wilson, Dean of the Faculty of Agriculture,
UWI, Trinidad and Tobago

1.0 INSTITUTIONAL ORIGIN AND MISSION

1.1 The University College of the West Indies

The University College of the West Indies (UCWI) was founded as a College of the University of London on the Mona Campus in Jamaica in 1948. The St.Augustine campus of the UCWI emerged in 1960 on the site of the Imperial College of Tropical Agriculture (ICTA), itself founded in 1924. The UCWI (St. Augustine) commenced operation with the establishment of Faculties of Agriculture, and of Arts and Sciences in 1960, and Faculities of Engineering and Social Science in 1961. Soon, thereafter, in 1962, the UCWI became the independent University of the West Indies, with its own Royal Charter and Statutes, but with direct responsibility to a University Council, including Ministers of Education of contributing CARICOM Member States.

1.2 Faculties of UCWI

Faculties of Natural Sciences (1962), Education (1974) and Medical Sciences (1989), including a School of Veterinary Medicine, were established on the St. Augustine Campus. Accordingly, Tertiary Education, Training, Research and Development (TETRAD) in agriculture and agriculture related areas are pursued on the St. Augustine Campus, not only in the Faculty of Agriculture, but also in the following Faculties:

- Engineering: Agricultural, Civil and Chemical Engineering, Land Surveying and Food and Process Technology.
- Natural Sciences: Fisheries, Aquaculture and Mammalian parasitology.
- Medical Sciences: Veterinary Medicine, including livestock parasitology.
- Social Science: Macro-economic policy, agricultural economics and management studies.

The agriculture and related disciplines in these five faculties are being constituted as the Headquarters of a proposed Inter-University Consortium for Tropical Agriculture, Forestry,

Fisheries and Food Science (ICTAFFF) for the CARIFORUM Region, including six Universities.

1.3 The Faculty of Agriculture

The Faculty of Agriculture was founded in 1960 as two separate, but closely related institutions, namely, the School of Agriculture (with four Departments of Agriculture, Chemistry and Soil Science, Botany and Plant Pathology and Zoology for teaching and research) and the Regional Research Centre (RRC) for research and development. By 1967, the Faculty had evolved into its current structure of six departments:

- Soil Science (DSS);
- Plant Science (DPS) (formerly Biological Sciences);
- Crop Science (DCS);
- Livestock Science (DLS);
- Agricultural Economics and Farm Management (DAEFM); and
- Agricultural Extension (DAE).

Also, the RRC was integrated into the teaching and research departments which were then responsible for all TETRAD activities. In 1975, the original RRC staff were convened into the Caribbean Agricultural Research and Development Institute (CARDI) with direct responsibility to a Board of Directors, and through it, to a Board of Governors, including Ministers of Agriculture of CARICOM Member States. CARDI was immediately given a mandate to decentralize staff and research and development operations to all twelve Member States.

1.4 Mission Statement

The mission of the UWI Faculty of Agriculture is acclaimed to be:

"Through processes of internal and external cooperation, to teach and to train agricultural scientists and technologists as well as scientific agriculturists; and

To generate and to transfer through outreach activities, alternative agricultural technology, management and policy options,

For the benefit and development of Caribbean Society."

However,no budgetary provisions are made for research and those for teaching and training are now drastically reduced.

1.5 Internal Cooperation

Internal, inter-faculty cooperation is pursued with four St.Augustine-based faculties for undergraduate teaching and postgraduate training as follows:

For undergraduate teaching in Technology and Management-oriented Degrees for:

- B.Sc. General Agriculture;
- B.Sc. Crop Production;
- B.Sc. Livestock Production; and
- B.Sc. Agribusiness Management,

assistance is obtained from the Faculties of Engineering for Food Technology, Medical Sciences for Veterinary Medicine, Natural Science for Chemistry, and Social Sciences for Economic and Agribusiness Management. In turn, the Faculty of Agriculture teaches the Natural Science B.Sc. Botany curriculum, as well as biology and agriculture courses for B.Sc. Agricultural Engineering students, livestock production courses for Veterinary Medicine students and agricultural economics for Social Science students.

For postgraduate training, in one-year Technology-oriented Degrees for:

- M.Sc. Crop Protection; and
- M.Sc. Tropical Commodity Utilization,

cooperation is pursued with the Faculty of Engineering for food technology training. For postgraduate research training for M.Phil and Ph.D. Degrees, offered by each of the six Departments and for research and outreach activities in extension and continuing education, internal cooperation is pursued through inter-departmental and interdisciplinary programmes involving all Departments in the Faculty of Agriculture. Inter-faculty cooperation with the four Faculties with which collaborative mechanisms have been established is also pursued, as appropriate.

1.6 Faculty of Agriculture

The Faculty of Agriculture pursues external cooperation with a wide variety of institutions and agencies both within and outside of the Region, towards effecting its mission. The international cooperation linkages are detailed in 5.0 - 5.6. Existing regional cooperative linkages are outlined below in relation to the major operational thrusts of the Faculty mission.

- Undergraduate Teaching

o Ministry of Agriculture, Land and Marine Resources (MALMR) of Trinidad and Tobago for Soils, Animal Nutrition and Forestry.

o Caribbean Food and Nutrition Institute (CFNI) for Food and Nutrition.

o Private agribusiness firms and farms for practical exposure.

- M.Phil & Ph.D. Training and Research

o CARDI, JARP (Jamaica), Ministries of Agriculture in St. Kitts, St.Lucia, St.Vincent, Dominica, Trinidad, Jamaica.

- Outreach, including Extension and Continuing Education (CEPAT)

o All CARICOM Ministries, IICA, CARDI, ADCU/TROPRO, CFC, CDB, CATCO, AVT, WINBAN, UWI/OUS, BDF among others (Appendix 1).

In all, some 64 agencies, institutions and Ministries of Agriculture in the CARICOM Region (Annex 1) have collaborated with the Faculty of Agriculture in mounting short-course training in CEPAT (Annex 2).

2.0 WORK PROGRAMMES IN AGRICULTURAL TECHNOLOGY, RESEARCH AND DEVELOPMENT

2.1 Formulation of Work Programmes

The Faculty of Agriculture has formulated work programmes in agricultural technology, research and development in five major areas. These are:

a) Natural Resource Management;
b) Commodity Improvement and Development;
c) Policy Evaluation and Human Resource Management;
d) Postgraduate Training; and
e) Outreach.

Interdepartmental and interdisciplinary research, development, service and outreach programmes have been pursued in each of these areas as follows:

a) Natural Resource Management Research

- Soils Programme
- Land and Water Management Programme
- Environment and Forest Ecology Projects
- National Herbarium of Trinidad and Tobago (NAHOTT)

b) Commodity Improvement and Development Research

- Cocoa Research Programme
- Cereals and Other Grains Programme
- Grain Legume Programme
- Horticulture Programme
- Root Crop Programme
- Plant Biotechnology Programme
- Livestock Programme

c) Policy Evaluation and Human Resource Management Research

- Agricultural Economics Programme
- Agricultural Extension Programme

d) Postgraduate Training

- M.Sc., M.Phil and Ph.D. Degrees

e) Outreach

- Extension - CAEP/AREP
- Continuing Education - CEPAT

Highlights of the Faculty's work in these programme areas are outlined below:

2.2 Natural Resource Management

Soil Survey and Land Use:
- Soil survey and land capability of Caribbean soils.

Soil Management:
- Fertilizer recommendations for soil/crop-specific locations;
- N-economy of fertilizer use in tropical soils;
- Organic matter chemistry and technology;
- Soil tillage requirements; rehabilitation of degraded land.

Soil Biology and Rhizobium Technology:
- Rhizobium and soil-based N-fixation technology for Cajanus and Vigna species.

Land and Water Management:
- Water requirement and irrigation protocol for banana in Saint Lucia;
- Soil management for erosion and soil loss control.

Biodiversity Forest Ecology and Environmental Studies:
- Management of the NAHOTT;
- Ecology of, and management of, natural forests and Nature Reserves in Trinidad; and
- Vegetation dynamics in abandoned quarry sites in Trinidad.

2.3 Commodity Improvement and Development

2.3.1 Crop Science and Technology

Crop Physiology:
- Growth, development and tuberization in tropical root crops and flowering in tropical grain legumes and Xanthosoma species.

Crop Breeding and Improvement:
- Breeding of new varieties of Cajanus, Vigna and Zea (sweet corn) and selection of Dioscorea, Ipomoea, Manihot and Xanthosoma varieties;
- Maintenance description and distribution of cocoa, pigeon pea and sweet potato germplasm.

Crop Biotechnology:
- Formulation of protocols for micropropagation of tropical ornamental, root crop, banana and fruit tree species;
- Somaclonal selection of disease-resistant lines of sugarcane and banana.

Agricultural Engineering and Agronomic Practice:
- Design of improved practices for cultivation of selected tropical root crops, cereal, grain legume and vegetable species;
- Fabrication of tropical root crop harvesters.

Crop Protection:
- Chemical and biological technology for pest, disease and weed control in tropical root crop, legume, cereal, vegetable and tree crop species.

Postharvest Technology:
- Gibberellic Acid Technology for yam tuber storage;
- Humid-medium storage of cassava tubers;
- Systems analysis and technology for tomato and hotpepper handling and storage.

2.3.2 Livestock Science and Technology

Livestock Physiology and Nutrition:
- Mineral requirements for productivity in small and large ruminants.

Livestock Breeding and Improvement:
- Cross breeding protocol for hairsheep;
- Comparative evaluation of Holstein and Jamaica Hope dairy cattle;
- Small scale rabbit production.

Livestock Diseases:
- Tick-borne disease control in cattle.

Livestock Feeds and Husbandry:
- Sugarcane, bagasse and rice-straw-based ruminant feed technology;
- Technologies for improved livestock performance based on sugarcane feeds (with Sugarcane Feeds Centre).

2.4 Policy Evaluation and Resource Management

Policy Studies:
- Policy studies on subsidies and crop insurance for Trinidad and Tobago;
- Policy and management studies on a pension scheme for farmers in a Commodity Association;
- CARICOM Food and Nutrition Programme.

Agronomic and Agribusiness Studies:
- Agroeconomic evaluation of tropical root crop cultivation in the CARICOM Region;
- Pre-investment Agribusiness Profiles for selected vegetable commodities, based on improved technologies.

Farm and Home Management Studies:
- Record keeping protocol for management of the farm/home enterprise among farmers in the Eastern Caribbean States (ECS).

Agricultural Extension Institution Building:
- Formulation and introduction of improved Extension professional practice and Extension Institution Building in the ECS.

Agricultural Extension Methodology:
- Social structure and extension approaches;
- SONDEO technology in the Caribbean.

2.5 Postgraduate training

The Faculty of Agriculture effects most of its programme of agricultural technology research, through postgraduate student trainees who read for M.Sc., M.Phil and Ph.D. degrees in Natural and Social Science and Technology and Management-oriented disciplines, as outlined above. This approach, which combines human resource development and technology and management skill generation and transfer in the same institutional programme, is the major advantage of agricultural technology research and development in Universities.

Over the period 1960-1992, the Faculty trained some 280 postgraduate students from the Caribbean, Africa, Asia, the South Pacific and Latin America.

2.6 Outreach

Publications:
- Seventy years of publication (36 ICTA and 24 UWI) of the International Journal of Tropical Agriculture. Publication of Agricultural Extension Newsletter and Proceedings of Conferences and Workshops.

Annual Agricultural Extension In-Service Training Courses:
- Twenty five years of annual courses for the Leeward and Windward Islands have been completed.

Caribbean Agricultural Extension Project (CAEP):
- Ten years of extension institution building and five years of research/extension consolidation in AREP in the OECS have been accomplished;
- Conduct of SONDEOs in the ECS and in counties in Trinidad.

Continuing Education Programme in Agricultural Technology (CEPAT):
- 43 regional and national short courses in a range of areas of agricultural technology and management for some 900 CARICOM participants (Appendix 2) have been mounted.

3.0 COMPARATIVE AREAS OF INSTITUTIONAL STRENGTHS

3.1 Areas of Institutional Strength

The comparative areas of institutional strengths in the Faculty of Agriculture are outlined under the following headings:
- Education and Training;
- Research and Development; and
- Outreach and Continuing Education

3.2 Education and Training

In the area of education and training the Faculty's comparative strength is in the area of Postgraduate training, linked to technology and management skill generation. This is achieved by locating students within institutional programme areas, as well as by inter-disciplinary definition of research projects and supervision of research operations. Postgraduate students from some 34 countries, worldwide, have been trained at UWI.

3.3 Research and Development

Comparative strengths in the area of research and development include:

- Soil classification, soil management and land capability;
- Crop-Soil-Water relations;
- Plant tissue culture and micropropagation;
- Crop physiology and improvement of tropical root crops, grain legumes and cocoa;
- Tropical root crop and grain legume production;
- Sheep breeding and selection;
- Ruminant nutrition, feeds and feeding;
- Sectoral commodity policy studies; and
- Agricultural extension methodology formulation.

3.4 Outreach and Continuing Education

The areas of strength in outreach and continuing education are in:

- International and regional publications;
- Agricultural Extension institution building in public and private sectors;
- In-service training for frontline extension officers; and
- Mobilization of human and institutional resources for Continuing Education programming for agricultural development.

3.5 University Service

In the tradition of university service, the University of the West Indies is committed to the global propagation of acquired knowledge through mechanisms for:

- international and regional publication of scientific papers;
- hosting of conferences, seminars and workshops;
- exchange of professional, academic and technical staff;
- training of postgraduate students; and
- apprenticeship of post-doctoral fellows.

These mechanisms are also areas of comparative institutional strength at UWI as described in the section on current International Cooperation Linkages. Accordingly, the Faculty will be interested in:

- Sharing publications by staff and postgraduate students and exchange of journals for its international Journal "TROPICAL AGRICULTURE";

- Accommodating Latin American participants at conferences, seminars and workshops sponsored by the Faculty;

- Exchange of professional, academic and technical staff with Latin American institutions;

- Training of Latin American postgraduate students, through cooperation with the Faculty of Arts and General Studies for English Language training; and

- Apprenticeship of postdoctoral fellows in the areas of comparative institutional strengths listed above.

4.0 INSTITUTIONAL CONSTRAINTS

4.1 The St. Augustine Campus and the Faculty of Agriculture, in particular, are experiencing a period of financial stringency, which limits the efficacy of all of its programmes. This limitation is the major general institutional constraint in the Faculty. Accordingly, specific constraints in individual programmes can be addressed through inter-institutional cooperation, only in-so-far as the cooperation addresses the general constraint of financial stringency.

4.2 Such inter-institutional cooperation mechanisms include, for example:

- funding of Spanish summaries and/or full Spanish translation in TROPICAL AGRICULTURE for Latin American distribution; and/or

- purchase of TROPICAL AGRICULTURE for distribution to institutions in Latin America;

- provision of support for reciprocal attendance of Caribbean and Latin American scientists at conferences in both regions (here particular attention is drawn to the September 1994 Conference on Advances in Tropical Agriculture in the 20th Century and Prospects for the 21st : TA 2000, which will celebrate 70 years of publishing TROPICAL AGRICULTURE);

- provision of support for exchange attachments of academic, professional and technical staff and students in Caribbean and Latin American Institutions;

- provision of support for Latin American and Caribbean students to pursue postgraduate degrees in the University of the West Indies, Faculty of Agriculture and in Latin American Universities, respectively; and

- provision of support for postdoctoral fellowships for Latin American and Caribbean scientists.

4.3 In St. Augustine-based exchange programmes, the real cost of the institutional exchange mechanisms must be considered because of the weakened infrastructural provisions in individual programmes for field and laboratory work, and technical and administrative support staff in the Faculty of Agriculture. In Latin-American-based programmes, institutional support for staff and postgraduate student training in the following areas will be desirable:

- Agroforestry and Watershed Management;
- Plant and Animal Biotechnology;
- Floriculture and Pomology;
- Small and Large Ruminant Improvement; and
- Agribusiness Management.

5.0 CURRENT INTERNATIONAL COOPERATION LINKAGES

5.1 The Faculty of Agriculture has maintained international cooperation linkages with institutions in the following areas:

5.2 Undergraduate Training

Exchange of students and inter-institutional accreditation of courses with the University of Wisconsin.

5.3 Postgraduate Training

Training of postgraduate students from Ministries of Agriculture, Universities and Research Institutes in East and West Africa, the South Pacific and asia, as well as Australia, USA and Canada.

Inter-institutional collaboration for postgraduate training at M.Sc., M.Phil and Ph.D. levels in:

- Plant tissue culture and distance education with Wye College, London;

- Crop Protection with the Imperial College of Science and Technology in London;

- Crop Production with CARDI (Barbados, Dominica) and with Ministries of Agriculture in Trinidad, Jamaica, St.Kitts and St. Vincent and with the Jamaica Agricultural Research Programme (JARP);

- Soil Science with WINBAN and CARDI (St. Lucia), JARP, Ministries of Agriculture in Jamaica and Belize, ORSTOM (French West Indies), Institute of Soil Science, University of Hamburg, Department of Soil Science, Reading University and Department of Agronomy, University of Illinois;

- Caribbean agricultural development with the University of the French West Indies.

5.4 Research and Development

Research and development can be listed under the following headings:

- Research in the postgraduate programmes listed above;
- Yam and breadfruit research with the Jamaica Agricultural Research Programme (JARP);
- White potato and aroid research with the Ministry of Agriculture, St. Kitts and Dominica;
- Mango, onion and banana research with CARDI;
- Tissue Culture research with NIHERST;
- N-economy of tropical soils with a University in Germany and a Research Institute in Israel;
- Economics of Sustainable Agriculture with CARDI and the University of Florida.

5.5 Conferences and Workshops

Conferences and workshops that have taken place include:

a) Biennial Agro-economic Conference with the Caribbean Agro-economic Society and CARICOM Ministries of Agriculture;

b) Meetings of the Regional Agricultural Research and Extension Coordinating Committee (RARECC) with CARICOM Ministries of Agriculture;

c) Meetings of the Association of Agricultural Economists of Latin America and the Caribbean (ALACAE).

5.6 Outreach

Extension training has been undertaken with all Ministries of Agriculture in the ECS, CARDI and the Universities of Illinois, Minnesota and Wisconsin.

CEPAT has initiated Training with all CARICOM Ministries of Agriculture and some 78 institutions and organizations in the Region (Appendix 1), including FAO (PROCAPLAN) (Santiago), a

Private Company in Florida, INIAP, CIP, PAHO, IICA, etc.

Funding for activities in these linkages is provided by international, regional and national agencies, Ministries of Agriculture, regional and national institutions and private firms and individuals.

6.0 SPECIFIC NEEDS FOR INTER-REGIONAL COOPERATION

6.1 The UWI St.Augustine Campus can participate in programmes for inter-regional cooperation for agricultural development on the basis of resources primarily in the Faculty of Agriculture, but also in Faculties of Engineering, Medical Sciences, Natural Sciences and Social Sciences. The most urgent specific need for inter-regional cooperation is assistance and resources to implement a formal mechanism for inter-faculty cooperation for agricultural development. The mechanism for such cooperation suggested by the Faculty is ICTAFFF.

6.2 The IICA Agenda for Latin American Cooperation for Agricultural Development names the UWI as the lead agency for sustainability and biotechnology and as an institutional resource for:

- Vegetable crops
- Small ruminants
- Macro-economic policy
- Machinery
- Training

The specific needs for inter-regional cooperation in each of these areas are listed in the following sections.

6.3 Sustainability

UWI's Faculty of Agriculture has had discussions with University of Florida Agricultural Economists and CARDI scientists on the sustainability of Caribbean agriculture. Three papers have resulted from these discussions, including the outlines of a methodology for studying sustainability. In order to assume responsibility as a lead institution, the specific need is for resources for further discussion and implementation of cooperative and interdisciplinary projects in the Latin American and Caribbean region.

6.4 Biotechnology

In the area of biotechnology, the Faculty had developed an ongoing plant biotechnology and tissue culture programme which can

be used for genetic resource management. However, the Faculty's capability in livestock embryo transfer is minimal and will need to be improved through staff training in order for the institution to be effective as a lead agency in this area. Other specific needs for cooperative institutional leadership in this area include training and resources for the establishment of genetic engineering technologies, including:

- useful gene identification;
- amino acid sequencing in protein;
- DNA production;
- gene transfer mechanisms;
- testing of transgenic plants and animals; and
- agro-industrialisation of biotechnological protocols and materials.

Collaboration with scientists in the Faculties of Engineering and Medical Sciences will greatly increase the effectiveness of the envisaged projects in this area.

6.5 Vegetable and Small Ruminant Germplasm Exchange

In order to fulfil responsibilities for germplasm exchange in vegetables and small ruminants, the Faculty would need resources to maintain and expand existing collections and to establish protocols for multiplication and distribution.

6.6 Reproductive Physiology of Small Ruminants

The Faculty has acquired a post of Reproductive Physiologist and it is envisaged that the incumbent would establish a cooperative programme in this area. However, resources and postgraduate studentships will be needed for research operations, if the incumbent scientist is to be effective. Valuable assistance can be given by the School of Veterinary Medicine in this respect.

6.7 Production Economics of Small Ruminants

In the area of production economics, projects for small ruminants have been implemented by agricultural economists in the Faculty, but the expansion of these projects will need additional resources in terms of research fellows and postgraduate students.

6.8 Macro-economic Policy Studies

In the past, the Faculty of Agriculture has conducted many policy studies. However, areas suggested in the Agenda viz. a) Impact of macro-economic policy on sustainability, and b) Macro-

economic policy for structural adjustments, although critical for the agricultural sector, will need the expertise of macro-economists from the UWI Faculty of Social Science and our collaborators in the University of Florida.

The specific need, here, is for resources to establish the inter-institutional linkages necessary for implementing these programmes, as well as, for post-doctoral fellowships and postgraduate studentships for projects for these important areas of work.

ANNEX 1

TABLE 2: ORGANISATIONS SUPPORTING THE ATTENDANCE OF PARTICIPANTS
(July 1990 - December 1991)

Organisation	Participants Supported
Canada Training Awards Project (CTAP)	142
Inter-American Institute for Cooperation on Agriculture (IICA)	64
Caribbean Agricultural Trading Company (CATCO)	34
Agriculture Diversification Coordinating Unit Indies Tropical Produce Support Project (ADCU/TROPRO)	30
Caribbean Development Bank (CDB)	23
Commonwealth Fund for Technical Cooperation (CFTC)	21
Caribbean Food Corporation (CFC)	12
Agriculture Venture Trust (AVT)	11
International Potato Centre (CIP)	10
Barclays Development Fund (BDF)	7
Caroni (1975) Ltd.	6
Food and Agriculture Organisation (FAO)(incl.Procaplan)	6
Caribbean Agricultural Research and Development Institute (CARDI)	4
Caribbean Farmers Development Company	4
Central Marketing Agency - T&T	4
Agricultural Development Bank - T&T	3
Barbados Marketing Corporation (BMC) - Barbados	2
Grenada Cocoa Board - Grenada	2
WINBAN	2
Dominica Export Import Agency (DEXIA)	2
World Health Organization/Pan American Health Organisation	2
Small Farmers Association - Antigua	1
Barbados Agricultural Society	1
St. Kitts Marketing Corporation	1
Sugarcane Feeds Centre - Trinidad	1
National Farmers Association - Saint Lucia	1
European Development Funds (EDF)	1
Antigua and Barbuda Development Bank (ABDB)	1
Trinidad and Tobago Oil Co. Ltd.	1
Palo Seco Agricultural Enterprises	1
Government of Trinidad and Tobago	8
Government of St.Vincent and the Grenadines	3
Government of Grenada	1
Government of Barbados	1
Government of Montserrat	1

REGIONAL COURSES - 1990

1. July 1-21 (Trinidad)
   Management of Ruminant Livestock under Intensive\ Production Systems (17 participants)
   Collaborator: Sugarcane Feeds Centre
   Course Coordinators: Mr. Floyd Neckles (SFC) and Dr. Fayez G. Youssef (UWI)

2. July 16-27 (Trinidad)
   Specialised Course in Agricultural and Rural Development Planning using the CAPPA Computerized System (15 participants)
   Collaborator: FAO/ITALY PROCAPLAN
   Course Coordinators: Dr. Ranjit Singh (UWI) and Dr. Lloyd Rankine (UWI)

3. Sept. 9-22 (St. Lucia)
   Diagnosis and Control of Pests, Diseases, Weed Problems and Nutrient Disorders in Selected Crops (25 participants)
   Collaborators: IICA and Ministry of Agriculture, Lands, Fisheries and Cooperatives
   Course Coordinator: Dr. Gene V. Pollard (UWI)

4. Sept.10-21 (Trinidad)
   Monitoring Pests and Diseases of Crops and Livestock in the Caribbean (Second Regional CARAPHIN Course) (35 participants)
   Collaborator: IICA

5. Nov. 19-12 (Trinidad)
   Abattoir Facilities, Meat Handling and By-Product Utilization (25 participants)
   Collaborator: Sugarcane Feeds Centre
   Course Coordinators: Mr. Floyd Neckles (SFC) and Dr. Fayez G. Youssef

REGIONAL COURSES - 1991

6. Jan. 21-25 (St.Kitts)
   Improved Technologies for White Potato Production in the Eastern Caribbean (23 participants)
   Collaborators: CARDI and Ministry of Agriculture, Land, Housing and Development
   Course Coordinators: Dr.Fritz Elango (UWI) and Mr.Jerome Thomas (Min. of Agriculture)

7. Feb. 17-23 (St.Vincent)
   Improved Technologies for the Production of Sweet Potato in the Caribbean (24 participants)
   Collaborators: CARDI, International Potato Centre and Ministry of Agriculture
   Course Coordinators: Dr. Lynda Wickham (UWI) and Dr. Murali Rao (CARDI)

Annex 2 (cont.)

8. Mar. 18-28 (Trinidad)
Tropical Floriculture Production for Export
(24 participants)
Course Coordinator: Dr. Dyanand Raj Kumar (UWI)

9. Mar. 25-28 (Barbados)
New Approaches for the Production of Onions for the Caribbean (18 participants)
Collaborators: CARDI, Ministry of Agriculture, Food and Fisheries, and Barbados Sugar Industries Ltd.
Course Coordinators: Prof. Lawrence Wilson (UWI) and Ms. Frances Chandler (CARDI)

10. Apr. 15-27 (Barbados)
Agribusiness: Development and Management of Small and Medium-Sized Enterprises in the Caribbean
(19 participants)
Collaborator: Agricultural Management Consultants
Course Coordinators: Dr. Ranjit Singh (UWI)
Dr. Lloyd Rankine (UWI) and Mr. James Nurse (AMC)

11. May 6-11 (Trinidad)
Pesticide Safety (including Application Technology)
(19 participants)
Collaborator: CARDI
Course Coordinator: Dr. Richard A.I. Brathwaite (UWI)

12. May 6-17 (Trinidad)
Tropical Fruit Crop Production for Export (15 participants)
Course Coordinator: Dr. Laura Roberts-Nkrumah (UWI)

13. Jul. 1-12 (Trinidad)
Monitoring Pests and Diseases of Crops and Livestock in the Caribbean (3rd Regional CARAPHIN Course)
(29 participants)
Collaborator: IICA

14. Jul. 1-7 (Dominica)
Improved Post-harvest Techniques for Tropical Fruits and Vegetables (28 participants)
Collaborators: OECS/ADCU-TROPRO; CARDI, DEXIA and the Ministry of Agriculture
Course Coordinators: Dr. Lynda Wickham (UWI), Dr. Stephen New (TROPRO) and Ms. Hannah Clarendon (DEXIA)

15. Jul. 7-27 (Trinidad)
Intensive Small Ruminant Production (15 participants)
Collaborator: Sugarcane Feeds Centre
Course Coordinators: Dr. Gary Garcia (UWI) and Mr. Floyd Neckles (SFC)

16. Sept. 2-20 (Trinidad)
Abattoir Facilities, Meat Handling and By-Product Utilization (15 participants)
Collaborator: Sugarcane Feeds Centre
Course Coordinators: Dr. Gary Garcia (UWI) and Mr. Floyd Neckles (SFC)

Annex 2 (cont.)

17. Sept. 9-16 (Trinidad)
Export Market Requirements for Fruits, Vegetables and Ornamentals (11 participants)
Collaborator: Export Development Corporation
Course Coordinators: Mr. Majeed Mohammed (UWI) and Mr. Anthony Pantaleon (EDC)

18. Oct. 20-31 (Trinidad)
Macro-Microeconomic Dimensions of Sectoral Planning and Policy Formulation in the Caribbean: Agriculture and Tourism (23 participants)
Collaborator: Caribbean Development Bank and IICA
Course Coordinators: Dr. Lloyd Rankine (UWI), Mr. Cecil Miller (CDB) and Dr. Dowlath Budhram (IICA)

19. Nov. 24-30 (Tobago)
The Responsibilities and Functions of Board Members of Commodity/Farmer Organisations (26 participants)
Collaborator: Faculty of Social Sciences
Course Coordinators: Prof. Lawrence Wilson (UWI) and Dr. Lloyd Rankine (UWI)

REGIONAL COURSES - 1992

20. Jan. 19-31 (Trinidad)
Nursery Management and Plant Propagation Techniques (16 participants)
Collaborator: Ministry of Food Production and Marine Exploitation (MFPME) and Canada Training Awards Project (CTAP)
Course Coordinators: Dr. Laura Roberts-Nkrumah (UWI) and Mrs. Gloria Simon (MFPME)

21. Mar. 15-22 (Jamaica/ Miami)
Export Marketing of Fresh Agricultural Produce (17 participants)
Collaborator: Agricultural Development Consultants Ltd.
Course Coordinators: Mr. Majeed Mohammed (UWI) and Mr. Mauricio Rodriguez (AGRIDEC)

22. Mar. 22-27 (Trinidad)
Microcomputers in Agricultural Research (11 participants)
Collaborator: CARDI
Course Coordinators: Dr. Isaac Bekele (UWI) and Mr. Bruce Lauckner (CARDI)

23. Apr.26-May 2 (Trinidad)
Improved Technologies for the Production of Vegetables in the Tropics (9 participants)
Collaborator: CARDI
Course Coordinator: Dr. Richard A.I. Brathwaite (UWI)

Annex 2 (cont.)

24. May 10-15 (St.Lucia)
The Handling and Marketing of Agricultural Chemicals
(9 participants)
Collaborator: CARDI
Course Coordinator: Dr. Richard A.I. Brathwaite (UWI)

25. Jun. 14-19 (Barbados)
Diagnosis of Pest Problems (Insects, Mites, Diseases and Weeds) in Selected Crops (13 participants)
Collaborator: CARDI
Course Coordinator: Dr. Gene V. Pollard (UWI)

26. Jun. 14-26 (Trinidad)
Establishment and Management of Orchard Crops
(17 participants)
Collaborators: CARDI & IICA
Course Coordinators: Dr. Laura B. Roberts-Nkrumah (UWI) and Dr. Gerald Barbeau (IICA)

27. Jun. 28 to July 10 (Trinidad)
Food and Nutrition Planning (13 participants)
Collaborator: Caribbean Food and Nutrition Institute (CFNI)
Course Coordinators: Dr. Curtis Mc Intosh (CFNI) and Dr. Carlisle Pemberton (UWI)

28. Aug. 10-21 (Jamaica)
Irrigation: Principles and Practices for Caribbean Agriculture (23 participants)
Collaborator: CARDI and National Irrigation Commission
Course Coordinators: Dr. Frank Gumbs (UWI) and Dr. Joseph Lindsay (CARDI)

29. Aug. 16-28 (Trinidad)
Artificial Insemination Technologies for Cattle
(17 participants)
Collaborator: Ministry of Agriculture, Land and Marine Resources
Course Coordinators: Dr. Gustave Borde (MALMR) and Mr. Lawrence Nurse (MALMR)

30. Aug. 24 to Sep. 4 (Trinidad)
Tropical Floriculture Production for Export
(25 participants)
Course Coordinator: Dr. Dyanand Raj Kumar (UWI)

31. Nov. 9-13 (Trinidad)
Production, Utilization and Conservation of Forages for Intensive Ruminant Production (19 participants)
Collaborators: Sugarcane Feeds Centre and Ministry of Agriculture, Land & Marine Resources (MALMR)
Course Coordinators: Dr. Gary Garcia (UWI) and Dr. Francis Davis (MALMR)

Annex 2 (cont.)

