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AGRICULTURAL RESEARCH POLICY AND MANAGEMENT

Papers presented at the Workshop on
Agricultural Research Policy and Management

26-30 September 1983
Port of Spain, Trinidad

VOLUME I

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CARIBBEAN COUNCIL FOR SCIENCE AND TECHNOLOGY

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A C K N O W L E D G E M E N T S

The organization of this Workshop was made possible by the financial support of the International Service for National Agricultural Research (ISNAR), the International Development Research Centre (IDRC) of Canada, the Swedish Agency for Research Cooperation with Developing Countries (SAREC) and the Commonwealth Foundation. Additional support was received from the Government of Trinidad and Tobago and the University of the West Indies.

FOREWORD

The Workshop on Agricultural Research Policy and Management took place in Port of Spain, Trinidad, in September 1983, and was convened by the United Nations Economic Commission for Latin America (UNECLA) Sub-regional Headquarters for the Caribbean in close collaboration with, and support from, the Caribbean Council for Science and Technology (CCST), the International Service for National Agricultural Research (ISNAR), the Swedish Agency for Research Co-operation with Developing Countries (SAREC), the International Development and Research Centre (IDRC), the Commonwealth Foundation and the Government of Trinidad and Tobago and the Faculty of Agriculture, University of the West Indies.

The Workshop was held at a very appropriate time, when attention is now being focused on revitalising the agricultural sector of the Caribbean region and where the need for a new focus on agricultural research was clearly apparent, involving as it did, discussions on more cost effective utilisation of the limited resources available. It thus provided the opportunity for participants from the entire region as well as the international and intergovernmental organizations to identify the best possible agricultural research policies and management principles that would assist governments in achieving their national goals. Ideally, policy-makers should have at hand a complete evaluation of policy alternatives which would enable them to base their policy decisions on careful analysis of the best information available from all sources at the time.

The wide range and quality of the papers presented which took into account the specificity of the problems of organizing, programming and co-ordinating collaborative research across the national frontiers, have provided a basis for evolving a regional strategy for inter-country co-operation in agricultural research at the policy and programme levels by the development of a regional network, to fit closely to national and regional needs.

The Workshop achieved a consensus, which is reflected in the recommendations which were adopted. It was agreed, however, that whatever the achievements, the Workshop provided a much needed focal point and a beginning of a dialogue which must continue, for the ultimate success will be judged not so much by what was achieved in the Workshop, but on how far and how fast the recommendations can be translated into action.

J. A. Spence

ADDRESS AT OPENING PLENARY

by

The Honourable Kamaluddin Mohammed
Minister of Agriculture, Lands and Food Production, Trinidad + Tobago

I am delighted to be present this morning and to formally open the Workshop on Agricultural Research Policy and Management, organised by ECLA.

I understand that the objectives of this Workshop are to examine the relationship between policy, decision-making and research activities, to identify mechanisms for consultation between the policy-making and research communities and to examine existing research programmes and facilities of regional and national institutions with a view to possible collaboration which may eventually lead to agricultural research network within the region. I also gather that you will make recommendations for the efficient management of agricultural research programmes and resources allocated to agricultural research activities.

During my long years as Minister, I have found that there is no shortage of conferences, seminars, workshops, lectures and talk-shops with special reference to research in agriculture, but we have been disappointed at the slow rate of progress in this field. I look forward to the present Workshop on agricultural research policy being different and hope that it will be productive, for I believe that the main theme of this Workshop is one which is crucial for our efforts at agricultural development, here in Trinidad and Tobago, and in the region as a whole.

Let me however sound a warning right from the very beginning. I am talking about research, in which our scientists must keep uppermost in their minds the crucial problems which affect our farmers in the field. My experience over the years, and this is my second term as Minister of Agriculture, makes me unhappy about most of what seems to take place in the name of agricultural research. Much of this research goes on for years, and we cannot see the benefits which reach our farmers who have been toiling in the sun and rain every day of the week. Nevertheless, I see from the information made available to me that a most impressive array of distinguished scholars and scientists, and top level administrators, including Permanent Secretaries, from our regional states, are participants at this Workshop. Let me extend a very warm welcome to all of you, especially those who have come from abroad.

As Minister of Agriculture, Lands and Food Production, it is my business to be in close touch with our farmers, every day of the week. They experience a variety of problems, and in many instances, we do not appear to have the answers in every case. Some of the problems have existed for years. But in spite of all the research which we hear is supposedly going on at considerable expense to the tax-payer, we cannot boast of any significant new technology which has clearly put much higher levels of income in the pockets of the farmer, or has given us much larger quantities of food for the consumer.

It must be of real concern to all of us present here to realise that the developing world has not really reduced its level of dependency on the "North" for basic food grains. Our regional territories are highly dependent on the developed countries for much of our meat, milk and some of our basic cereal grains. Large food surpluses in those countries result in national policies which lead towards the reduction of stocks and higher prices for us, the recipient countries. We in Trinidad and Tobago are very conscious of the cost of obtaining our food from external sources, much of it from the developed countries. Already, these countries have harnessed science and technology at very high levels for food production, and yet the price is high, and is rising. Trade confrontation in the grain market, or hot dry summers in the U.S.A., as in the case of this past summer, tend to create havoc with food prices. In these circumstances, agricultural research in the widest sense, including production, marketing and distribution, is a key activity if we are going to achieve a new and sustained thrust in agriculture. I recognise, however, that agricultural research is only a part of the total national effort in the development of science and technology.

There can be no doubt about Trinidad and Tobago's serious concern with scientific activity for national development. In his 1976 Budget Speech, our late Prime Minister, Dr. Eric Williams, reviewed briefly the situation relating to the organizational framework for science and technology in Trinidad and Tobago. The problems indicated the absence of an environment that would place science and technology in its proper perspective; limited initiatives in research and development, an almost static picture in the level of technology; and indeed a growing deterioration in technology in some areas, e.g. some agricultural crops.

I want to stress the apparently "static picture" in the level of technology. We know that there are many research scientists carrying on agricultural research in the University, in our Ministries, in CARDI, CARIRI, etc.; we know that it is

costing us millions of dollars every year. We also know that there are quite a lof of interesting areas being explored; I say this because ever so often someone shows you or tells you about work on sweet potatoes and cassava, new varieties of tomatoes, lettuce or cabbages. However, I cannot see or hear about anything dramatic; some bit of encouraging research output which would make me feel that we have done something tangible of which the community in general and the farmers in particular feel that we in our lifetime can get some benefit. In fact some people are saying that we talk of research from our birth to death without results.

The Government of Trinidad and Tobago has provided substantial support, specifically for agricultural research, to the Faculty of Agriculture, University of the West Indies. We provided $2M for agricultural research in 1979, in the first instance. Subsequently we committed, in principle, another $12M to a longer term Phase II programme of research in agriculture which will not only benefit Trinidad and Tobago, but the entire region. For this second phase, $2.2M has already been approved formally. These are for special projects in addition of course to our substantial development and recurrent expenditure on U.W.I.

I wish to emphasize that we need the technological information now. In Trinidad and Tobago, we are at this time faced with having to make a major decision concerning the future of the sugar industry and over 70,000 acres of land. There are, I am informed, particular problems relating to the nature of the soils, including drainage, if we are going to proceed with the extensive cultivation of food crops. However, with an import food bill which rose from $800. to $900.M from 1981 to 1982, we cannot wait for another 10 years to receive the research and development recommendations as to how we can produce food from these areas.

I have observed that among the participants of this conference are representatives of the International Research Centres, e.g. the International Centre for Tropical Agriculture (CIAT), Colombia; also from CIMMYT - The International Centre for Improvement of Maize and Wheat which is located in Mexico. There is no doubt that research scientists at these centres have conducted useful research work which has benefitted the countries utilising their results and the new technological packages which they have prescribed.

Trinidad and Tobago has been, and continues to be, the recipient of the benefits of some of this research work, e.g. in respect of rice, maize, cassava and other

vegetable crops. Nevertheless, we need to remind ourselves that the heavily financed and properly staffed International Research Centres are no substitute for the establishment and maintenance of a minimum critical mass of research capability within our own territories, or at least within the Caribbean region. In fact, the global recession and the reduced availability of support funds from the donor countries and donor agencies have already had its impact on the funding arrangements for the international group. Perhaps this is a kind of warning for the national planners and the national research scientists not to attempt to become too complacent, and simply sit back and wait for the output from the international centres. Hopefully, both the international, the national and their associated scientists, can continue to put their heads together, determine areas or zones of responsibility and ultimately ensure that the total research effort benefits agricultural development in the developing countries.

This workshop brings together some of the most distinguished and brilliant scientists from within the region, as well as some equally distinguished persons from various parts of the world. You are here for a purpose - Agricultural Research, Policy and Management. I cannot over-emphasize that the evolution and implementation of an effective system for the formulation of policy in agricultural research and the management of our resources - physical, human and otherwise - for agricultural research, is vital to the future growth and development of our economies.

I urge you to do your best and to ensure that the total expenditure of resources which is involved in the organisation of this Workshop will prove to be an investment which will give us positive returns for the future development of agriculture in our Caribbean territories.

Thank you.

INTRODUCTION

This report summarizes the main discussions, the findings and recommendations of the Workshop on Agricultural Research Policy and Management in the Caribbean which was held in Port of Spain, Trinidad from 26 - 30 September 1983.

The Workshop was organized jointly by the United Nations Economic Commission for Latin America and the Caribbean (UNECLAC) Subregional Head-Quarters for the Caribbean and the Caribbean Council for Science and Technology (CCST) with support from the International Service for National Agricultural Research (ISNAR), the Swedish Agency for Research Co-operation with Developing Countries (SAREC), the International Development and Research Centre (IDRC), the Commonwealth Foundation and the Government of Trinidad and Tobago, the Inter-American Institute for Co-operation on Agriculture (IICA), and the University of the West Indies (UWI).

Background

The agricultural sector is important in the economy of the member countries of the Caribbean Development and Co-operation Committee (CDCC).[1/] In recent years, earnings from export agriculture have declined while the volumes and cost of imported foods have increased.

Caribbean Governments have expressed increasing concern about such trends and have recognized the urgent need to revitalize the sector.

The fundamental role of agricultural research in increasing production, and its contributions to the economic development of the Caribbean are well known. However, agricultural research in the Caribbean is facing a number of problems which limit, to critical levels, the contributions which are required of it for the development of the subregion. This has resulted in a crisis of confidence in agricultural research in the area.

1/ The member countries of the CDCC are Antigua and Barbuda, Bahamas, Barbados, Belize, Cuba, Dominica, Dominican Republic, Guyana, Grenada, Haiti, Jamaica, Saint Christopher/Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname and Trinidad and Tobago. Associate members are Montserrat and the Netherlands Antilles.

Limitations of funding, technical capability and inadequate linkages to facilitate application of research results are easily identified. It is increasingly recognized that inadequate organizational and management practices impose further, if not extreme, limitations on the efficiency of agricultural research institutions and on the usefulness of their programmes.

Concerted efforts are required to increase the efficiency of national and subregional agricultural research systems. The co-ordination of such efforts would contribute much towards effective agricultural research in the Caribbean, promote reciprocal co-operation between the countries and accelerate the process of generation and dissemination of improved technologies for increased agricultural production.

During recent years considerable attention has focused on the potential benefits to be derived from placing greater emphasis on policies and management, and the co-ordination of national and subregional efforts for the solution of common agricultural research problems.

At the first meeting of the Caribbean Council for Science and Technology in June/July 1981, a decision was taken to establish a Working Group on Agricultural Research for the CDCC countries. Having had favourable responses from a number of the member governments, the CCST considered it opportune to convene a workshop to be attended by high-ranking officials and experts concerned with policy formulation, policy implementation and the management of agricultural research in CDCC countries.

Objectives of the Workshop

The long-term objectives of the Workshop were:

(i) To strengthen the relationship between activities at the policy level and at the research programme level so that the programmes would focus on national priorities;

(ii) To facilitate, to the maximum, reciprocal co-operation among national research agencies; and

(iii) To encourage their participation in international programmes.

The immediate objectives were:

(i) To examine the relationship between policy, decision-making and research activities;

(ii) To identify and/or suggest mechanisms for consultations between the policy-making and the research communities during the formulation of agricultural research policy guidelines; and

(iii) To examine existing research programmes and facilities of regional and national institutions with a view to possible collaboration between the various institutions leading eventually to an agricultural research network within the region.

Participants

Given the objectives of the Workshop, it was necessary to ensure the participation of high level policy-making and management/policy implementation personnel of the Ministries of Agriculture in CDCC countries, and also senior personnel of agencies concerned with both agricultural research and development in those countries. Consequently, the participants invited were the Permanent Secretaries and Directors of Research for Agriculture and senior policy and management personnel, researchers, academics and advisers from appropriate national, subregional and international agencies.

A list of the participating countries and organizations is given at Annexes I and II.

Structure of the Workshop

The opening address was delivered by the Honourable Kamaluddin Mohammed, Minister of Agriculture, Lands and Food Production in the Government of Trinidad and Tobago.

The first two days were devoted to issues relating to policies, the critical role of institutional and programme management for the effective conduct of research, and interaction with the international agricultural research institutions.

During the following three days attention was given to: (a) the preliminary identification of common agricultural research needs which could indicate possibilities for co-operation in specific research activities; and (b) mechanisms which would facilitate co-operation.

Working groups formed an important part of the Workshop activities. One group which consisted only of Government Permanent Secretaries and Directors of Research recommended policy outlines towards agricultural research and formulated criteria and strategies for research collaboration. The findings of the Working Groups are summarized in the body of this report, and the individual reports form part of the documentation.

A special task force consisting of senior administrators and scientists with experience in the management and co-ordination of agricultural research programmes recommended specific mechanisms for collaboration in agricultural research. Five other working groups consisting of Directors of Agricultural Research and other participants with interest and experience in the subject, carried out a preliminary sorting of priority research needs of specific commodities which are of high ranking importance to various CDCC countries.

The final plenary session considered and accepted the reports of the various working groups with amendments where appropriate. At this session, the participants also drew up and formally accepted a number of recommendations designed to strengthen national agricultural research systems, to impact on the management of agricultural research institutions and agencies in the subregion, and to promote active co-operation among the CDCC countries in agricultural research.

I. SUMMARY OF PROCEEDINGS

The opening address was given by the Honourable Minister of Agriculture, Lands and Food Production, Trinidad and Tobago, who noted that the theme of the Workshop had identified issues which are critical to the current national and regional efforts to increase food production. In his opinion, the increasing dependence on imported food indicated the need to establish and maintain a critical mass of research capability within the Caribbean, in order that the research establishment could ensure the development of improved production technologies compatible with the needs and capabilities of the farming community.

The Minister considered it important for the research scientists to intensify consultations and to co-ordinate activities in order to increase the efficiency of research efforts at both the national and international levels. However, priority should be given to the evolution and implementation of effective systems for the formulation of policy and the efficient management of the resources allocated to agricultural research. Finally, the Minister urged the participants to ensure that the outputs from the Workshop include recommendations and proposals that were relevant to the needs of the sector, and which could be implemented with siginficant impact on agricultural research and agricultural production in the region.

The Director of the ECLAC Subregional Headquarters for the Caribbean summarized the background and objectives of the Workshop. He pointed out that it was an unprecedented opportunity for the agricultural research policy and management personnel of CDCC countries to meet and also to have representatives of international agricultural research agencies participate in their discussions with the objectives of improving co-operation in Caribbean agricultural research.

The first part of the Workshop concentrated on an overview of agricultural research policy and management with relevance to the Caribbean. It was noted that there was a serious crisis of confidence in Caribbean agricultural research, as well as divergent views in some official and scientific establishments concerning the value and the achievements of agricultural research carried out in many countries of the region.

Inadequate technology transfer systems, low level support services and in particular poorly developed marketing systems imposed constraints on the potential benefits which could be realized from the application of agricultural research findings. Consequently, the value of the research and its potential contribution to agricultural development were often considered to be minimal.

With respect to the role of agricultural research in the development process, it was emphasized that agricultural research was an integral part of agricultural development, the scope and required function being determined at the national planning level. This was particularly important when a country derived a large part of its income from agricultural production. The research policy should be compatible with the national agricultural plan and should also form a part of the general development programme for the country.

Improvements in the agricultural research systems could be facilitated by establishing mechanisms for consultations between the policy-makers and research communities, during the formulation of agricultural research policies. Continued consultations would also facilitate feedback, evaluation and necessary adjustments to programmes.

Economic Aspects of Agricultural Research

Seldom does the agricultural research scientist in a developing country become concerned with the economics of research activities. However, the basic economic factors influencing policy considerations in the allocation of resources within the framework of national development, often determine the organization, scope and continuity of agricultural research. The participants were reminded that agricultural research is only one of several activities which compete for funds from limited resources. Research activities should be considered as a productive process required to yield economic returns on inputs with a cost/benefit ratio at least similar to that of other investments. Past experience and also perceptions of anticipated benefits from proposed research had had major influences on resource allocation and consequently research funding.

Management

Although the inadequate allocation of funds imposes basic constraints on research programmes, there was growing concern that the organization and management of research institutions and of the research conducted could be the most critical elements which determine the efficiency of resource use and the utility value of the research findings. The participants were of the view that the management of a research institution should ensure clear objectives for the research activity; the types of activities required to attain the objectives; the minimum possible research required; the minimum research output and the maximum time that should be allowed for the activity. Further, the effective use of the resources required careful analysis of options to ensure that resources were channelled to priority areas for maximum contribution to national development.

The role of management in the planning and evaluation of agricultural research were considered to be important functions, without which research could not be directed towards the resolution of specific problems which imposed constraints on the agricultural production system.

Management should necessarily include administration, and considering the role of administration in agricultural research, it was noted that an effective and efficient administration component is absolutely necessary to a research institution, for without adequate administration a research institution cannot function. However, it was stressed that the role of administration is to facilitate the work of the scientists, to create the conditions in which scientists work most effectively as only the scientists produce new technology.

Reference was made to comments and the writings to a number of eminent persons who at various times, as heads of successful agricultural research institutions, had "recommended strongly that the head of a research institution should himself be a trained scientist as people trained exclusively in management without a research background do not understand the potentialities of research ... or how research has to be carried out". It was also noted that, in general, scientists were often deficient in the basic principles of management.

Policy

Discussions relating to agricultural research policy and research activity at the national level indicated the need to strengthen the national institutions, and that a restructuring of the organizational framework and orientation of research activity might be necessary in some cases.

The Workshop found that clearly defined national policies and the objectives of research programmes were often lacking. Participation at various levels of the research community to develop a framework for national agricultural research systems was considered desirable. However, as noted at an earlier session, the basis for allocation of resources to agricultural research, and the competition with other sectors for a share of limited resources was not always apparent to researchers.

Strengthening national research could be achieved through the careful evaluation of research needs, identification of areas for collaboration between various national agencies and co-ordination of research efforts by a single national council or institute.

At the subregional level, the participants endeavoured to find a basis and to identify mechanisms for establishing links between the research establishments of the subregion. Increased consultations and the exchange of information on common problems could constitute initial steps towards regional co-operation activities.

Existing framework for agricultural research

There are at least 25 agricultural related research institutes and agencies in the English-speaking Caribbean. Of these, some 15 are funded exclusively from public funds, two from both public and private funds and six from private funds. The eight privately funded institutions are commodity research units, three of which are monodisciplinary and have extension units separate from the national extension service. A significant feature of the institutions financed from public funds is the separation of teaching and research functions and their exclusion from the extension function.

In the four large non-English-speaking states, viz., Cuba, Dominican Republic, Haiti and Suriname, research is conducted mainly in commodity or resource-oriented institutions funded by the public or private commodity organizations.

Many of the states whose economies rely heavily on agriculture do not have the resources to support an effective national agricultural research service. The larger states may have, or are in the process of putting into place, the basic framework on which an effective national service can be developed, but in others, notably the small islands forming the Organization of Eastern Caribbean States, existing agricultural research services are small or non-existent with uncertain prospects for improvement.

Throughout most of the subregion, systems for technology transfer and programmes for human resource development are very limited; and this imposes constraints on efforts to improve the efficiency of research and the application of improved technology in production systems.

The subject of the effective functioning of available personnel, and indeed, the effective use of resources allocated to agricultural research and development was common to all discussions. Attention was focused on goals for regional agricultural research and development; the integration of research and training; and the principles and approaches for the development of an alternative framework for agricultural research in the Caribbean.

Proposed alternative framework for agricultural research in the Caribbean

The number of agricultural research agencies and institutions which have varying responsibilities for one or more functions related to agricultural research in the Caribbean, indicate that there is a substantial scientific research capability in the subregion. It also suggests that there is potential for considerable contribution by the various institutions and researchers to agricultural and scientific development. Further, it seems reasonable to expect that the co-ordinated efforts of these agencies and institutions, with support from the many technical assistance

and funding agencies which are active in the Caribbean, could significantly increase the capacity of the subregion to resolve its worsening food and nutrition problems.

Since the desire to co-operate in agricultural research became firmly established during the Workshop sessions, it was recognized that the immediate objectives were then to identify activities and define mechanisms toward realizing subregional co-operation in (a) research; and (b) related activities which impact directly on the research efforts and on the application of research findings.

The basic characteristics and general objectives of regional co-operative research activities were discussed at length using existing and planned co-operative programmes in Latin America as models for these discussions.

The basic concept of the co-operative programme is to share scarce resources for the resolution of common problems. The objectives were to use available resources in an organized manner, with the effect of mutually strengthening the national research programmes of the participating countries and enhancing their capability to develop and deliver useful technology for increased productivity in agriculture.