32. Nov. 15-20 (Grenada) — **Improved Techniques for the Post-Harvest Management of Tropical Fruits and Vegetables** (27 participants)
Collaborator: OECS/ADCU West Indies Tropical Produce Support Project (TROPRO) and Ministry of Agriculture, Trade, Industry, Energy and Production
Course Coordinators: Mr. Majeed Mohammed (UWI) and Dr. Stephen New (TROPRO)

NATIONAL COURSES - Trinidad and Tobago

1. Jan. 22 to Mar. 13 (1991) — **The Management of Perishables: Key Aspects of Post-Harvest Handling and Marketing** (33 participants)
Collaborator: Central Marketing Agency
Course Coordinators: Dr. Lynda Wickham (UWI) and Dr. Lennox Sealy (CMA)

2. June 3-25 (1991) — **The Handling and Marketing of Agricultural Chemicals** (31 participants)
Collaborator: The Pesticide and Toxic Chemicals Control Board (Ministry of Health)
Course Coordinators: Dr. Richard A.I. Brathwaite (UWI) and Dr. Ronald Barrow (MFPME).

3. Nov.11 to Dec. 3 (1991) — **The Handling and Marketing of Agricultural Chemicals** (31 participants)
Collaborator: The Pesticide and Toxic Chemicals Control Board (Ministry of Health)
Course Coordinators: Dr. Richard A.I. Brathwaite (UWI) and Dr. Ronald Barrow (MALMR)

4. Jun. 1 to July 1 (1992) — **The Handling and Marketing of Agricultural Chemicals** (18 participants)
Collaborator: The Pesticide and Toxic Chemicals Control Board (Ministry of Health)
Course Coordinators: Dr. Richard A.I. Brathwaite (UWI) and Dr. Ronald Barrow (MALMR)

CONTRACTUAL COURSES

1. Nov.22-23 (1990) (St.Vincent) — **Post-Harvest Handling of Tropical Root Crops** (63 participants)
Mounted for: CATCO/ADCU under the USAID-funded TROPRO Project
Course Coordinator: Dr. Lynda Wickham (UWI)

Annex 2 (cont.)

2.	Sept.16-21 (1991) (Barbados)	**Agribusiness: Development and Management of Small and Medium-Sized Enterprises in the Caribbean** (21 participants) **Mounted for:** Caribbean Food Corporation (CFC) and Agricultural Venture Trust (AVT) **Course Coordinator:** Dr. Lloyd B. Rankine (UWI)

3.6 PERSPECTIVE FOR COOPERATION BETWEEN LATIN AMERICA AND THE CARIBBEAN

E. D. Reid, Director, WINBAN R/D, Saint Lucia

1.0 BACKGROUND

The Windward Islands Banana Growers' Association (WINBAN) is a Company limited by guarantee, not having a share capital and registered under the laws of Dominica in 1958. It was, subsequently, registered in the other islands of Saint Lucia, Saint Vincent and Grenada wherein it operates. Its registered office is in Saint Lucia where it is also headquartered.

The Articles of the Company places responsibility on WINBAN, as an organisation, inter alia, "to promote, foster and encourage and institute measures for the well being of the banana growers in the islands of Dominica, Saint Lucia, Saint Vincent and Grenada and to protect their interests and further the objects of the Banana Growers' Association in the respective island; to take steps to improve cultivation, production, yield, fruit quality, etc., of banana through appropriate research and development activities; and to represent the common interest of the Island Associations in dealing and negotiating with buyers of banana produced by the Associations."

To administer the affairs of the Banana Industry in the Windward Islands, WINBAN, as an organisation, consists structurally of five divisions;

a) An Administrative Division responsible for all corporate aspects; personnel management and development, and negotiations/liaison with worker representatives;

b) A Finance and Accounting Division responsible for the controllership and treasureship function;

c) An Economic and Statistics Division responsible for the collection, analysis and interpretation of economic data in order to provide guidance to the Industry; and the preparation, monitoring and evaluation of projects;

d) A U.K.-based Division responsible for monitoring of market conditions and the marketing arrangements with buyers of Windward Islands' bananas, and for general representation of the Windward Island Banana Industry at international forums concerned with bananas;

e) A Research and Development Division responsible for defining, analysing, researching and developing/ providing practical cost-effective solutions to problems confronting the Industry in the areas of production, diseases and pests and fruit quality.

The individual island Banana Growers' Associations are co-operative type organisations which co-ordinate and administer the production and export of banana. They also provide a wide range of services to the banana growers, including a regular supply of inputs, leafspot disease control and extension. In an Industry comprising of well over 23,000 farmers, the majority of which may be classified as small, these services are best provided by such organisations. The services provided by the Associations, as well as WINBAN, are therefore, vital to the sustenance of the Banana Industry.

WINBAN's activities are financed primarily through cess contributions from the member Associations and, to a much lesser extent, through technical assistance from various agencies.

2.0 WORK PROGRAMME IN AGRICULTURAL TECHNOLOGY RESEARCH AND DEVELOPMENT

The Banana Industry has, in recent years, been confronted by a number of issues which threaten its long term viability and, indeed, its survival in the short term. These include the following:

- The inconsistency of Windward Islands banana quality in the market place.

- Farm productivity has been shown to be among the lowest within the banana producing world. The average yield of farms in the Windward Islands is 6-8 tonnes per acre, considerably lower than in nearby Martinique (12 tonnes/acre) and in Central America (17 tonnes/acre).

- The level of use and cost of inputs have been increasing over the years. Presently, the cost of these represents some 30 % of the FOB cost of the product. With the increasing level of agrochemical usage there is much concern for their effect on the soil's chemical, physical and biological status.

- Banana production is a labour intensive activity. Competition from other sectors of our economies, has, apparently, reduced the labour force available to agriculture and sharply increased labour costs to banana producers. The labour input, presently, accounts for some 60% of production costs, compared to less than 30% in Central America. Thus, labour use optimisation and its substitution with resources that are more

readily available, are clearly desirable strategies for the Banana Industry.

- Banana production is severely affected by Yellow Sigatoka and is threatened by Moko (now present only in Grenada) and Black Sigatoka (now present in Cuba). These diseases, especially the last two, have the potential for destroying the Industry.

In addressing these issues, the Research and Development Division has identified two major areas of concern, one relating to the quality of bananas, and the other, to the cost of producing these bananas. It has, therefore, developed a number of technology generation and development activities within these areas to enable producers and organisations to meet the quality and productivity goals required to sustain the Banana Industry. The broad objectives of the Research and Development Division activities include the following:

a) To increase marketable yields per hectare through improvements at all stages of production;

b) to enhance the competitiveness of the Industry by evaluating alternative measures to reduce unit cost of production, and to improve the level of productivity and fruit quality;

c) to develop a strategy to more effectively manage the supply of high quality fruit to the market, consistent with demand pattern;

d) to explore and identify appropriate systems to effectively reduce the incidence of crop loss due to pests and diseases; and

e) to develop forecasting models to achieve greater optimisation of field operations, particularly in terms of yield and the level of pest and disease infestation.

These activities form the components of two research and development programmes, namely:

A FRUIT QUALITY PROGRAMME which addresses objectives a), b) and c) and comprises projects which target the main quality defects affecting Windward Islands bananas. Activities within each project address factors giving rise to increased incidence of the defect, investigate measures to control these and develop relevant practices and/or procedures. In addition, facilities for the processing, handling, storage and transporting of fruit are being reviewed and/or investigated in ensuring that the quality of the product is maintained from the field to market. The delivery of recommended practices and procedures to farmers is assured through the implementation of a technology transfer component of each project.

A FARM PRODUCTIVITY PROGRAMME which addresses objectives a) - e) and the projects comprising this programme target the main issues affecting farm productivity and sustainability including the quality of plant nutrition, pest and disease control, the quality of the root/soil environment, management of the crop and farm and the selection of cultivars suited to Windwards' conditions.

In addition, procedures to forecast production, manage timing of crop, and manage farms effectively, are being investigated. The overall aims are to increase marketable yield per acre on a sustainable basis, reduce unit cost of production, and reduce the level of field losses. Each project includes activities to deliver recommended technologies to extension agents and farmers.

3.0 COMPARATIVE AREAS OF INSTITUTIONAL STRENGTHS

The WINBAN Research and Development Division has had considerable experience in banana technology generation and development. The Division has, over the years, found answers to some critical problems which, if remained unsolved, may have precipitated the collapse of the Industry. Plant nutrition and fertiliser formulation to meet the unusually high demand of bananas for nitrogen and potassium were among the first problems addressed. Extensive field research resulted in the mapping of the soils of the Windward Islands on the basis of the fertiliser requirements for successful banana production and the description of nutrient uptake and distribution in the plant and identification of areas of trace nutrient deficiency.

More recently, activities have targeted the management of increasing acidity and the decreasing base status of the soils. The physical status of Windward Islands' soils and its impact on crop productivity, fruit quality and susceptibility to post harvest diseases are, currently, being researched.

Early agronomy research was directed to determining approximate growing conditions of banana in the Windward Islands. Thus, plant spacing and density, pruning and follower setting practices, weed control, and comparative assessment of the three main cultivars, were the main areas addressed. More recent work addresses the effect of various management practices on yield, rate of ratooning and timing of the crop in terms of market demand, and the evaluation of improved varieties of triploid and tetraploid bananas, both with respect to productivity and resistance to the main banana pests and diseases.

Research on plant parasitic nematodes in bananas was pioneered by the Division and the control practices developed continue to the present with the liquid nematicides having been almost totally displaced by granular ones. Testing of available chemicals has facilitated the selection of products effective against both

nematodes and the corm weevil and which may be used with minimum risk under Windward Islands' conditions. The Division has also investigated the effect of the then used nematicide on the chemical properties of the soil and examined the interaction between nematicide and fertiliser in influencing crop yield on different soil types. Current work targets the potential for reducing nematicide use through timing of application based on climatic and diagnostic data, and investigating bio-control agents.

Leafspot disease has been a continuing problem to the Banana Industry. Whereas much of the early control practices were the result of technology transfer from elsewhere, much effort has been expended in adapting these to local conditions. The adaptation of disease forecasting systems to local conditions, which has potential for reducing the number of aerial spray cycles required annually, thereby resulting in substantial savings to the Industry, has been attempted in all the islands. However, some work remains to having such systems fully integrated into the local BGAs' operational activities.

The Division's Leafspot programme has included testing of new fungicides, spray coverage as this relates to droplet size, and the testing of emulsions to reduce on the volume of oil used. The Division also continually monitors for tolerance to the fungicides in use and for the presence of the Black Sigatoka fungus.

Early research in the area of fruit quality was concerned primarily with mechanical injury. With the introduction of cardboard cartons in the seventies, the foam padding used to protect the bunch during transport had to be replaced. The Division developed special plastic boxes to transport dehanded fruit to boxing plants and padded trays to carry bunches. While these technologies offered some protection to the harvested fruit, mechanical injury remained a major defect.

The move to cartons also focused attention on crown rot and fruit scarring. The Division, consequently, carried out a series of investigations on Crown Rot and on control techniques resulting in recommendations to the Industry on cost effective control practices. Similarly, work on fruit scarring led to recommendations for the control of Thrips, and other fruit scarring pests.

The continuing problem with mechanical injury led to the development of "field packing", a practice involving the processing and packing of fruit in the field. This resulted in a minimum of handling of the fruit, thus minimising the risk of mechanical injury. The design of the system such that Crown Rot is adequately controlled, latex staining minimised and the fruit properly packed, has been particularly challenging; the system must be safely used by both small and large producers. However, developments in the market dictated that an alternative system of fruit processing and Crown Rot control be implemented.

The Division has worked along with the BGAs to test and implement an appropriate system which met market requirements, at the individual farm level. Current activities include the continuing development and expansion in the use of the cluster-mini-wet pack method of fruit processing. Nevertheless, the Division is continuing to seek alternative and cost-effective systems of Crown Rot control which are more suitable for use on smaller farms, and which require the use of little or no fungicide.

More recently, the Division has been investigating pre and post-harvest factors likely to influence quality. Work on the epidemiology of the causal organisms in Crown Rot has indicated production and harvesting practices which may reduce the risk of infection. Other ongoing studies seek to relate the field, transport, and storage environment conditions to degradation in quality.

For research and development to be effective, the findings and recommendations must be transferred to and be adopted by farmers. The Division had developed a number of programmes in the seventies and eighties, to accelerate this technology transfer process. The Division provides support to the Associations' extension staff, with educational materials for their extension campaigns. Most of these material are produced by the Division's Communication and Documentation Centre. The Division's technical staff also provide training to the BGAs' field staff and, on occasions, to farmers, on all aspects of banana production.

4.0 INSTITUTIONAL CONSTRAINTS

Notwithstanding the many achievements of the Research and Development Division, its performance has been constrained by a number of factors including:

4.1 Manpower

The Division comprises seven core professional staff, only three of whom are involved in technology generation. Critical areas including soil and water management, sociological research, biometry, entomology, nematology, and pesticides impact research can be pursued only through external collaboration or assistance. The Division also lacks a technology development/transfer specialist and this, seriously, limits its ability to pursue new technology to full adoption at the farm level.

4.2 Facilities

Unavailability of the following facilities has resulted in the Division either being unable to pursue activities of potential

value to the Industry, or having to do so through costly and, at times, inefficient arrangements:

- Pesticides analysis laboratory;
- Soil physics analysis laboratory;
- Plant/fruit physiology laboratory;
- Biotechnology research and development and germplasm multiplication/hardening facilities.

5.0 CURRENT INTERNATIONAL COOPERATION LINKAGES

The Research and Development Division is, presently, involved with the following Organisations/Institutions in one form or another:

5.1 Natural Resources Institute (NRI)

- Provision of expert services in plant pathology, fruit physiology, packaging, biometry, fruit quality research and others on request.
- Development of fungicide concentration monitoring and waste liquor disposal systems.
- Research on biological control of Crown Rot.
- Research on banana rhizosphere.

5.2 Fundacion Hondurena de Investigacion Agricola (FHIA)

- Breeding of hybrids resistant to the main diseases, nematodes and the weevil borer.
- Field testing of promising hybrids.

5.3 Institut de Recherches Sur les Fruits et Agrumes (IRFA) Cameroon Banana Research Institute (CRBP), Catholic University of Louvain, Belgium (UCL).

- Research on banana rhizosphere.

5.4 Caribbean Agricultural Research and Development Institute (CARDI)

- Research on banana production systems.
- Inter-institute Memorandum which provides for easy access of the one to expertise and facilities of the other.
- Plantain research and development.

5.5 University of the West Indies (UWI)

- Research on banana production systems (with CARDI).
- Soils research.
- Research on banana rhizosphere.

5.6 Larenstein Agricultural College

- Research on the relationship between plant growing conditions and Crown Rot.

In addition to the above well-defined activities, there is active networking with these Institutions and with others such as the Jamaica Banana Board, International Network for the Improvement of Banana and Plantain (INIBAP), and the Union of Banana Producing Countries (UPEB).

6.0 SPECIFIC NEEDS FOR INTER-REGIONAL CO-OPERATION

Arising from the constraints highlighted above, the following are the specific needs of the Research and Development Division in improving its capacity to lead the technological development of the Windward Islands Banana Industry:

- Technical co-operation in developing an effective biotechnology research and development unit;

- Upgrading of its soils and water diagnostic and management unit;

- Research into the impact of agri-chemicals and other material on the environment and the sustainability of current banana production systems;

- Identification and development of alternative, value added, banana products;

- Identification and development of suitable crops complementary to bananas;

- Socio-economic research on banana production in the Windward Islands;

- Development of integrated control techniques for the main banana pests; and

- Networking on all aspects of banana production, processing, packaging and marketing.

7.0 SUMMARY

The WINBAN Research and Development Division continues to play a significant role in the technological development of the Windward Islands' Banana Industry. Its current activities are directed, primarily, to improve the international competitiveness of bananas produced in the sub-region by generating, developing and transferring the technologies required to minimise quality defects and improve the cost-effectiveness of production systems.

However, because of the limited resources available from the Industry, it is unable to maintain the complement of staff and facilities required to meet the needs of the Industry. In addressing this gap, the Division has developed a number of collaborative activities with regional and international Institutions. However, it has not been possible to pursue a number of important areas.

It is hoped that through this effort to encourage co-operation between Latin America and the Caribbean, the Division will be able to effectively address most, if not all, of the outstanding areas of concern.

3.7 INTRODUCTION TO AJAX

J. Cummings, Technical Manager, AJAX, Trinidad and Tobago

1.0 BACKGROUND

The company, Ajax Manufacturing and Fabricating Limited, a member of the Neal and Massy Group of Companies, was inaugurated in September, 1990, with its operating foundation based on the experience of the motor vehicle assembly industry and many years of fabrication of precision assembly jigs and fixtures. These items were all built to Japanese specifications for Japanese makes of vehicles.

Given the country's impending trade liberalisation and structural adjustment programmes, it was anticipated that the local automobile assembly industry would die. To utilise the expected excess capacity, management took a decision to diversify into other areas including the agricultural and agro-processing sectors.

The decision to diversify into the food industry was largely influenced by:

(a) The work done by CARIRI in its attempt to develop a local capability in the manufacture of agricultural tools and equipment.

(b) The downturn in the economy and the massive turn to self employment via the agriculture-based cottage industries.

(c) The need for equipment to meet the local scale of production and diverse raw material types.

2.0 ACTIVITIES

The company's present activities include:-

(a) The design and manufacture of machinery and equipment for use in agricultural, agro-processing and industrial production.

(b) The design and/or manufacture of various fabricated products and components.

(c) The provision of all support services related to (a) and (b) above.

(d) Contract manufacturing.

(e) Fabrication of jigs and fixtures for the automobile industry.

Examples of manufactured items specific to the food and agricultural industry are as follows:

- Coconut Dehusker
- Pigeon Pea Sheller
- Rice Thresher
- Batch Dryer for rice, cocoa, cassava, etc.
- Barbecue Pits
- Axial Flow Pumps
- Coconut/Cassava Press
- Urea/Molasses Block Press

A line of food vending and transport trailers was also introduced recently.

Presently most of AJAX's activities have been on the local market with only limited success in the wider CARICOM area. However, the company is now beginning a new marketing thrust into Latin America and the other non-English-speaking territories of the Caribbean.

3.0 STRATEGY FOR THE FUTURE

AJAX's strategy for agriculturally oriented projects to the year 2000 and beyond is to:

(a) Determine a number of flagship products that can be manufactured in large quantities and, thus, take advantage of economies of scale;

(b) penetrate the regional and Latin American markets through a vigorous marketing drive;

(c) continue meeting demands and creating markets for small to medium scale machines for processing and primary agriculture;

(d research the needs of the large scale processors in the country and address them, wherever possible. This has to be done within the limitations of the existing agreements between these large processors and their foreign partners of suppliers;

(e) continue to develop its human and material resources; and

(f) continue to liaise with lending agencies regarding the types of projects preferred by them and for which loans have been given.

It is hoped that this strategy will allow AJAX to fulfill all its objectives and develop into a successful manufacturer of agricultural equipment.

4.0 FACILITIES

As mentioned earlier, AJAX evolved out of the automobile assembly industry. AJAX is still located within the assembly plant which has facilities as described in the attached plant description (Annex 1). AJAX, therefore, offers excellent physical facilities to any organisation wishing to enter into a joint venture or other mutually agreeable relationship.

5.0 CONCLUSION

AJAX is still in its early stages of development. It is, therefore, too soon to define a clear philosophy especially given the rapid changes in the world environment.

While a tentative strategy for the future has been outlined, there will be a need for close monitoring, and possibly, constant revision in response to the demands of the market place; the formation of trading blocs and the policies of the Government with its programme of structural adjustment and trade liberalisation.

PLANT DESCRIPTION

1.0 LAYOUT

Total Area (acres)		
Site Area	-	50.0
Enclosed Plant Areas	-	29.5
TOTAL		79.5
Covered Area (sq. metres)		
Body Assembly	-	10,292
Paint Shop	-	5,016
Passenger Final Assembly	-	10,412
Commercial Final Assembly	-	5,320
Employee Facility	-	1,230
Other Covered Areas	-	2,900
TOTAL		35,170

The "T" shaped layout of the main Assembly Buildings gives maximum flexibility and accessibility for materials handling and traffic which is facilitated by a network of heavily paved roadways. Main open storage area is 13,000 square metres of which 30% is paved. All buildings are open sided allowing excellent working environment.

2.0 UTILITIES

2.1 Electricity

Power supply from T & TEC (national network) is 12 KV which is broken down to 415V and further to 110V for distribution throughout the Plant. Three Generators of 1.25 MVA each provide reliable standby for main Plant operations.

- One 650 KVA Generator for Paint Shop - standby
- One 125 KVA Generator for Office Services - standby

2.2 Compressed Air

- Five Compressors, each rated 400 cfm at 125 psig.
- Three Compressors each rated 72.7 cfm at 200 psig.

Air is distributed throughout the Plant. Dried air is supplied to Paint Shop only.

2.3 Water

- Fresh water storage - 150,000 gallons with Fire Reserve of 50,000 gallons.

- Mains water supplied from WASA System through 4" lines.

- Water distributed throughout the Plant.

3.0 FUEL

- Gasolene	-	One 5,000 gal tank.
	-	One 1,000 gal tank.
- Diesolene	-	One 1,000 gal tank.
	-	Two 500 gal tanks.

Natural gas supply from mains through 4" line at 320 psig. Consumption up to 350,000 SCF per day. LPG storage of one 10.7m tank at 150 psig and two 3.6m tanks at 100 psig.

4.0 MAIN FACILITIES

4.1 Body Assembly Shop

- Welding Equipment
- Suspended Spot Welders
- Heavy Duty Arc Welders (375A)
- Mig Welders
- Mig Brazers
- Stud Welding Equipment
- Oxy-Acetylene Gas Welders

4.2 Machine Shop Equipment

- Three Lathes
- Milling Machine
- Radial Drill Press
- Shaper
- Bench Grinders
- Drill Press
- Sheet Bender
- 1/2" Hypertherm Cutting Machine
- Bandsaw
- Numerous Small Tools
- Work Tables

4.3 Paint Shop

- Electrophoresis Plant capable of pretreatment and exposed-metal priming (including normally unseen and inaccessible surfaces) and Baking.

- Electroprime capable on any items under one ton weight and 4.8m length x 2.2m width x 1.9m height.

- Two conveyorised air controlled Paint Booths with natural gas fired ovens.

  (i) Electrostatic Prime Booth.
  (ii) Colour Booth capable of painting five colours simultaneously.

5.0 PASSENGER & COMMERCIAL FINAL ASSEMBLY SHOP

Fully equipped, well laid out assembly shops with air, electricity and water distribution throughout; conveyorised assembly lines; hoist capability of lifting any vehicle weight and total access for effective materials management. Flexible hoist can be adapted for assembly fabrication of any special vehicle including very heavy commercial type.

6.0 OTHER

6.1 Security

The Plant is a completely secured custom-bonded area within a double perimeter fence. Driving and pedestrian access is from one Security point.

Fire Security is fully provided for throughout the Plant. Waste disposal is effected through an Effluent Treatment Plant for Paint Shop waste, sewerage treatment plant for sewerage and incinerator for combustible waste.

6.2 Employee Facilities

Employee facilities include spacious canteen, recreational areas, playing field and normal changing room facilities. Both male and female conveniences are provided within the working area. A First Aid Centre is also located on the Shop floor.

6.3 Office Area

The main office area is approximately 900 square metres of air-conditioned space on two levels located centrally in the Plant.

A fully equipped Testing Laboratory is located within the Plant Shop Area.

6.4 Plant Location

The Plant is located in the north-eastern part of Trinidad, approximately 32km from the main shipping Port in Port-of-Spain and 12.87km from Piarco Airport.

3.8 REVIEW OF COOPERATION INITIATIVES BETWEEN LATIN AMERICA AND THE CARIBBEAN COMMUNITY WITH SPECIAL REFERENCE TO AGRICULTURAL TECHNOLOGY TRANSFER

L. Simpson, Agricultural Officer, CARICOM Secretariat, Guyana

1. INTRODUCTION

CARICOM/Latin America relations have been described by Gill (1992) as being still quite underdeveloped. This, at first, appears quite surprising because of the close proximity and, in some cases, interwoven nature of the Member countries of the two sub-regions. However, the British colonial heritage of the member countries of CARICOM has tended to link them more easily with the United Kingdom (UK) and other former colonies in Africa, Asia and the Pacific. Economic ties to the UK have also led to the evolution of economic ties with the developed countries of Australia and Canada. Relations with the United States of America (USA) have also developed due to its dominance in the hemisphere.

In response to the above situation the Conference of Heads of Government at its fifth Meeting held in Nassau, The Bahamas, embodied, in the Nassau Understanding of 7 July 1984, what can be considered a hallmark decision to promote the cultivation of cooperation between CARICOM and Latin America. Under the subject of External Economic Relations the document details various initiatives to promote programmes of cooperation between CARICOM as a group and the Dominican Republic, Haiti, Suriname, Brazil, Mexico and the Andean Group. The document also agreed that the feasibility of cooperation agreements with other countries and groupings should be studied by the CARICOM Secretariat.

The post-independence era in the Commonwealth Caribbean has seen much activity in the development of bilateral relations between individual member countries of CARICOM and Latin America. However, formalised relationships between the two sub-regions at the institutional level have been rather limited, and very recent. The current developments can be considered as a changing pattern of interaction between the two sub-regions. The most active of these is the CARICOM/Central America relations which will be further highlighted.

The major activities in CARICOM/Latin America relations have been a series of bilateral arrangements which have developed to varying levels, and appear to have sporadic bursts of activities. Some of the more important arrangements which have components related to the topic at hand will be discussed in this presentation.

In addition, several Latin American countries have requested, and have subsequently been granted, Observer status to Institutions

of CARICOM, including the Standing Committee of Ministers responsible for Agriculture (SCMA). The Agricultural Development Section of the CARICOM Secretariat is looking to pursue a programme of cooperation in agriculture for these states which will also be highlighted in this presentation.

2. CARICOM/CENTRAL AMERICA RELATIONS

Activity in this area was initiated at the second Inter-Sessional Meeting of the Conference of Heads of Government of the Caribbean Community held in February, 1991, when the Prime Minister of Belize conveyed to the Conference a proposal by the President of Honduras for a high-level CARICOM/Central America Conference aimed at the intensification of cooperation among countries of the two sub-regions.

This led to the convening of the first CARICOM/Central America Ministerial Conference in Honduras, January 1992 and subsequently, to the First and Second Meetings of the CARICOM Secretariat and the Secretariat for Central American Economic Integration (SIECA). No formal agreement has, however, been signed between the two sub-regions.

Of importance to this discussion is Item 10 of the agenda of the Second Meeting between CARICOM and SIECA in Guatemala City, Guatemala, February 1993. On this item entitled "Consideration of the establishment of a mechanism for the sharing of information and the development of cooperation among the institutions of the two sub-regions," a decision was taken to exchange a listing of all their regional institutions together with an indication of their functions. This is, presumably, a first step in the process towards information exchange similar to the type being discussed at this workshop.

3. CARICOM/VENEZUELA RELATIONS

From the decade of the 1970's, relations between the Commonwealth Caribbean and Venezuela have been intensified. This has been particularly so in relation to individual Member States of CARICOM. At the regional level Venezuela was granted non-borrowing member status in the Caribbean Development Bank (CDB) in 1973 and Observer status in the CARICOM ministerial fora responsible for Agriculture, Education, the Environment, Health, Labour and Science and Technology.

An important impetus for the CARIÇOM/ Latin America relationship was the adoption of the Tobago Initiative. The President of Venezuela visited Trinidad and Tobago in August, 1989. In the context of that visit on 5 August, 1989, the Heads of Government of Barbados, Guyana, Jamaica, St Vincent and the

Grenadines, and Trinidad and Tobago met in Tobago with the President of Venezuela.

At the meeting, the Heads of CARICOM Member States mentioned, welcomed Venezuela's request for Observer status within CARICOM and stressed the importance of increased collaboration and cooperation, not only between CARICOM Member States and Latin America, but also between the integration movements of both subregions. Arising from the same meeting was a decision to establish a Working Group comprising CARICOM officials and officials from Venezuela, and other interested Latin American countries, to design mechanisms for the achievement of the following goals:

- regional self-sufficiency in food;
- effective joint exploration of the mineral resources of the Region;
- the development and exploitation of export potential in selected areas and development of joint marketing capabilities and strategies;
- increased levels of intra-regional trade;
- the sharing of technology;
- cooperation in human resources, training and development; and
- the rationalisation of the communications and training systems of Latin America and the Caribbean.

In this connection, in January 1990 a meeting of the Working Group was convened in Caracas with officials representing CARICOM, Brazil, Colombia and Venezuela.

In further pursuit of the goals established in the context of the Tobago initiative, two Meetings of Ministries and Institutions responsible for Science and Technology in Latin America and the Caribbean were convened. These meetings were held in Caracas and Trinidad and Tobago in June 1990 and April 1991, respectively. These meetings, which included participants from Brazil, Colombia and Ecuador, in addition to Venezuela, were aimed essentially at the identification of possible areas of cooperation with a view to the formulation of a cooperation Programme in the area of Science and Technology between the two sub-regions. Activities of the working group seem to have waned in the last two years. The offer by President Perez to the 1991 CARICOM Conference of Heads of Government in St.Kitts and Nevis of a one-way, free trade arrangement and the subsequent signing of an agreement in 1992 has overshadowed the activity of this Working Group.

4. CARICOM/MEXICO RELATIONS

Relations between the Commonwealth Caribbean countries and Mexico began, in earnest, during the presidency of H.E. Luis Echeverria who visited Jamaica, Guyana and Trinidad and Tobago in 1973. In the same year a Mexico/CARICOM agreement was signed.

However, the joint commission established within the framework of the agreement remained relatively dormant with two meetings; the inaugural in October, 1980, and a second meeting in April, 1988

Relations are now being accorded a higher priority. This has led to the signing of three agreements in 1990. These are:

1) a framework Agreement on Professional upgrading and technical cooperation with the University of the West Indies (UWI) for professional upgrading in areas such as biotechnology, aquaculture and tourism.

2) an agreement on technical cooperation with the Caribbean Community to support integration and economic development efforts; and

3) an agreement on technical cooperation with the Caribbean Community on trade promotion.