The participants recognized that the successful functioning of a co-operative research network would require careful planning, clearly defined objective and adherence to the principle of mutual benefits to the co-operants. Most importantly, co-operative programmes were not substitutes for effective national programmes specific to the needs of the particular country. Indeed, as noted earlier, the co-operative programmes should be based on efficient national programmes in most, if not all, participating countries.

Research programmes in the Member States

Each country participating in the Workshop, presented a brief outline of its national agricultural research policy; the management organization; the structure of the national system; the links with other national; regional and international services; the resource base; the major programmes and projects; and also priority needs of the research system.

Representatives of the commodity and other research institutions of the subregion and the international agencies made brief presentations also.

These presentations, the findings of which are summarized later, indicated extensive commonality of research needs and research activity, widely varying national capability to carry out research, the importance of the commodity research institutions to the commercial agricultural sector and to the economy of many of the states; the dependence of the smaller island states on regional and international support. The requirements even for high priority research and in particular the transfer of technology to the farmers remain unsatisfied. Research policy, programming and linkages with national development objectives continue to be lacking notably in the smaller island states. No institution appears to have established formal procedures to monitor and evaluate research projects or to have guidelines that would provide indicators to assist in making decisions as to the continuation or termination of specific activities.

A. Working Groups

During the course of the Workshop, the following Working Groups were formed to consider specific topics:

(i) A Working Group consisting only of the Permanent Secretaries and Directors of Agricultural Research considered policies toward collaboration and criteria for collaboration in Agricultural Research;

(ii) A Special Task Force of senior researchers and administrators, considered complementary views on collaboration;

(iii) Working Group on Bananas;

(iv) Working Group on Livestock;

(v) Working Group on Rice;

(iv) Working Group on Underexploited crops, including Tropical Fruits;

(vii) Working Group on Sugar-cane and alternate uses of Sugar-cane.

The reports of these working groups are attached to the present report, but their main findings are summarized in the subsequent paragraphs.

Recommendations

The reports of the Working Groups were discussed and formally adopted by the Final Plenary Session which also drafted and formally accepted a number of recommendations which are attached.

The most important recommendation from the Workshop was the unanimous support for a proposal to set up a Caribbean Co-operative Agricultural Research Network. This could be achieved by effective co-operation between research institutions and agencies, collaborative commodity research, promoting the exchange of information and consultations between the research scientists of the subregion and seeking to have the international agricultural research centres increase their research activities and support for subregional agricultural research and development.

Finally, the Directors of Agricultural Research nominated, from among themselves, six persons to be the members of a Working Group which was given the responsibility to formulate detailed proposals for the establishment of the Caribbean Co-operative Agricultural Research Network. Jamaica, Dominican Republic, Dominica (on behalf of the OECS), Barbados, Suriname and Trinidad and Tobago were nominated as the initial members of the Group. It was recommended that the Faculty of Agriculture of the UWI, and ECLAC/CCST, should co-ordinate the activities of this Working Group and act as its Secretariat.

Working Groups on Commodities

The predominance of the agricultural sector in the economies of most of the participating countries led them to consider with great care their collective research activities in order to increase their involvement in co-operative efforts with those facing similar problems. With this objective in mind, the Workshop established Working Groups on some of the major commodoties of economic importance to the subregion viz., Bananas, Sugarcane, Rice, Underexploited Crops and Livestock.

The Groups identified a number of priority areas of common interest to the countries concerned, the solution of which would be facilitated by inter-territorial research co-operation. The areas identified cut across

national frontiers and are critical to sustained and expanded production. The limited resources both of finance and scientific manpower available, in particular to the small island states, makes this approach the only realistic and practicable one, in order to solve the problem of underdevelopment in agricultural research, and imposes on the Governments of the region the obligation to decide on the measures necessary for its implementation.

Such measures were considered by the Groups for transmission to their Governments. The measures proposed, by themselves, reflect the serious limitations and gaps in both national and regional research programmes, and the international agencies have been requested to consider as a matter of urgency, the funding of some of the basic programmes.

Bananas

In the case of Bananas for example, the resources available to the Banana Breeding Scheme are totally inadequate to produce a variety with the necessary resistance to pathogens, and the ability to produce high yields of fruit with desirable commercial qualities. The need to formulate a banana research strategy between the CDCC countries in order to minimize duplication of effort was emphasized and funding to achieve this aim is to be explored. A further important recommendation emerging from the Working Group was the need to explore the possibilities for use of selected cultivars in agro-based industries, and alternative uses of traditional cultivars.

Rice

Participants of the Working Group on Rice agreed to a proposal to convene a workshop of rice research personnel in order to develop a Caribbean network on rice research, which they considered essential to expanding rice production in the region. The Caribbean region with a population of almost 30 million has over the past decade been a net importer of rice, which is a basic staple throughout most of the region, with an overall per capita consumption of about 33 kg. of rough rice per annum, and which by the turn of the century, may well be the basic food crop of the Caribbean as a whole. By 1990, population is expected to increase to 35 million and 42 million by

the year 2000. The historical trends project an increase in some areas from 503,000 hectares in 1980 to 624,000 hectares by 1990 and 767,000 hectares by the year 2000, but the historical trend in regional average rice yield, projects an increase from 3.14 tons per hectare in 1980, to only 3.56 tons in 1990, and 3.76 tons by the year 2000.

Thus a significant increase in rice yield in all rice-producing countries in the region appears to be absolutely essential if national or regional self-sufficiency is to be achieved. Recognizing the importance of the rice problem to the region, the Working Group agreed in principle to a project proposal by CIAT for a rice research scientist for the region, who would have responsibilities for co-ordination of a wide range of activities both between and within national research programmes in the region, and for overall research liaison with the Rice Programme and Seed Unit at CIAT, as well as other sciences provided through CIAT's international co-operation activities. The regional nature of the work will be emphasized at a network Workshop to be held in the first year of the project. The organizing institution for the Rice network should be ECLAC working in close collaboration with CIAT.

Sugar Cane

In the Working Group on Sugar Cane and its alternate uses, discussion centred on alternate use of raw sugar both for human consumption and industrial uses, without prejudice to basic sugar production. In particular the group placed emphasis on agricultural production systems with research directed towards fibre production as building material to replace declining timber supplies. As in the case of Rice, it was felt a regional proposal could be elaborated under the umbrella of the ECLAC/CCST.

Underexploited Crops

The apparent loss of comparative advantage in the production of the traditional crops of the region, such as sugar, bananas, coconuts and citrus led the Working Group on Underexploited crops to consider putting some emphasis on the non-traditional underexploited crops which held promise for

stimulating inter and intraregional trade. The Group identified a wide range of legumes, cereals, fruits and vegetables, and the type of research needed for them if they were to play a role in diversifying the production of the region.

Livestock

The Working Group on Livestock examined the constraints which prevented the development of viable livestock industries and made specific recommendations with respect to the use of local raw materials as feed ingredients for non-ruminants, the use of ligno-cellulose material for use as animal feeds, and among other recommendations maximizing the use of animal by-products including hides, hair and wool.

B. Recommendations of the Final Plenary Session

CDCC Governments are urged to examine their national agricultural research programmes with a view to strengthening national systems and to enhancing functional integration of agricultural research, training and extension, possibly by the appointment of a Council.

CDCC Governments should lend full support to the mechanisms which have been agreed to at this meeting to establish regional collaboration in research on particular commodities.

In view of the fact that research results, however worthwhile, may not be by themselves adequate to increase production and productivity, and since any weakness in the continuum between agricultural policy, land use management, production, credit, training, extension and marketing may result in effectiveness in the whole system, Governments are urged to assess comprehensively the whole agricultural system in relationship to research.

Governments are urged to devise and establish functional mechanisms for evaluation of agricultural research results and as a separate exercise, evaluate the contribution of research to agricultural production and productivity. Regional and International Agencies are urged to assist national Governments in the evaluation of their research results.

Every support should be given by CDCC Governments to the activities of the Working Group, that the meeting has established, to prepare a set of recommendations regarding the creation and operation of a network mechanism for regional co-operation in agricultural research.

That every support be given to the convening of an annual workshop of Directors of Agricultural Research of CDCC countries.

Directors of Research and Permanent Secretaries are urged in the management of the national agricultural research systems to make every effort to enhance regional co-operation.

International agricultural research centres and other international agencies and regional institutions are urged to give their support in the discharge of their responsibilities to the governments of the region to the advancement of the concept of regional co-operation in agricultural research.

The international funding agencies are also urged, in association with regional governments and regional institutions to integrate more fully their programmes in their support toward the realization of regional co-operation in agricultural research.

The closest co-ordination be developed between agricultural education, research and extension and other services, and that National Councils for Research should be established from a wide cross section of representatives from the public and private sector.

II. REPORTS OF WORKING GROUPS

A. Report of the Joint Working Group of Permanent Secretaries and Directors of Research on Agricultural Research Policies, Management and Collaboration

The Group regarded the Conference as a recognition of the need for scientific collaboration not only at the national and regional levels of small island states, most of which have non-viable research organizations, but with the more broadly based group of the CDCC states. The decline of agriculture, the high food import bills and the increasing population, increasing land scarcity and the push for industrialization will compel the governments and the responsible officials of the Caribbean region to take steps at the highest level to elaborate policies and co-ordinate research activities, in order to optimize both the use of capital and scientific manpower resources. It was this philosophy which informed the meeting of agricultural research scientists of the region at a time when there was evidence of a crisis of confidence in the impact of research on the agricultural productivity of the Caribbean.

From the general discussion on the contribution of research to the specific problems of the agricultural sector in the Caribbean, and the significant role of policy-making in agricultural development, concern was expressed by many participants at the apparent lack of appreciation and the apparent crisis of confidence shown by governments of the area in the potential of research in the production process. It was emphasized that the policy-makers were not convinced that the investment made in research resulted in any significant increases in agricultural production and productivity. More particularly, there was the feeling among the decisionmakers that agricultural research did not impact on the domestic small farm sector, which led them to question the relevance of current research to the problems of the farming sector as a whole.

The Working Group was of the view that this was a vast oversimplification of the problem, which ignored the question of the interdependence between investment in agriculture and investment in other sectors.

Agricultural development was not a process independent from the rest of the economy and enlightened general economic policies, e.g. trade, taxation, pricing, marketing facilities, etc., may be as important in determining the pace of agricultural development as policies for research, mechanization, agricultural extension, subsidies, or modern inputs. The Group emphasized this complementary nature of investment activities in the context of agricultural development in low income countries, like the Caribbean, where research could not be considered in isolation from the social, cultural and economic environment. It was the continuous efforts in research and its application that led to the agricultural development of the advanced countries of the world.

The Group in general agreed that it was a fundamental error to underrate the role of agricultural research in agricultural development policies, but recognized that economic research should be a vital part of the research spectrum and should seek to identify selective crops and schemes in the computation of gross profits to farmers. Such research, it was agreed, should examine the needs of the farmers, suggest solutions and pass on these solutions to the farmers via the Extension Services and farmers' organizations. It was the consensus that emphasis should be put not only on physical yields per acre, but also on profitability of investment, if only to underline the fact that the economics of technical agricultural research should be developed in close co-operation between agricultural economists and biological researchers, with profitability of available technology as the operational concept. The Working Group recognized that recommendations for farmers must be in terms of economics if they are to have real basis, and be accepted by the farmers.

The Group also agreed on the need for initiating socio-economic studies insofar as they may be needed for a better understanding of the factors governing receptivity to change and the required incentives, since any proposed measures for improving agriculture must be feasible and profitable in the eyes of the farmers. Situated in the same context in the research programme was the need to find out the obstacles encountered by farmers in adopting the recommended results of researchers.

On the theme of research organization, the Group recognized the limited research capability of the smaller islands, and at the regional level the dispersion of research among a multiplicity of agencies which constrained the performance of available manpower and scarce financial resources. It was noted that in these circumstances that although concentrated research could and did make an impact on a particular commodity, such as Banana Research by WINBAN, the impact of research on the sector as a whole was not dramatic, because of the small recommendation domains with low payoffs.

The need for a synergistic relationship between national and regional organizations was generally recognized, especially in areas where a commonality of problems may permit an orderly system of co-operation in well planned programmes and pooling results across national frontiers. The Group also took the view that the cost of running regional organizations required that such institutions should not isolate themselves from one another or compete with one another, but that they should be a focal point for co-operation, mutual guidance and co-ordination of action, bringing together in a unified way the national efforts of the CDCC countries. It was recommended therefore that closer collaboration and a division of labour be established which would utilize the capabilities of existing regional organizations more effectively to complement the national effort.

A number of parallel considerations were raised by many participants. Discussion centred on the question of funding research in small island systems whose research organizations which posed a formidable difficulty, and whose research programmes are now viable are susceptible to capricious external pressures. The Group felt that this situation should not be allowed to prejudice the national ranking of research priorities; and that any aid should be built firmly into the requirements of the country in question.

Other issues raised were the relative isolation and generally limited scope for discussion and exchange of experiences, ideas and results among researchers in the Caribbean. It was felt that this was a constraint which could be counteracted by the creation of professional societies and linkage with international research agencies, whose results and resources could be utilized by collaborative mechanisms established within the regional groupings.

Recommendations of the Joint Working Group

In considering some of the major problems facing agricultural research in the Caribbean and their implications for policy formulation, the Group recommended a clear definition of goals for national and regional research with the aim of increasing food production and productivity and, in particular, improving methods of handling, processing, storage, distribution and marketing of local foods.

It was considered of equal importance that regional trade in food should be encouraged and monitored as an instrument of food security. The pressing food population problem as reflected in the enormous import bills of the region, although of the highest priority, should not exclude attention being given to the expansion of selected export crops, consistent with overall world demand projections. Attention should also be given to the devleopment of the underexploited and non-traditional plant resources of the subregion in order to diversify production.

As a means of achieving these goals the Group recommended continuous dialogue between the research directorate and the policy-makers which would focus on means, methods and priorities in relation to the national agricultural and research goals.

The Group recommended that governments should be asked to agree to and seek assistance in the establishment of co-ordination mechanisms at the national level with a view to strengthening their national research and extension capabilities as a matter of urgency, and in that context to give serious consideration to granting a large measure of autonomy which would allow research institutions to function more effectively. In the same context, the Group recommended the functional integration of research and teaching, research and development, extension and farmer training, under some flexible mechanism such as Research Training and Policy Councils or Agricultural Research and Training Institutes. It was also recommended that training of the less specialized extension personnel should be carried out along subject matter lines.

At the Regional level the Group recommended that the commonality of research needs should be studied in order to identify areas for research collaboration, and which would serve as a basis for establishing linkages

between national research agencies and the exchange of information on common problems.

It was emphasized that the work and capabilities of research organizations should be rationalized to support the national efforts, fill the research gaps and work essentially on common or collaborative programmes. It was considered essential, therefore, that an urgent and critical review of the roles and capabilities of these organizations should be made within the context of national and regional agricultural goals and resources, to establish a division of labour and to determine the areas of collaboration and the possible functional relationships.

The Group considered a form of regionalization which has its roots in the establishment of systems of research collaboration cutting across national frontiers, and recommended that donor agencies should continue to fund such agencies whose aims were to foster research linkages and research collaboration. In this connection, the Group was of the view that in implementing this recommendation, two considerations should be borne in mind, viz: (i) the desirability and the long-term goal of strengthening national systems without which regional networks would be ineffective; and (ii) encouraging the individual countries to organize their own systems with backstopping by donor agencies.

Arising from the network establishment it was recommended that concentration should be put in the first instance on establishing the basis for co-operation in the form of meetings, exchange of information, materials, etc., and carrying out research on a few selected commodities. Further expansion to other commodities would be determined by the experience gained and the benefits derived.

The Group further recommended that follow-up meetings in the nature of the current Workshop should be held to review and evaluate the progress made in collaborative programmes and in the establishment of networks of research.

As a conclusion to the discussion the Group laid down some basic criteria, which in their view should form the basis for collaboration both within and between countries. The following criteria which do not necess-

arily imply an order of priority were recommended to be used for initiating mechanisms of collaboration:

(i) Common problems and interests;

(ii) Voluntary initiation;

(iii) Mutually acceptable benefits in relation to the satisfaction of needs;

(iv) The goals, objectives and programmes should be clear and acceptable;

(v) The use of flexible mechanisms in devising and executing programmes;

(vi) Joint actions must lead to maximization of use of limited resources and should be cost-effective in results;

(vii) The mechanisms should serve to strengthen existing institutions rather than establish new ones;

(viii) General good faith between collaborators;

(ix) Continued political and financial support for sustaining successful collaborative efforts.

At the closing session, the Conference adopted unanimously the Reports of the Working Groups which would enable governments on the one hand to take the necessary steps to reorganize the research services for the effective development of agricultural research, and on the other hand, permit donor agencies and international organizations to reinforce their co-operation with small island research systems.

B. Report of the Special Task Force on Collaboration in Agricultural Research

This Group examined a series of contributed papers including:

(i) The Role of Agricultural Research in Agricultural Development;

(ii) The Organization and Management of Agricultural Research in the Caribbean;

(iii) Agricultural Research Management;

(iv) Towards the Future - An Alternative Framework for Agricultural Research in the Caribbean.

The complementary nature of the Conference which involved issues of Policy, Management and Collaboration encouraged an integration of the work and its organization, where the two Committees met as a whole to establish a range of complementary objectives to further co-operative research. The discussion resulted in a general concordance of views which have been described in the Report of Permanent Secretaries and Directors of Research.

With respect to the criteria laid down for collaboration research among members of the region, the Task Force recommended that those Commodity groups, such as Rice, which had advanced proposals for co-operation, could proceed to implement them without delay.

The Task Force also proposed the establishment of not more than six persons who would be responsible for elaborating proposals for regional co-operation on the basis of the guidelines laid down and who would design steps for their implementation, and to report within six months. In order to achieve this aim, the Task Force recommended that assistance should be sought from donor agencies for interim funding.

To achieve the aim of establishing the network system, the meeting mandated the University of the West Indies in collaboration with CDCC/CCST to continue the initiative by acting as Secretariat to the proposed group of six persons.

It was further agreed, in discharge of the mandate, that the University be requested to prepare a background document for discussion by the Working Group, in consultation with regional and international agencies operating in the agricultural sector of the region. After finalization of the document, it should be presented by ECLAC/CCST and the UWI to the funding agencies. This proposal was formally adopted by the Directors of Agricultural Research.

C. Reports of the Commodity Working Group

(i) Working Group on Bananas

Banana and Plantain Breeding

In the four Windward Islands of Dominica, Grenada, Saint Lucia and Saint Vincent and the Grenadines, bananas contribute some 70 percent of export earnings amounting to approximately EC$100 million each year.

Approximately 20,000 banana farmers in these islands are dependent on the crop which is also an important staple food.

In Jamaica, bananas rank second as the most important agricultural export and, as in the Windward Islands, are a source of livelihood for thousands of farmers, an important employer of labour and a major food commodity.

Specific information relating to this crop in Belize and the other CDCC countries was not available to the Working Group. However, it is known that bananas is an important economic crop in Belize and a major crop in some of the other CDCC countries.

The highest item of production cost in the Windward Islands and Jamaica relates to the control of yellow Sigatoka (Leafspot), the estimated total expenditure being J$12 million in Jamaica and EC$8 million in the Windward Islands. The global estimate of annual expenditure on the control of yellow Sigatoka is in excess of US$100 million.

Recently, a very virulent strain of the fungus (black Sigatoka) has been spreading through Latin America and Africa, affecting both bananas and plantains. The estimated cost to control black Sigatoka is more than twice the cost to control the yellow strain. The spread of black Sigatoka to the Caribbean is a real possibility and should this occur, there will be devastating effects on the Caribbean banana industry which is so vital to the economy of the region.

In this connection, it is important to note that the Banana Breeding Scheme in Jamaica has been carrying out research to improve varieties through breeding and selection for some 30 years. This scheme has a proven capacity to produce tetrapolois which are:

(i) Resistant to black and yellow Sigatoka;

(ii) Resistant to Race 1 of Panama disease;

(iii) As resistant as Cavendish clones to Race 2 of Panama disease;

(iv) Comparable to Cavendish clones in yield;

(v) As a cooking banana, better in eating quality than Cavendish clones;

(vi) Better performers under unirrigated conditions than Cavendish clones.

In 1960 all banana breeding work in the Caribbean was concentrated in Jamaica under the general supervision of the Banana Board. At that time, the Windward Islands Banana Industry entered the Scheme as a contributor, the remaining costs being met by the British and Trinidad Governments. Today, the Jamaican Government is the only source of financing to this Scheme, which is believed to have the best banana germplasm collection in the world.

The resources now available to the Banana Breeding Scheme are inadequate to carry out the activities which could result in the production of a variety having the necessary resistance to pathogens and the ability to produce high yields of fruit with desirable qualities.

In view of the above, it was recommended that the international agencies consider, very urgently, funding a revitalized banana breeding programme for the Caribbean. Such funding should include collaborative work by the existing banana research stations of the region to evaluate new clones produced by the breeding programme.

Moko Disease

A bacterial disease called "Moko" disease of bananas is at present causing significant losses in the production of bananas, plantains and bluggoe in Grenada. It is recorded that this disease has been responsible for the decline of the banana industry in Trinidad. Because of the importance of bananas to the economies of a number of Caribbean countries, it is most important that this disease be contained and not be allowed to spread to other countries.

The Working Group recommended that the existing programme to eradicate Moko disease in Grenada, which is funded by the EDF, should be extended beyond the present phase scheduled to end in April 1984. A Phase II of this programme should include the introduction and evaluation of:

(i) Substitutes for the existing bluggoe; and
(ii) Advanced tetraploids from the Jamaica Banana Research Scheme.