Arising out of these agreements six projects were identified for execution. At present, three of these projects are being implemented, namely:

- language training development for Regional Agencies;
- rationalisation of Maritime Education and Training in the CARICOM Region; and
- formulation of an agro-industry development programme for the CARICOM region.

5. CARICOM/COLOMBIA RELATIONS

CARICOM/Colombia relations are less active than relations with either Mexico or Venezuela. Colombia had intimated its intention to sign an agreement with CARICOM along the lines of the Mexico/ CARICOM Agreement. This pledge was, however, not followed-up. More recently Colombia also participated in some aspects of the Tobago Initiative already mentioned. Colombia is one of the countries granted Observer status to some institutions of CARICOM including the SCMA. The fourth Inter-sessional Meeting of the Conference of Heads of Government of CARICOM accepted a proposal by the Government of Colombia to initiate negotiations towards the conclusion of a Free Trade Agreement between CARICOM and the Republic of Colombia.

6. CARICOM/BRAZIL RELATIONS

Brazil has participated in the Working Group coming out of the Tobago Initiative. It has shown interest in cooperation with CARICOM countries in areas such as diplomatic training, language training, cultural activities and information exchange. A technical

cooperation agreement with CARICOM has been mooted, but to date, nothing has developed.

7. DEVELOPMENT OF BILATERAL COOPERATION PROGRAMMES WITH OBSERVER COUNTRIES AND ASSOCIATE STATES

The Fifteenth Meeting of the Standing Committee of Ministers responsible for Agriculture (SCMA) held in Barbados from June 1st to 3rd, 1992, while discussing the role of Observers and Associate States members of SCMA agreed that in order to elicit benefits for Observers, Associate Members and the Community the following approaches could be considered:

a) the formulation of cooperative bilateral programmes with each of the observers and associate members in specific areas of interest according to relative circumstances; and

b) the need to effect a set of administrative, legal and other arrangements for the active participation of the observers.

The meeting also requested the CARICOM Secretariat, in collaboration with FAO and IICA, to develop bilateral cooperative programmes with Observer countries and Associate members for presentation at the next meeting of the SCMA.

These bilateral programmes were envisaged to cover, inter alia, agricultural technology transfer.

8. GENERAL CONSIDERATIONS

An important aspect to be considered in all the agreements, arrangements and understandings mentioned above is their dynamic nature. In the past, this has led to the abandonment of some initiatives and the cultivation of new ones. In the future, the situation is not likely to change.

In view of the above, it may be very important for this Workshop to note two important developments occurring in the past eight months. Firstly, the Caribbean Forum, which developed informally during the execution of programmes funded under Lomé III and was then consisting of all the independent Commonwealth Caribbean States as well as Suriname, was formalised with set Rules of Procedure on 19 October, 1992, in Port-of-Spain, Trinidad and Tobago.

The Forum now also includes Haiti and the Dominican Republic and is the official institution for the monitoring, management and utilization of regional allocation for Lomé IV programmes, as well as other aspects of relations between the Caribbean ACP States and the European Economic Community (EEC) under the Lomé Convention.

The Regional programmes developed under Lomé IV are likely to be of such a nature that they necessitate new and innovative interactions between States of the Caribbean Forum.

A second occurrence that should be noted is the decision of the CARICOM Heads of Government, at their third inter-session in Trinidad and Tobago, to establish an Association of Caribbean States (ACS). This decision came out of the recommendations of the West Indian Commission. The ACS is expected to advance both economic integration and functional cooperation among all Caribbean countries.

The ACS would be open to all CARICOM Member States, the other Island States of the Caribbean, Suriname, the States of Central America and other Latin American countries situated on the Caribbean littoral.

The coming into being of the ACS is likely to have fundamental effects on the type and magnitude of cooperation between the traditional CARICOM States and Latin America.

9. CONCLUSION

The Caribbean Community is firmly committed to the development and cementing of cooperation agreements between Latin America and the Caribbean. If the Nassau Understanding is considered the signalling document of this intent, then the decision to move towards the establishment of an Association of Caribbean States by the Conference of Heads of Government must be seen as a giant step along the way.

It must also be recognised that even as the procedure for the development of the ACS is worked out, the other arrangements already discussed are continuing. To all these must also be added this initiative by the Inter-American Institute for Cooperation in Agriculture (IICA) to convene this First Meeting of the Technical Committee for Agricultural Technology Transfer between Latin America and the Caribbean.

The CARICOM Secretariat wishes to applaud this initiative of IICA's and hopes that the discussions and deliberations of the meeting will be fruitful.

REFERENCE

Gill, H. S. 1992: CARICOM, the Wider Caribbean and Latin America. Study prepared for the West Indian Commission Jan.1992, pg.154.

3.9 CIRAD - FROM AGRICULTURAL RESEARCH TO RURAL DEVELOPMENT

J. Servant, Director Antilles, CIRAD, Martinique

1.0 INTRODUCTION

The Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement (CIRAD) is a French Centre for international cooperation in development-oriented agricultural research, with emphasis on tropical and subtropical zones. It is a state-owned body sponsored by the Ministry of Research and Technology and the Ministry of Cooperation and Development.

CIRAD was established in 1984 following the consolidation of agricultural, veterinary, forestry and food technology research organizations specializing on the tropics. It contributes to the development of these regions through research, experimentation, training and dissemination of scientific and technical information. CIRAD has a matrix organization crossing seven research departments with eight missions for research coordination.

Research Departments:
- Forestry (CIRAD-Foret)
- Livestock Production, Veterinary Medicine (CIRAD-Emvt)
- Annual Crops (CIRAD-CP)
- Perennial Crops
- Food Technology, Rural System (CIRAD-SAR)
- Management, Common Services and Laboratories
- Documentation (CIRAD-Gerdat)

Missions for Research Coordination:
- Crop and Environment Management
- Plant Improvement
- Plant Protection
- Animal Production
- Technology
- Economics and Sociology
- Remote Sensing
- Biometrics

Research centres and laboratories in Greater Pris, Montpellier, and the French overseas departments and territories comprise of a staff of one thousand eight hundred and fifty persons, including nine hundred and twenty professionals.

2.0 NEW ORGANIZATION OF CIRAD

The new departmental organisation of CIRAD is summarized in Table 1.

Table 1. CIRAD - Departmental Organisation

YESTERDAY	TODAY
1. IRAT 2. IRCT and groundnut programme from IRHO	1. **CIRAD-CA** annual crops
3. IRFA and vegetable and ornamental plant programme from IRAT	2. **CIRAD-FLHOR** fruit and horticultural crops
4. IRCA 5. IRCC 6. IRHO	3. **CIRAD-CP** perennial crops
7. IEMVT	4. **CIRAD-EMVT** livestock production and veterinary medicine
8. CTFT	5. **CIRAD-FORET** wood and forestry
9. DSA 10. CEEMAT	6. **CIRAD-SAR** food technology and rural system
11. GERDAT	7. **GERDAT** management, common services, laboratories and documentation

3.0 CIRAD IN THE CARIBBEAN

CIRAD, a French organization specializing in the agriculture and rural development of tropical and sub-tropical regions, is active in the Caribbean Islands, French Guiana and Central America.

It has a staff of more than fifty researchers and research centres in Martinique, Guadeloupe, and Guiana. It cooperates with a variety of partners in both public and private sectors for the development of regional and international cooperation activities. Its main objectives are:

- to improve agricultural production (quality, productivity, disease and pest control);

- to optimize management of natural resources while protecting the environment;
- to take account of those features specific to insular environments;
- to diversify rural economies;
- to contribute to development and popularization; and
- to train researchers and technicians.

CIRAD covers wide-ranging fields of activities, such as:

- citrus, banana, pine-apple and other fruit;
- sugar-cane, rice, horticulture, cotton;
- coffee, cocoa, coconut;
- wood and natural forest; and
- livestock production and animal health.

CIRAD's partners in regional and international cooperation include regional bodies (CATIE, CARDI, OIRSA), international organisations (IICA), private companies and producers' associations.

4.0 CIRAD IN MARTINIQUE AND GUADELOUPE

CIRAD has Research Centres in Guadeloupe and Martinique and a staff of 35 researchers (12 researchers in Martinique and 23 in Guadeloupe).

There are three Research Departments of CIRAD located in Guadeloupe and Martinique.

4.1 CIRAD-FLHOR (ex-IRFA)

CIRAD-FLHOR has 23 researchers. It is now referred to as the department of fruit and horticultural crops and will conduct its activities in the scientific, technical and economic fields on fruit, vegetables and ornamental channels as well as on the agro-industries that are using those products and on the commercialization of the products.

- Banana: Guadeloupe and Martinique - 13 researchers;
- Pineapple: Martinique - 3 researchers;
- Citrus: Martinique - 2 researchers;
- Other fruit: Guadeloupe - 2 researchers, Martinique - 1 researcher; and
- Vegetables: (from CIRAD-CA in 1993) Martinique - 2 researchers.

4.2 CIRAD-CA (ex-IRAT)

CIRAD-CA has seven researchers. It is the annual crops department, including crops that provide food (rice, sorghum, maize) or income (sugar-cane, ground-nut, cotton). CIRAD's research aims at quantitative and qualitative crop improvement in both traditional and intensive farming systems.

- Sugar-cane: Guadeloupe - 4 researchers;
- Maize: Guadeloupe - 1 researcher (in cooperation with INRA);
- Rice: Guadeloupe: 1 researcher; and
- Ornamental horticulture: Guadeloupe - 1 researcher.

4.3 CIRAD-EMVT (ex-IEMVT)

CIRAD-EMVT has four researchers. It contributes to the improvement of tropical livestock and industries using animal products. Based in Guadeloupe, it covers the areas of:

- tick-borne diseases;
- epidemiology;
- diagnostic tests and control;
- ecology; and
- control of vectors.

5.0 CIRAD'S COOPERATION IN THE CARIBBEAN AND LATIN AMERICA

The range of CIRAD's cooperation in the Caribbean and Latin America is summarized in Table 2.

Table 2.CIRAD's COOPERATION IN THE CARIBBEAN AND IN LATIN AMERICA

Programs	Countries	Partners	CIRAD's Cooperation
Pineapple and fruit diversification	Colombia	Instituto Colombia de agricultura Federacion Federacion Nacional de Cafeteros	CIRAD FLHOR 2 researchers
Banana and Plantain	Honduras	Fundacion Hondurena de investigacion agricola	CIRAD FLHOR
	Costa Rica	CATIE, CRBP, INIBAP FHIA, Corbana	CIRAD FLHOR 1 researcher
	Colombia	FNCC, ICA	CIRAD FLHOR 1 researcher
	Ecuador	PNB, MAG	CIRAD FLHOR
Fruit diversification	Trinidad Barbados Guyana OECS	IICA, CARDI, UWI CATIE	CIRAD FLHOR
Intensified farming systems including rice	Brazil		CIRAD CA 3 researchers
Granos basicos	Costa Rica Central America	IICA	CIRAD SAR 1 researcher
Rice	Colombia	CIAT	CIRAD CA 1 researcher
Farming systems Silvania project	Brazil	EMBRAPA (CPAC)	CIRAD SAR 2 researchers

Table 2 (cont'd) CIRAD's COOPERATION IN THE CARIBBEAN AND IN LATIN AMERICA

Cotton	Honduras Cost Rica Brazil Paraguay	Algosur Costasem Ocepar MAP	CIRAD CA 5 researchers
Rubber	Guatemala Brazil	Gremial de huleros	CIRAD CP CIRAD CP 1 researcher
Coffee DIMAC project	Mexico	SARH INIFAP	CIRAD:CP and SAR 2 researchers
Coffee Promecafe project	Guatemala Costa Rica Nicaragua	Promecafe	CIRAD CP 5 researchers
Cocoa	Trinidad	CRU/UWI	CIRAD CP 1 researcher
Oil-palm	Colombia	Indupalma Fedepalma	CIRAD CP
	Ecuador	Indupalma	CIRAD CP
	Brazil	Embrapa	CIRAD CP 1 researcher
Coconut	Brazil	Embrapa CNPCo	CIRAD CP
	Brazil	Sococo	CIRAD CP 1 researcher

Table 2 (cont'd) CIRAD's COOPERATION IN THE CARIBBEAN AND IN LATIN AMERICA

Research and Technology Transfer Procitropicos	Latin America	IICA and National Bodies	CIRAD: CA, CP, FORET, SAR 1 researcher
Economy and Agricultural Policies	Costa Rica	IICA	CIRAD GERDAT 1 researcher
Agro-industry	Costa Rica	IICA	CIRAD SAR 1 researcher
CIRAD's Delegation for Latin America	Costa Rica	IICA	CIRAD GERDAT 1 researcher

4.0 STATEMENTS FROM LATIN AMERICA

4.1 CATIE IN THE AMERICAN TROPICS

C.J. Rivas-Pagoaga P., Director INRM Programme, CATIE, Costa Rica

1.0 INTRODUCTION

Cooperation is as easy to explain as it is difficult to bring about, especially when it concerns development and, above all, technology transfer. At CATIE (Tropical Agriculture Research and Education Centre) one of the greatest efforts has been in the promotion of the goal of development through technology transfer. In this sense, we offer our experience in order to achieve effective and efficient cooperation; that is, by extending to the Caribbean countries our postgraduate teaching programme, our research on agricultural production and natural resource management, and our technical assistance, which are currently operating for the benefit of our member countries.

2.0 INSTITUTIONAL STRATEGY AND EXPERIENCE

CATIE has accumulated a great amount of experience and knowledge related to natural resource management and conservation in the American Tropics. This knowledge is based on the Centre's two decades of experience in its current form, as well as the three previous decades in the guise of the Inter-American Institute for Cooperation on Agriculture (IICA). During these fifty years the Centre has foreseen today's preoccupation with assuring the generation and transfer of technology, and the parallel formation of human resources, all within a framework of development with conservation.

For the reasons stated above, CATIE is unique in the American Tropics. As a regional institution of the Inter-American system, it counts with a well established and widely recognized postgraduate education programme combined with research and development programmes.

The Tropical Agriculture Research and Education Centre (CATIE) is a private, nonprofit institution, with a regional mandate and is scientific and educational in nature. Founded in 1973, its mandate is centered on agricultural sciences and natural resources for the benefit of the American Tropics, especially Central America and the Caribbean. Its member countries are Costa Rica (since 1973), Panamá (1975), Nicaragua (1978), Honduras and Guatemala (1979), Dominican Republic (1983), El Salvador (1987), Mexico and Venezuela (1992).

3.0 CATIE'S MISSION

CATIE's mission is to promote and encourage research and education on agriculture and related sciences, directed towards the development and sustainable use of the natural resources of the region and the improvement of the living standards of the peoples of the American Tropics.

In light of this general statement of aims, CATIE's priority for the 90's is sustainable agricultural development and conservation through the management of natural resources held within fragile ecosystems, particularly those ecosystems of which the medium and small farmers of the American Tropics increasingly form a component.

Critical priority areas are characterized by inappropriate land use and the demographic pressure of the inhabitants. Consequently, the beneficiaries of CATIE's action include not only national, regional and local institutions and organisations of the member countries, but also, the farmers trying to make a living in the ecosystems concerned.

In operational terms, CATIE's priority option is orientated towards solving the problems and improving the living standards of the users of the technologies generated and promoted by the Centre. Those benefitted by the Centre include, in the first place, the different private or public institutions concerned with the management of the priority ecosystems, as well as the end users of the technology generated, and their families.

CATIE's task, on behalf of its beneficiaries, is to seek sustainable development on the basis of research, training and technology transfer. CATIE's teaching programme embraces formal postgraduate courses as well as short courses permitting specialization or providing training. Basic, strategic, adaptive or applicable research is complemented by transfer activities that minimize the time between generation, validation, adoption and diffusion of practices and technologies generated.

These activities are grouped in two interacting programme areas: sustainable tropical agriculture and natural resource management. Sustainable production and conservation are inseparable and this programme structure functions on the basis of this principle. In this context, the interaction of management and agricultural practice with economic, social, cultural and biophysical variables is also at the forefront of CATIE's activities.

4.0 CATIE'S ACTIVITIES

In agreement with it's mandate, CATIE's activities are developed in three fundamental and interrelated fields. These are:

4.1 Research:

Concerning the fields of agriculture - including livestock - and integrated natural resource management in member countries.

4.2 Education:

The teaching/learning process takes place within the postgraduate and training course program. CATIE's mandate regarding higher education comes from the Inter-American Board of Agriculture (JIA) and covers the American Continent.

4.3 Technical Cooperation:

This activity is concentrated in the member countries but will, eventually, take in the other countries of the region, with the aim of establishing collaborative links with national higher education institutions and private or governmental research and development institutions in the fields of agriculture and natural resources.

5.0 CATIE's PROGRAMMES

For the planning and implementation of action directed towards achieving it's objectives, CATIE is organized into two research programmes: Integrated Natural Resource Management and Sustainable Tropical Agriculture, in agreement with the institution's priorities and strategies. Respecting the sustainable development concept, implicit in which is a continuous interaction between the generation and the mastery of new technologies, CATIE possesses a third programme, that of Teaching in Development and Conservation. These three programmes represent the basis for translating agreements into concrete cooperation between the Centre and the Caribbean.

5.1 Sustainable Tropical Agriculture Program (ATS)

The Sustainable Tropical Agriculture Programme faces the necessity of greater productivity, and therefore, greater agricultural production linked to the conservation of ecological systems within which productive activity takes place. The justification for this programme rests on the significant increase

of demand for food and services from the ever-increasing population, and its objective is to meet pressing national socio-economic needs, particularly those of poorer peoples living in the most fragile ecosystems of the American Tropics.

The Programme fulfils its task through three lines of research and their respective technical units, namely, Agroforestry Systems, Tropical Crops and Plant Protection.

5.1.1 Agroforestry Systems

CATIE is a pioneer in agroforestry and collaborates closely with national and international institutions in this field. Agroforestry production systems - in which at least two species of plants coexist and interact biophysically, one of these species being a woody perennial and the other a forage plant, or annual, perennial or industrially important food crop - have the potential to contribute to the sustainable production and conservation of the natural resources of the American Tropics.

5.1.2 Tropical Crops

In the last two decades, the appearance of new technologies, the substitution of local varieties and the exploitation of new crop areas, plus changes in the techniques of crop husbandry and conservation, have caused a rapid genetic erosion of crop species, both of cultivated species and of wild plants with potential agricultural use.

5.1.3 Plant Protection

The fight against agricultural pests (insects, pathogens, nematodes, weeds, rodents and birds) is characterized by the predominance of chemical methods, outstanding among which are the synthetic pesticides. In this context, CATIE is dedicated to the discovery of biological methods of pest control and to the reduction of the costs associated with this activity.

5.2 Integrated Natural Resource Management Program (MIREN)

The Integrated Natural Resource Management Programme seeks solutions to the rapid and continuous conversion of natural forests to other land use which results from economic and demographic pressures. Land degradation, loss of productivity, soil erosion and qualitative and quantitative changes in hydrological cycles, are only some of the most outstanding biophysical problems which aggravate rural poverty.

The programme's major effort is on the interaction of natural resources (water, soil, biodiversity), with each other and, most importantly, with the social sector that uses them, in order to look for viable options and establish guidelines on what may and what may not be done.

The Programme relies on four lines of research, each of which has its own units of management and execution into which specific projects are inserted. The lines of research are: Silviculture and Management of Tropical Forests, Conservation and Management of Biodiversity, and Watershed Management. The fourth and final line of research is Economics of Production and Conservation. This line is inter-programmatic and is instrumental in promoting interaction between CATIE's two programmes.

5.2.1 Silviculture and Management of Tropical Forests

Over the past 50 years, CATIE has gained a leading position in research, demonstration, education and training on the silviculture and management of tropical forests. The strategic aim of this activity is to develop ecologically sustainable, economically attractive and socially acceptable forest management systems applicable to the different types of forests in the region.

5.2.2 Conservation and Management of Biodiversity

CATIE studies the utilization of biodiversity resources by local communities, under the conviction that the misuse and destruction of biodiversity and tropical ecosystems will be controlled to the extent that these resources contribute to social and economic development. Because of this, CATIE will concentrate its efforts on aspects of planning and the implementation of field activities in the buffer or multiple use zones of biosphere reserves.

5.2.3 Watershed Management

Inappropriate land use on watersheds gives rise to onerous social and economical costs, as well as threatening the future of agriculture, the supply of drinkable water, natural drainage, navigation and tourism. Because of this, CATIE gives priority to the rehabilitation of steep terrain, particularly with respect to production systems in place on such terrain, and seeks to strengthen capacity in decision making, land use planning, and monitoring and evaluation through a modern and efficient geographic information system.

5.2.4 Economics of Production and Conservation

The importance of agriculture and renewable natural resources in the economy of the region render them a central pillar of sustainable development. Consequently, it is necessary to focus on development in an integrated manner, in such a way that the technological contribution will not contradict, or be neutralized by, economic, social, cultural, institutional or management restrictions. This is why this programme analyzes the conditioning effects of the factors mentioned on sustainable development, as well as the need to incorporate such factors into the generation and transfer of technology.

5.3 Conservation and Development Education (EDECO)

The promotion and development of technological options and improved practices for the utilization of tropical ecosystems face a serious problem in the lack of trained human resources possessing the necessary knowledge and ability to conduct strategic investigation, education and leadership tasks with respect to the sustainable development and conservation of the fragile ecosystems of the Region.

This Programme has four fundamental lines of action: formal postgraduate education, training, continuity and graduate support, and communications and data processing areas.

5.3.1 Postgraduate Education

In fulfilment of its continental mandate, the Centre offers the quality guarantee conferred by 50 uninterrupted years invested in postgraduate education. Over 1,100 CATIE graduates dedicated to research and training in agricultural and natural resource sciences, or occupying decision-making positions in a wide range of national and international institutions, are distributed throughout America. During CATIE's half-century of teaching, the experience necessary for education administration, for the identification and validation of proper methodologies in teaching/learning, and for the management and development of academic curricula appropriate to the needs of the American Tropics, has accumulated and become part of the Centre. The quality of the education-related infrastructure of lecture theatres, laboratories and information hardware is exemplified by the Orton Library, which currently constitutes the most complete book and journal collection for agricultural sciences and natural resources in Latin America and the Caribbean.

Currently, the Programme offers a "Magister Scientie" degree in one of two areas: Sustainable Agriculture Production Systems,

with specialization in Tropical Crops, Agroforestry Systems or Animal Production Systems; and Integrated Natural Resource Management, with specialization in Tropical Forest Management, Management of Protected Areas or Watershed Management.

The graduate is one of CATIE's achievements par excellence. The graduate's profile includes sufficient scientific management and field capability to face demands for greater agricultural production and conservation of natural resources in the American Tropics.

Given the complexity of the regional context and the demonstrated strength of the Postgraduate School, CATIE believes it now to be both advisable and opportune to offer doctoral studies. The Doctoral School will be constituted according to the needs of the region and will be supported by direct cooperation from prestigious universities from outside the region.

5.3.2 Training

The strategic importance of the training courses offered by CATIE rests on their incalculable value in the strengthening of regional institutions and organizations and the consequent increase in their effectiveness, achieved by the training on short courses of a significant number of individuals with sufficient capacity and judgement to manage new production and conservation technologies and practices.

Through short courses (one week to three months) CATIE trains, per year, around 1,000 professionals who already have higher degrees. The participants come from all the member countries and other countries of Latin America and the Caribbean. The courses are mainly in specific areas of knowledge and have varying academic levels.

5.3.3 Graduate Support and Follow-up

Students are a continuous preoccupation at CATIE. From this stems our commitment to follow up, systematically, on the careers of graduates in order to ensure that their work has the greatest positive impact possible.

5.3.4 Communication and Data Processing

In this context, we seek to disseminate research results and link the education process to that of research. Concomitantly, data bases of research results on tropical agriculture and natural resource management are managed. These data bases, as well as the research results disseminated, are at the service of all the member

countries of the inter-american system, and the international community.

The administration of the Orton Library and the modern computer centre, both at the service of CATIE's students, professors and other users, are two of the Centre's major strengths.

6.0 QUALITATIVE ADVANCES

To break new ground in aspects of agricultural production and natural resource management in the American Tropics is the essence of CATIE. The following are some subjects in which CATIE is committed to the breaking of new ground:

- The transformation of the mentality, ability and knowledge of the region's human resources through the education and training programME. CATIE's lead rests on its being able to face scientific, administrative, institutional and field problems for whose management it offers complete dominance, leadership and capacity.

- Collection, storage, generation and dissemination of information on tropical crops, agricultural production, plant protection, genetic resources, natural forests, silviculture, livestock, hydraulic resources, agroforestry, soil and water conservation, biodiversity management are some of CATIE's main achievements in service for the countries. Units such as the Orton Library, specialized documentation centres, a modern geographic information system and current distribution networks are instrumental in CATIE's achievements in this area.

- The study of the functioning, interactions, value and potential of fragile tropical American ecosystems in order to objectively understand the reaction of the resource to attempts at management.

- The pioneer initiative in natural forest management (wet and dry, primary, secondary or high elevation) is of particular importance to the American Tropics, because of the land area covered by natural forest resources, as well as for the human population intimately linked to the forests. The close relationship of natural forest management to biodiversity conservation, in general, is emphasized in this area.

- The challenge of reforestation set by the serious problem of forest destruction and the rising demand for forest products is being met at CATIE. Our revolutionary interest in the promotion of the management of plantation forests takes in extension activities and research, validation and transfer of

fast growing tree species, both native and exotic, adapted to the diverse ecological conditions of the region. In parallel with these activities, little known forest genetic resources in danger of extinction are characterized and conserved as a vital effort for the improvement and optimal use of forest species in plantations and agroforestry systems.

Intervention in fragile ecosystems with inappropriate production systems, and the consequent deterioration of water, soil and forest resources, are counteracted by research and the promotion, at a field level, of technological practices appropriate for the conservation and utilization of watersheds. CATIE is at the forefront in watershed rehabilitation, facilitating their utilization and conservation in harmony with new land use and planning techniques.

Our understanding of water-soil-crop-tree interactions in tropical agroforestry confers the potential to contribute to the sustaining of agricultural production, resource conservation and the re-establishment of multi-purpose trees in the landscape, on the basis of a knowledge of cause and effect.

CATIE investigates and promotes reforestation with forage trees to feed livestock; forage from certain tree species has a greater protein concentration than that of commercial concentrates.

The Centre's genetic resource collection is one of the biggest in the tropics and is at the service of any country. This natural genetic diversity has great potential for the low input agriculture best adapted to many tropical situations. CATIE's commitment, in managing this invaluable heritage, is to research on the value and potential of the species in this collection for competitive agriculture.

CATIE seeks an alternative to a modern agricultural technology characterized by it's high costs and inputs. From this stems, for example, our uninterrupted search for biological alternatives, ecologically sustainable, economically feasible and socially acceptable, in the context of an integrated pest management.

The countries of tropical America need to develop technologies for the commercial production of tropical products. CATIE's contribution is experimentation on new culture methods, transplants, vegetation propagation and the selection of promising varieties.

Without competing with other, mainly commercial, institutions, CATIE trains personnel and gives technical assistance in an

effort to raise the capacity of the countries of the region in biotechnology.

7.0 OPERATIONAL MECHANISMS

CATIE's Headquarters in Turrialba, Costa Rica, serves as a focal point for the implementation of its programme activities. From here are maintained the coordination, coherence and synthesis of the activities which CATIE's programs and projects develop in the countries, the development and implementation of standard methodologies for research, management and the dissemination of information, and education and training at a regional level.

One of CATIE's operational principles is the establishment of research, education and joint cooperation activities with national, international, private and public organizations and institutions. In fact, the Centre actively supports the integrated approach to sustainable agriculture and natural resource conservation in the region. For similar reasons, CATIE gives priority to technical collaboration of a type most likely to have a measurable impact in the generation of technology and at the field level.

In this context may be mentioned collaborative agreements with the member countries and with such international institutions as IICA, CADESCA CCAD, CEPAL, CIAT, CIFOR, CIMMYT, CIRAD, CORECA, FAO, IBPGR, ICRAF, INIBAP, OIF, OIRSA, ORSTOM, PRODERE, RISPAL, UICN and WWF. There are, also, many individual agreements with research, education and service institutions in each member country.

Education and training activities are coordinated specifically through the Regional Cooperative Network for Higher Education in Agriculture and Natural Resources (REDCA), which integrates universities, research centres and official organisations of the Region, as well as some universities of the United States of America, Canada and Europe.

CATIE's inter-institutional collaboration includes close relations with donor agencies. Thanks to these good relations, CATIE's history has been knitted together for the benefit of the member countries. The trust placed in CATIE, the mutual respect between the Centre and the donor agencies, and the back-up for its technical decisions are commensurate with the achievements attained.

The current decade will, undoubtedly, see the continuation of support from the international community. Among the current donor agencies working with CATIE are USAID/ROCAP, ACDI, ASDI, BID, BM, CE, CIID, COSUDE, DAAD, DANIDA, DSE, DSO-IO, FIDA, FINNIDA, CGIAR, GTZ, JICA, MAE, MOLISV, NORAD, NRI/ODA, PNUD, PROCADES, SAREC and USAID.

8.0 CONCLUSION

The main constraint on CATIE's freedom of action is financial. The geographical range of its activities is limited because:

1) research and technical assistance take place only in the member countries; while

2) education and training take place in benefit of the whole of the American Tropics, in agreement with the Centre's mandate.

In both cases, the finance is dependent on specific projects. These projects, of mutual interest for CATIE and the countries, are promoted to the donors by both parties. CATIE's actions have not been expanded to the Caribbean because of this reason.

Currently, CATIE's presence in the Caribbean is limited to the membership of the Dominican Republic and, consequently, to the support that is given to that country in tissue culture, access to and management of information, and through the formation of postgraduate professionals interested in specializing in one of the areas offered by CATIE's Masters degree programme. The number of professionals trained through short courses also constitutes an important contribution. CATIE has also supported the agricultural and natural resource sectors of Haiti through education and training.

However, there is no reason why CATIE should not broaden the scope of its collaborative action in the Caribbean. CATIE's promise is commensurate with its dedication to continue breaking new ground. It is a fact that the way is clear for the making of formal applications for membership of CATIE. The projects which may be developed will always depend on:

1) the interest, needs and demands of each country and of the zone as a whole;
2) the Centre's "know how", summarized above; and
3) the interest and support of the donors.

During its history, CATIE has had sufficient imagination, flexibility and capability to forecast future problems. Currently, the same qualities underlie its success; these qualities form the solid foundations for possible cooperation between CATIE and the Caribbean nations. The challenge concerns us all.

4.2 PERSPECTIVES FOR COOPERATION BETWEEN LATIN-AMERICA AND THE CARIBBEAN

A. Duque Portugal, Executive Director, EMBRAPA, Brazil

1.0 BACKGROUND

The Brazilian Agricultural Research Corporation (EMBRAPA) is a public enterprise attached to the Ministry of Agriculture, Food and Agrarian Reform, acting through 37 Units in different fields of agriculture. Present in every state of the Brazilian Federation, under diversified ecological conditions, its mission is to generate, promote and transfer scientific and technological production in order to make possible sustained development of agriculture and agro-industry for the well-being of the Brazilian society, through the rational use of natural resources and environmental protection.