Fertilizer Placement

Recent trials under limited agro-ecological conditions in the Windward Islands have shown that:

(i) The uptake of fertilizers was increased when placed about 5-8 cm deep and about 45 cm from the pseudostem;

(ii) Higher yields were produced by placement and in some cases using smaller amounts of fertilizer than in broadcast applications;

(iii) There was less toppling with fertilizer placement.

It was recommended that a programme of fertilizer placement and fertilizer evaluation trials be carried out under a number of agro-ecological conditions, not only on research stations, but most importantly through carefully conducted on-farm trials. It was also recommended that this programme should be carried out as a collaborative programme in which WINBAN, the Banana Company of Jamaica, Belize and other CDCC countries, would participate.

Research Collaboration, Exchange of Personnel and Information

At present banana research agencies in the CDCC countries plan and implement their programmes in isolation, also there are no mechanisms whereby research results are shared for mutual benefit although some countries produce for the same market on a complementary basis. For example, the four Windward Islands and Jamaica share the United Kingdom Market and a shortfall in supply from any one island adversely affects the market security for fruit from the other islands. This indicates that co-operation in banana research and development programmes would be of mutual benefit to the participating countries. The working group recommended that the Banana Company of Jamaica and WINBAN formulate a Joint banana research strategy which would minimize duplication of effort and that formal channels of communication be established for the sharing of research results, the exchange of visits by researchers and field and laboratory observations of ongoing research of mutual benefit.

Constraints in financing WINBAN Research

Inadequate financing is the major constraint on banana research and development in the Windward Islands. A cess is levied on export bananas to provide core financing for research. However, in recent years, major disasters have adversely affected production and the ability

of the industry to finance its research needs. In 1978 hurricanes destroyed plantations and reduced Windward Islands' exports to 32 percent of the annual estimate. In 1980 another hurricane destroyed 100 percent of the plantations in Saint Lucia, 95 percent in Dominica and 40 percent in Grenada. A windstorm caused some 40 percent damage in Saint Lucia during 1983. Volcanic eruptions in Saint Vincent and the Grenadines reduced projected exports by 29 percent during 1979 and a leafspot epidemic during 1978 and 1979 reduced Dominica's export to approximately 58 percent of the 1977 level. These disasters have interrupted research programmes and have placed severe constraints on the ability of these islands to finance necessary research.

In view of the adverse effects which interruptions in funding have had on banana research, it was recommended that methods be devised to:

(i) Ensure necessary continuity of research activities; and

(ii) Alleviate the existing constraints on banana research agencies in the Caribbean.

Non-traditional Banana Cultivars

At present, almost all banana research efforts in the Caribbean are directed to the production of fresh fruit for export. Neglected areas include the possible use of selected cultivars in agro-based industries and also alternate uses of traditional cultivars. The need for research and development activities in these two broad areas has been highlighted by the Faculty of Agriculture of the University of the West Indies.

It is recommended that urgent attention be given to:

(i) The non-traditional banana cultivars as sources of food and for possible agro-industrial uses;

(ii) The non-traditional use of present commercial banana cultivars.

It is also recommended that this programme should give special attention to the member countries of the Organization of Eastern Caribbean States: Antigua and Barbuda, Dominica, Grenada, Montserrat, Saint Christopher/Nevis, Saint Lucia and Saint Vincent and the Grenadines.

ACORBAT - Latin American and Caribbean Networking in Bananas

The University of the West Indies, University of Puerto Rico, WINBAN, the Government of Trinidad and Tobago, IRFA and Jamaica are founding members of the Association for Collaboration in Banana Research in the Caribbean and tropical America (ACORBAT). ACORBAT has, so far, from 1964 served as the only linkage of banana technologists from the Caribbean and Latin America.

The need to maintain this linkage is vital for technology interchange and the bridging of technological gaps that may exist between and within banana-growing countries in the Caribbean and Latin America. This organization now encompasses banana researchers in Latin America, the United Kingdom, Africa and South Pacific. Consequently, a global network between banana researchers has been fostered. The broad objectives of the Association are:

(i) To recommend any study, research, survey or trial on bananas in the Caribbean and tropical America designed to improve their cultivation management, packaging or processing;

(ii) To seek and mobilize resources to carry out approved activities relating to the banana industry;

(iii) To promote by all available means, the adoption of methods and techniques designed to improve the quality of the fruit and to stimulate consumer acceptance of bananas produced by the member countries of the Association.

The General Assembly of ACORBAT in Guadeloupe in 1983, mandated its President to seek to establish the organization under the umbrella or within the structure of an existing institution or international organization. It is therefore recommended that an appropriate base facility be identified and created for the present and future development of ACORBAT. Assistance in identifying such a base and modest financing for the same should be considered by countries and aid donors represented at this Workshop.

Studies on Leaf Spot Organisms

At the meeting of banana researchers in Guadeloupe in 1983, under the umbrella of ACORBAT, it became evident that there was very little in-depth research on the epidemiology, pathogenicity and variability of leaf spot organisms, or the mode of action of fungicides presently used in their control in the region, or indeed, in Latin America. Such a study is vital in forecasting changes in population or in determining the development of resistant strains of the fungus, such information can be of great value in determining disease control strategies, which could result in savings to the banana industries and the development of disease resistant cultivars.

In view of the high cost of leaf spot control referred to earlier, it is recommended that a comprehensive comparative study be made of different populations of the leaf spot organisms in the region, to determine their natural variability and pathogenicity on different banana cultivars in the region, with particular reference to the tetraploids produced by the Jamaica Banana Breeding Scheme. Such a study would best be done at a University and funding for such a research programme needs to be found.

ACORBAT - Research Priorities Requiring Networking

At the meeting of ACORBAT in Guadeloupe in 1983, a listing of research programmes which would best be carried out on a collaborative basis between member countries was considered and accepted by the banana researchers. The Working Group recommended that the programmes which are of relevance to the CDCC countries should be studied with a view to their implementation.

This report was formally adopted at the final plenary session of the Workshop.

(ii) Working Group on Rice

Proposal

The participants accepted in principle the project proposal presented by CIAT and agreed with its objectives, and that a workshop of rice research personnel and others directly involved in rice production should be the first step in implementing the proposal. It was agreed that the development of a

Caribbean Network on Rice Research was essential and urgent for the future development of rice production by countries of the Caribbean, and that the Network should be open to voluntary participation by Caribbean countries.

Workshop

The main objectives of the Workshop will be:

(i) To characterize the individual countries' Rice Research and Production Profile;

(ii) To identify common region-wide researchable problems and priorities;

(iii) To identify training needs, and training capabilities within the region;

(iv) To identify the project base, and research project sites in selected countries;

(v) To identify germplasm to be included in the initial nurseries;

(vi) To identify seedrice production needs in terms of training, infrastructure and programmes;

(vii) To appoint a Project Steering Committee and define its Terms of Reference;

(viii) To detail a Final Project Profile in terms of Network Activities.

Workshop Preparatory Stage

The Working Group discussed and agreed on the following preparatory steps to organize the Workshop:

(i) That the organizing institution be a regional institution such as ECLAC/CCST, or possibly IICA, UWI, CARDI or CARICOM, working in close collaboration with CIAT;

(ii) That the organizing institution and CIAT jointly seek funding for the Workshop and for necessary preparatory work;

(iii) That a Technical Rice Consultant be selected from the region to assist in preparation of the technical aspects of the Workshop including the preparation of the country documents dealing with the above objectives. For this purpose the initial funding should include provision for travelling and 3-4 months consultancy;

(iv) That the Workshop location be within the region at a place to be identified by the organizing institution and CIAT;

(v) The May-June period of 1984 was agreed as the most appropriate time for the Workshop for participants engaged in the Rice Industries.

The final plenary session accepted the report of the Working Group and recommended:

(i) That the organizing institution should be ECLAC/CCST;

(ii) That ECLAC/CCST should work in close collaboration with CIAT and in consultation with other organizations, in particular IICA;

(iii) That efforts should be made to convene the Workshop by mid-1984;

(iv) That the venue for the Workshop be a member country of the CDCC.

(iii) Report of the Working Group on Sugar Cane and its alternative uses

The Group noted that Conventional research associated with the sugar cane has been concentrated on the sugar component of the sugar cane plant and that it was imperative that urgent attention be given to:

(i) Research into alternate uses of the sugar cane plant, including possible industrial uses; and

(ii) Alternate use of raw sugar for both human consumption and industrial purposes.

It was considered equally important that research directed toward increasing efficiencies in the use of the sugar cane plant for the production of sugar must not suffer, in spite of research into alternate uses.

It was recognized that increasing demands for energy in the Caribbean islands were causing an increasing drain of foreign exchange, and the Group emphasized the use of sugar cane fibre as an indigenous renewable energy resource. The Group was aware that Pilot schemes of energy conservation in sugar factories exist where excess fibre to generate electricity for sale to the national grid, was being used, but considered that a vigorous expansion of this approach would be of economic benefit nationally, and to the sugar cane industry as a whole.

There was growing interest in the use of sugar cane fibre as building material to replace declining timber supplies. This was of special interest to the Caribbean, since most of these countries import the major part of their requirements. The Group noted that aid-assisted work on the industrial uses of fibre was proceeding, but recommended that research on agricultural production systems with emphasis on fibre production should now be started.

The Group considered that agricultural research into total biomass production of the plant involving breeding varieties, optimization of inputs, appropriate harvesting systems, and investigation of industrial uses of components of the plant, whether for energy, building materials, animal feed or fermentation or a combination of these with or without sugar production, should be of vital interest to all countries with an existing sugar industry or with a potential to grow the plant.

The industries themselves were not at present in a position to undertake more than a fraction of the needed research. A region-wide interest justifies external assistance to the scheme, and it was hoped that research in the agricultural and industrial fields could be intensified immediately.

The small working group present was not fully mandated to speak for the countries involved, but the hope was expressed that an attempt will be made to catalyse a regional proposal for interested countries and industries.

The group finally recommended that the CCST should provide the organizational mechanisms to promote interest in regional work on the alternate uses for sugar cane.

This report was formally accepted at the final plenary session of the Workshop.

(iv) Working Group on Underexploited Crops

Non-traditional export crops and other commercially underexploited crops of the subregion are important sources of food for the local populations. These crops are in the main, neglected by research institutions

in the Eastern Caribbean or at best receive sporadic attention. The inability to ensure continuity of funding has been a major cause of the failure to carry out necessary research and development of some tree crops.

During the last decade, the Caribbean has lost, or is rapidly losing its previous comparative advantage in the production of national export crops such as sugar, coconuts, citrus and bananas. Diversification of agriculture, and the increased production of food for local consumption is now crucial and it is reasonable to expect that adapted underexploited crops may contribute much to the economic development and food security of the subregion.

It was recognized that the Universities and Research institutions could be the focal point for some of the needed long-term research. However, the level of co-operation between the various research agencies would have to be intensified and systems for field evaluation and pilot production put in place. The failure to commercialise some apparent prospects after much research effort as in the case of pigeon peas and calypso tomato seed production indicate the need to ensure strong linkages between research and development.

The working group identified a number of non-traditional and underexploited crops which seemed to offer potential for the crops, and some of the apparent research needs are listed.

It was recommended that a small working group should be convened to develop a comprehensive research programme and projects for the relevant crops for presentation to funding agencies.

The final plenary session accepted the report and also recommended that the UWI and CARDI, acting jointly, should co-ordinate a working group to make specific recommendations with respect to priority research needs of underexploited crops, which are of specific interest to the CDCC countries.

Research Needs of Underexploited Crops

1. Food Crops:

Aroids	-	Need to breed new varieties.
	-	Increase screening for known diseases.
	-	Increase screening for better yield.
	-	Increase information and availability of such information.
	-	Diversify the utilization of this group.
Breadfruit	-	Need to build information base.
	-	Need to broaden germplasm base.
	-	Need screening for specific physical properties.
Irish Potatoes	-	Need screening of true seeds for the region.
	-	Need information collection system
	-	Site specific screening.
	-	To develop agronomic and production practices .

2. Legumes

Chick Pea	-	Introduce and evaluate varieties to substitute for imports especially in the Northern Caribbean.
Pigeon Peas	-	Screening for Photo-insensitive cultivars.
	-	Commercial seed production for distribution to farmers.
	-	Screening for pest and diseases .
	-	Develop agronomic and production practices.
	-	Intercropping .
Peanuts	-	Information collection system .
	-	Varietal studies; screening for pest and disease .

Peanuts (cont'd)	-	Commercial seed production for farmers.
Cow Peas	-	Screening for pest and diseases.
	-	Screening for increased yields.
	-	Screening for seed and vegetable material.
	-	Commercial seed production.
3. Cereals		
Sorghum	-	Introduce and evaluate varieties.
	-	Identify and evaluate both forage and grain varieties.
	-	Cost of production studies.
4. Fruits		
Avocado	-	Screening for early, middle and late maturing varieties for local use and export.
	-	Development of agronomic, pest and disease control practices.
	-	Post-harvest and quality control.
	-	Agro-industrial potential and utilization.
	-	Inter-cropping studies.
Carambola	-	Agro-industrial potential; harvesting methods.
Billimbi	-	Agro-industrial potential; harvesting methods.
Sour Cherry/Gooseberry	-	Agro-Industrial potential; harvesting methods.
	-	Selection of germplasm; interest in large fruit with small seeds.
	-	Utilization in livestock feeds.
Passion Fruit	-	Agro-industrial utilization.
	-	Agronomic practices.

Sweet Sop	-	Varietal screening for less seeds.
	-	Rapid propagation.
	-	Post-harvest/quality and agro-industrial utilization.
Sour Sop	-	Varietal Screening for less seeds.
	-	Rapid propagation.
	-	Post-Harvest/quality.
	-	Agro-industrial utilization.
Cherimoya	-	Varietal screening for less seeds
	-	Rapid propagation.
	-	Post-harvest/quality.
	-	Agro-industrial utilization.
Guava	-	Varietal screening for fewer seeds.
	-	Post-harvest/quality.
	-	Agro-industrial utilization.
Cashew	-	Varietal trial to identify large nuts.
	-	Evaluation for high yield potential.
	-	Agronomic practices.

5. Vegetables

Onion	-	Varietal studies to select appropriate varieties for various seasons and areas.
	-	Post-harvest management drying/curing.
	-	Pest and disease management.
Other Vegetables	-	The need to co-operate with other research groups which have much on improved varieties, etc., for example, AVDRC in Taiwan for more tomatoes, sweet potatoes and some other tropical varieties.

(v) Working Group on Livestock

The development of viable livestock industries in the Caribbean suffers from the following constraints:

(i) The low animal population of most countries;

(ii) Poorly developed grazing and feeding systems;

(iii) The need for improved systems of management;

(iv) Inadequate marketing systems.

As a basis for collaboration, the Working Group considered that in order to realize progress in livestock research, it is necessary to:

(i) Have clearly defined priorities to determine the choice of research projects;

(ii) Have viable organizational framework for conducting research so that necessary long-term activities can be initiated and maintained;

(iii) Develop functional co-operation between research institutions and co-ordination between institutions funding research.

The Working Group took special note of the existing Regional Livestock Development Programme and also the Committee of Directors of Livestock Research for the CARICOM region which provide framework for co-operation in livestock research and development in the CARICOM countries.

Recommendations

(i) Institutions which have comparative advantages to carry out certain research should be given necessary support e.g. the Sugar Cane Feeds Centre in Trinidad and the Bodles Research Complex in Jamaica;

(ii) Increased attention should be given to the evaluation of local/regional materials to supply both the protein and energy requirements of different classes of livestock;

(iii) Particular attention must be given to the evaluation and use of local raw materials as feed ingredients for non-ruminants. The involvement of the private sector and their support to finance this needed research and development is considered to be important;

(iv) Specific research programmes should be directed towards the use of ligno-cellulose material for use as animal feeds.

(v) Early attention should be given to the development of production systems based on well-conducted comparative studies;

(vi) Breeds of livestock suitable for Caribbean conditions must be identified or produced;

(vii) Research is needed to develop relevant systems of using animal power for farm operations. This research may be usefully incorporated into programmes related to the use of energy in agriculture;

(viii) Efforts should be made to maximize the use of animal by-products including hides, hair and wool;

(ix) Systems and programmes in land use and land management are needed in order to realize effective application of research results and development of a viable Caribbean livestock industry;

The final plenary sessions of the Workshop accepted the report and recommended:

(i) That the Regional Livestock Development Programme and the Committee of Directors of Livestock Research in the CARICOM grouping should be examined as possible models on which to build co-operation activities in livestock research by linking with other organizations and institutions including IICA and CIAT. The mechanisms for Caribbean-wide co-operation need to be developed;

(ii) That in view of the limited land resources of most Caribbean countries, increased attention should be given to non-ruminants and to land-efficient production systems;

(iii) That attention be given to improvements in the management of livestock research and livestock production.

III. POLICY AND MANAGEMENT PAPERS

A. Agricultural Research Management
(Dr. John N. Nickel - CIAT*)

It is an honour for me to address this distinguished group on the important subject of agricultural research management. The need for well-managed agricultural research institutions has never been greater, especially in tropical developing countries where new agricultural technology is urgently required to reverse the current trends that show these countries becoming increasingly dependent on food imports. Fortunately, national governments and international financial institutions are recognizing the key role of agricultural research and more funds are becoming available to build, develop and strengthen national research institutions in the Third World. This workshop on agricultural research policy and management in the Caribbean, therefore, is very timely and the topic most relevant.

All of us who manage research institutions are aware of funding constraints and convinced that if we had more funds for our particular institution we could accomplish more. No doubt that is true. Nevertheless, the topic of how to obtain more funds will be conspicuous by its absence in this paper. I am convinced that the key constraint for more effective agricultural research in many institutions today is management. Until management is improved, additional resources will not be used effectively.

The topic assigned to me, agricultural research management, is an extremely broad one. Viewed from the perspective of the management of a national agricultural research system, this subject would encompass definition of national agricultural research goals and priorities; the formulation of a detailed plan of research programmes and projects in the framework of a national agricultural research strategy; assignment of responsibilities between various institutions to carry out these programmes and projects; allocation of necessary financial, personnel and physical resources to the respective institutions; submission of the resulting plan and budget to appropriate policy working bodies; implementation of the approved research

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programme; periodic evaluation of results and revision of the strategy and plans; dissemination of the results to the users; obtaining feedback on the impact, strengths and weaknesses of the new technology and incorporating this information into the technology generation process; and last, but not least, keeping key policy-makers informed on agricultural research achievements.

Obviously, all of these important components cannot be discussed within the scope of a single paper. I assume that the important subjects of developing national science and agricultural research policies, allocation of resources, and integrating the various elements, such as research institutions and universities into national scientific and development programmes will be dealt with elsewhere in this conference. I shall therefore restrict my comments to a consideration of the practical aspects of managing a major agricultural research institution, once the role of such an institution within the national, regional or international framework has been determined and the resources allocated to it.

Many aspects of managing an agricultural research institution are sufficiently similar to the management of any organization so that the principles of management which have evolved over the years, and about which many books and articles have been written, provide useful guidance. The problem is that most agricultural research managers are scientists who suddenly find themselves in an administrative role without the necessary intervening formal training or opportunity to study management principles. Managing scientific research in general, and agricultural research in particular, is sufficiently different from managing other types of enterprises so that special management skills and considerations are indicated.

The need for special management considerations in scientific research organizations stems chiefly from the nature of the personnel involved. Not only are scientists highly educated, but they are also engaged in work that emphasizes independence of thought. Thus, even in large corporations, where general management techniques are usually well understood and employed, it is recognized that these people require unique management skills, and a considerable body of literature on industrial R+D has developed.

Within the overall category of scientific research, agricultural research has some unique characteristics. Pierre[1/] described some of the peculiar characteristics of agricultural research, which include dependence on a wide range of scientific disciplines; susceptibility to highly variable environmental conditions; an international character; and the problem of farmers' acceptance of the end results. The complex nature of agricultural research can be understood by thinking of it as a two-dimensional grid: one dimension covering a spectrum of disciplines from the physical sciences through biology and engineering to the economic and social sciences, and the other dimension a spectrum ranging from basic research on the one hand to developmental and technological research on the other[2/].

I will now turn to a consideration of some aspects of the management of an agricultural research institute and the research it conducts.

Management of the Institution

Organization

Traditionally, agricultural research institutions have been organized along disciplinary lines. More recently, some organizations have created departments based on lines of production. Frequently these two types of organizations are superimposed in a matrix, or multiple command organization.

Matrix management is particularly appropriate when scientists representing different bodies of knowledge and distinct approaches must work together to solve problems, and when expensive resources must be shared[3/, 4/]

1/ Pierre, R.E.: Administration of Agricultural Research in the Caribbean. In: Warren M. Forsythe, Antonio M. Pinchinat, and Lyndon McLaren (Eds.), Proceedings of the Caribbean Workshop on the Organisation and Administration of Agricultural Research, Christ Church, Barbados, 1981. San José, Costa Rica: Inst. Interamericano Coop. Agric., 1982. pp.79-87.

2/ Walsh, T.: Some Aspects of Agricultural Research Management. In: OECD, The Management of Agricultural Research. Paris: Org. Econ. Coop. Devel., 1970. pp.39-55.

3/ Davis, S.M. and Lawrence, P.R.: Matrix. Reading, M.A.: Addison-Wesley, 1977.