EMBRAPA is also responsible for coordinating the National Agricultural Research System, organized by various institutions at state levels which carry out research in specific geographic areas and/or specialized fields of scientific knowledge. Recently, the Corporation has also included in its mission the responsibility of coordinating the Brazilian System of Rural Technical Assistance and Extension under a new system aimed at sustained development. EMBRAPA has nearly 10,000 employees, more than 2,100 research scientists (of whom 80% have either a doctorate or masters degree), and administers a budget of aproximately US$ 230 million, per year.

EMBRAPA has a wide scope of action in the area of international cooperation, first in terms of receiving knowledge from other international institutions and organisations in order to use it in generating appropriate technologies, and later in transferring knowledge, services and products to other international partners, mainly the Latin American and African countries.

EMBRAPA's aims, in harmony with world tendencies, seek environmental quality, technological modernization of the agribusiness complex by means of territorial ordinance, farming production systems and sustainable forestry management. This approach guarantees production efficiency, quality and competitive improvement, development of gene banks and multiplication of basic materials, technologies to reduce agricultural risks, harvest and post-harvest losses, farming business managerial techniques and other technologies for products with competitive and market potential, and finally, technologies for the improvement of competitiveness of strategic products.

EMBRAPA is, also, concerned with the rationalization of farming yields for small and medium-sized farmers seeking to

develop adaptable production systems, offer technological support for settlement projects and develop managerial techniques for sustainable and competitive farming activities.

The main goals of EMBRAPA for the coming years are to generate and diffuse new technologies which will make it possible to:

- attain a sustained increase in productivity above 3% per year;
- generate and diffuse sustainable agricultural and agroforestry production systems to different agro-ecological zones;
- subsidize policies to the agricultural sector;
- increase basic seed production and usage of improved seeds;
- generate and diffuse technologies to increase efficiency of machinery and equipment in order to reduce harvesting losses and diminish relevant energy consumption;
- generate and diffuse technologies which substitute pesticide utilization;
- generate and diffuse technologies which minimize the loss of soils under cultivation; and
- maintain a computerized management information system open to rural managers and producers so that they can access the results of research and technologies generated by EMBRAPA.

2.0 WORK PROGRAMMES IN AGRICULTURAL TECHNOLOGY RESEARCH AND DEVELOPMENT

Agricultural research has produced or adapted numerous technologies, products and services for Brazilian agriculture, from increased agricultural and forest productivity and quality, to an economy of input resources.

In the historical context, Brazilian agricultural research has been traditionally oriented towards the production of technologies capable of producing high yields and has contributed decisively to the increase in Brazilian agricultural harvests in the last ten years showing that the utilization of appropriate technologies makes an increase in yields through agricultural productivity possible.

Following are the highlights of EMBRAPA's National Research Plan and its 16 main programmes of research, recently proposed by the Corporation for the years ahead:

2.1 Natural Resources: Evaluation, Management and Recuperation

This first research programme aims at developing better knowledge in relation to the Brazilian environment. Alert to the bio-ecological diversity of the great Brazilian ecosystems, the Corporation maintains a network of research units to give priority to the evaluation and rational utilization of natural resources of the humid tropical area, the semi-arid North-east, the Cerrados (Savannas), the Pantanal, and the lowlands in the south of Brazil. Other units are responsible for specific actions to monitor the environmental impacts by means of remote sensing to protect agriculture against disequilibrium through a search for alternatives to agrochemicals.

2.2 Genetic Resources: Conservation and Multiplication of Basic Materials

EMBRAPA established a unit for the collection and maintenance of germplasm and has one of the largest banks of genetic resources in the form of semen, seeds, plants, live animals and even pollen and freeze-dried cells. In addition to preserving species in extinction these banks aid research in the task of genetic improvement of plants and animals.

2.3 Development of Basic Research in Biotechnology

Among modern methodologies, biotechnology is revolutionizing various sectors of productive activities, especially in the agricultural sector. This research programme is directed towards:

- assisting in the diagnosis of diseases;
- the acceleration of genetic improvement of animals and plants;
- the creation and manipulation of genes;
- the genetic transformation by means of techniques of genetic engineering; and
- the establishment of methodologies for characterizing and identifying plants, animals and micro-organisms.

Especially concerned with the biological diversity of the great Brazilian ecosystems, EMBRAPA has established a network of research units to dedicate priority to the development of technologies for the management and conservation of natural resources. The Corporation maintains one of the largest gene and germplasm banks where more than 60,000 accessions of different organisms from seed, living plants and pollen to freeze-dried cells, animals, semen or embryos are conserved.

2.4 Grain Production Systems

This research programme aims at improving and increasing the production of better varieties and production systems, more productive and appropriate to the different regions of Brazil.

2.5 Fruit and Horticulture Production Systems

This programme aims at improving the production of fruits and vegetables through the development of new varieties and production systems adapted to different agro-ecological and agro-climatic regions.

2.6 Animal Production Systems

This research programme aims at improving animal production systems adapted to different regions. A wide range of activities are covered by EMBRAPA's animal production centres. These include nutrition, genetic improvement, reproduction, economics, health and farm engineering. Research involves animals such as beef and dairy cattle, pigs, sheep, goats, buffaloes, horses and poultry.

2.7 Production Systems for Raw Materials

With the national growth and development expected (involving the quantitative expansion of industry and population increase with anticipated improvement in the quality of life, increase in income and demand for quality, besides environmental sustainability), it is essential to develop the production of raw materials such as vegetable oils, fibres, colourants and latex.

2.8 Forestry and Agroforestry Production Systems

Forestry has contributed, significantly, to national economic development. Forest activities mobilize 4% of the GNP and are responsible for 50,000 new jobs each year while maintaining 400,000 jobs directly. In the past ten years, the exportation of wood and by-products has, practically, doubled and now represent 5% of total Brazilian exports.

For the most part, success has been guaranteed by agricultural research. Productivity growth in implanted forests took place without any undesirable ecological change. This programme intends to improve the quality of wood and forest products, rational use of natural forests and genetic conservation of endangered species.

2.9 Rationalization of Subsistence or Low Income Agriculture

In view of the various denominations and interpretations which exist in regard to this type of activity, it is necessary to appraise the objective of this research programme:

- Production for family subsistence (submercantile): when more than 50% of the production is consumed on the productive unit and more than 50% of manpower is familial;

- Nonfamilial subsistence production (submercantile): more than 50% consumed on the property and more than 50% of contracted manpower;

- Familial commercial mercantile production: puts on the market more than 50% of that which is produced, however, using more than 50% of familial manpower;

The programme intends to generate and/or adapt technology and knowledge which provide greater stability to the productive units above.

2.10 Harvest/Extraction, Postharvest, Transformation and Preservation of Agricultural Products

Commitment to quality is always present in EMBRAPA research, particularly for the development of production systems, for the creation of new and better prepared nutritional farm products for fresh consumption, and for industrial processing. Research conducted in the field of agribusiness food technology develops and modernizes systems for harvest, postharvest storage, processing, packaging and conservation of fruits and cereals.

2.11 Environmental Quality Protection and Evaluation

The intensification of economic activities in rural areas tends to affect the ecosystem in many ways. This programme consists of activities of research and development in the evaluation and monitoring of environmental quality, in modified or potentially to be modified ecosystems, as a result of the intensification of agricultural activities.

2.12 Automation for Agriculture

This programme aims to contribute to scientific and technological modernization of Brazilian agriculture through the use of instrumentation, information and automation by the Brazilian agricultural, agro-industrial and agroforestry complex.

2.13 Support for Programmes of Rural and Regional Development

This programme includes support projects of the research of EMBRAPA's Units and institutions of the National Agricultural Research System linked to the areas of diffusion and transfer of technology, socio-economy (socio-economic zoning, studies of agricultural policies and others, not linked to products or resources included in the other programmes), basic seeds, marketing of products, technologies and services.

2.14 Interchange and Production of Information in Support of Research and Development Activities

The objective of the programme is to collect, organize, aggregate and disseminate the R/D information produced in the country, therefore orienting training and facilitating technological innovations within the SNPA. This is a dynamic system of storage, recovery, manipulation and up-dating of the data already existent and of new information generated by different sources. It must also be interchangeable with similar data banks which exist in the country and abroad.

3.0 COMPARATIVE AREAS OF INSTITUTIONAL STRENGTHS

Since its foundation in 1973, EMBRAPA has generated more than 8,000 new technologies for Brazilian agriculture and agro-industry. Moreover, the Corporation contributed towards reducing production costs and aiding the country to increase the offer of food, while at the same time, conserving natural resources and the environment, and decreasing the dependence on external technologies, inputs and genetic materials. Furthermore, consultant services for organizational development, training and management of science and technology, and diffusion and transfer of technologies are other examples of institutional strengths which have been developed by the Corporation and which could be the motive for technical and economic cooperation with other countries.

A series of technologies have been created by the Corporation and some can be highlighted as examples of EMBRAPA's institutional strengths:

3.1 Grains and Fibres

EMBRAPA has put hundreds of new cultivars on the market, including many which are more productive and more appropriate to different regions in Brazil. These varieties, when allied to sustainable farming management systems and technology for more efficient use of inputs, have contributed towards an increase in Brazilian grain harvests from 39 million tons in 1980 to more than

70 million tons in 1992. Moreover, an increase in productivity in traditional crop areas occurred and previously unoccupied areas were settled, attracting people from scarce land resources regions.

Presently, EMBRAPA dominates technologies apt to raise grain yields to more than 100 million tons without increasing cultivated area.

3.2 Fruits and Vegetables

The rapid incorporation of new knowledge and technology generated by research, including irrigation systems, into the productive system has contributed to the effective development of fruit and vegetable cropping in Brazil. The multiplier effect of research results achieved for such crops as carrots, peas, potatoes, garlic, cashew, peaches, grapes, citrus and pineapples has been highly significant. Increase in yields and productivity has improved internal reserves and released stocks for exportation.

3.3 Seed Production

Producing some 15,000 tons per year of basic seed (90 types of seed) EMBRAPA is the greatest supplier at the national level. The Corporation participates with more than 50% of the total distribution of basic seed. Special mention should be made of rice, 74% of the total offer, 51% for wheat and beans, and an average of 25% for corn, including hybrids and open-pollenized varieties.

EMBRAPA's seed-benefitting units answer for a great part of the seeds repassed to Brazilian private firms. These, in turn, produce and market certified seeds. EMBRAPA not only establishes the parameters for quality but also plays a strategic role in the North and North-east of Brazil where the private sector is not always present.

3.4 Animal Production

Technologies generated by EMBRAPA vary from simple recommendations on fencing and nutritional management to the development of new breeds and sophisticated micro-manipulation techniques and transfer of embryos. The common aim of such a wide scope of technologies is to confer efficiency on animal production systems characterized by diversity of technological standards adopted.

Cryo-preservation, splitting and transfer of cattle embryos make it possible to increase populations of endangered breeds and also accelerate the multiplication of animals with high genetic value.

In recent years, EMBRAPA has developed more knowledge on buffaloes in Latin America and has contributed to the growth of national herds with varied technologies for the breeders in different Brazilian ecosystems. The Corporation has, also, revolutionized livestock pastures by introducing new grass strains. Technology for pasture recuperation in Amazonia, the Cerrados (Savannas), semi-arid regions and the Mata Atlantica in Minas Gerais has increased forage availability by over 200%. The development of cultivated pastures, intercropped ryegrass, white clover and birdsfoot trefoil, has allowed a 50% to 80% increase in the birth rate of cattle and has reduced the slaughter age from 54 to 24 months. At present, technology available is adequate to even double the Brazilian livestock production.

3.5 Biodiversity and Genetic Resources

Germplasm-collecting expeditions have been carried out all over Brazil, especially in endangered areas where the farming frontiers advance and great engineering works such as hydroelectric dams are being built and mineralogical projects are being installed. Conservation expeditions collect primitive cultivars which are still in the hands of traditional farmers, and forest species of value for research and for plant genetic improvement. Besides species of immediate economic interest, others of future potential for food and for the economy are also being collected for the pharmaceutical industry, for fibre and colourants, and for the production of alternative energy sources.

EMBRAPA has developed protocols for the detection of virus, viroid, fungi, bacteria, nematodes and insects in plant germplasm for research. The interception of pests and exotic pathogens through inspection and quarantine of germplasm (seed, cuttings and seedlings) originating from other countries has prevented their dissemination in Brazil, thus reducing or eliminating harmful effects to the farming economy and national biodiversity.

3.6 Biological Control

One of the greatest challenges faced by EMBRAPA in relation to farming research was to conciliate food production, protection of the environment and preservation of man's health. This is the context within which research is carried out by the organisation. Technologies based on the biological control of pests and diseases gain more and more exponents within the farming sector and contribute to reducing the use of chemicals and costs to farm production.

At present, important pests such as the banana and sugarcane borers, the coconut leaf caterpillar and the rice bug are controlled by natural enemies. The control of the hornfly, for

instance, which appeared recently in Brazil, and is considered the most serious cattle pest in the USA, is now possible thanks to the help of Onthopagus gazella which buries the excrement of animals, and thus, prevents the proliferation of the disease.

A disease which attacks the roots of the apple tree is now being eliminated through biological control activities of the genus Trichoderma. The biological control of the tomato moth, using Trichogramma pretiosum is assuring the sustainability of tomato cropping in the semi-arid regions.

Bio-insecticides were developed and transferred to the private sector to control the bloodsucking mosquito, transmitter of malaria and dengue. The active principle of the product is the bacteria Bacillus sphaericus which kills mosquitoes without causing problems to public health nor the environment. The biological control of the soybean caterpillar, using a soluble powder with Baculovirus anticarsia, produced by private firms through technology transferred by EMBRAPA, has reduced or eliminated pesticide applications.

A bio-insecticide using Baculovirus spodoptera was developed to control the corn caterpillar which also attacks other crops such as wheat, sorghum, rice and sugarcane.

Studies on climate and on the behaviour of pest populations in wheat fields made it possible to control wheat aphids, almost completely, by using a wasp introduced by the research project. Pesticide application was reduced to a single spray, saving millions of dollars.

3.7 Use and Management of Soils

EMBRAPA, concerned with sustainable development, has developed research aiming at higher productivity indices, using economic feasibility, positive social impact and environmental conservation. These research principles are followed in soil surveys, management, and the conservation and biology of soils. New paths were opened when EMBRAPA discovered the bacterium Acetocbacter diazotrophicus, capable of fixing nitrogen in sugarcane, aiming at dispensing the use of nitrogen fertilizer, for example. The development of bacteria of the genus Bradyrhizobium adapted to Brazilian soils for the inoculation of soybean seeds has eliminated the application of nitrogen fertilizer in soybeans and guaranteed a significant economy in Brazilian imports.

The current production of beans can be tripled with biological fixation as the main nitrogen source. Research has, also, shown that it is possible to replace vegetation where low fertility, erosion and degradation of soils occurs. This has been achieved with low investments in fertilizers, using arboreal legumes with

nodules and mycorrhiza. Besides replacing the vegetation, reverting erosion and incorporating organic material for the growth of various species, arboreal legumes represent economic returns on firewood and logging production.

4.0 INSTITUTIONAL CONSTRAINTS

EMBRAPA, as a public enterprise, is facing serious operational problems in relation to the maintenance and expansion of its research programme. At present, the most serious constraint is related to its budget which has decreased over the last three years. As the Brazilian economy is facing severe economic stagnation due to high inflation rates, EMBRAPA is lacking adequate financial resources to implement its activities. This constraint forced it to develop a strategic planning process aimed at modernizing the Corporation's procedures and attitudes in relation to the future.

The development of a computerized management information system aimed at establishing a real network between EMBRAPA's units and agricultural research institutions at the state level is of fundamental importance. The implementation of this computerized system during the period 1993-1994, bringing reliability and consistency the National Agricultural Research System, has been proposed.

5.0 CURRENT INTERNATIONAL COOPERATION LINKAGES

EMBRAPA has been able to count on support and encouragement from scientific, technical and finance institutions throughout its history. However, international cooperation will always be necessary to research institutions and the Corporation is seeking new agreements and partners. This is especially true in the case of those international organisations dealing with biotechnology, genetic engineering, and environmental and sustainable agricultural issues.

To obtain technical and financial sponsorship for technical cooperation, EMBRAPA is promoting and articulating contacts between the CGIAR System and its Centres, including international institutions and corporations interested in developing advanced partnerships aimed at implementing research projects of mutual interest.

Furthemore, EMBRAPA has been attempting to identify new commercial opportunities benefiting from the basic comparative advantages which it enjoys. In fact, the quality of its research activities has attracted the attention of international corporations, foreign universities, institutes and organisations in other countries. At present, it is fully recognized that EMBRAPA

possesses a significant stock of scientific and technological knowledge and, above all, has produced an impressive multidisciplinary team, trained in agricultural and related sciences. Consequently, it has the capacity to cooperate, market, and promote the transfer of scientific and technological knowledge and methodology to countries at an equal or lesser stage of agricultural development. It is internationally recognized as possessing important technologies, especially for regions of tropical agriculture, which qualifies it to transfer such knowledge to other countries.

In this context, the Latin American, Caribbean and African countries represent potential partners and, in some cases, target markets for transfer of technologies, products and services in areas in which the Corporation enjoys comparative advantages.

EMBRAPA maintains cooperation agreements and financial support programmes with several international organizations and institutions such as the following:

- IICA;
- IDB and IBRD;
- FAO and UNDP, of the United Nations;
- CIRAD and ORSTOM, of France;
- JICA, of Japan;
- Agriculture Canada, CIDA and IDRC, of Canada;
- ODA and the University of Oxford, of the United Kingdon;
- ARC/USDA, FS/USDA and USAID/BIFADEC, of the United States of America;
- Several American and European Universities; and
- Several Bilateral agreements with Latin America, Caribean and African countries.

6.0 NEEDS FOR INTER-REGIONAL COOPERATION

EMBRAPA will be very pleased to discuss and to receive international cooperation in the areas of biotechnology, genetic engineering, information science and genetic resources.

4.3 HONDURAN AGRICULTURAL RESEARCH FOUNDATION: ROLE IN AGRICULTURAL TECHNOLOGY TRANSFER

W. L. Kline, Research Advisor, FHIA, Honduras

1.0 INTRODUCTION

The Honduran Agricultural Research Foundation (FHIA) is a private foundation founded in 1984 through a cooperative agreement among the Government of Honduras, Chiquita Brands International and the United States Agency for International Development (USAID). The Foundation's main focus, in the early years, was to support the export industry in Honduras with applied research and transfer of technology. This is, still, the main focus of the Foundation. However, additional emphasis is now being placed on research for domestic crops.

FHIA is governed by a sixty-five member assembly which meets once a year to approve the annual working plan, budget and elect a Board of Directors. The original assembly was made of private and public institutions in Honduras which were selected to be members. Since its inception membership has increased by thirty seven with members from several countries or regions including:

- The Windward Islands Banana Growers' Association (WINBAN);
- Caribbean Agricultural Research and Development Institute (CARDI);
- Organization of Eastern Caribbean States (OECS);
- Mexico; and
- Ecuador.

A membership fee of approximately US$ 20,000 is charged. The Board of Directors meets six times a year to set policy for the organisation. The day-to-day operations are run by a Director General and Director of Research.

2.0 RESEARCH AND TECHNOLOGY TRANSFER ACTIVITIES

FHIA is divided into five programmes under a Director of Research with a supporting technical unit. The six divisions are described below:

2.1 Banana and Plantain Programme

This programme's main activity is to develop varieties of cooking and dessert banana and plantains for all areas of the world. The group is made up of four PhD's: two in plant breeding, one in plant pathology, and one in post harvest handling. The last two recently joined FHIA through the International Network for the

Improvement of Banana and Plantain (INIBAP) project. The agronomic component of the programme has developed and is transferring technological packages to Honduran plantain farmers to increase yields and quality for the export market.

2.2 Cocoa Programme

The cocoa programme with a 2-person technical staff, has developed cultural practices for the cocoa industry in Honduras and Central America which has been transferred to the producers. Most cocoa production is in the hands of smallholders which has led the cocoa group to develop teaching materials that can be used by technicians for on-farm training. Information is available on all aspects of production from selecting planting material to drying and semi-processing. Much of this material was developed in cooperation with IICA and CATIE during the execution of a regional cocoa project which has now concluded. Programme staff are maintaining their on-farm activities with demonstration plots and research.

The cocoa group is now placing more emphasis on developing sustainable systems that can be used in conjunction with cocoa to provide continual income to smallholders. Examples are:

- intercropping a new cocoa planting with annual crops;
- planting cocoa with wide alleys so that annual crops can be continuously cultivated;
- interplanting cocoa with other perennials (coconut, Cocus nucifera; rambutan, Nephelium lappaceum; black pepper, Piper nigrum; or tropical woods).

2.3 Diversification Programme

The diversification programme is responsible for identifying new or existing crops, in Honduras, that have commercial potential. They conduct investigation on the crops identified and transfer the information to producers. The group is composed of a five member technical staff headed by a PhD. They are concentrating on five groups of crops at the present time:

- mango,
- heart of palm;
- black pepper, Piper nigrum;
- tropical fruits; and
- hot peppers, Capsium sp..

The staff also provide informational material and technical assistance in a wide variety of crops.

2.4 Seeds Programme

This programme is composed of a plant breeder and an agronomist who work on two crops, soybeans and sweet corn. Major effort is placed on selecting soybean varieties which are adapted to the different climatic zones of Honduras. They are also developing crop rotational systems using soybeans as the base.

2.5 Vegetable Crops Programme

The technical staff is composed of four individuals headed by a PhD who carries out research and technological transfer activities on a wide variety of commodities. Present activities centre around the following crops: processing tomatoes, onions, cucurbits (cucumbers, hard squash, and watermelon), asparagus, blackberry, raspberry, and specialty vegetables. Research is carried out on all aspects of these crops including varietal, fertilization, density, weed control and post harvest.

There is a strong emphasis in supporting the export industry. This past year FHIA contracted with a group of growers to provide technical assistance in the export of onions. This followed FHIA's research in varieties and cultural practices plus export trials in 1990. The producers received a training course, weekly visits by the field staff with recommendations, and assistance in grading and shipping. Based on the success of the 1992-1993 technical assistance, additional growers have signed up for 1993-1994. The production area will increase from 20 ha. to over 200 ha. in 1993-94. FHIA also hosted the Central American regional training for producers interested in growing onions for export. This same type of technical assistance is being provided for most of the above mentioned crops on a contract basis.

2.6 Technical Unit

This is the support group for the FHIA programmes. It is made up of six sections:

- plant protection;
- plant biotechnology;
- agronomy;
- biometrics;
- agricultural economics; and
- postharvest handling.

2.6.1 Agricultural Economics

A new economist will start in June to work with individual programmes in developing crop budgets and to work with the

technical services unit to provide cost/benefit studies for consulting projects. In the past, this unit has carried out several feasibility studies for a series of projects.

2.6.2 Agronomy

This unit runs the soil and tissue analysis laboratory, carries out fertility research and provides technical assistance to producers and the FHIA staff. It is headed by a PhD soil scientist, with a second returning from obtaining her degree in September. The laboratory processes approximately 10,000 samples per year.

2.6.3 Biometrics

Biometrics provides the statistical support to the research programmes. It is headed by a PhD who also carries out training activities for FHIA staff and other technical personnel in experimental design, on-farm research and software applications. The unit is involved with technical services in project design, implementation, and with the Director of Research in project and programme evaluation.

2.6.4 Plant Biotechnology

This is, mainly, a micro-propagation laboratory that produces banana and plantain cultivars for sale. The laboratory has the capacity to produce 50,000 plants per year with plans for expansion as it develops its expertise and as demand warrants. Additional biotechnology techniques and crops are being explored. The unit is headed by a PhD.

2.6.5 Plant Protection

The unit is comprised of entomology, plant pathology and nematology. There is a four member technical staff of which two are PhDs. The group carries out applied research in cooperation with all the programmes, manages a diagnostic laboratory for producers, carries out independent research through grants, and assists with technological transfer and consulting. They also collaborate with other institutions in Honduras with projects such as whitefly research.

2.6.6 Postharvest Handling

Four individuals make up this unit which is headed by a PhD. They work on all aspects of pre- and postharvest handling of the commodities in which FHIA has interest. This unit also provides

technical assistance to producers who want to store products for the local market or export. Examples of activities are:

- Melon shipments to Europe;
- drying fruit for the United States and European markets;
- onion storage for domestic consumption; and
- modified atmosphere packaging for bananas.

3.0 OTHER SERVICES AND ACTIVITIES

3.1 Pesticide Residue Laboratory

The laboratory has a staff of four who carry out residue analysis on a wide range of fruits, vegetables, meat, water, and soil on a charge basis. They also perform contract research for chemical companies and train personnel from other laboratories. Laboratory usage has increased, this year, with a projection to analyze, approximately, 1500 samples.

3.2 Technical Services

This unit is staffed by three to four specialists in irrigation and drainage, project preparation, soil classification, and land preparation. They develop projects requested by individual producers and/or companies to provide all the information an individual or company will need to obtain funding and carry out the project. Projects range from designing and installing irrigation systems to providing a complete farm plan including crop rotations. Technical Services relies on programme personnel for additional technical expertise.

3.3 Communications

Communications has responsibility for administration of the Training and Communications Centre which includes the library, conference centre, and publishing operation. They support the programme and technical units in developing materials and carrying out seminars, field days, conferences and courses. Each year every programme has, at least, one course and one or two field days.

4.0 MAJOR ACHIEVEMENTS IN TECHNOLOGICAL MODERNIZATION OF AGRICULTURE

4.1 Banana and Plantain Programme

The Banana and Plantain Programme has expanded its activities to several parts of the world with the testing of new material. At present, varieties from this programme are being tested in, at

least, thirteen countries. The variety FHIA-01, Goldfinger is being reproduced in the United States for mass distribution over the next year. The variety has demonstrated resistance to the principle banana diseases and does not discolour after peeling. It is considered to have a niche as an organic banana and as a general commercial banana in countries such as Australia. FHIA-03 has shown excellent results as a cooking banana in various parts of the world. It is resistant to the major banana diseases and produces better than most bananas under cool weather and poor soil conditions. The programme has a new group of plantains that will be tested internationally starting this year. They appear to be resistant to the major diseases and produce higher yields than the common plantain.

4.2 Cocoa Programme

This programme has accomplished its initial objectives of identifying cultural practices to increase production not only in Honduras, but also Central America. In Honduras, the planted area and yields have approximately doubled since the programme started. The programme's efforts, in the future, are directed toward producing cocoa intermixed with other crops in agroforestry systems using tropical woods and fruits. Initial studies have demonstrated promise in controlling soil erosion and providing a steady income for smallholders.

4.3 Diversification Programme

Diversification has identified several commodities for additional research. These are being incorporated into FHIA's work plans as resources permit. The programme has determined which black pepper varieties produce best in Honduras, developed a planting scheme and promoted the planting of 35 ha. which are now in production.

Mango planting has been promoted and a system to induce early production has been tested and demonstrated to producers. This flower induction system has enabled growers to ship mangoes to the European market before the traditional shipping period.

Production of palm hearts has been a major activity for the last three years. A system has been developed to produce palm hearts in high density plantings (70,000 plants per ha. or more) in 18 months. Commercial trial plantings have started.

Cultural practices for tabasco pepper have been evaluated and transferred to Honduran producers. Yields have increased approximately 50% with the introduction of the new management practices.

4.4 Seeds Programme

The programme continues to develop new soybean and sweet corn varieties. FHIA released two soybean varieties (FHIA 11 and 15) in 1991 and will have new releases soon. A sweet corn variety will be released in 1993.

This programme has also provided technical assistance in all of Central America and carried out two studies to determine the feasibility of soybean production in Central America.

4.5 Vegetable Crops Programme

This programme has supported the export industry by identifying improved varieties and cultural practices which have been widely adapted by the industry. For example, the varieties of cucumbers being grown were recommended by FHIA (64,100,000 lb. exported in 1991[1]). The planting system and varieties of winter squash used by the industry were tested and recommended by FHIA (7,800,000 lb. exported in 1991[1]). FHIA evaluated the varieties and cultural practices (planting systems) that are being used for export onion production in Honduras as well as the rest of Central America (200,000 lb. exported in 1991[1]). The programme is now recommending asparagus, blackberry and raspberry varieties and planting systems.

4.6 Technical Unit

All sections in this unit have several accomplishments, but only the most important will be discussed here.

4.6.1 Plant Protection

The entomology group has carried out extensive research and provided technical assistance to the tomato processing industry for the control of whitefly and to increase production. Based on their recommendations and changes in production practices, processing tomato yields increased from 20 tons per ha. to 60 tons per ha. in one year.

The plant pathology group has developed fast screening techniques for Black Sigatoka of banana for micro-propagated plants and are screening pesticides to determine Black Sigatoka resistance.

4.6.2 Postharvest Handling

The postharvest unit has developed methods for shipment of melons to Europe, better handling of bananas, and storage of onions under high temperature, among others.

4.7 Communications

In 1992, training activities carried out by the different programmes in cooperation with the communications unit totaled 44, with 1,135 participants many of whom were from throughout Central America. Fourteen publications were printed in 1992 with plans to increase the number in 1993.

5.0 MAJOR CONSTRAINTS

5.1 Funds

The lack of sufficient funding to maintain a high quality staff is a continual constraint. Staff members are in demand to accept positions with private sector companies both in Honduras and the region. Many of their benefit packages are beyond what FHIA can offer.

5.2 Expansion of Endowment Fund

The need to expand FHIA's endowment fund will be a constraint for the near future as the necessity to procure funds competes with the need for research. To maintain a strong research base the foundation must expand its endowment and maintain its value for the future.

6.0 CURRENT INTERNATIONAL COOPERATION LINKAGES

FHIA maintains cooperative agreements and carries out projects with several regional and international organisations. These include:

- Windward Island Banana Growers' Association (WINBAN);
- Organization of Eastern Caribbean States (OECS);
- Caribbean Agricultural Research and Development Institute (CARDI);
- Overseas Development Administration/Natural Resources Institute of Great Britain (ODA/NRI);
- Germany Overseas Development Agency (GTZ);
- Free University of Berlin, Germany;
- University of Lobaina, Belgium;
- Canadian International Development Agency (CIDA);
- Dutch International Development Agency (DIDA);
- International Network for the Improvement of Banana and Plantain (INIBAP);
- Tropical Agricultural Research and Training Centre (CATIE);
- United States Department of Agriculture (USDA);
- United States Agency for International Development (USAID);
- University of Florida, United States;

- University of Montana, United States;
- University of Arkansas, United States;
- Pan-American School of Agriculture (El Zamorano);
- United Nations Development Programme (UNDP);
- United Nations Food and Agricultural Organization (FAO);
- International Institute for Tropical Agriculture (Nigeria);
- International Atomic Energy Commission (Austria);
- International Food Research Institute (France); and
- Japanese International Agency for Cooperation.

There are contracts with international and regional companies to carry out research on specific topics. The Foundation has signed agreements with various institutions in different countries for specific activities, especially for evaluating varieties of banana and plantain.

7.0 INTER-REGIONAL COOPERATION

The Honduran Agricultural Research Foundation is willing and able to cooperate in several areas. Among these are:

7.1 Collaborative research and transfer of technology with regional and international organizations in all the areas listed in the agenda, except animals, since FHIA does not have an animal component.

7.2 Provide laboratory services and technical assistance in the region.

7.3 Provide facilities and projects for students carrying out thesis research and facilities for exchange of researchers.

7.4 Design, develop and conduct courses on a regional basis for the agricultural sector in cooperation with other institutions. This can be done anywhere in the region.

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4.4 PERSPECTIVE FOR COOPERATION BETWEEN LATIN AMERICA AND THE CARIBBEAN

V. Gonzales R., Technology Manager, FONAIAP, Venezuela

1.0 INTRODUCTION

The National Fund for Agricultural Research (FONAIAP) is the Venezuelan official institution responsible for research and technology transfer for agriculture and fishery production. The Institution was created in 1961.

FONAIAP has defined its mission as: "To contribute to the economical and social development of Venezuela through the generation of knowledge and technologies to be applied on benefit of agricultural and fishery production activities."

From this definition FONAIAP understands as its responsibility the carrying out of research and technology transfer activities aimed to solve the main problems which constrain the productivity of the most important agricultural commodities. As a government institution FONAIAP also has to be concerned with the small farmers' technology needs.

FONAIAP is structurally organized as follows:

Direction Offices:

- National Council for Agricultural Research (CONIA): In charge of establishing institutional policies.
- Administrative Board of Directors: In charge of making administrative decisions.
- Corporative Management: Integrated by a General Manager and eight Line Managers.

Operative Units:

- Eleven Research and Technology Transfer Centres;
- Six Experimental Stations;

Within the Centres and Experimental Stations there are a number of Experimental Fields and Laboratories.

The human resources involved in research and technology transfer activities are 503 researchers and 483 technicians.

2.0 WORK PROGRAMMES IN AGRICULTURAL TECHNOLOGY RESEARCH AND DEVELOPMENT

The research activities are organized as twenty one programmes which cover the most important crops and animals used in agricultural business in the country, and the main disciplinary areas of knowledge related to agriculture and fishery. These programmes which are located in the main centres are:

2.1 Plant Crop Programmes

The Plant Crop Programmes include:

- Cereals (rice, corn and sorghum);
- Annual Oil Crops (sesame, sunflower and soybean);
- Perennial Oil Crops (oil palm and coconut);
- Fruit Crops (musaseas, citrus, mango and avocado);
- Sugar Cane;
- Legumes (beans, peas and pigeon pea);
- Vegetable Crops (pepper, tomato and onion);
- Root and Tuber-crops (potato, cassava, sweet potato and yam);
- Coffee; and
- Cocoa.

The plant crop programmes are aimed at the generation of agronomic management practices, as well as new higher, yielding crop varieties. They are also involved with the study of the social and economics implications of agricultural production for the crops under study, in order to facilitate the process of technology transfer.

2.2 Livestock Production Programmes

- Bovines

The livestock production programme is aimed to develop the best bovine genetic stock for dual purpose production under grassing management system in the tropics. Besides the animal breeding activities, the study of grassing systems is one of the main areas of concern for this programme.

2.3 Fishery Programmes

The Fisheries Programmes cover two areas of activity:

1) Fishing and aquaculture of continental species; and
2) Fishing and aquaculture of seawater species.

The fishery programmes are aimed at having the best knowledge about the potentiality of fresh and seawater resources in order to define policies for their rational use. In connection with this purpose, the programme is also concerned with the development or adaptation of fishing technologies.

The programme is also concerned with the development or adaptation of technologies for fresh and seawater aquaculture.

2.4 Disciplinary Areas Programmes

The Disciplinary Programmes include:

- Natural Resources;
- Plant Genetic Resources;
- Plant Protection (plant pests and diseases control);
- Biotechnology;
- Animal Health; and
- Animal Technology.

The disciplinary programmes are designed to characterize and evaluate the resources of soil, climate and vegetation on the agricultural lands. This is done in order to define the actual and prospective use of them. At the same time, research is done to develop and evaluate technologies for the rational use of these resources to benefit agricultural production. Besides the physical components and vegetation of the environment, these disciplinary programmes are involved in the study of the biology of pests and disease-causing organisms and their interaction with crops and livestock.

Other important areas of concern are protection and study of genetic resources; study of the basic physiological functions of the plant and animal species used in agricultural production. Finally, the biotechnology programme being developed is designed to develop and evaluate modern technology to enhance the yield and quality of crop plants and livestock.

2.5 Special Areas Programmes

The Special Areas Programmes are:

- Management of savannas; and
- Farming systems.

3.0 COMPARATIVE AREAS OF INSTITUTIONAL STRENGTHS

From the descriptions given of the programmes and the areas of

interest linked to them, it would indicate that FONAIAP has some strength, and the possibility to offer expertise, in the following:

- Soil survey and land use evaluation;
- Germplasm evaluation and use: tropical fruits, cereals (corn, rice, sorghum) and oil crops;
- Breeding of annual crops (corn, sorghum, rice, sesame, cotton, legumes);
- Breeding of semiperennial crops (sugarcane, cocoa, coffee, coconut);
- Reproduction physiology of bovines and small ruminants;
- Nutrition and feed development of bovines and small ruminants;
- Small ruminant production systems;
- Seed technology;
- Animal and plant health;
- Fishery: Reproductive physiology and production systems of fresh water fishes;
- Fishery: Artesian technologies for seawater fishing; and
- Fishery: Processing of fishery products.

4.0 INSTITUTIONAL CONSTRAINTS

The institutional constraints faced by FONAIAP include:

- plant biotechnology;
- post harvest physiology; and
- machinery design and management for small farms.

5.0 CURRENT INTERNATIONAL COOPERATION LINKAGES

FONAIAP, through its Office for Technical Cooperation, has established linkages with a wide variety of national and international institutions.

At present, FONAIAP has agreements with the following institutions:

- PRACIPA-CIP: Potatoes and sweet potatoes;
- POTATOES-CANADA: Potatoes;
- JUNAC: Coffee (Rust);
- ARS-USDA-LAMP: Corn;
- IBPGR: Genetic resources;
- CIMMYT: Corn;
- ORSTOM: Fishery;
- CIRAD: Cocoa, oil palm;
- INRA: Monogastric animal nutrition;
- IICA-PROCITROPICOS: Amazonas Natural Resources;
- IICA-PROCIANDINO: Several Areas;
- CIAT: Cassava, forage grasses, edible legumes and rice;

- OIEA: Plant Mutation Breeding, Phosphorus and Nitrogen Dynamics;
- ICRISAT: Pigeon pea, sorghum;
- USDA: Several areas;
- CHILEAN GOVERNMENT: Fruit crops, animal technology, fishery;
- ICA-COLOMBIA: Several areas;
  INIBAP: Banana;
- REDBIO: Biotechnology; and
- CUBAN GOVERNMENT: Livestock, fruit crops and sugar cane.

6.0 SPECIFIC NEEDS FOR INTER-REGIONAL COOPERATION

Specific needs identified for inter-regional cooperation include:

- Vegetable Crops: Breeding and Seed Production;
- Biotechnology: Germplasm Characterization Through Genetic Molecular Markers;
- Fruit Crops: Germplasm Exchange;
- Vegetable Crops: Germplasm Exchange.

4.5 PERSPECTIVES FOR TECHNICAL COOPERATION BETWEEN LATIN AMERICA AND THE CARIBBEAN: COLOMBIA (English Summary)

J. Navas A., Sub-Manager of Research, ICA, Colombia

1.0 BACKGROUND, CURRENT ORGANIZATION AND FUNCTIONS OF ICA

The Colombia Institute of Agriculture (ICA) was created in 1962 by the Ministry of Agriculture to direct agricultural research and technology transfer aimed at fostering socio-economic development in Colombia.

The ICA is governed by a Board of Directors. At the national level, it comprises the General Management or Directorate (formed by Government, Business, Farmer and University Representatives) and five Divisions (Subgerencias), that make up the Advisory Committee, encompassing:

- Research;
- Technology Transfer;
- Protection for Agricultural Production;
- Planning; and
- Administration and Finance.

The aim of ICA is the achievement of food self-sufficiency and export of surplus production.

Through these five structures, ICA performs the functions assigned by the Government, grouped as follows:

- Generate and transfer agricultural technology, according to the socio-economic conditions and agro-ecologic characteristics of each region and type of user.

- Train its staff and promote continuing education within and outside the Institution.

- Monitor and advise other organizations in animal and plant health, advise businesses to ensure supply of optimum-quality products, in coordination with the institutions responsible for monitoring the quality of agricultural products.

- Formulate agricultural development plans, programmes and projects, in coordination with the policies of the Ministry of Agriculture.

- Distribute and monitor the budget assigned to ICA projects and programmes.

- Establish institution building plans referred to physical aspects and human resources.

At the regional level, ICA maintains nine Regional Directorates that span the country's 29 geo-political Departments. This level coordinates the implementation of plans, programmes and projects designed through consultations among relevant parties.

Each Regional Directorate comprises the Regional Management and two Technical Coordination Offices as well as one Administrative Unit that relate the regional to the national levels and direct the execution of plans at the local level.

The local level is represented by 64 Centres for Extension, Training, and Diffusion of Technology (CRECED). Basically, they conduct in greater detail, the micro-regional and local diagnostics to pinpoint technological constraints by homogeneous agro-ecologic areas thereby validating the technology generated by the Research Centres, for its adequate transfer to farmers.

Each CRECED is formed by a Directorate, three Technical Units, one Administrative Unit, a Consultative Council and an Advisory Committee.

2.0 AGRICULTURAL RESEARCH AND DEVELOPMENT PROGRAMMES

ICA conducts agricultural research through 22 Research Centres (Annex 1) and two National Laboratories. Annex 2 lists the crop and livestock commodities for domestic use or export on which ICA concentrates its research and technology transfer activities. ICA also carries out cooperative research with private enterprises on cocoa, sugar cane and plantains. Basic research is conducted at the five centres indicated in Annex 3.

ICA's roster of professional staff in research and technology is summarized in Annex 4. A breakdown of the 1993 budget is summarized in Annex 5.

3.0 LEVEL OF RELATIVE STRENGTH OF ICA'S RESEARCH PROGRAMMES

The comparative strength of ICA's technical work programmes is rated for Crops in Annex 6 and for Livestock in Annex 7.

4.0 STRATEGIC RESEARCH AREAS NEEDING MORE EFFORTS AND RESOURCES

4.1 Natural Resource Management

4.2 Germplasm Resource Management

4.3 Integrated Management of Phyto and Zoosanitary Problems

4.4 Biotechnology

4.5 Mechanization and Post-Harvest Handling

4.6 Production Systems

4.7 Agro-ecologic Zoning

5.0 INTERNATIONAL COOPERATION REQUIRED

Technical cooperation would be helpful in the following areas and crops.

5.1 Rice

-	Crop Improvement:	Widening of genetic base.
-	Entomology:	Economic damage of phytophagous diseases; biological control.
-	Phytopathology:	Disease epidemiology; sources of genetic resistance.
-	Physiology:	Effects of planting time (storage) on rice production.
-	Soils:	Land preparation in dry savannahs.
-	Harvest:	Product handling.
-	Post-Harvest:	Product handling.

5.2 Fruit Crops

-	Crop Improvement:	Widening of genetic base.
-	Physiology:	Especially of soursop, avocado and cashew nut.
-	Soils:	Management and fertilization.
-	Irrigation:	Water consumption and management.

5.3 Oil Crops:

-	African Palm:	Phytopathology and disease management; soil management and fertilization; water management; management of effluent and physiology.
-	Coconut Palm:	Processing and uses; soil management and fertilization.
-	Soybean:	Widening of genetic base; tolerance to adverse conditions; management of root diseases; training in ecophysiology.

5.4 Industrial Crops

-	**Cotton:**	**Methods of minimum tillage and destruction of ratoons.**
-	**Cocoa:**	**Germplasm exchange and fertilization studies.**
-	**Sugarcane:**	**Water and agronomic management techniques.**

ANNEX 1.

AGRO-ECOLOGICAL CHARACTERISTICS OF ICA's RESEARCH CENTRES

Region	Research Centre	Altitude (masl)	Temperat. (C)	Precipitation (mm)	Natural Region[1]
1	TIBAITATA	2543	13	751	Andean
	SAN JORGE	2800/3400	12	790	Andean
	SURBATA	2485	15	690	Andean
2	TURIPANA	20	28	1.188	Carib
	EL CARMEN	152	27	1.339	Carib
3	CARIBIA	18	28	1.393	Carib
	MOTILONIA	130	29	1.400	Carib
	LA PEPILLA	20	28	1.370	Carib
4	TULENAPA	28	28	2.900	Carib
	LA SELVA	2120	17	1.865	Andean
	EL NUS	700/3200	13	843	IAV
5	PALMIRA	975	24	1.020	IAV
	OBONUCO	2700/3200	13	843	Andean
	EL MIRA	16	25	3.170	Pacific
	BALBOA	960	24	944	IAV
6	NATAIMA	431	27	1.375	IAV
	MACAGUAL	280	27	3.510	Amazonia
7	EL ZULIA	90	28	2.400	IAV
	TINAGA	2600/3000	13	800	Andean
	EL ARSENAL	1450	22	1.292	IAV
8	CARIMAGUA	160	26	2.100	Orinoco
	LA LIBERTAD	336	27	2.700	Orinoco

[1] Codes: Carib = Caribbean
IAV = Inter Andean Valley

ANNEX 2.

RESEARCH CENTRES BY NATURAL REGION AND PLANTS AND ANIMALS OF REGIONAL IMPORTANCE

Natural Region	Centre	Crops	Animal Species
ANDEAN	Tibaitata	Vegetables, Potatoes, Corn, Wheat, Barley Wheat, Barley	Dairy cattle, Pasture and Forages, Poultry and Pigs
	San Jorge	Potatoes	Sheep, Pasture and Forages
	Surbata	Potatoes, Wheat, Fruit crops, Legumes	Small Livestock
	La Selva	Legumes, Fruit crops, Vegetables, Corn, Potatoes	-
	Obonuco	Wheat, Potatoes, Corn, Legumes, Fruit Crops	Dairy cattle, Pasture and Forages and Cuyes
	Tinaga	-	Sheep
INTERANDEAN VALLEYS	Palmira	Annual oil crops, Fruit crops, Vegetables, Cotton	Poultry, Pigs
	Nataima	Sorghum, Fruit crops, Rice, Cotton, Annual oil crops	-
	El Nus	-	Beef cattle, Dual-purpose cattle, Pasture and Forages
	El Arsenal	Tobacco, Legumes/Corn	-
	El Zulia	Sugarcane, Corn	-
	Balboa	Cash crops	-

Annex 2 (cont'd)

Natural Region	Centre	Crops	Animal Species
CARIBBEAN	Turipana	Corn, Sorghum, Cotton, Plantains, Annual and Perennial oil crops, Rice	Beef cattle, Dual- purpose cattle, Pasture and Forages, Pigs and Small livestock
	Motilonia	Corn, Sorghum, Cotton, Plantains, Annual and Perennial oil crops and Rice	Beef, cattle, Dual-purpose cattle, Pasture and Forages, Hair sheep
	Caribia	Fruit crops, Vegetables, Plantains and Bananas, Tropical Tubers, Perennial oil crops	-
ORINOCO			
	La Pepilla	Perennial oil crops	-
	El Carmen	Tobacco, Tropical tubers	-
	Tulenapa	Plantains, Cocoa, Corn	Pasture and Forages
AMAZON			
	La Libertad	Rice, Annual and Perennial oil crops, Cotton, Corn, Sorghum, Fruit crops, Tropical tubers and Plantains	Beef cattle, Dual- purpose cattle, Pasture and Forages
	Carimagua	Fruit crops, Oil crops	Pasture and Forages, Beef cattle
PACIFIC			
	Macagual	Plantains and Corn	Dual-purpose cattle, Pasture and Forages, Small livestock
	El Mira	Perennial oil crops	-

ANNEX 3.

RESEARCH CENTRES BY NATURAL REGION WHERE BASIC RESEARCH IS CARRIED OUT

Natural Region	BASIC RESEARCH		
	Centre/Location	Crop	Livestock
ANDEAN	Tibaitatá (Bogotá Savannah)	Plant biotechnology, Natural resources, Integrated phytosanitary management, Processes and machinery Production systems, Biometrics	Animal biotechnology, Physiology and genetics, Animal nutrition
	CEISA* (Bogotá)	-	Livestock biotechnology, Animal health
INTERANDEAN VALLEYS	Palmira (Cauca Valley)	Plant biotechnology, Natural resources, Integrated phytosanitary management, Biometrics	Animal nutrition, Animal health
CARIBBEAN	Turipaná (Sinú Valley)	Natural resources, Integrated phytosanitary management, Machinery and processes Biometrics	Animal nutrition, Physiology and genetics
	CISPAT* (Sinú Valley)	-	Animal health

* Animal Health Research Centres

ANNEX 4.

LIST OF RESEARCH AND TECHNOLOGY TRANSFER PERSONNEL 1993.

AREA	PROFESSIONALS[1]	ASSISTANTS	TOTAL
RESEARCGH	407	668	1075
TECHNOLOGY TRANSFER	280	600	1160
TOTAL	687	1268	2235

[1] The total comprises 90 PhD, 250 MSc, and 347 BSc-equivalent graduates

ANNEX 5.

BUDGETARY RESOURCES FOR RESEARCH AND TECHNOLOGY TRANSFER 1993 (US$ 000s)

AREA	PS/T[1]	GE/INV[2]	TOTAL
RESEARCH	13798.8	4480.3	18279.1
TECHNOLOGY TRANSFER	5316.4	4069.2	9385.6
TOTAL	19115.2	8549.5	27664.7

1 PS/T = Personal Services and Transfers
2 GE/INV = General Expenditure and Investments

ANNEX 6.

COMPARATIVE STRENGTH OF ICA'S DISCIPLINARY ACTIVITIES IN CROPS

DISCIPLINES	AREA STRENGTH LEVEL		
	HIGH	INTERMEDIATE	LOW
SOILS	Fertility, Soil analysis	Microbiology	Soil conservation and physics
WATER	-	Irrigation systems	Consumption by ecosystems
AGRICULTURAL MECHANIZATION	-	Implements and equipment for slopes	Minimum tillage
PHYTOSANITARY PROTECTION	Insect taxonomy, Conventional control methods	Integrated pest management	Transfer methods
GENETICS AND IMPROVEMENT	Production of materials and Germplasm banks	-	Improvement of promising peasant planting materials
PLANT PHYSIOLOGY	-	Weed control	Seed physiology and ecophysiology
POST-HARVEST AND AGRO-INDUSTRY	Processing of brown sugar	Storage of cereals by small farmers.	

COMPARATIVE STRENGTH OF ICA'S DISCIPLINARY ACTIVITIES IN LIVESTOCK

DISCIPLINES	AREA STRENGTH LEVEL		
	HIGH	INTERMEDIATE	LOW
GENETICS AND IMPROVEMENT	Characterization of creole breeds	Performance of crosses (Bos taurus x Bos indicus)	Study of adaptation of European races
ENVIRONMENTAL PHYSIOLOGY	-	Identification of physiological parameters in the tropics	Climatic effects on domestic animals
ANIMAL REPRODUCTION	Identification and control of reproductive diseases	Reproductive management in the tropics	Environmental effects on reproduction
ANIMAL HEALTH	Epidemiological studies	Disease control	Use of biotechnology to study diseases
ANIMAL NUTRITION	Nutritional contents for forages and pasture, and minerals.	Use of agricultural by-products and organic waste as feed	Identification of needs by species, age and weight
PASTURE AND FORAGE	Establishment and management of pastures, Agronomic performance of tropical forage plants	Pasture/crop rotation, Studies on quality and consumption of forage.	Establishment of tropical legumes Pasture seed production

4.6 BRIEF ACCOUNT OF RESEARCH ACTIVITIES

B. Busto B., General Manager, ICTA, Guatemala

1.0 INTRODUCTION

The Institute of Agricultural Science and Technology, is an autonomous and decentralized institution of the Agricultural Public Sector of the republic of Guatemala.

Its main objective is centered in the generation of technological options to improve the productivity and income of the production systems of small and medium farmers.

ICTA has taken several steps to change its actual structure so as to become more efficient for the benefit of the agriculture of the country.

2.0 ACTUAL AND PROJECTED AGRICULTURAL PROGRAMMES

2.1 Basic Grain Programmes (Includes corn, beans, rice, sorghum and wheat).

2.1.1 Main Research Activities

- Breeding and improvement of corn varieties and hybrids.
- Maintenance of valuable breeding stock.
- Development of agronomic practices for the different production systems.
- Description and utilization of local collections.
- Development of Integrated Pest Management practices.
- Studies of better pre- and post-harvest practices.
- Selection of genotypes resistant and/or tolerant to biological limiting factors.
- Selection of genetic materials for industrial purposes.
- Carrying on of activities related to technology diffusion (seminars, publications, courses).
- Production of Foundation, Registered and Certified Seed.

2.1.2 Medium and Long Range Activities

- Improvement of genetic materials through non conventional means (Induced mutations with Gamma Rays and Cobalt 60).

- Production of genetic materials through anther tissue and meristematic cultures.

- Strengthening of the Transference of Technology process.

- Studies of the farmers' production systems aimed to the integration of self-sustained agriculture practices.

- Integration of the traditional genetic improvement schemes into the modern methods of genetic engineering.

2.2 Diversified Agricultural Programmes

These include work on horticultural and oil crops, as well as deciduous and tropical fruits.

2.2.1 Main Research Activities

- Introduction, characterization and evaluation of local and imported stocks of horticultural, fruit and medicinal plants adapted to warm, temperate and cold climates; marketing and industrial uses will also be determined.

- Selection of genetic materials resistant or tolerant to fungal, bacterial or viral diseases.

- Development of agronomic practices for irrigation, fertilization and disease and pest control.

- Development of agronomic practices for the management of annual crops and deciduous and tropical fruits as well.

- Storage, industrial processing and marketing methods for horticultural and fruit crops.

- Reproduction systems of plant breeding stock.

- Collection, characterization, improvement and small scale production of native species, for genetic improvement purposes.

- Production of seeds and vegetative stocks, as the case may be.

- Development of Integrated Pest Management Practices.

2.2.2 Future Work

- Production of genetic materials through tissue and meristematic culture processes.

- Widening of research work on a larger number of horticultural crops.

- Development of agronomic practices in the field or organic gardening.

- Development of agro-industrial processing systems specifically for small farmers.

- Production of certified seed of promising materials.

- Development of working projects with the private sector.

2.3 Livestock Production

2.3.1 Ongoing Activities

Development of production systems for milk and beef cattle, goats and sheep.

- Options to correct nutritional deficiencies in the feeding systems at the farm level. Efforts will be oriented to the utilization of farm subproducts and improvement of pastures.

- Improvement of cattle management practices with the purpose of optimizing the genetic potential of the different species.

- Selection of native and crossed stock as the starting base for genetic improvement.

- Development of health and sanitary programmes for specific regions and species.

- Improvement of the productive and reproductive indicators present in the traditional systems of dual purpose cattle growing.

2.3.2 Future Activities

- Improvement of production systems of minor species; Pigs, poultry, rabbits, bees, etc.

- Development of an integrated and multi-disciplinary methodology to generate and validate technological options through on-farm research.

- Development of a sampling methodology to orientate the generation, validation and transfer process for small farmers.

3.0 MAIN ACHIEVEMENTS

Between 1976 and 1992 ICTA released 107 varieties and hybrids

of different crops; 64% corresponding to basic grains and 43% to horticultural and other crops.

Many of the new materials are now being grown by the farmers replacing older or traditional ones. The reason for the wide adoption of the new material has been the outstanding agronomic characteristics, namely tolerance to drought, resistance or tolerance to diseases, better quality and yield, etc.

As a result of ICTA's work the following data has been recorded:

- Certified seed imports of basic grains has been reduced by 80%, especially in corn, beans, rice and wheat.

- It has been estimated that about 80% of the land in rice is sown exclusively with ICTA's rice varieties.

- The average yield of corn has been stabilized at national and regional levels.

- A high percentage of the land devoted to beans is planted with Bean Mosaic Virus resistent varieties developed by ICTA. This virus disease is the principal limiting factor and yields under high incidence of this disease, have reached up to 1800 kg/ha.

- The entire area (30,000 ha) devoted to wheat in the Highlands, is planted with ICTA varieties; average yields are approximately 2,200 kg/ha.

- Gradual adoption of Integrated Pest Management Control by small farmers has reduced the amount of pesticides used in the growing of horticultural and fruit crops.

In addition to the above, ICTA has generated some technology for primary processing of horticultural crops at three levels; domestic, artisan and semi-industrial. This includes dehydration, potato flour and flakes. fruit jellies, marmalades, etc.

4.0 MAIN OBSTACLES

There are several obstacles that hinder the development of technological options that would, substantially, improve not only production but quality as well. The following are worth mentioning:

- Due to lack of incentives and better work opportunities in private firms or regional projects, a significant percentage of technical personnel has left the Institution. As would be expected, the more capable and qualified personnel are the first to move to other positions.

- There is no well-defined agricultural policy to support research and extension activities. On the contrary, financial support is reduced every year.

- Despite the serious efforts made to, effectively, link Research and Extension activities very little has been accomplished.

- There is lack of information on international commerce and marketing trends.

5.0 INTERNATIONAL LINKS

Ever since its foundation ICTA has kept strong ties with Centres of Excellence to pursue and support its own research activities. Usually, this has been done by signing agreements with national, regional and international organisations. Another effective way has been by closely cooperating with networks under the auspices of international or regional centres to solve specific problems.

Following is a list of the main working agreements signed by ICTA:

- CIAT-COLOMBIA	Research on beans and rice.
- ICRISAT	Research on sorghum.
- CIMMYT	Genetic and agronomic research on corn.
- LAMP	Maintenance of corn collections.
- JICA-GOVERNMENT OF JAPAN	Acquisition of apparatus and equipment for the Biotechnology Laboratory and Research Stations.
- MISSION TECNICA CHINA	Production research on grapes and horticultural crops for export.
- ARF	Integrated Pest Control Management in horticultural crops for export.
- UNIVERSIDAD LANDIVAR	Work on Biotechnology.
- REDCA	Integration of Research and Extension for the transference of technology.
- KELLOGG'S	Development of corn and rice varieties for industrial use.

-	CIID	Development of production systems in dual purpose cattle to increase meat and milk production.
-	PRIAG	Agronomic research in basic grain crops.
-	PRECODEPA	Regional research organization to conduct research studies on potatoes.

6.0 INTER-REGIONAL COOPERATION NEEDS

- Increased support of germplasm exchange.
- Effective integration of regional networks with national programmes.
- Support of exchange of technical personnel within the Central American Region.
- Support of research activities on Integrated Pest Management Control.
- Current information on trends in agribusiness.
- Training of technical personnel on fast plant reproduction systems.
- Training on modern horticultural production techniques.
- Training of processing systems of horticultural products at the Artisan level.
- Effective working systems to integrate agriculture research personnel into the process of giving technical assistance to farmers.
- Training on production of radio programmes to promote mass diffusion of ICTA's agricultural findings.
- Development of clear-cut technological options to promote more efficient production systems that take into account the preservation of our natural resources.
- Economic analysis of experimental trials.
- Software for analysis of experimental results.

4.7 NATIONAL INSTITUTE FOR AGRICULTURAL AND FORESTRY RESEARCH

H. Roman P., Director of the Regional Research Centre,
INIFAP, Mexico

1.0 INTRODUCTION

INIFAP is an Institution dependent of the Secretary of Agriculture and Hydraulic Resources, responsible for planning, programming, executing and evaluating the activities of crops, animal and forest research.

INIFAP was created in 1985, when the three National Research Institutes INIA (Crops), INIP (Animal) and INIF (Forest) were merged, in order to increase and improve the affectiveness and efficiency of the research activities whithin the Agricultural Sector.

2.0 MISSION

The Mission of INIFAP is to participate in the integrated development of the country, in support of farmers, through Research and Development, as an output of scientific and technological research, which would contribute to the effective, efficient and sustainable production of food and fibre, considering the rational use of the natural resources, all of it within a participative model.

3.0 OBJECTIVES

The institutional objectives are to generate, validate and transfer new technologies and participate in Development Projects to:

- ensure sustainable production and productivity;
- diversify production alternatives;
- increase competitiveness and profitability;
- promote the rational use of natural resources;
- contribute to technological self reliance; and
- increase the offer of consultative activities and training of extension agents and farmers.

4.0 GENERAL STRATEGIES

- Integrate the medium and long range Strategic Plan.

- Define high research priorities in terms of commodities, problems and research opportunities.

- Concentrate efforts and establish the structural changes required by the research programmes.

- Fortify the capacity to generate, validate and transfer competitive technologies.

- Establish strategic centres as headquarters for specialized research staff and upgrade its research equipment in order to accomplish competitivenes and research excellence.

- Promote and support leading reseach developments and scientific technological leadership.

- Strengthen the capacity to monitor all scientific and technological development with potential for adaptation and use in México.

- Promote the evaluation of its research programmes' results and their impact in agricultural production.

- Establish an effective interaction with the central administration to set up high national priorities within the crops, animal and forest sectors.

- Increase and improve the interaction with farmers through the promotion of Patronatos (Board of Farmers to support research) to:
  - identify the real priorities of technology demands;
  - promote the transfer-adoption process of new technologies; and
  - diversify the financial sources to support research.

- Promote and support complementary actions with national and international research institutions, to develop an active interaction of the institution with the world research community.

- Promote the use of its research results, participating in agricultural development projects.

- Support educational development of the research staff in accordance with the institutional priorities.

- Increase the institutional capacity response and the quality of research.

- Strengthen the institutional image of capacity, quality and effectiveness, which in turn should increase the technology credibility among farmers.

5.0 RESEARCH ORGANIZATION

5.1 Central Administration

INIFAP has a Board chaired by the Secretary of Agriculture and Hydraulic Resources. It gives direction to research activities, according to the government National Development Plan and the Programme to Modernize Agriculture activities. It approves the annual budget for INIFAP programmes.

The Chief Executive Office is responsible for the planning and programming for crops, and animal and forest research. It sets up priorities and executes the institutional policies.

Research is organized in three Divisions, namely Crops, Animal and Forest. They interact with the SARH Central Administration and are responsible for the integration of the Division's national strategic research plan. They coordinate the Division's national Programme, assign resources to research projects, look for complementary actions with educational and research institutions, integrate the Division's research results and participate in the evaluation of its programmes.

Division Directors coordinate the activities of the disciplinary research centres (CENID). These are responsible for promotion and support of research development with a broad scope and new scientific knowledge, oriented to high priority national problems and to support the training and development of the research staff.

5.2 Regional Administration

INIFAP has eight Regional Research Centres. Within the regions, research projects are integrated by commodities, considering the national research programmes by Division. The Region ensures the technical support needed to establish and develop the research projects and coordinates the operation of 87 experimental stations.

INIFAP also has State Coordinators whose role is to promote the use of commodity technology innovations, through validation actions on farmers' fields, and to identify farmers technology demands. They also establish and promote a close interaction with farmers' associations and coordinate actions with state government and with the state educational and research institutions.

At the Experimental Stations, research projects are established and the validation and technology transfer activities are performed, based upon the national, regional, state and local priorities. Support services and resources are provided to the research staff for the operation and administration of the research

programmes (Annex 1).

INIFAP has 1559 researchers; 64% in crops research, 23% in animal research, 13% in forest research and 12% on leave for graduate studies. Approximately 69% of the research staff has a Masters or PhD Degree (Table 1). Annex 2 lists the number of experimental stations dealing with research, and Annex 3, the number of those conducting validation and transfer of technology.