4/ Birnbaum, P.H.: Academic Interdisciplinary Research: Problems and Practice. R+D Management 10(1): 17-22 October 1979.

Matrix management models can be differentiated into two types: the leadership matrix and the co-ordination matrix[5/] In the former, the project leader motivates the team to work for project goals, whereas in the latter, the co-ordinator merely keeps everyone informed about the project status and when their contributions will be needed. Multidisciplinary projects following the co-ordination matrix model are appropriate for universities in which strong, departmental lines are sharply drawn and individual scientists are more dependent on peer approval and publication within their own disciplines. In a problem-solving, production-oriented research organization, however, an interdisciplinary leadership matrix is more appropriate.

In terms of the need for scientists from specialized disciplines to work together to develop and evaluate new technology, and eventually make sure it gets to the consumer, agricultural research bears many similarities to pharmaceutical research and development. Thus the experience of the Upjohn Corporation in converting from a co-ordination to a leadership matrix is highly relevant. Stucki[6/] has described this process and reported that conflict resolution was much better under the latter than in the former organization and cited preliminary evidence of increased productivity under the new scheme.

Merely placing a breeder, a pathologist and an economist together in the same team does not automatically ensure interdisciplinarity. Without some "organizational coercion", the individual scientists may continue to think and work within their own disciplines and remain multidisciplinary[7/].

5/ Gunz, H.P. and Pearson, A.W. Matrix Organisation in Research and Development. In: K. Knight, Matrix Management: A Cross-Functional Approach to Organisation. London: Gower Press, 1977.

6/ Stucki, J.C.: A Goal-Oriented Pharmaceutical Research and Development Organization: An Eleven-Year Experience. R+D Management 10(3):97-105, June 1980.

7/ Payne, R. and Pearson, A.: Conference Report: Interdisciplinary Research Groups: An International Comparison of their Organization and Management R+D Management 10(1):35-37. October 1979.

In my opinion, in many agricultural research institutions such organizational coercion can best be accomplished by eliminating the matrix and organizing the research scientists into interdisciplinary programmes along commodity lines. I have managed all three types: i.e. a co-ordination matrix in a university context; a leadership matrix, with "woof and warp" cross hatching of disciplinary departments and commodity-oriented programmes; and, more recently, an interdisciplinary organization in which all scientists are assigned to one commodity programme or another. Each type of organization has its place, depending on the kind of institution being managed and the amount of financial and manpower resources available in relation to the commodity areas which must be covered. However, the simplicity of the chain of command and the loyalty and motivation that come from building an effective team effort around a single commodity or set of related commodities give this type of organization great advantage when it can be achieved.

Probably the most important ingredient toward making an interdisciplinary team work together effectively is the team leader. Such leadership requires special, rare skills, so the programme leaders must be selected with extra care. National research institutions usually bear responsibility for a large number of commodities. Therefore, individual species commodity programmes, except for the most important crops and animal species, may not be possible; instead, the organization of programmes around groups of related commodities, i.e. grain legumes, root and tuber crops, ruminant animals, etc., may be necessary.

Another resource-related problem is that even in a large organization with few commodities to cover, it may not be possible to assign scientists in highly specialized disciplines to each programme on a full-time basis. A useful compromise is to organize most of the institution along interdisciplinary, commodity programme lines and to conduct the more specialized research within a scientific support unit serving all programmes. The need to share expensive facilities as well as the desirability for close collaboration and communication between scientists within the same discipline can be satisfactorily handled by physically grouping together the labs and offices of scientists who are in the same discipline, but who are assigned to two different commodity programmes.

Regardless of the organizational structure employed, strong support units, e.g. biometrics, laboratory services, greenhouses and experiment station facilities, are essential. These should be organized into service units providing support for all programmes.

Research Institution Administration

Role of Administration

An effective and efficient administration component is absolutely essential to a research institution. Without adequate administrative services, such as accounting, personnel, maintenance, supplies, etc., a research institution cannot function. Nevertheless, the raison d'être of the institution, and the service nature of the administrative units, must never be forgotten.

Arnon[8] referred to the problems that can be created "if the people engaged in administration come to consider administration as an end in itself and not as a means of furthering research, which is the basic justification for the work of all the people in the organization". Similarly, Pierre[1] emphasized that "administration should be used to facilitate rather than control research". I frequently remind my colleagues in administration that our role is to facilitate the work of the scientists. This is not to say that the administrative unit staff should not be given important status and treated with full respect as essential partners in an important task. However, non-scientific personnel must always recognize that only the scientists produce new technology; the role of everyone else, including the head of the institution, is only to create the conditions in which this can be achieved most effectively.

Arnon[8] also pointed out that people trained exclusively in general management without a research background do not understand the potentialities of research, the idiosyncrasies of the researchers, or how research has to be carried out. He and Moseman[9] both recommended strongly that the head of a research institution should himself be a trained scientist and that the administrative functions should be handled by skilled management personnel; that the administrator of any institution

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[8] Arnon, I.: Organisation and Administration of Agricultural Research. Amsterdam: Elsevier, 1968.

[9] Moseman, A.H.: Building Agricultural Research Systems in the Developing Nations. New York: Agricultural Development Council, 1970.

should be a staff officer to the scientist director, acting only after due consultation with him. My own experience supports this view.

Administrative Procedures

While I firmly believe that the head of a research institution should be an experienced scientist, the implementation of these principles introduces a built-in weakness which probably represents one of the largest problems in many research institutions today. Scientists undertaking the duties of director of a research organization often do not even realize how ignorant they are of the basic principles of management[8/]. Research directors tend to concentrate on programme development and neglect the establishment of sound administrative procedures. Among administrative procedures, none are more important than those related to fiscal management. Thus research directors must depend on and give considerable authority to well-trained and experienced financial specialists and see to it that all the instruments for proper budgetary control and internal and external audit procedures are in place to ensure fiscal integrity and a high level of cost consciousness while, at the same time, avoiding excessive bureaucracy.

In the enforcement of administrative procedures, high degrees of fairness, integrity and flexibility are essential. These cannot be achieved unless the procedures and policies are well codified. It will be very hard for a senior manager to be fair, or be seen to be fair, if each decision seems to be an ad hoc one. Thus the rules have to be clear. However, the proper codification of policies does not automatically result in an overly rigid bureaucracy; on the contrary flexibility in making exceptions to the rules can be most effectively executed when the rules are well established and well-known. The establishment of clear rules and the spelling out of well-defined procedures in an efficient, streamlined administration do not mean a proliferation of paperwork. A requirement of many copies and many approvals is not synonymous with good controls. It may be just the opposite.

Participatory Management

In the entire range of activities involved in the management of a research institution, from the establishment of the administrative procedures to the elucidation of overall research policies and priorities, the

individual scientists must be brought into the decision-making process. The ability to permit participation by subordinates and others without the feeling of being threatened is a recognized characteristic of successful executives[10]. This quality is particularly essential in scientific research management. Arnon[8] pointed out, too, that people who staff research institutions are those who "by training and inclination have usually been conditioned to averseness to administration in all of its manifestations". Later he stated "the whole concept of superior-subordinate relationship, as it exists in governmental or industrial organizations, is uncharacteristic of the relationships between the different levels of research leadership. The need for decentralization, delegation, participation and consultative management, as stressed by the human relations approach, is applicable to research organizations".

The advantage of shared deliberations include the development of a close relationship between the research director and the senior research workers; the development of a feeling of common purpose, shared interest, and a sense of involvement; stimulation of awareness of problems with which the organization is faced; improvement of communication, with opportunities for emphasis and clarification where required; and the fact that collective judgement may be more effective than individual judgement and that a check-and-balance system helps to prevent arbitrary decision-making by individuals[8]. Some disadvantages of sharing deliberation include the use of valuable researchers' time and the fact that researchers often do not have a sufficiently broad understanding of the problems involved. Because they are more concerned with their individual subject fields than with institutional requirements or policies, they tend to resist proposals that might encroach on existing prerogatives.

In spite of their obvious and well-known weaknesses, shortcomings and even dangers, committees seem to present the best mechanism for introduction of participatory management into a research institution. While this does use valuable

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10/ Argyris, C.: Some Characteristics of Successful Executives. Personnel Journal 32(2):50. June 1983.

scientist time, the resulting improvement in communications and the feeling of involvement that results from the inter-action in these committees more than offset the time lost. Indeed there is evidence that scientists are most effective when involved part-time in other activities such as teaching and administration. In a survey of 522 scientists in engineering in 11 industrial, governmental and university research units, it was found that scientific performance (as measured by scientific or technical contribution and by general usefulness to the organization) for Ph.D.'s and assistant scientists was highest for those who spent three-quarters of their time on scientific work.[11/, 12/]

The use of committees provides great benefits in improved communication, understanding and a sense of participation derived from involving scientists in the process of major policy decisions. This process also contributes greatly to the quality of the decisions made and the morale and productivity of the institution. The director bears the ultimate responsibility for the institute's policies; only [*/]he can balance group judgement on one hand with the needs and goals of the organization on the other. Thus, while the various committees must have different degress of executive authority, normally they are advisory in nature. Whereas the director must maintain the right to make the final decision, he is well advised to act contrary to the considered judgement of committees he has appointed only rarely and after careful consideration.

Delegation of Responsibility and Authority

In the same way as a research manager is able to do a better job of decision-making by involving others in participatory management, he is able to be a more efficient and effective executive to the extent that he

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11/ Albers, H.H.: Principles of Management: A Modern Approach. 3rd Edition ed. New York: Wiley, 1969.

12/ Andrews, F.M.: Scientific Performance as Related to Time Spent on Technical Work, Teaching or Administration. Admin. Quart. 9: 182-193, 1964.

*/ The words "he", "his" and "him" are used in a generic sense when referring to research directors or scientists who may, of course, be male or female.

appropriately delegates responsibility and authority. As mentioned above, the final responsibility for management of the institute must rest on the director. However, only by delegating a major portion of his authority will he find time and freedom to handle adequately the many functions which evolve uniquely on him. Making the important strategic decisions and developing a sound research philosophy for the institution require unhurried deliberation and wise advice. This requires time for thought as well as adequate communication. Only the director can perform some of the representation duties required for government relations and donor support. None of these functions can be performed well by a harrassed chief, overly burdened by details which can and must be handled by subordinates.

Everyone knows that responsibility must be delegated; the mistake many managers make is to delegate responsibility without passing on commensurate authority. The most basic principles of classical organization theory first put forward by Fayol,[13/] and supported by many schools of management science since, emphasize that authority and responsibility should be commensurate; that is if a person is made responsible for a certain function and task he must be given authority to ensure that he is able to carry out his obligations. Delegation of authority is ineffective if it is not visible and consistent. For example, when an area of responsibility has been handed over to a subordinate, it is that person who should sign the memos and the approvals related to that area of activity. Too often it is easier for the chief executive to take action himself in an area he has already given to someone else. This temptation must be resisted or schizophrenic administration will result.