TABLE 1. INIFAP- RESEARCH STAFF BY DIVISION

DIVISION	BSc	MSc	PhD	ON-LEAVE	TOTAL
CROPS	260	546	88	103	997
ANIMAL	97	170	41	59	367
FORESTRY	123	43	4	25	195
TOTAL	480	759	133	187	1559

ANNEX 1.

RESEARCH PROGRAMMES

1. CROPS DIVISION

- Staple Crops
- Strategic Crops for National Demand
- Export Crops
- Natural Resources
- National Problems
- Sector Problems
- Biotechnology
- Socio-economics
- Extension and Technology Transfer

2. ANIMAL DIVISION

- Veterinary Microbiology
- Veterinary Parasitology
- Animal Feeding and Nutrition
- Animal Breeding and Genetics
- Animal Reproduction
- Epizootioloy
- Forages
- Range Management
- Socioeconomics
- Animal Products Technology
- Animal Production Systems by Region
- Validation and Technology Transfer

3. FOREST DIVISION

- Pine
- Oak
- High Value Tropical Hardwood Species
- Conifers
- Common Tropical Species
- Common Hardwood Species
- Dioscorea
- Fiber Agave
- Wax Shrub
- Desert Shrubs
- Forest Products Technology
  Improvement of Forest Enviroment
- Integrated Management of Forest Natural Resources

ANNEX 2.

INIFAP - PRIORITY RESEARCH PROGRAMMES BY EXPERIMENTAL STATIONS

REGIONAL RESEARCH CENTRES	EXPERIMENTAL STATIONS				TOTAL
	CROPS	ANIMAL	FORESTRY	C-A-F	
NORTH WEST	5	1	O	O	6
CENTRAL NORTH	5	1	1	0	7
NORTH EAST	3	1	0	2	6
CENTRAL PACIFIC	3	2	1	1	7
CENTRAL	5	1	0	0	6
CENTRAL GULF	1	1	0	0	5
SOUTH PACIFIC	4	1	0	0	5
SOUTH EAST	1	1	2	0	4
TOTAL	27	9	5	4	45
%	60	20	11	9	100

ANNEX 3.

INIFAP - VALIDATION AND TECHNOLOGY TRANSFER PROGRAMS BY EXPERIMENTAL STATIONS

REGIONAL RESEARCH CENTER	EXPERIMENTAL STATION				TOTAL
	CROPS	ANIMAL	FORESTRY	C-A-F	
NORTH WEST	5	1	1	0	7
CENTRAL NORTH	3	0	0	0	3
NORTH EAST	5	0	0	0	5
CENTRAL PACIFIC	3	1	1	0	5
CENTRAL	1	0	0	3	4
CENTRAL GULF	2	1	0	0	3
SOUTH PACIFIC	2	2	0	1	5
SOUTH EAST	3	0	1	0	4
TOTAL	24	5	4	4	36
%	66	14	12	12	100

4.8 PERSPECTIVE FOR COOPERATION BETWEEN LATIN AMERICA AND THE CARIBBEAN

C. J. Torres, National Director, INTA, Argentina

1.0 BACKGROUND

The National Institute for Agricultural Technology (INTA), of Argentina, was established by law (December 1956), in response to existing economical and political circumstances, as an autonomous public institution of the Federal Ministry of Agriculture. Previously, the Ministry's Directorate of Agricultural Research, the Directorate of Livestock Research, as well as the Extension Services located at the so-called "regional agronomies", had similar missions.

INTA's objectives guide its course, define action areas, and determine its broad global priorities, as stated in articles #1 and #2 of INTA's Law: INTA shall organize, develop and stimulate agricultural research, experimentation and extension as fundamental aspects, to which end it shall promote directly, or through other institutions:

- research on natural resources;
- research concerning the production, storage and primary processing of agricultural products;
- technical and cultural assistance to farmers and their families, and the improvement of their communities; and
- extension and promotional action necessary for the adoption of the results of research and experience.

These goals are still valid, even after thirty years, and the outcome of economical development in Argentina. During this period there has been a continuous adaptation of structure and action courses, by which INTA's scientific and technological capability, as well as the relations between its acting units and its actions, managed to keep up to date.

By means of multidisciplinary programming, implemented by decentralized units endowed with a barely "critical mass" of human resources, INTA has been able to join successfully in the significant changes in Argentina's most recent history.

When INTA was organized, in the mid-fifties, it was the only technological organisation for agriculture. Today, a host of public and private institutions generate and disseminate technology in Argentina, and many of them are cooperating with INTA in specific areas.

In the last ten years INTA has undergone structural transformations sustaining a dynamic institutional modernization

based on the following principles:

- **Decentralisation:** Regional Centres, in most cases one for each province, and Research Centres, with their own Governing Bodies, and administrative and technical autonomy.

- **Participation:** representatives of the different sectors involved in the creation, transfer and adoption of technology in the governing bodies of the Regional and Research Centres.

- **Integration:** the institutionalized incorporation of the involved sectors in each Region and in each scientific area tends towards an efficient use of the available human, material, financial and information resources.

INTA, as a decentralized autonomous institution, is governed by a Board of Directors as its highest authority. The National Director, who reports to the Board, is the scientific and administrative leader of INTA; he has a staff of four National Assistant Directors (Planning; Operations; Control and Evaluation; and Organization and Human Resources) and a Director of Administration.

The fifteen Regional Centres cover one or two (in one case three) provinces (with the exception of the Province of Buenos Aires, the most populated and productive large province, which has two Centres). The Regional Directors report to their Regional Council, and coordinate several experiment stations (a total of 41) and numerous extension units (a total of 202).

The three Research Centres (Natural Resources; Veterinary Science; and Agricultural Science) are each governed by a Council, and comprise a total of thirteen institutes doing research in more fundamental disciplines.

There are, also, a few specialized units, such as one coordinating technological venture agreements, another for small resource-poor farmers, and one for postgraduate education projects with universities.

INTA has a staff of 4,500, 35% with an academic degree, 5.5% are technicians, 28.5% have clerical jobs, and the rest (33%) are field and laboratory helpers.

One of the reasons for INTA's relatively successful evolution is its financial autonomy and substantial operating independence, never interfered with by successive National Administrations (except a short period just before 1983). Another reason is the active and dedicated participation of the representatives of the various sectors involved with agricultural production in its governing bodies.

A recent estimate shows that, through improved production, lower losses at harvest, and farmland that has been put to other uses, technology created and/or promoted by INTA in twenty years added more than $US 1,000 million to Argentina's economy.

2.0 AGRICULTURAL TECHNOLOGY RESEARCH AND DEVELOPMENT PROGRAMME

The aforementioned structure and resource endowment are assigned to programmes that fit the regional capabilities and initiatives and, at the same time, guide the overall coordination of interregional projects and national programmes, always complying with the objectives of the National Government and the Provincial Governments.

National Programmes, Regional Programmes, and Research and Technology Transfer Projects are the main programming devises. They all take into account:-

- the increasing diversification and specialization of agricultural production in the Regions;

- the need for a closer link with research and the ever-changing production problems, and the need for a closer relationship of INTA with the users of its outputs;

- a closer connection with R/D recently developed by independent professional advisors, private corporations, universities, cooperatives, and others; and

- opportunities for training and problem solving offered by international agencies and foreign countries, to keep INTA's staff in contact with scientific advances in industrialized countries.

Ultimately, INTA's "products" are technologies effectively incorporated by farmers into their production systems. The politico-technical cohesion - in space and time - of INTA's actions are described in "Plan de Tecnología Agropecuaria, PLANTA, 1990-1995" (Agricultural Technology Plan 1990-1995) as a methodical proposal of INTA's medium term institutional action.

PLANTA 1990-1995 has been developed with the technical agreement of many qualified participants, always keeping in mind the creativity of a scientific and technological institution. PLANTA follows the global objectives set by the National Government for the agricultural sector, seeking the solution to problems and taking advantage of opportunities, both emanating from domestic circumstances, and from outside the country; and, finally, reaching the goals set by INTA's Board of Directors for the period.

PLANTA is, first of all, a guide for the achievement of

efficiency in production, sustainability, diversification, and equity. It expands production and exports, reaches more markets in the world with processed (value added) high-quality products, controlls the degradation of the natural resource base, and ensures that all components of the agricultural sector - particularly the more deprived ones - receive the benefits of technological change.

PLANTA embraces a proposal of organized and coordinated action in sixteen National Research Programmes, as well as a Regional Research and Extension Programme for each of the fifteen Regional Centres.

INTA's activities are implemented in the whole country by experimental stations, extension units and research institutes. The research and extension actions implemented by each Regional Centre have been defined by its PLANTAR (Plan de Tecnología Agropecuaria Regional, Regional Agricultural Technology Plan). The objectives for each Regional Plan (PLANTAR) have been defined by each Centre and its Regional Council, within the global institutional goals set by INTA's Board of Directors.

Each PLANTAR is based on regional characteristics and local needs, and is a guide for local action. It comprises the Regional Programme and the parts of National Programmes to be implemented in the Region.

The National Research Programmes cover research in more than one Region, avoiding unnecessary duplication of efforts, and taking advantage of existing "critical mass" of personnel and facilities. Cooperation between Centres and operating units is achieved by Programme Coordinators.

The National Research Programmes are of three kinds:-

Basic and Strategic Research Programmes: The five programmes include:

- Advanced Biotechnology;
- Animal Health;
- Plant Physiology and Pathology;
- Agro-Industries; and
- Agricultural Economics and Social Studies.

They are organized on the basis of scientific disciplines for the preservation and improvement of the yield of plants and animals; the processing of agricultural commodities; the discovery of new uses; and the expansion of potential markets.

Applied Research Programmes on Commodities: There are seven programmes in this group, including:

- Cereals and Oilseeds;
- Fruit Trees;
- Horticulture;
- Industrial Crops;
- Forest Trees;
- Animal Production I (Ruminants); and
- Animal Production II (Non-Ruminants).

Each programme covers a major group of commodities with multidisciplinary research, developing technologies that are more effective, efficient and profitable than those used at present.

Research Programmes on Natural Resources: These programmes emphasize an accurate knowledge of the farm environment and living species, analyzing static and dynamic characteristics, seeking new uses and, at the same time, the sustainability of the resource base. They include:

- Climate and Water Resources; Soils;
- Natural Plant Resources and Wildlife; and
- Genetic Resources (germplasm bank).

The operating parts of the National Programmes are work plans and projects implemented by one or more of the research institutes and experiment stations and other units of the Regional Centres, searching for the solution of specific problems or seeking results that can be extrapolated to other regions.

INTA's Board of Directors has earmarked $US 1.5 million per year for strategic research aiming at future needs, anticipating future demands, so as to expand the competitive possibilities of Argentina's agriculture. The projects now implemented cover biological control; plant resistance against insects; biological nitrogen fixation; "organic" meat production; etc. Future competitiveness of the agricultural sector is closely associated with the inclusion of new technological developments which will hopefully be achieved by the research projects of the National Programmes.

Extension and Adaptive Experimentation Projects cover institutional action for technology transfer. These projects analyze the problem to be solved, clearly state the final situation to be reached, and define the course to be followed. When these projects are implemented, under coordination, in more than one region, they are called Integrated Projects, whereas those projects implemented specifically in and for a Region, are called Regional Projects.

At present, there are over one hundred of these projects being implemented all over the country. One of them, for instance, has to do with the improvement of grain harvest by combine, with the purpose of reducing harvest losses by at least 20% in five years;

benefits are estimated at $US 100 million per year. INTA's Board of Directors has been increasing the yearly allocation for these projects, among them forestry development; integrated control of foot-and-mouth disease; sustainable agriculture; and prevention and control of desertification in Patagonia.

Other relevant actions complement the aforementioned some of which are implemented by specific units, such as projects for small resource-poor farmers, joint venture agreements for the development of new products, and postgraduate training projects.

The Project for Small Resource-Poor Farmers as well as urban and rural poor is carried out together with the Federal Ministry of Public Health and Social Action, the Ministry of Agriculture, Livestock and Fisheries, and several private organisations. Adaptive research and technology dissemination, as well as training and organisation of farmers, is directed at economically self-sustained communities, producing food for their own consumption, with acceptable well-being and quality of life.

Through **Joint Venture Agreements** with private sector enterprises innovations generated by INTA are developed by a specialized firm, in order to reach the market. In 1987 INTA's Joint Venture Unit was established, and guidelines for the selection and definition of agreements were developed.

About 90 joint venture agreements are being implemented at present. Risks and benefits are shared, combining INTA's scientific expertise with industrial management and marketing expertise. Joint venture projects range from the development of tyres for agricultural machinery to the generation and dissemination of new sunflower cultivars, and the improvement of virus disease diagnosis in animal semen.

Postgraduate Training Projects in Agricultural Sciences have been performed by INTA since 1963, as the responsibility, at first, of a Department of Specialization and, at present, of the National Assistant Director for Human Resources and the Director for Advanced Education, with the cooperation of several universities. The training courses are for INTA's staff and faculty, and professionals of other institutions from the Argentine and other countries. In this way, INTA has contributed, and still contributes, to the development of much needed solid scientific knowledge, with emphasis on domestic problems and circumstances.

Degrees are granted by the University of Buenos Aires and by the National Universities of La Plata, Córdoba, Rosario, the South (at Bahía Blanca), Mar del Plata and Litoral (at Santa Fe). INTA takes care of part of the funding (fellowships, fees for teachers) and many of INTA's more experienced researchers and extensionists teach classes in postgraduate courses.

The postgraduate courses now implemented are:

- Soils: (Buenos Aires and Bahía Blanca);
- Natural Resources: (Buenos Aires);
- Plant Production: (Buenos Aires and Balcarce);
- Genetic Plant Improvement: (Pergamino);
- Seed Technology: (Córdoba);
- Animal Production: (Balcarce);
- Animal Health (Buenos Aires);
- Agricultural Mechanization (La Plata);
- Biometrics (Buenos Aires);
- Agricultural Extension (Rafaela, Santa Fe).

3.0 RELATIVELY STRONG INSTITUTIONAL AREAS OF INTEREST TO CARIBBEAN COUNTRIES

For possible cooperation with institutions of the Caribbean, INTA feels it can offer cooperation in certain areas. Some of these activities are already implemented through bilateral agreements, or with the support of international or regional institutions. INTA's participation could comprise of training courses; visits and on-the-job training in Argentina; courses given in the interested country; or consultants and short technological and scientific missions.

Following are some areas of possible cooperation.

3.1 Sustainability

- Causal diagnosis and planning of sustainable farming systems;
- monitoring of natural resources;
- development of soil management and conservation models;
- conservation practice training;
- use of primary productivity models;
- image digital processing systems;
- interconnection of data and meteorological observation stations, storage and information processing;
- evaluation of soil degradation caused by man;
- land evaluation for specific crops (FAO system) and agricultural crops (ALES systematized);
- linear programming for the design of farm systems;
- study and monitoring of the state of natural resources, through mapping of soil biophysical conditions;
- transformation due to usage and urban development tendencies;
- soil pests control in sustainable farm systems;
- impact of chemicals and other technological inputs on the environment; and
- agro-forestry systems, ecology, and monitoring of forest trees planted for soil protection.

3.2 Fruit Trees

- Genetic improvement (e.g., citrus fruits, deciduous fruits, grapes);
- evaluation methodology and germplasm banks;
- selection of grape cultivars for specific ecological conditions;
- behaviour of cultivars and rootstocks in genetic improvement;
- improved management of citrus cultivars;
- fertilization, sanitary control and harvest methods (e.g., of oranges and other citrus fruits);
- planting and management technology for fruit orchards and vineyards;
- information on sanitary problems (e.g., citrus chlorosis and cancrosis, Mediterranean fruit fly, and others);
- integrated management of fruit pests and diseases (including the reducing of pesticide residues in fruits);
- nutritional diagnosis techniques; and
- correction of nutritional disorders.

3.3 Vegetables

- Genetic improvement for higher productivity, higher quality and/or for resistance to pests and diseases (e.g. in garlic, onions, potato, tomatoes, cucumbers, asparagus, peppers, green salad);
- development of data banks for germplasm;
- information on and provision of germplasm for sweet maize, both for consumption or for processing;
- production of improved tomatoes for processing;
- in vitro production and provision of germplasm;
- management technologies for potato, onion and garlic crops;
- fertilization and sanitary control methods for same crops;
- integrated pest control;
- technology for crops grown under plastic cover (e.g., tomatoes, pepper, celery);
- improvement of intensive crops (e.g., asparagus, cucumbers);
- biotechnology for pathogen-free material of garlic and onions;
- virus and other pathogen diagnosis techniques for potatoes and garlic; and
- production of certified and pathogen-free seed.

3.4 Sheep and Goat Production

- Intensive and extensive management and integrated planning;
- production, evaluation, management, use and recovering of pastures;
- feed supplements;
- digestion and digestibility methods (ruminal dynamics);
- insemination techniques with frozen semen and embryos;

- facilities for sheep and goat production;
- quality control of wool;
- meat technology;
- physiology of growth;
- feedstuff quality; and
- wastage control of processing plants.

3.5 Biotechnology

- Information on production of plant cell and tissue cultures (micropropagation laboratory);
- new meristem isolation techniques for dicotyledones;
- heat and chemotherapeutic cleaning of field material for meristem isolation;
- molecular biology techniques for germplasm characterization;
- embryo transfer techniques;
- molecular biology techniques to modify embryo genome;
- production of cattle, sheep and goat embryos, in vitro fertilization, freeze preservation and manipulation; and
- semen extraction and freezing.

3.6 Special Training Areas

INTA can offer expertise in the following areas:

- Institutional organisation;
- decentralization;
- sector participation in institutional government;
- interinstitutional integration for the generation and transfer of technology;
- research and extension planning and programming systems;
- monitoring and evaluation systems for technology generation and transfer;
- human resources management and development;
- postgraduate training in agricultural sciences;
- research and extension manager training.
- technology linkages with the private sector for production and marketing of patentable technologies;
- financial resources budgeting, management and control systems; and
- evaluation of economic and social impacts of technology generated by R/D.

4.0 OTHER RELATIVELY STRONG INSTITUTIONAL AREAS

4.1 Genetic Resources

- Prospecting, identification and provision of potentially useful plant and animal germplasm;
- gene evaluation systems and information on quality and

behavior (ecological adaptability, immunity, productivity) of material for improvement;
- methodology for the implementation and development of germplasm banks and associated data banks;
- evaluation methods and systems of genetic value and genotype comparisons;
- selection of genetic material (e.g., for specific ecological conditions);
- characterization of biotypes for different production systems; and
- genetic evaluation of breeder animals and breeder line selection.

4.2 Cereals and Oilseeds

- Genetic improvement and seed production;
- development of superior varieties and hybrids of wheat, maize, sorghum, rice, soybeans, flax, sunflower and peanuts;
- cultivar evaluation;
- development of new methods for the integrated control of pests in these crops;
- low cost weed control methods, especially in soybean crops;
- development of selected lines resistant against specific diseases (e.g., Sclerolitinia in sunflower); and
- improvement of harvest efficiency technology (see also Industrial Crops).

4.3 Industrial Crops

- Cotton: genetic improvement for high yields and industrial quality of cultivars;
- information on and provision of genetic material, and cultivar performance evaluation;
- crop management and tilling techniques;
- evaluation and integrated pest management (integrated control);
- early alarm systems;
- insecticides applied to seeds;
- improvement of harvest combines; and
- sugar cane: genetic improvement, crop management, protection, etc., as stated for cotton.

4.4 Forest Trees

- Production of improved propagation material;
- genetic conservation techniques for the preservation of species of economic, scientific and environmental significance;
- techniques for monitoring ecological management for soil protection;

- information on and use of genetic material; and
- transfer of new production technologies.

4.5 Dairy Cattle Production

- Animal evaluation for genetic improvement;
- evaluation of pastures and preserved forage;
- animal nutrition;
- dairy herd health management; and
- milking and milk quality (installation, equipment, quality and hygienic evaluation and improvement).

4.6 Beef Cattle Production

- Genetics and improvement (biotype characterization for specific production systems);
- genetic breeder evaluation;
- genetic line selection;
- feeding and nutrition (forage plant germplasm bank);
- ecologically adapted high producing grasses and leguminous forage plants;
- dynamic evaluation of natural pastures and management and retrieval techniques, under pasture;
- digestion and digestibility (ruminal dynamics, metabolite plasmic concentration, macro-elements);
- herd management and "organic production";
- classification of herds by characteristics and ecological areas;
- management of breeding herds;
- reduction of after-delivery anoestrus;
- heat-synchronization with luteinizing chemicals;
- evaluation of bull performance;
- production and preservation of embryos;
- semen extraction and freezing; and
- meat technology (growth physiology, fats, proteins, enzymes, feed safety, control of residues, industrial processing).

4.7 Pig Production

- Genetic improvement;
- experimental and pure commercial lines;
- hybrids;
- genetic evaluation methods and genotype comparison;
- integrated planning of selection and hybridization;
- feeding and analysis of feedstuff quality;
- nutritional needs;
- biological techniques for digestibility studies;
- information on rational use of traditional feedstuffs and industrial by-products;

- management in confinement and on the field;
- installation and equipment;
- techniques for semen extraction, quality analysis, dilution and preservation;
- information on frozen semen of genetic lines;
- animal health;
- pathological diagnosis on pork;
- meat technology;
- growth physiology, fats, proteins, enzymes;
- residue control; and
- industrial processing.

4.8 Fur-Bearing and Hair-Producing Animals

- Breeding and management of otters, mink, foxes and rabbits (for meat and hair);
- genetics and mutations in nutrias;
- methodology for the calculation of feed rations and feeding need of nutrias and carnivores;
- disease diagnosis methods;
- semen extraction methods and artificial insemination of foxes;
- nutria meat quality technology; and
- analysis of production and marketing organisation.

4.9 Poultry Production

- Genetics:
  - improved lines of wide-breasted white turkeys, ducks, broiler chicken and laying hens under intensive, organic-type, production;
  - germplasm evaluation methods; and
  - gene-pool development and use;
- Nutrition:
  - feedstuff ingredient analysis;
  - biotechnical estimations of energy disposal and amino acids;
  - feed ration evaluation and feeding requirements; and
  - use of traditional and non-traditional components in feedstuffs.
- Management:
  - norms for meat and egg (both fertile and for consumer use) production, under intensive and semi-extensive conditions.
- Reproduction:
  - technology for semen extraction, quality analysis and artificial insemination of chicken and turkey hens.
- Health:
  - disease diagnosis; and
  - health control in intensive and semi-extensive production systems.

4.10 Animal Health

- Development of integrated animal health systems;
- health planning for intensive, semi-extensive and extensive production systems;
- health control and improvement of cattle herds (especially anaplasmosis and babesiosis);
- venereal diseases:
- diagnosis, antigenic characterization of strains and experimental vaccine production;
- control of paratuberculosis;
- evaluation of external and internal antiparasites;
- integrated control of ticks and tick-transmitted diseases;
- special disease diagnosis and characterization of pathogens;
- role of animal vectors;
- foot-and-mouth disease biotechnology and control, also for brucellosis, and of other animal diseases;
- symptoms and treatment of deficiency diseases;
- toxic plants;
- feedstuff safety;
- development of laboratory installation and equipment, for parasitology, serology, virology, and others; and
- technical assistance for pathological diagnosis of meat products.

5.0 SPECIFIC NEEDS FOR INTERNATIONAL COOPERATION

For certain areas of cooperation, INTA may need international, or bilateral, support or help; e.g., to reinforce its own research staff, or to complete institutional facilities. Such is the case with Advanced Biotechnology, particularly for agro-industrial processing; the development and management of integrated agro-silvo-livestock systems; last generation processing (such as fruit and vegetable processing, packaging and preservation) and post-harvest machinery. This type of problem will have to be solved by means of previously implemented study missions.

6.0 LITERATURE ON INTA

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- Plan Nacional de Tecnología Agropecuaria 1990-1995. Buenos Aires: INTA, Serie Documentos Institucionales No.1, 96pp., 1990.
- Planes de Trabajo del INTA. Buenos Aires: INTA, Dirección Nacional Asistente de Control y Evaluación, 265pp., 1991.
- INTA en Acción. 100 Proyectos para el Cambio Productivo.
- Convenios de Vinculación Technológica del INTA con el Sector Privado.

4.9 INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES: THE REGIONAL OFFICE FOR THE AMERICAS

K. A. Okada, Leader of the Americas Group, IBPGR, Colombia

1.0 INTRODUCTION

The International Board for Plant Genetic Resources (IBPGR) is one of the 17 international centres of agricultural research under the aegis of the Consultive Group of International Agricultural Research (CGIAR). IBPGR was, formally, established in June, 1974, and has operated with the support of, and under the legal and administrative umbrella of the Food and Agriculture Organization of the United Nations (FAO).

The International Plant Genetic Resources Institute (IPGRI), the legal successor of IBPGR, was formally established on 9 October, 1991, and will become operational once the Italian Parliament has ratified IPGRI's Headquarter's Agreement with the Italian Republic. The creation of IPGRI is in response to both the evolving needs of our partners and IBPGR's own needs as this institution has come of age and has reached a complex institutional development in terms of its scientific staff, research topics, global and regional strategy, as well as complex interactions with international, regional and national organizations.

The emphasis in the 1970's was on the protection of the environment and this was reflected in IBPGR's programme where heavy emphasis was given to collecting and conservation of plant genetic resources. The emphasis of IPGRI at the end of the twentieth century and the beginning of the twenty first century will be in the links between conservation and use of plant genetic resources. The new strategy is reflected in the four primary objectives of IPGRI, as well as in its strategic plan named "Diversity for Development". Also, the implementation of agenda 21 has been fully taken into consideration in IPGRI's strategic plan.

2.0 OBJECTIVES

2.1 First Objective

IPGRI's first objective is to assist countries, particularly developing nations, to assess and meet their needs for conservation of plant genetic resources, and to strengthen links to users of plant genetic resources. IPGRI will pay particular attention to those countries that lack the capacity to develop a fully effective system themselves, to assist them to assess their own needs for genetic resources conservation, exchange and use. Increasing emphasis will be given to surveying genetic resources to plan collecting missions, genetic erosion early warning systems,

appropriate sampling strategies and the handling, characterization and evaluation of accessions.

2.2 Second Objective

IPGRI's second objective is to build international collaboration in the conservation and use of plant genetic resources. IPGRI will encourage and support the formation of networks, both on a crop and a geographical basis. Networking efforts will concentrate on those plants of key importance to regional agriculture of forestry. IPGRI will cooperate closely with national programmes, and other GG's centres, as well as with FAO in providing scientific and technical advice and support to the initiatives of the FAO Commission on Plant Genetic Resources. IPGRI will continue to collaborate with international conservation NGOs, and forge closer links with key developmental NGOs.

2.3 Third Objective

IPGRI's third objective is to develop and promote improved strategies and technologies for plant genetic resources, and integrated methods of conservation. Research will concentrate on `genetic' problems, the solutions to which are likely to be broadly applicable. Retention of diversity in collections, conservation technology and plant health are major topics. Work on wild relatives of crops and on forest genetic resources will involve research on in situ conservation. Taking into account the human dimension of plant genetic resource conservation and use, IPGRI will initiate research for conserving traditional knowledge about plant characterization and local practices for using and conserving plant genetic resources.

2.4 Fourth Objective

IPGRI's fourth objective is to provide an information service to inform the world's genetic resources community of both practical and scientific developments in the field. Technical and scientific publications will be targeted, primarily, at staff of national programmes. In addition, an active public awareness programme will target donors, policy makers in donor and partner countries, and those that influence them.

2.5 Future Plans

IPGRI has no plans to develop any independent research facilities. Headquarters and regional offices will remain as administrative and coordination centres. Our scientific and technical activities will be done mainly in collaborating

institutions, either with the direct involvement of IPGRI staff or through research contracts. Partnership is the keynote of IPGRI's strategy, and the changes in organization are specifically made to enable IPGRI to work more closely and effectively with its partners.

IPGRI will have a single integrated programme built on a set of projects, each designed to contribute to one or more of the institute's objectives. Individual projects will be designed to achieve clearly defined objectives within an agreed budget in a specified period of time through a number of related but independent activities. A project will, most commonly, be multidisciplinary, involving a number of the different areas of specialization available with IPGRI (e.g. genetic diversity, training and information), but this need not always be the case. A project will, therefore, nearly always involve the participation of a number of IPGRI staff and one or more partner institution.

To achieve its goals, IPGRI will consolidate its structure in five Regional Groups and three Thematic Groups (Annex 1). As from January, 1993, IBPGR decided to consolidate all its operations in the Americas in the regional office for the Americas based at CIAT, Cali, Colombia.

The regional office for the Americas is supporting national programmes through three networks of plant genetic resources, namely: the Mesoamerican Network of Plant Genetic Resources (REMERFI); the Andean Network of Plant Genetic Resources (REDARFIT); and the Amazonian Network of Plant Genetic Resources (TROPIGEN). All three networks were set up, jointly, with IICA through PROCIANDINO for REDARFIT and PROCITROPICOS for TROPIGEN. IPGRI will promote similar developments in the Southern cone and in the Caribbean.

3.0 MAJOR ACHIEVEMENTS

From its first effective year of operation (1975), IBPGR spread its activities widely, promoting interest and awareness of plant genetic resources through meetings, publications and training.

3.1 Support to National Genetic Resources Programmes

IBPGR's scientific and technical support to national genetic resources programmes has contributed to the establishment in over 100 countries of ex situ conservation facilities comprising national and international storage facilities for germplasm of particular crops.

3.2 Germplasm Collecting and Distribution

IBPGR was always heavily involved in collecting germplasm, especially in the early years when massive genetic erosion was occurring as traditional cultivars were replaced by new varieties. By 1991, almost 200,000 samples had been collected on missions sponsored by IBPGR.

3.3 Training

IBPGR's training efforts were, initially, concentrated on supporting a postgraduate course on conservation of plant genetic resources at the University of Birmingham, UK. Soon, however, activities expanded to also cover short courses, individual training and internships to qualified scientists and technicians. IBPGR had sponsored almost 1,500 trainees on different aspects of plant genetic resources by 1990, 60% of whom still study or work on some aspect of plant genetic resources.

3.4 Documentation and Characterization

Fundamental work by IBPGR on the documentation of plant genetic resources has resulted in a standardized system for characterizing germplasm samples. The system has been adopted by institutions all over the world and IBPGR has developed and published almost 70 standardized descriptor lists. Databases covering a wide range of information have now been established.

3.5 Publications

IBPGR has produced over 200 publications, from informative newsletters to research level textbooks and conference proceedings.

3.6 Genetic Resources Networks

IBPGR pioneered the concept of networks dealing with the genetic resources of individual crop genepools or with the indigenous genetic resources of crops of a given ecogeographic region, as a mechanism to ensure better conservation and wider use of under-exploited genetic resources, provide better support to crop improvement programmes, and strengthen links among and between developed and developing countries. This idea was rapidly accepted and an ever-increasing number of such networks are being established.

3.7 Research

IBPGR became involved in research from the first years of its existence. It supported ground-breaking research to improve conservation technology, particularly seed storage methods and standards for storage, monitoring and management in genebanks that are employed all over the world today. A number of widely accepted guidelines and handbooks on basic seed conservation resulted from these early efforts. The programme expanded into other areas of work badly needing attention. Fundamental research on in vitro conservation, genetic diversity, conservation technology, regeneration and evaluation has resulted in significant advances in conservation strategies and techniques.

4.0 MAJOR CONSTRAINTS AFFECTING PLANT GENETIC RESOURCES ACTIVITIES IN THE REGION

The two most important constraints affecting plant genetic resources activities in the region are:

1) insufficient economic support, and
2) lack of trained personnel.

5.0 INTER-REGIONAL COOPERATION

We see ample scope for cooperation in plant genetic resources between the Caribbean countries and the plant genetic resources networks established for Mesoamerica, the Andean, the Amazon and the Southern Cone.

5.0 COOPERATION NETWORKS ADMINISTERED BY IICA

5.1 IICA'S HORIZONTAL COOPERATIVE RECIPROCAL PROGRAMMES ON AGRICULTURAL RESEARCH AND TECHNOLOGY TRANSFER

E. Alarcon, Technology Generation and Transfer Specialist,
IICA, Costa Rica

1.0 PRESENTATION

These short notes have been prepared by the author using as a base the Medium Term Plan of IICA's Technology Generation and Transfer Programme 1987-93. Also, they present the author's view of IICA's network objectives and major features. A list of the actual horizontal reciprocal cooperative programmes is also presented for information to the participants of the First Meeting of the Technical Committee for Agricultural Technology Transfer between Latin America and the Caribbean, May 18-20, 1993, Castries, Saint Lucia.

2.0 PROGRAMME II: TECHNOLOGY GENERATION AND TRANSFER

Programme II was established in response to two fundamental issues: i)Recognition by the countries and the international technical and financial community of the importance of technology to production development in the agricultural sector; and ii) A general conviction that the potential of science and technology can be fully tapped only with the existence of institutional models capable of developing appropriate technological responses to the specific conditions of each country, and with the framework that encourages and facilitates the incorporation of new technology into production processes.

2.1 Objective

To promote and support Member State actions in connection with institutional development and modernization aimed at improving the design of technology policy, strengthening the planning, programming, organization and administration of national technology generation and transfer systems, and promoting closer ties among these, with a view to increasing reciprocal cooperation and improving international relations.

The above aims to make better use of the available resources and a more effective contribution to solving the technological problems of agricultural production. Efforts in this field are taking place in a framework of equitable distribution of benefits and conservation of natural resources.

2.2 Strategy

The Programme will focus efforts on two strategic areas:

i) increasing the quality and amount of resources available, in general; and

ii) improving the existing resources at the country level.

With regard to the first of these areas (focus of these notes), efforts are being made to actively promote and support reciprocal cooperation mechanisms among countries, and among them and the international scientific community. Efforts are also being made to establish coordination mechanisms with different funding sources, with a view to increasing the amount of existing resources and creating alternatives for obtaining same.

2.3 Working Areas

On the basis of the strategies mentioned aboved, Programme II concentrates its activities on four areas:

- Development of research and technology transfer institutions;
- Promotion of reciprocal technical cooperation and the international transfer of technology;
- Cooperation in boosting technological development in strategic areas; and
- Administration of technical assistance and financial resources for research and technology transfer.

3.0 HORIZONTAL RECIPROCAL COOPERATION ACTIVITIES

The region already has experience with networks for information exchange, technology transfer and international coordination of research activities in specific areas. These experiences have proven an effective way to make better use of available resources for such activities. This is particularly true for the smaller countries, which cannot meet all their technological needs if they act in isolation. To function effectively, the horizontal cooperation programme and networks must be adequately funded and receive enough administrative suppport to operate internationally. In this context, the programme cooperates with the member countries to:

- identify areas and opportunities for cooperation and information exchange;

- seek and obtain needed financial resources; and

- design and implement institutional and administrative mechanisms for cooperations and exchange.

4.0 FEATURES OF THE HORIZONTAL RECIPROCAL COOPERATION PROGRAMMES

4.1 Purpose

The reciprocal cooperative programmes have been designed to solve common problems through joint actions identified for the participant institutions themselves. The aim is to obtain equitable distribution of benefits.

4.2 Objectives

To strengthen the capacity of the participant institutions to develop and transfer technologies by improving their efficacy and efficiency working under the framework of a horizontal reciprocal cooperative institutional model.

4.3 Major features

The scope: Multinational

Participants: National agricultural research institutions possessing similar characteristics with regard to their mission, objectives, activities and with high possibilities of carrying out complementary activities. Coordination and cooperation among the countries are also achieved through the participation of national, regional and international agencies whose mandates coincide with the objectives of the programmes and networks. This is the case of international agricultural research centres and of the international technical and financial cooperative organisms.

Autonomy: The "owners" of the networks and cooperative programmes are the same participant institutions. They agree on the priorities to work with, and set norms and regulations for the operation of their own network or programme.

Functioning structure: The programmes consist of a Central Component and National Components. The Central Component is comprised of the Steering Committee; the Executive Secretariat; the Technical Advisory Commission; and the Regional Project Coordinators. The National Components consist of the national institutions, and membership is extended to representatives of other national level organisations for agricultural technology generation and transfer for the technical areas of the cooperative program.

Funding: Usually, funding is provided by several major sources:

i) External donors;
ii) national institutions's own resources; and
iii) a combination of the above.

In addition, IICA provides the executive secretariat, using its own resources to hire the programme's Executive Secretary.

Institutionalization: The long term aim is to consolidate regional reciprocal cooperation mechanisms among "sister institutions", continuosly operating and highly solid in terms of their funding. Institutionalization has taken place for some programmes. Indeed, they now form part of the life of the national research institutions' strategic plans, annual operative programs and budgets.

Administration: The programmes and networks are administered by IICA. A cooperation agreement is subscribed between the national research institutions and IICA to establish the legal framework and operating mechanisms for creating and implementing the cooperative programmes.

Programming: The cooperative programmes are carried out in accordance with a general plan and separate annual programmes of operation. The general plan is set for medium-term objectives and goals and gives a general description of activities to take place under specific sub-programmes or regional projects. The annual programmes specify concrete projects, technological exchanges, advisory activities to be conducted by national and international professionals, training activities, expected results, dates and detailed budgets.

Actions: The cooperative reciprocal programme actions fall into the following categories:

- Scientific and technological exchange;
- germplasm exchange;
- training;
- information and documentation;
- specialized technical assistance;
- cooperative research;
- coordination and cooperation with other national, regional and international agencies; and
- assistance to the international research centres in the transfer and adaptation of technology generated outside of the region.

5.0 IICA'S RECIPROCAL COOPERATIVE PROGRAMMES AND NETWORKS

IICA is a pioneer in strenghtening research and training related to the tropical areas. Also, the Institution has broad experience in designing and administering cooperative programs and agricultural technology generation and transfer networks. The joint action of IICA, the countries and, on occasion, donor agencies has led to the creation and operation of programmes and networks that can be grouped according to the following criteria:

5.1 Programmes in Operation

5.1.1 Phases of the Technological Process and Major Political Regions

PROCISUR, Cooperative Programme for the Development of Agricultural Technology (Sponsors: Country members and IICA).

PROCIANDINO, Cooperative Programme on Research and Technology Transfer for the Andean Zone (Sponsors: Country members and IICA).

5.1.2 Major Regional Ecosystems

PROCITROPICOS, Cooperative Programme on Research and Technology Transfer for South American Tropics (Sponsors: Country members and IICA).

5.1.3 Multidisciplinaries

RISPAL, Research Network on Animal Production Systems in Latin America (Sponsors: IDRC and IICA).

RIMISP, International Network on Farm Systems Research Methodology (Administered by IICA and sponsored by IDRC).

5.1.4 Commodities

PROMECAFE, Cooperative Programme for the Technological Development and Modernization of Coffee Cultivation (Sponsors: Country members and IICA).

PROCACAO, Regional Network for Cacao Technology Generation and Transfer (Sponsors: IICA and AID/ROCAP; ended in 1992).

PRIAG, Program to Strengthen Agricultural Research on Basic Grains in Central America (Sponsor: European Economic Community).

5.1.5 Sustainability of Natural Resources

Networks on Plant Genetic Resources: REMERFI, (Mesoamerican Region; REDARFIT (Andean Region); TROPIGEN, (Countries of the Amazon Basin); Cooperative Sub-programme on Genetic Resources of the Southern Countries (under the framework of PROCITROPICOS) (Promoters: IBPGR, CATIE, IICA).

5.2 Other Networks in the Process of Creation

To create new horizontal cooperative mechanisms there are several initiatives in progress. Among the most important ones are the Central America system for agricultural research and technology development; the Central America horticulture network; the Caribbean network on plant genetic resources; the Andean system for cooperation on graduate study programs; and the Latin America and Caribbean cooperative network (or association) among private sector foundations that support agricultural technological development.

6.0 IMPACT OF RECIPROCAL COOPERATION ACTIONS

- Institutionalization of reciprocal cooperation has been achieved for several networks.

- Integration has been achieved in the fields of agricultural research and transfer of technology between the public national institutions of the Latin American countries.

- Political integration mechanisms such as CONASUR, JUNAC and CORECA have recognized the role and importance of the cooperative programs and networks as means for discussion of technological issues and for the harmonization of policies.

- The capacity of several hundreds of scientific professionals of the national institutions to carry out agricultural research has been significantly improved through the training activities of the networks.

- The efficiency of the national research institutions in the delivery of technologies has significantly improved. Economic impact evaluation studies made for PROMECAFE, PROCISUR, and PROCIANDINO, among other programmes, have shown internal rates of return that vary from 25% up to 120%.

- Scientific and technological international cooperation to the region has been more efficiently channeled through the existing horizontal cooperative programmes. This is the case of the support given to the networks by the international research centres and other organisations, such as, CIRAD, IDRC, EEC, AID, IDB, among others.

5.2 A MODERN TECHNOLOGICAL COOPERATION APPROACH

A. Dall'Agnol, Executive Secretary PROCISUR, IICA, Uruguay

1.0 GENERAL FRAMEWORK

The agricultural technological development model that has prevailed over the last decades is exhausted due to the fact that the hypothesis which supported it is no longer valid. This model was based on low energy costs and petrochemicals, which allowed development of production models with intensive use of inputs, without considering the ecologic impacts.

Most of the National Institutes of Agricultural Research (NIARs) in our region were created under this approach, fulfilling the role of technological converters, and adapting technologies generated in developed countries. These institutions have the imperative need to carry out their structural reformulation and modernization, having to adapt to situations with clear signs of strong retraction in public expenses and restructuring of the State. The State can no longer provide NIARs with the financial resources, and the private sector plays a fundamental role in the generation and transfer of agricultural technology. The production technologies based on the intensive use of inputs (which promoted the "Green Revolution"), are no longer feasible due to the high cost of these supplies, plus the environmental polution they can generate.

The easy transfer of abundant and free technology, from industrialized countries, belongs to the past. Intelectual property of the appropriate agro-technologies is a worldwide tendency, and is the reason for the growing interest, on the part of the private sector, to invest in an area traditionally left to the State, which has become weaker and no longer has the ability to carry this out.

The technological revolution under way in the areas of biotechnology, microelectronics, informatics and the new materials fields, generating clean and healthy technologies for the environment, constitutes the new technological paradigm, generally called sustainable agriculture'. We are led to this due to the increasing costs of energy and world pressure to preserve natural resources and protect the environment.

Due to these new challenges the need for integration arises. I say need, because integration does not come as a spontaneous election of the parts involved, but as a need to survive in the context of the new world order. It must be thought of in terms of a useful tool to stimulate institutional reformulation and development of improved capacities for research.

The importance of competitiveness of 'comprehensive' markets resulting from integration is enormous; and technology is the key to enter and compete in this market.

The success of any integrated initiative already in force, or that could arise in this decade, will be strongly determined by the possibility that all the countries belonging to the bloc have homogeneous access to technology, which is the main source of competitiveness and will allow them to totally express their natural comparative advantages. On the other hand, the homogeneous access to technology is not enough to raise the competitiveness of a nation in terms of the rest of the partners of the bloc and outside it, in third markets. There is a need, also, to have trained human resources to absorb and incorporate these technolgies into the productive processes of the country.

The horizontal technical cooperation, as promoted by PROCISUR in the countries of the Southern Cone of America, constitutes one of the main elements to boost the efforts of national generation and transfer technology organizations, easing the flow of technological knowledge leading to assure more homogeneous access to competitive sources.

PROCISUR's experience can be used as a starting point for the technological mechanisms that will be required as part of the processes of economic and commercial integration.

2.0 PROCISUR'S EXPERIENCE

PROCISUR is a reciprocal technical cooperation program among the NIARs of the Southern Cone: INTA/Argentina, IBTA/Bolivia, EMBRAPA/Brazil, INIA/Chile, DIA/Paraguay and INIA/Uruguay, managed by the Inter-American Institute for Cooperation on Agriculture (IICA).

2.1 Antecedents

The present phase of the Program is the result of a long process of learning and consciousness on the part of the region's countries regarding the advantages offered by the cooperation, in terms of the efficient and full use of a great potential of information, knowledge, experiences and materials, that would otherwise not be adequately used nor improved by the countries. Its beginings were the exchanges of technology among Argentina, Brasil, Chile, Paraguay and Uruguay, promoted by IICA since the end of the '60s.

These first efforts, which Bolivia joined later, were organized and developed in the Cooperative Program for Agricultural Research in the Southern Cone Countries (IICA-Southern Cone/IDB,

1980-1983), with financial contribution from the Inter-American Development Bank (IDB) and IICA. This step represented a joint effort of the countries of the region to overcome some common agricultural difficulties and establish a cooperative system between the NIAR's of the participating countries. The inter-institutional cooperation sought, through technical knowledge and experience exhanges, to strengthen the research with the purpose of increasing the production and productivity of maize, wheat, soybean, and cattle. The main support items were information, documentation and training, focused on production systems, technical exchange and high level technical advice.

Based on the success obtained by the IICA-Southern Cone/IDB Program, a new consolidation phase of the regional cooperation system called the Cooperative Program for Agricultural Research in the Southern Cone (IICA/IDB/PROCISUR) (1984-1990) was projected. This programme had the financial support of the IDB, IICA and the countries themselves, which took on the responsibility of providing additional cash resources to the customary contributions of goods and services.

The specific objectives were directed towards the consolidation of actions and joint mechanisms of the NIARs; reinforcement of mutual assistance to take advantage of individually developed technologies; identification of new possibilities of cooperative efforts and joint actions to take advantage of available resources and search for solutions to common problems; increased use of developed technology by the International Centres for Agricultural Research (ICARs) and accomplishment of activities that will increase capacity of the NIARs for the management of technology and the improvement of their efficiency level and effectiveness.

The final objective agreed on was the regional institutionalization of a permanent coordination and support technological system for the reciprocal support and exchange of knowledge through joint and cooperative actions.

This phase of the Program extended its activities to a larger number of products that were part of the sub-programmes of summer crops, winter crops, oil crops and cattle, together with additional sub-programs in production systems, information and documentation, transfer of technology and training, and communication.

The fact that PROCISUR developed its activities under the technical cooperation Agreement with the IBD made it rather rigid. Although this was essential for the execution of a programme with these characteristics, it meant that from the beginning, the different items and subjects had to be predetermined. Consequently, there was a very small margin left for the countries to program and incorporate new items of common interest that arose later on.

2.1.1 Quantitive Synthesis of Works Already Carried Out

- Meetings	189
- Seminars	38
- National Assessments	312
- Observations	1052
- Participants at Conventions	30
- Long Term Consultants	1
- Short Term Consultants	54
- Assessments of Specialists of International Centres	45
- Short Courses	24
- Training in Service	178
- Training in Specialized Institutions	113
- Postgraduate Scholarships	10
TOTAL	2,046

The following were involved in the above activities:

- Participants with cost for PROCISUR	4,012
- Participants with no cost for PROCISUR	4,368
TOTAL	8,380

2.1.2 Accomplishments

Within the accomplishments achieved by the Programme during its first two phases, we can point out:

- Integration of the technological knowledge individually developed by each country.

- Production technologies used by the countries in maize, wheat, soybean and cattle were harmonized.

- Knowledge and recognition of the human and institutional resources of the region.

- The meetings of managers, coordinators and national specialists, besides other activities of exchange (e.g. national assessments, observations, etc.), made them motivate towards the improvement of their organisations, in fact, that was a clear process of institutional emulation.

- Likewise, progress was noted in the professional attitudes and conduct of the participants towards the different events of the Programme.

- PROCISUR's work in the agricultural sector is an important example of the great effort made in the development of the regional integration policies.

- PROCISUR represents the recognition of the institutional potential the region has for the reciprocal cooperation among the countries in the scientific and technological fields.

- PROCISUR's performance not only inspired, but served as a basis for the creation of similar programmes.

- PROCISUR represents a way to assure a continuous and integrated action, with the advantage of reaching excellent levels in terms of graded economy, as it uses a unique structure of support, management, and coordination, under the supervision of the Board of Directors.

A study concerning the economic impact caused by the Cooperative Programme in the Southern Cone (carried out by Dr. Robert Evenson, outstanding specialist in Socio-economic evaluation in agricultural research of Yale University, USA), demonstrated that an investment of one dollar in PROCISUR generates a current of benefit that after approximately ten years, increases to levels of $33, $11 and $29 per annum, for maize, wheat and soybean, respectively. This indicates a return rate of approximately 191%, 110% and 179% for investments in these items.

2.2 Present Phase

We are now in the institutionalization stage of the Programme, establishing the final goals planned during the last period. The Cooperation Agreement establishes the conditions and assures the means for the permanent accomplishment of the joint effort, allowing sufficient flexibility in the planning of activities. This implies a major role and commitment the countries are prepared to take on.

The Cooperative Programme for the Technological Agricultural Development of the Southern Cone, which started in March 1990, with a foreseen duration of six years and a possible extension to four more years, is somewhat differences now from its initial stages. As an institutionalized mechanism, it provides annual contributions aimed at the continuity of actions over the years. At the time when the new Agreement was being prepared, its structure was modified and objectives concerning integration processes, joint actions and large markets were added.

The following is to be added to support NIARs' joint objectives, promotion of reciprocal assistance among countries, identification of new possibilities of integrated efforts, cooperative and joint actions, and cooperation in the articulation of NIARs and ICARs:

- Support identification and transfer from other countries in the world, to the participating countries, with useful knowledge for agricultural development;

- registration of up-dated information of the Southern Cone NIARs' organization and functional situation; and

- identification, preparation and execution of integrated cooperation projects, including projects that may be used as support of the technological integration process.

2.2.1 CONASUR's Mandate

PROCISUR is responsible for the formulation of a technological development strategy of the region by the decision of the Consultive Council for Agricultural Cooperation of the Southern Cone Countries (CONASUR).

2.2.2 Operational Structure

PROCISUR has two different sectors with a high degree of interaction: 1) Basic Structure of the Program and 2) the Projects.

The Basic Structure is composed of the Board of Directors, a technical team and the administrative-secretarial structure. The Board of Directors is the main authority and is composed of the NIARs' representatives of the six countries. Its purpose is to guide, organize and supervise the execution of the Program approving activities, budgets, reports, as well as the selection and definition of the researchers' work. At meetings, there are representatives from IICA and delegates specially invited from IDB, CIMMYT, CIAT, CIP, ISNAR, FAO, CIID, OEA, etc.

The integrated technical team comprises the Executive Secretary of the Programme and two resident support specialists hired by IICA; Sub-programme International Coordinators and National Coordinators resident in the countries; Project Leaders and National Specialists who take part in activities; and finally, International Consultants and the Specialists of the International Centers who participate as advisors.

The Projects, which form the basic planning and execution unit based on the subjects considered in the Sub-programs, are developed over set periods, with specific objectives. Financial resources

either coming from the countries themselves or, that can be specially negotiated with donor entities, with the possibility of co-financed projects are used. The execution of the Projects has a direct relationship with the achievement of the Program's objective. The Projects with external finance will have a technical structure that will be defined in the respective Agreement with the donor entity. This Agreement must be previously approved by the Board of Directors and by IICA, and will be signed by the donor entity/ies, national research institutes and IICA's Director General.

As previously mentioned, PROCISUR's planning structure is as follows:

- Sub-programs;
- Subjects;
- Projects; and
- Activities.

Each Sub-program stresses the importance of its respective subject as detailed further ahead. These serve as guidelines for formulation of the cooperative Projects.

The following are the Projects' activities:

- Reciprocal Technical Cooperation: meetings, seminars, national assessments and observation exchanges.

- Technical Advice: international consultants and experts from International Centres or other specialized institutions.

- Training: short courses, applied or in-service training and at specialized institutes.

- Studies and Analyses: which allow for up-dated and simultaneous information on the agricultural sector situation, especially with regard to organisms of generation and transfer of technology of the Program's participating countries, as well as those which may deepen the technological integration process.

- Joint Research: Projects may contemplate these activities partially or totally. Nevertheless, this Program proposes to emphasize joint research, and studies and analyses activities. Technical cooperation and training activities were successful in the previous stage of the Program. Reaching their actual degree of maturity, they will now be used as ways to favour the first contacts among national specialists acquainted with the new subjects of the Sub-programmes.

PROCISUR is now looking further than increasing mutual knowledge, technical exchange and training activities to update institutions and their personnel. As an institutionalized entity, the Program is able to promote integration through, essentially, 'joint work'. This means that the countries will advance in the same direction, working towards the same and concrete objectives in a reciprocal action, where each one offers its knowledge and resources and makes its work available. Unlike the horizontal cooperation activities, such as meetings, seminars and exchanges, in which transfer of knowledge is stressed (donor-beneficiary relation), the joint research activities build new realities, at the same time, for the different countries and, in general terms, with equal benefits. The homogeneous access to the same type of technology, which was and is one of PROCISUR's goals, finds a fitted mechanism in the 'joint research' work.

The Projects written by the countries' specialists are prepared on subjects defined in each Sub-program. The outlines of the areas for the different Sub-programs are the result of the exchange of ideas at the Coordination/Planning Meetings among the International Coordinator, the National Coordinators and the invited specialists.

There are guidelines, prepared by the Executive Secretary, for the elaboration of the Projects. The proposals are presented to the International Coordinator who, at the Coordination/Planning Meeting (instance that acts as a Technical Committee), decides on the feasibility. The recommended proposals are presented to PROCISUR's Executive Secretary, and, after its technical and financial analysis, are submitted to the Board of Directors for their final consideration and approval.

Besides the technological and methodological aspects considered by the Project, the Coordination/Planning Meeting must take special care in that the proposal should consider the interests of all the countries participating in the Program, although this does not imply direct participation of all the countries in its execution. It must be pointed out that the Project should, directly or indirectly, benefit all the countries, keeping the essentially cooperative spirit of the Program.

Each Project is executed under the responsibility of a Technical Leader who, besides directly participating in the Programs' activities, coordinates the works of the participating specialists and acts as interlocutor with the Executive Secretary and the International Coordinator of the Sub-program in the annual planning and the required adjustments for its execution. The International Sub-program Coordinators should supervise the execution of all the Projects of the respective Sub-program, carrying out, with the support of the National Coordinators, the follow-up of the anually planned and approved actions of the Board of Directors.

From the aforementioned it is understood that the following participants form the technical structure for the planning and follow-up of the general performance and specific activities of each Project created by PROCISUR:

- Executive Secretary;
- Sub-programme International Coordinator;
- Sub-programme National Coordinators;
- Project Technical Leaders; and
- National Specialists.

3.0 PROCISUR IN THE PRESENT CONTEXT

Considering the changes, regionally and worldwide, to which we refer to above, PROCISUR in its new structure is considering the following topics: Biotechnology, Natural Resources and Sustainability, Genetic Resources, Institutional Development and Agroindustry. The focus is changed from product to discipline. This approach has the advantage of identifying common interests to start more precise joint research Projects and allows work to be carried out more thoroughly, integrating national specialists with academic training and common specific interests.

The fact that PROCISUR decides to move away from a cooperation based on products means that a key role is being played by the new disciplinary topics and those cooperative activities taking part in the regional development of scientific-technological capacities.

The change of focus in PROCISUR will mean the need to adjust the NIARs which have, traditionally, structured and organized the research and development activities based on products. The modernization and institutional development aspects have a new interest in the modern focused cooperation topics and the adjustments required by the new framework.

Considering the new flexibility, the number of Sub-programs in execution may vary according to the topics to be covered by the Program.

The present structure consists of four Sub-programs, namely;

- Biotechnology;
- Genetic Resources;
- Natural Resources and Agricultural Sustainability; and
- Institutional Development.

The agro-industrial area, which has been given priority by the Board of Directors, has not yet been considered a Sub-program, being postponed the framework analysis which may identify strategic areas for cooperation. Besides, it is necessary that other similar national institutions take part in these topics, as at NIARs'

levels, it generally shows scarce development, encouraging only a few aspects of this area.

To define future actions in the Sub-programs approved by the Board of Directors, the Executive Secretary, with the support of researchers of the participating countries coordinated by a high level specialist belonging to the NIARs, prepared the framework documents for each Sub-program. The following is a brief description of the objectives for each of those, establishing the main aspects to be considered by PROCISUR in the short term.

3.1 Biotechnology

3.1.1 General Objectives

- To increase the technological capacity of PROCISUR's participating countries to use biotechnologies, which they consider appropriate for their agricultural development.

- To match the existing differences in the application of the different biotechnologies.

- To guarantee access to the available technologies to all the countries in the region, through the horizontal transfer of technology and support to multidisciplinary programs.

3.1.2 Specific Objectives

- To develop NIARs' scientific and technological capacity within the region to solve problems and production constraints of the agricultural sector through the use of appropriate biotechnologies.

- To establish technical cooperation projects with emphasis in the areas of cell and tissue culture, genomic genetics, and genetic engineering, focused on crops and livestock species of high productive significance in the regional agro-system.

- To monitor and evaluate the state of the regional and international applied biotechnologies to the agricultural sector, using extension strategies and exchanges between researchers of the different participating laboratories.

- To promote and extend knowledge and new technologies created individually by each country or through multilateral joint research projects, through direct or indirect consultation (via informatics systems) to the regional database on agro-biotechnology.

- To promote the implementation of an Agricultural Biotechnological Information System (SIBA) to ease users' access (researchers, producers, businessmen) to the available biotechnologies in the region, allowing the consolidation of joint research, transfer of technology and training activities of the Biotechnological Sub-program.

3.1.3 Priority Topics

- Cell and tissue in vitro culture;
- Genomic genetic;
- Genetic engineering; and
- Animal biotechnology.

3.2 Genetic Resources

3.2.1 General Objectives

- To prepare, through joint actions, a regional policy on genetic resources that assures its availability for the present and future research.

- To strengthen the genetic resources' national banks, in their specific tasks as well as in support of the national programs of improvement and technology.

- To improve exchange terms and use of germplasm, promoting a better knowledge of the useful characteristics of the genetic material offered.

- To support the national laws to stimulate the exchange of genetic resources.

- To create and improve human resources.

3.2.2 Specific Objectives

- To collect species, populations, etc., whose priority arises from the analysis of the following factors:

  - genetic erosion of collected materials;

  - old germplasm collections in bad conditions;

  - native varieties and primitive cultures abandoned and/or in disuse (rural migration, replacement of primitive cultures by modern ones, etc.);

  - areas not sampled or sufficiently explored for a taxon;

- species at risk of extinction;

- destruction of natural habitats where there is great biodiversity (overgrazing, new areas added to the agricultural sector, highway infrastructure, changes to vegetation for specific building of dams, urban development, etc.).

- Develop appropriate techniques to keep genetic resources, such as cryopreservation, to decrease germplasm losses and cost conservation.

- Select genetic resources.

- Develop database networks to publish:

  1) germplasm catalogues;
  2) lists of useful species (of agro-chemistry actions, of pharmacological action, and/or risk of extinction); and
  3) vegetation maps.

- Create and improve national institutions' genetic resources.

- Agronomically point out genetic resources (quality, illness resistence, yield, etc.) and the botanic (taxonimic) identification.

3.2.3 Priority Topics

- Germplasm evaluation;
- Germplasm conservation; and
- Germplasm collection.

3.3 Natural Resources and Agricultural Sustainability

3.3.1 General Objectives

- To promote the execution of actions which will lead to the management and conservation of natural resources, and technological and institutional changes in the Southern Cone which will ensure the continuous satisfaction of human needs in the present and future generations.

3.3.2 Specific Objectives

- To develop technical training, according to present needs, to solve sustainability problems.

- To strengthen institutions in the formulation of policies and in program development; getting used to and applying new technologies compatible with environmental conservation.

- To identify, quantify and monitor present and potential environmental degrading problems.

- To stimulate the integration of regional capacities; and

- To coordinate integrated action proposals of research and the implementation of adequate environmental technologies.

3.3.3 Priority Topics

- Monitory and sustainabilty indicators;
- Soil conservation management;
- Biological control; and
- Wildlife management and recovery of degraded areas.

3.4 Institutional Development

3.4.1 General Objectives

- To support modernization processes for the technical change of policies, innovation and strengthening of the research and transfer of agricultural technology institutes.

- To promote modernization and make future plans for the existing cooperation mechanisms in this field, in the countries and regionally, through generation and socialization of a new strategic institutional idea and of technical assistance for its use in specific institutional required processes.

3.4.2 Specific Objectives

- To develop proposals in the areas of research and transfer of technology policies.

- To prepare proposals for the modernization and institutional development, including assistance for the introduction of strategies and derived operational mechanisms.

- To develop policy inventories, institutional capacities and operational mechanisms and analytical diagnosis support to the Sub-programs.

- To create analyses and materials on strategic topics in the institutional area of agricultural technology.

- To form discussions groups, training workshops and other extension activities, validation, and promotion of exchanges surrounding the advances in exchange proposals and institutional changes for the technological environment.

- To assist selectively and strategically to follow specific adjustments, redesigning of national institutions or of national mechanisms related to the previous mentioned processes.

4.0 PROCISUR's COOPERATION WITH THE CARIBBEAN

We offer the experience of our Program to the Caribbean countries as a valid cooperative instrument, advanced in its beginnings to shoulder the integration processes which are, at present, a reality.

We agree that PROCISUR's specialists could offer advice in areas of interest, and receive researchers from the Caribbean for training and exchange knowledge, provided that this does not imply costs for the Program. Unfortunately, PROCISUR's financial situation (low incomes from the countries and from IICA and high costs resulting from the demand to face areas such as sustainability, biotechnology, and others) makes it difficult to extend the cooperation spectrum towards other regions, in case this situation implies expenses.

We understand that the transfer of the steps taken by the Program, the difficulties it has faced, and the dynamic review of its mechanisms to be part of worldwide and regional demands, could be of use for similar experiences.

With no doubt, through PROCISUR, the Caribbean countries have the possibility of accessing each INIA and benefiting from its accomplishments and experiences.

5.3 RISPAL: A COOPERATIVE SCIENTIFIC SCHEDULE

M. Ruiz, Coordinator of RISPAL, IICA, Costa Rica

1.0 WHAT IS RISPAL?

The Latin American Research Network for Animal Production Systems (RISPAL) is the result of a truly grassroots movement beginning in 1976. It was formally created in 1986, with the support of IDRC and coordinated by IICA. From its beginnings, the Network has been designing methodology for the development of improved systems, working hand-in-hand with the small farmer. The technical inroads achieved have been instrumental to the development of other projects and to the training of researchers in the art and science of farming systems, changing the research focus into a much more farm-oriented approach, closely related to national development strategies and buffered by environmental limitations.

RISPAL is made up of sixteen research projects in twelve institutions and eleven countries, plus three international institutions and one NGO.

2.0 PRESENT OBJECTIVES

RISPAL's present objectives are:

- To strengthen the links between national, regional and international organisations by promoting coordination and information exchange.
- To encourage and support the development of improved methods for livestock production systems research.
- To evaluate and diffuse methodologies and validated technologies promoting their use by local institutions.
- To strengthen local programs, projects and institutions through the provision of technical support and training.

3.0 MAIN ACHIEVEMENTS

3.1 Coordination and Information Exchange

Firm cooperative arrangements have been made with several networks, the Latin American Association of Animal Production and IICA's International Cooperative Program for the South American Southern Cone (PROCISUR). Collaborative activities have been effected with several international networks (RIMISP, RINAP,

RERUMEN, ARNAB, PANESA, Inter-Network Group) and with institutions through organisations and participation in methodology research workshops, data sharing and training. An information System for Latin America and the Caribbean (SAPLAC) has been successfully developed and implemented, with IDRC's support. A data base on twenty-one topics has been established covering various aspects related to sustainable animal agriculture. In addition, RISPAL is participating in electronic information networks to enhance outreach programs within and beyond Latin America and the Caribbean region.

3.2 Methodology Development

This area constitutes the main technical thrust. Practically all of RISPAL's publications contain methodological procedures and analytical tools developed for animal systems researchers. The research methodological tools and procedures that the Network has been incorporating into its knowledge base can be appreciated in the following Figure X. This diagram is not intended to offer a complete and detailed account of the actual set of techniques and methods; it only shows the ones that marked a turning point in the course of RISPAL's relatively short life.

3.3 Methodology and Technology Dissemination

The RISPAL's Coordination Office has encouraged its projects to release their information on appropriate technologies for small landholders in a systematic fashion, and has been very active in the organisation of workshops leading to the preparation, editing and publication of methodological guides.

In summary, RISPAL has facilitated technical cooperation among researchers and the strengthening of the national institutions which they represent; to this end, a variety of activities have been conducted so far:

- holding of 25 workshops on research methodology, system modeling and research proposal preparation;
- training of nearly 400 researchers from 11 Latin American and Caribbean countries; and
- cross consultancies among the 16 research projects that make up RISPAL.

5.4 PROCIANDINO - STRATEGIES FOR THE DECADE OF THE '90's (English Summary)

PROCIANDINO, IICA, Ecuador

Important and significant changes, which have globally re-evaluated agriculture as a basic element within the economic growth strategy, have occurred in the development models in Latin America and the Caribbean during the present decade.

These new models have had a direct impact on the structural adjustment policies of the Andean Group countries. Likewise, the crisis stemming from the external debt, has accelerated the search for alternatives to the worn out imports substitution model, and has brought about economic growth, freedom of international trade, and integration, as options for the growth and development that our countries require.

As a result of this new situation, the agricultural sector now faces important challenges which will allow the scientific and technological components to demonstrate their social and economic importance by making valuable contributions to the growth of sustainable agriculture.

This situation favours competitiveness of agricultural products in terms of quality and diversification and, as a result, a new technological model also promotes the concepts of quality and quantity for productivity. These changes make it necessary for the Agricultural Research Institutions to adapt their organisation and management policies, since they are part of the political and economic scene. In the assignment of resources, undoubtedly, the new research priorities and development schemes should be considered.

In addition to the new and complex challenges of technological innovation, agricultural development demands a greater participation by different segments of society as protagonists in the definition of policies, plans, research programmes, and promotion processes. In keeping with this urgent need to increase the efficiency and modernisation of the productive process, equity, competitiveness and preservation of natural resources must be considered as integral components in sustainable agricultural systems.

Due to the political decisions related to economic growth and the opening up of markets, the Ministers of Agriculture of the Andean Region countries have decided to extend the mission of PROCIANDINO as a technological component to the sub-regional integration and institutional development. The mutual technical cooperation contributions are established through the strengthening of Research and Technology Transfer Networks; modernisation of the

organisational, technological and managerial knowledge; and harmonisation of technological policies.

Within its global context, PROCIANDINO focuses these actions primarily toward food security, modernisation of the productive process, competitiveness, sustainable use of natural resources and institutional strengthening.

Considering these aspects as a whole, the Andean countries are potentially rich in the number and diversity of plant and animal resources, especially those currently used as basic foods, thereby justifying their economic and social importance. There are opportunities for other commodities to be successfully introduced into the overseas markets but their exploitation is restricted at present.

In addition, the Andean ecosystems offer a wide distribution of situations with satisfactory opportunities for farming and agro-industrial development. However, with the application of technologies, the Andean eco-region's biophysical systems have been deteriorating with the result that their sustainable use is unlikely.

It is imperative, therefore, that the combined efforts of the national researchers with international cooperation support, be addressed to the development and modernisation of the region's agriculture within a focus on equity in its social context. Priority should be given to the preservation of natural resources and the environment in the management of sustainable agricultural systems for the benefit of future generations.

6.0 TECLAC

6.1 TECHNICAL COMMITTEE FOR AGRICULTURAL TECHNOLOGY TRANSFER BETWEEN LATIN AMERICA AND THE CARIBBEAN: CONCEPTUAL AND OPERATING GUIDELINES

E. Alarcon, Technology Generation and Transfer Specialist,
IICA, Costa Rica

1.0 INTRODUCTION

The countries of Latin America and the Caribbean (LAC) have shared knowledge and experiences on technology in many ways and on numerous occasions. Given the political and socioeconomic challenges of this decade, which offer the agricultural sector many opportunities to assume a leading role in the economy, the need to forge stronger ties among the nations of both regions must be given top priority.

Technology is a determining factor in agricultural modernization therefore, the processes to generate and develop technology must be improved substantially. This can be accomplished in a variety of ways; either to tackle specific problems through the actions of individual countries, or by means of multinational actions aimed at solving common problems and taking advantage of opportunities shared by participating countries. As far as multinational action is concerned, it has been demonstrated that technological integration can considerably improve the efficiency and effectiveness of technology development and transfer.

IICA has collaborated directly with national institutions in Latin America and the Caribbean to enhance their capabilities for technology generation and transfer. The Institute has gained a considerable amount of successful experience in the area of technological integration, through mechanisms set up for reciprocal cooperation within Latin America and the Caribbean. PROCISUR, PROCIANDINO, PROMECAFE and PROCACAO are examples of such mechanisms in which reciprocal cooperation has greatly benefitted the countries.

The challenge today is to strengthen integration between the Latin American and the Caribbean countries, to ensure continuity of the process, and, if possible, institutionalize it.

Since the early 1990s, IICA has been executing a multinational project entitled "Facilitating Latin American/Caribbean Linkages and Technology Transfer for Agricultural Development (LACTTA)". Under this project, Latin American and Caribbean institutions have participated in important technical and scientific exchanges, albeit in isolated fashion. With a view to upgrading the project in order to strengthen linkages between the institutions, better organized cooperation initiatives, follow up on same and evaluate their impact, a formal mechanism should be established to advise

LACTTA. This mechanism has been called the Technical Committee for Agricultural Technology Transfer between Latin America and the Caribbean (TECLAC). This document proposes conceptual and operating guidelines related to the operations and objectives of TECLAC.

2.0 TECLAC'S MISSION

Initially, TECLAC is envisaged as line mechanism of the IICA's LACTTA project, whose objective is to promote technological integration. The scope of its work should include the identification of opportunities to promoting linkages between the two regions. (Figure 1)

3.0 GENERAL OBJECTIVE OF TECLAC

TECLAC seeks to assist LACTTA in more effectively and efficiently achieving its goal of linking the human resources and assets of national agricultural research and technology transfer systems and institutions in Latin America with those in the Caribbean, to facilitate technology transfer among them.

4.0 CRITERIA ON WHICH TECLAC IS BASED

4.1 Advisory Services

Although the multinational project to which TECLAC is attached is coordinated and executed by an institution, in other words IICA, the project should receive support from an outside source. This support required is not for leading or executing the project; its purpose will be to provide advisory services. In other words, it will advise on how to address opportunities, assess existing comparative advantages, develop strategies and proceed to facilitate technology transfer and links between the two subregions.

4.2 Orientation

The many existing needs, given an abundance of technological supply in some areas and a shortage of same in others, and the logistics involved in bringing them together, means that TECLAC should provide orientation with regard to the options available and alternative ways to coordinate and reach agreement on activities. TECLAC should contribute to drawing the "navigation chart of the project," keeping it on course, without co-directing it. In addition to providing orientation, the members of TECLAC can foster stronger integration linkages among those involved in technology transfer in the two subregions.

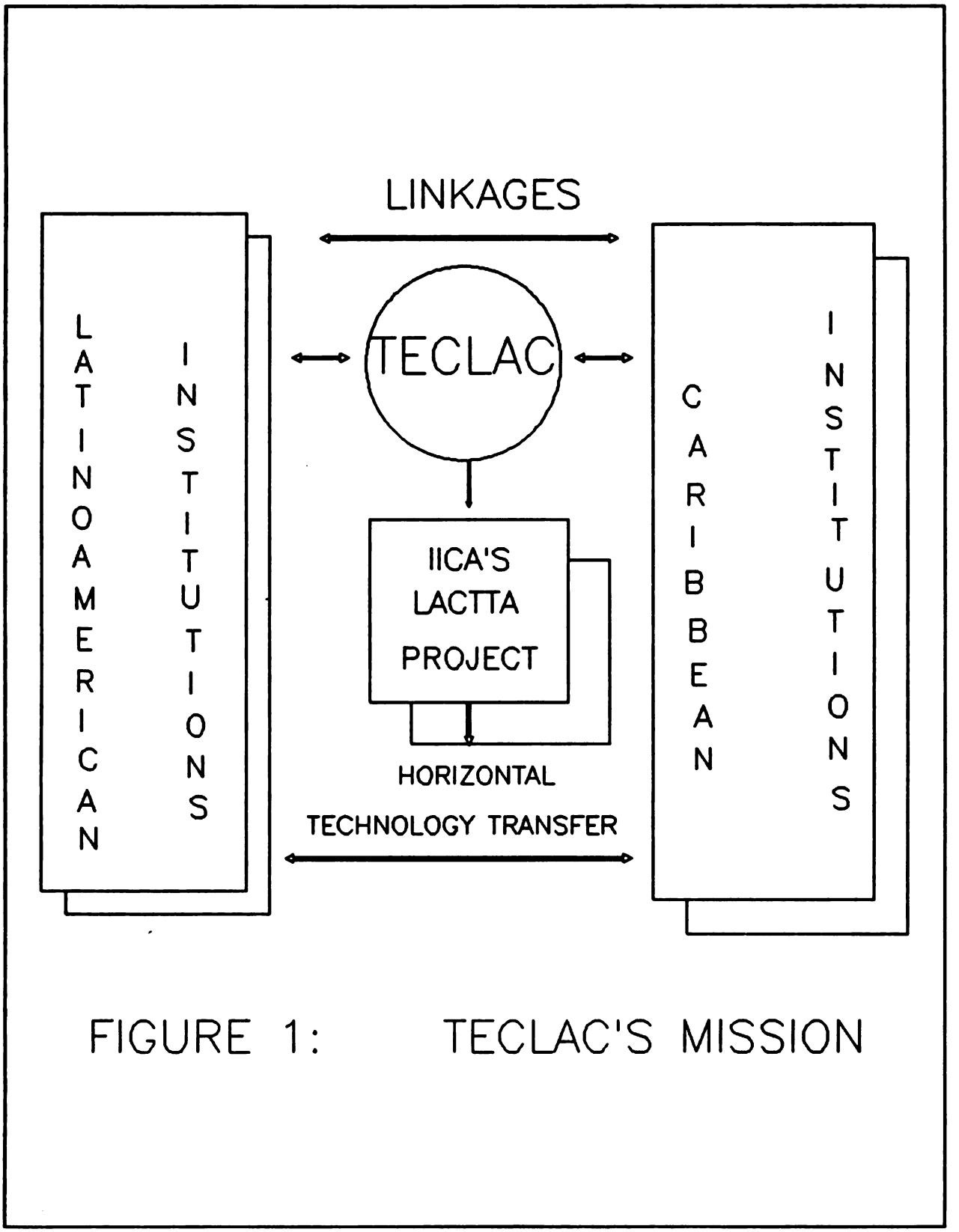

FIGURE 1: TECLAC'S MISSION

4.3 Strategic planning

Integration between the two subregions requires the development of conceptual and operating strategies. With regard to the former, in providing advice, TECLAC must give consideration to the likely scenarios in which Latin American and Caribbean agriculture will develop in the future, including their interrelationships and their links with markets in other parts of the world. Also, it should see horizontal technology transfer as a process that can, on occasion, involve not only public but also private institutions throughout the production chain. This latter point, in some cases, will have implications on the availability and transferability of technology, as well as where it takes place; in other words, not only for primary production in rural areas, but also in connection with the agroindustrial processing of inputs and products. At the operational level, TECLAC should contribute to meeting the technology needs of both regions and to identifying areas for complementary efforts between institutions for future joint actions.

5.0 TECLAC's FUNCTIONS, COMPOSITION, STRUCTURE AND MEETINGS

5.1 Functions

As its name implies, TECLAC will serve a line mechanism to the LACTTA project, which is headquartered in Castries, St. Lucia. The primary function of TECLAC is to assist the project in:

1. Establishing technology transfer priorities vis-a-vis technological limitations in the two subregions.

2. Identifying institutions with the human resources and assets needed to provide the technology to be transferred.

3. Identifying specific strategies and mechanisms that will facilitate linkages and technology transfer between the two subregions, as well as development of the project.

4. Identifying opportunities for complementary short- and medium-term technology transfer actions, and for execution of some of them.

5. Identifying sources of funding and possibilities for mobilizing different types of resources as a means of strengthening the scope and objectives of the project.

6. Orientation to set up simple mechanisms for following up on and evaluating the results and impact of the project, to be used for future actions.

5.2 Membership

TECLAC shall be made up of representatives of Latin American and Caribbean research and technology institutions, and of international technical cooperation agencies heavily involved in both subregions.

Regarding the representation of Latin America, three options are put forth. One is to select representatives from at least two institutions that could contribute greatly to the project because of the comparative advantages they offer in meeting the needs of the Caribbean. It is preferable that these two institutions be located in two different regions; for example, Andean and Southern or Central and Southern. Another is to enlist the participation of the Executive Secretaries of reciprocal cooperation programs such as PROCISUR, PROCIANDINO or PROCITROPICOS. The third is to combine the two above options. While each option offers advantages and disadvantages, it is clear that the third would be the best, through the most costly, given the greater number of participants.

Regarding the representation of the Caribbean this would include the participation of representatives from ministerial units and national institutions involved in research, and representatives of agencies of regional scope such as CARDI, CARIRI, UWI.

Given the above, TECLAC would be made up of two representatives each from Latin America and the Caribbean. Initially, the selection of representatives and the invitation to participate in TECLAC will be made by the chief of the LACTTA project. Nonetheless, it would be preferable if the countries themselves were to appoint the representatives, during different fora and annual meetings they attend. Initially, representatives will be appointed for two years. At the conclusion of the first term, they will either continue or be replaced, depending on the evolution and needs of the project.

IICA will participate in TECLAC, both as a facilitator of the work of TECLAC and through its work to support the project in achieving its objectives. IICA will be represented by the chief of the IICA project, and a representative of the Technology Generation and Transfer Program at Headquarters.

5.3 Other Participants

Given TECLAC's objetives and scope, other organizations are encouraged to participate in activities related to the horizontal transfer of technology between the two regions. This is the case of the international agricultural research centers and technical cooperative international agencies whose mandates coincide with the objectives of TECLAC. Their participation will primarily involved advisory services and support for technical-scientific exchanges.

Also, organizations from the private sector whose nature and mandates coincide with the objectives of TECLAC would be encouraged to partipate; this is the case, for example, of the national agricultural research development foundations. They would be taking part in the area of information and exchange of technology which could contribute to the implementation of the TECLA's operational plans. When it is deemed advisable, the private institututions could be invited to participate in the TECLAC's meetings.

5.4 Structure

TECLAC will elect a Chairperson and Vice-Chairperson among its members whose terms will last one year. These positions may be occupied on a rotating basis by the members of the committee. The Chairperson will be responsible for convening meetings, presiding over them, promoting links between institutions, and other duties related to the objectives of TECLAC. The chief of the LACTTA project will serve as Executive Secretary of TECLAC. At the same time, as secretary of the TECLAC meetings (Figure 2). In general terms, the Secretariat will be responsible for distributing the call to the TECLAC meetings, providing inputs for the programming of activities, reporting on progress made in establishing linkages and transferring technology, submitting proposals, gathering information of use to the Committee and serving as secretary during TECLAC meetings.

5.5 Plans of Operation

LACTTA will be carried out in accordance with annual plans of operation. They will be formulated according to the major priority needs of LACTTA's users, the links established among the research institutions of the two regions and the available funds. The annual plans of operation will specify, among other things, the following: concrete areas for horizontal transfer of technology, contributing and recipient institutions, activities to take place with the cooperation with other organizations, exhange of professionals, training activities, expected results, dates of accomplishments, costs and sources of funding and major logistic procedures. TECLAC will play an essential role advising the configuration of such plans, promoting their execution and monitoring and evaluating the obtained results.

5.6 Meetings

TECLAC will meet at least once a year for as long as it takes to carry out its assigned duties. In special cases, and depending on the availability of resources, the Chairperson of TECLAC may, at the request of the IICA project chief, convene one or more additional meetings, should circumstances so warrant.

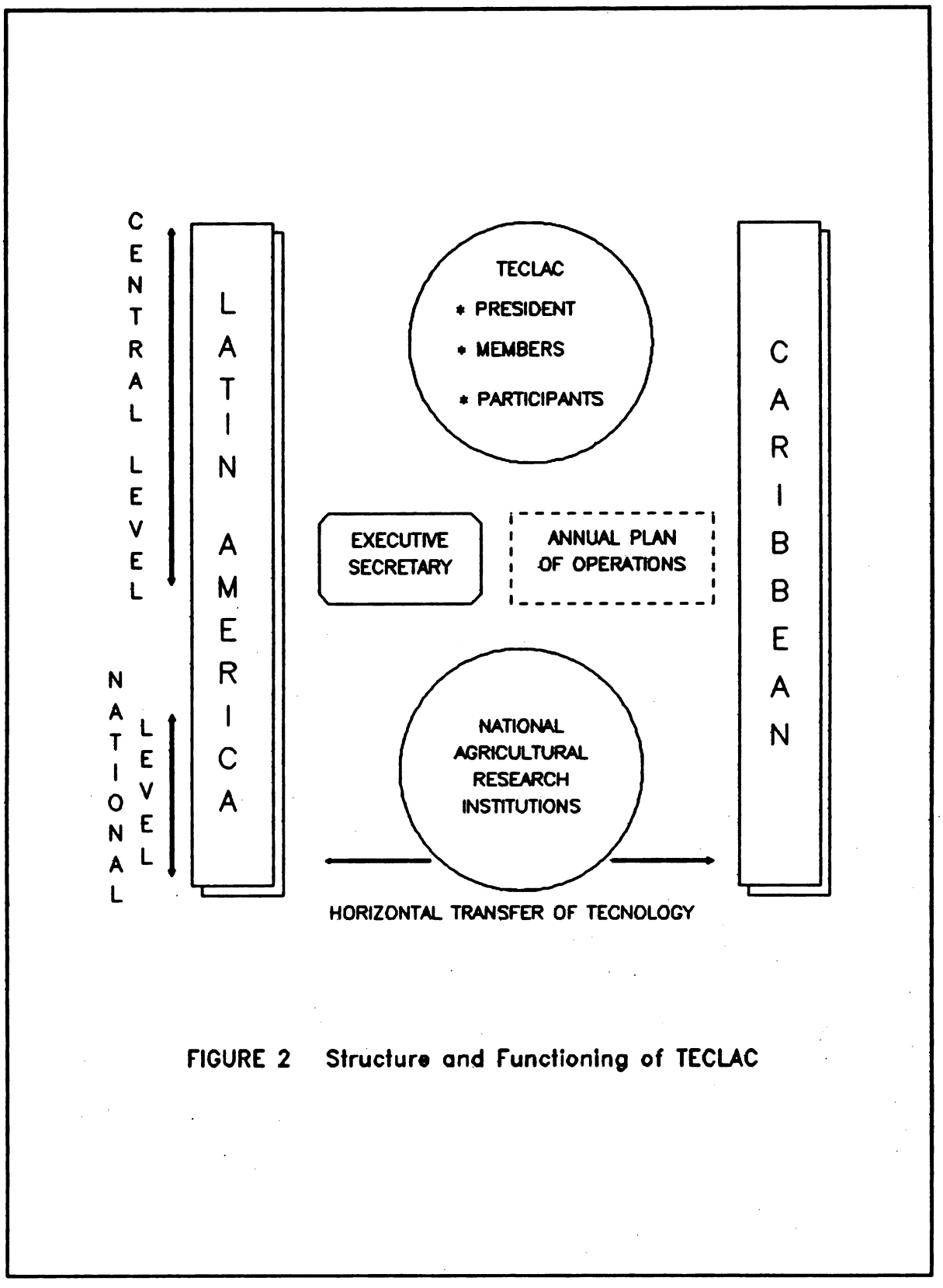

FIGURE 2 Structure and Functioning of TECLAC

7.0 ANNEXES

Annex 1

7.1 PROGRAMME

Date	Hours	Subject
Day 0 Monday May 17	All Day	- Arrival of Participants 0.1 Registration at Hotel
Day 1 Tuesday May 18	0850-0900 0900-1000 1000-1030 1030-1045 1045-1245 1245-1400 1400-1600 1600-1630 1630-1730	Seating of Participants 1.0 Inaugural Address by Authorities C o f f e e B r e a k 1.1 Introduction by IICA 1.2 Statement by R/D institutions from the Caribbean (Activities, Achievements, Constraints, Needs for cooperation) . CARDI . CARIRI . NARI . SRC . UWI . WINBAN L u n c h 1.3 Plenary Discussios C o f f e e B r e a k 1.4 Summary of discussions
Day 2 Wednesday May 19	0830-1030 1030-1130 1130-1230 1230-1400 1400-1600 1600-1630 1630-1730	2.1 Statement by R/D institutions from Latin America (Activities, Achievements, Constraints, Needs for cooperation) . CATIE . EMBRAPA . FONAIAP . ICA . INIFAP . INTA C o f f e e B r e a k . IICA PROCIs . Other Presentations L u n c h 2.2 Plenary Discussions C o f f e e B r e a k 2.3 Summary of Discussions 2.4 Formation of Work Groups
Day 3 Thursday May 20	0830-1100 1100-1230 1230-1400 1430-1630 1630-1700	3.1 Parallel work group sessions 3.1.1 Crops 3.1.2 Livestock 3.1.3 Agricultural sustainability 3.2 Discussion panel (Group Rapporteurs) L u n c h 3.3 Working Group Conclusions and Presentation and Discussion of Proposal on TECLAC 3.4 Closing - IICA Representative - Caribbean Representative - Latin America Representative - CARICOM Secretariat Representative - Representative, Ministry of Agriculture, St Lucia
Day 4 Friday May 21		4.0 Departure of Participants

Annex 2.

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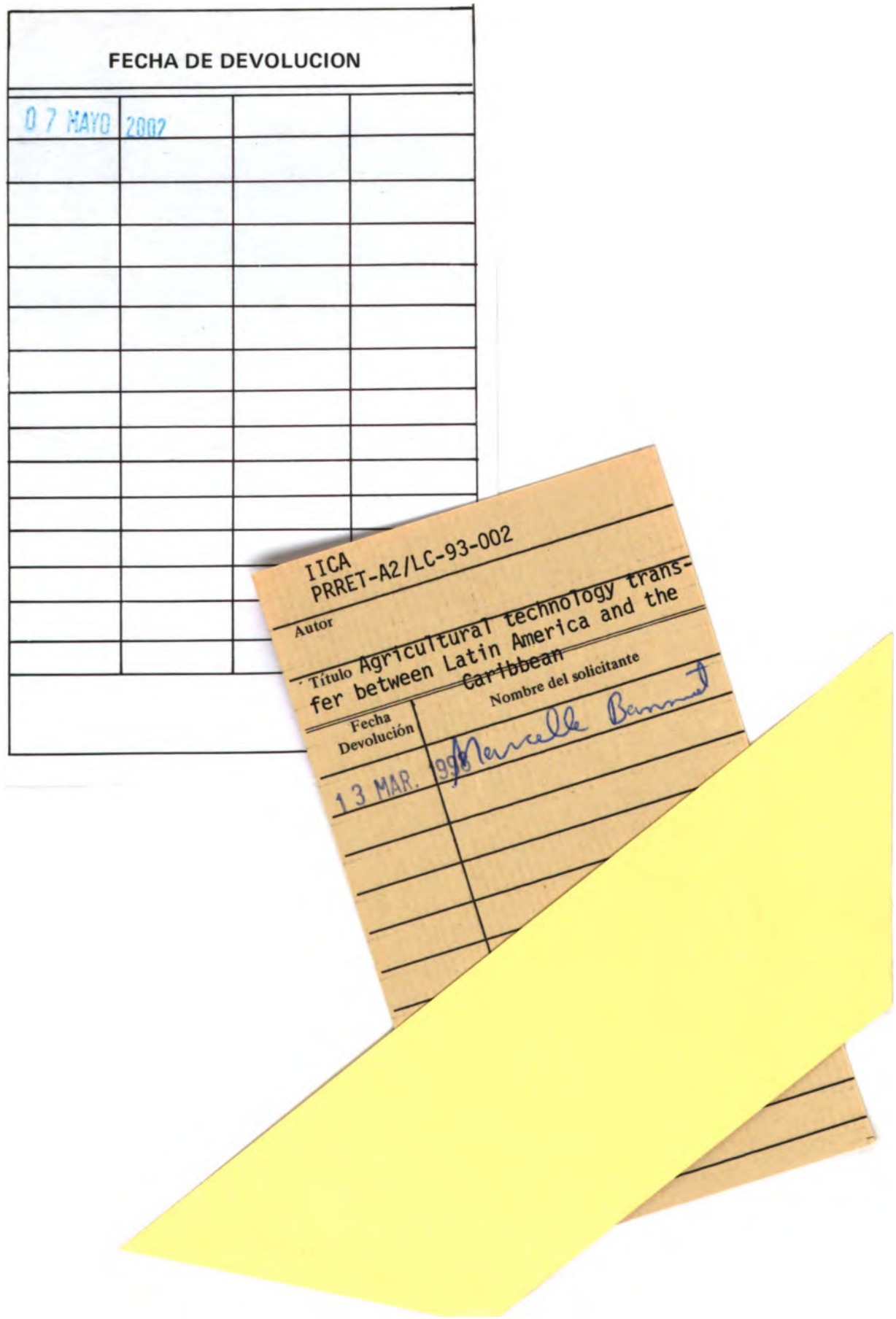

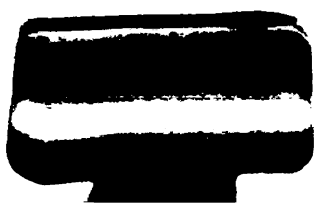

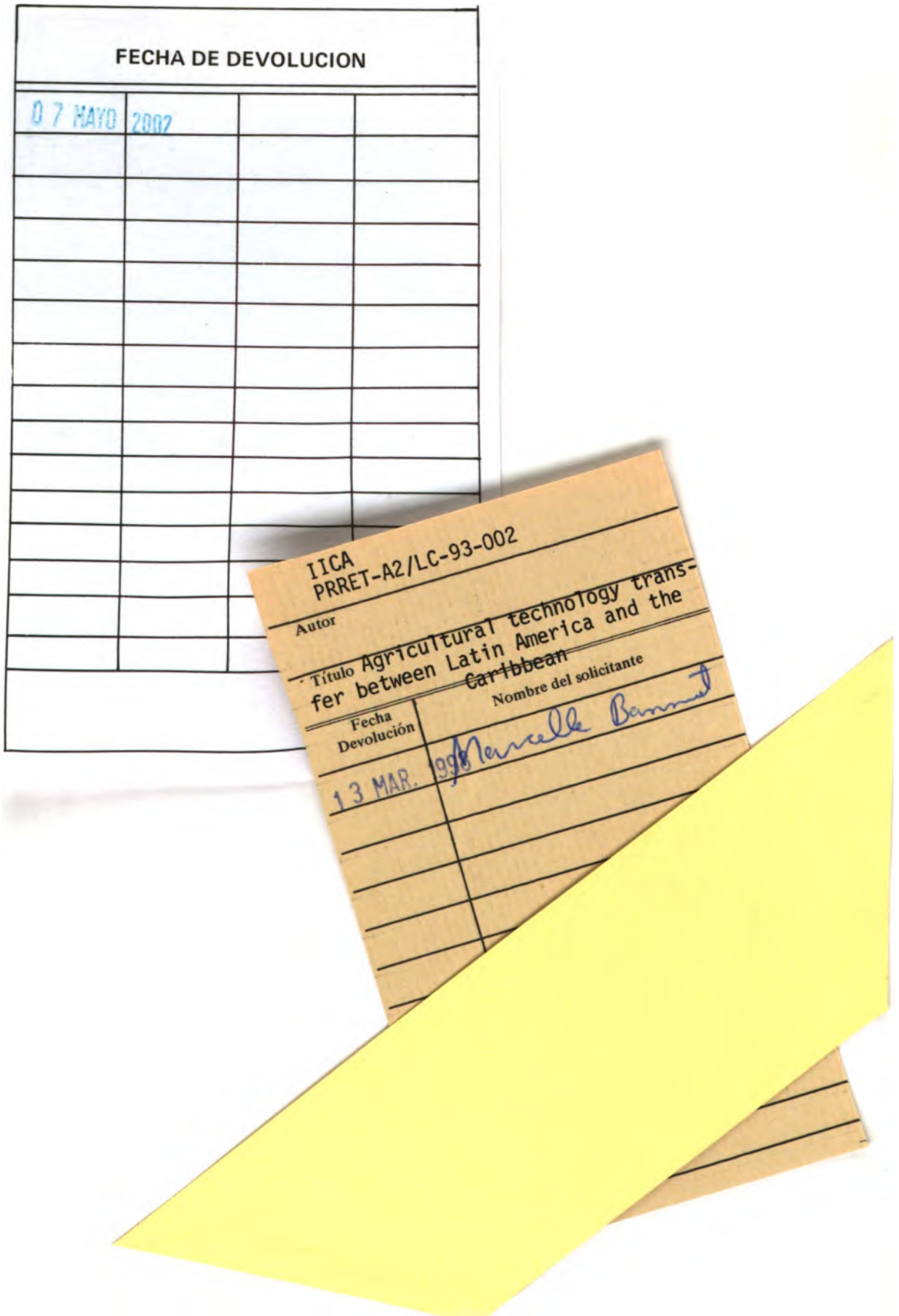

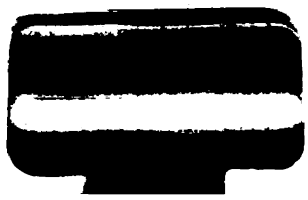

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