Delegation of authority and responsibility includes allowing subordinates to make mistakes and supporting them even when not fully in agreement with their decisions.

While I have repeatedly referred to the "director" as though he were a single person, much of what has been stated above applies equally to the several people who make up the top management of a research institution. Furthermore, in the same way as interdisciplinary teams are often the best way to organize problem-solving

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13/ Fayol, H.: General and Industrial Management. London: Pitman, 1949.

research, I have found "team management" to be an effective means of directing a research institution. Such team management is characterized by a broad sharing of responsibilities between the head of the institution and his close subordinates, along with a system of open communication, which keeps all members of the team informed about the actions of the others and makes it possible for any one to take on the responsibilities of another when necessary.

Research Management

Having dealt with some of the principles of the management of a research institution, I now wish to comment on some aspects of the management of the research conducted in the institution.

Functions of Research Management

Breck[14] described management as the determination of objectives, the laying down of a broad policy for the achievement of these objectives and the translation of that policy into programmes for action. He summarized these functions as planning, organizing, leading, motivating, and controlling. Kidd[15] defined administration of research as "research planning on a broad scale, the development of scientific strategy, the evolution of a consistent philosophy of research, and the difficult tasks of bringing a sound philosophy to bear upon the conduct of research".

For the purpose of this paper I have organized discussion into three topics: planning and evaluating research, organizing research and personnel management.

Planning and Evaluating Research

You may have noted that in my presentation so far I have used the terms "research manager" and "research director" somewhat interchangeably when referring to the person or persons in charge of a research institution.

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[14] Breck, E.F.L. (Ed.). The Principles and Practices of Management, 2nd ed. London: Longmans, 1963.

[15] Kidd, C.V.: Research Planning and Research Policy-Scientists and Administrators. Science 118:147-152. 1953.

This is not surprising. If one accepts that agricultural research is the application of scientific principles and knowledge to the solution of agricultural production constraints, then, by definition, agricultural research activities connot be interest-oriented, or opportunity-oriented, but must fit within a directed programme oriented towards the solution of specific problems, a condition incompatible with the free choice of research subject[8]. Thus the scientists in an agricultural research institution must work within the framework of a plan, and research management involves a strong sense of direction.

Koontz and O'Donnell[16] defined planning as "the executive function which involves the selection, from among alternatives, of enterprise objectives, policies, procedures and programmes." There is more literature on the subject of agricultural research planning than on many other aspects of research management. I will, therefore, not go into detail on this subject in this paper. However, I do wish to point out the importance of setting priorities and making the hard decisions of what to emphasize and what to leave undone. One of the most general, firm impressions I have perceived in visiting many national research programmes is that too much is being attempted with the resources available. In order to be effective, national, regional and international institutions must carefully analyse priorities and decide to concentrate efforts on a limited number of the most important commodities and research subjects. Similarly, every ecological zone connot be adequately covered and many national research programmes have too many stations for each to be properly staffed, equipped and financed. The reduction of these to those which can be operated efficiently with a critical mass of scientists will also require some very hard decisions.

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[16] Koontz, H. and O'Donnell, C.: The Principles and Practices of Management, New York; McGraw Hill. 1955.

In this respect, planning cannot be separated from evaluation. Usually resources are limited; therefore the introduction of a new activity or expansion of an existing one often means a shift in resources already engaged elsewhere. Scientific programmes must be regularly evaluated to determine whether or not any should be discontinued. As Irving colourfully puts it, "those most closely involved are most likely to see a need of continued research, just one more step and then another. In some cases the end comes not by natural death but requires administrative euthanasia."[17/] Setting priorities involves not only the research director; he must depend on the informed advice of his colleagues. While much of the information on the establishment of priorities is intuitive, careful ex-ante economic analysis to determine the costs, as well as the amounts and distribution of the socio-economic benefits anticipated from the research, provides a valuable tool in the planning process.

One further point I wish to make regarding the evaluation of research programmes and projects is the importance of a peer review. Clearly, the scientists must be involved in the evaluation process. Recognition, approval and evaluation of his work by his peers is an important motivational force for a scientist, and peer review provided informed opinion which would not otherwise be available to the research management. The procedure of an annual, in-house review (IHR) has become generally enshrined within the International Agricultural Research Centres. Dr. Jock Anderson, an Australian scientist who was a Visiting Scientist at CIMMYT, published an excellent review of the IHR procedure[18/]. He stated that in spite of the fact that this takes an entire week of scientists' busy time, they "seemingly approach the IHR with enthusiasm and vigor." He pointed out that one of the important features in such a review is its comprehensive nature, and indicated that the feeling of "all in it together" is important in discouraging feelings of victimization and transparent vulnerability that must always accompany any probing criticism of research work in progress.

[17/] Irving, G.W., Jr.: Programming Research Activities. In: OECD, The Management of Agricultural Research. Paris: Org. Econ/ Coop. Devel, 1970.

[18/] Anderson, J.: Forum on Formalized Opinion of Peers in Monitoring Agricultural Research. Rev. Marketing Agric. Econ. 44(3):119-122. Sept. 1976.

He noted the open, constructive atmosphere for in-depth criticism in this process, which requires particular personalities who can direct and lead discussions along perceptive and useful channels and who can criticize work without insult or personal attack. Anderson considered the process sufficiently effective that he recommended it for use within Australian agricultural research organizations. I believe it can be applied usefully to many national research institutions as a key component in the evaluation process.

Personnel Management

I have purposely passed over the important functions of planning and evaluation rather superficially in order to leave adequate time for what I consider to be the most important single component of research management.

The essence of research management is the art of managing scientists. Much attention is given to resource allocation, programme planning and evaluation and different institutional models, but in the end it is the scientist who is the key component to successful agricultural research. Without well qualified, well motivated, well-led scientists, the most adequately funded, best-equipped and best-organized research institution is useless. Thus, the most important role of the research manager is the "care and feeding" of research scientists. While the research director connot devote all the time he would like to many aspects of his work, personnel decisions should never be made hastily. Whether it is in recruiting, reviewing the activities of individual scientists, or dealing with personal problems, no effort or time should be spared to do this part of the research management job well.

Selection

Research institutions spend 70 percent or more of their budget on personnel; yet the matter of recruitment and selection is often done routinely and without sufficient in-depth analyses. I had the pleasure

of serving as a Visiting Scientist in the International Rice Research Institute in 1964 during its formative years. Naturally, when I first arrived I was favourably impressed by the quality of the facilities. However, the more important and lasting impression was the uniquely high quality and high motivation of the scientists I found there. The late Dr. Sterling Wortman was at that time Associate Director for Research, under the strong leadership of an outstanding administrator, Dr. Robert Chandler. In this capacity Dr. Wortman was responsible for a major part of the scientific staff recruitment. Years later, when I was a Research Director myself, I asked him what was the secret of his success in recruiting such outstanding scientists. He did not hesitate a moment in his reply; "the most important ingredient to the recruitment of scientists" he said, "is to have a very clear understanding of what that person was going to do and how he would fit into the overall institute programme before beginning the recruitment process." This is an important distinction, because so often research institutions do it the other way around, attempting to fit the scientist to the job or fit the job to the scientist rather than to select the most outstanding scientist, uniquely qualified for the specific task at hand. Let me give a simple illustration. If a particular research programme needs a field-oriented crop physiologist, and the candidate selected is a laboratory-oriented biochemical physiologist, it will be very difficult to change his nature and interests, regardless of how intelligent and motivated he may be. On the other hand, changing the job to fit the scientist recruited changes the whole nature of the programme. Thus I have learned to recognize the wisdom of Dr. Wortman's advice.

Since I have emphasized the value of interdisciplinary team research, two points that relate specifically to recruitment for such organization should be noted. One is that the ability of the candidate to work as a harmonious member of a team should be considered along with other qualifications. The other is the importance of a degree of involvement of team members in the selection of potential future colleagues.

Motivation

Of course scientists must be adequately remunerated and those performing exceptionally well must receive special merit increases to reward good performance. Many national programmes are unable to provide adequate compensation or differential merit awards because they are tied to a civil service system. Fortunately there is a strong trend to establish agricultural research institutions as autonomous or semi-autonomous organizations, which is beginning to help overcome this important problem. However, financial remuneration is not enough. Even more important, in my opinion, is that the scientists must feel that what they are doing is important and know that their work is recognized and appreciated. In the field of agriculture research, particularly in developing countries, we have the distinct advantage of having little trouble in finding grounds to convince scientists that their work is indeed very important. What could after all be more important than contributing to the solution of hunger and poverty today? Recently a research manager was telling me that the role and importance of agricultural research was not adequately recognized by government officials and policy-makers. This was not surprising; but what shocked me was when he went on to say that even the individual scientists did not seem to recognize that what they were doing was important, but merely doing their own thing without an understanding of how their work contributed to the whole. While as a guest I could not say so, I was tempted to say: "Well, what are you doing about it?" Since the motivation of scientists to understand the important role of the institute and the key role they play in it is one of the most important duties of a research manager.

I have found that good working conditions are also probably more important than monetary remuneration for the motivation of scientists. This means not only adequate research facilities but also appropriate administrative policies that minimize bureaucratic constraints and maximize the amount of support the scientists receive.

Finally in the area of motivation, I cannot over-emphasize the importance of recognizing each scientist as an important, individual human being, with problems, concerns, ambitions and pride which must be recognized with concern, interest and compassion. In a study carried out by the University of Michigan, which investigated the relationship between relationship and research performance, it was found that frequent stimulation and encouragement from the supervisor contributed to high research performance[8]. In my experience, it is often the most productive scientists who require the most attention. The research manager who dismisses such personnel as prima donnas or troublemakers is foregoing a very valuable asset.

Some scientists will seek attention; others are more shy. In order to ensure that all have opportunity to express their views and report personally on their activities, a systematic programme for meetings of the research director with the individual scientists should be established.

Leading

While I have stated that the research in an agricultural research institution must be directed and have mentioned "control" as one of the important functions of research management, such direction and control can be applied effectively only through leading and guiding in an atmosphere of persuasion and consent. Scientists, probably even more than others, are usually allergic to excessive control, even if exercised by other scientists. A good research leader provides scientific guidance without stifling initiative. He cannot do so without occasionally having to criticize. However, the right to criticize is earned by praising when praise is due. An effective leader will, therefore, actively seek opportunities for genuine praise (not flattery), and when criticism is necessary will be careful to criticize the performance rather than the person. Blanchard and Johnson[19] pointed out the importance of reprimanding the behaviour only and never attacking the person's worth of value as a person. They also emphasized the need for each person to have very clearly stated goals and objectives. This is in contrast to what they refer to as the "leave alone-zap" style which characterizes some leaders who never make it quite clear to a person how he is doing but save all the criticism

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[19] Blanchard, K. and Johnson, S.: The One Minute Manager. New York: William Morrow. 1982.

for the annual evaluation. It is much better to set clear objectives so that staff know what is expected of them and let them know when they are doing things right and when they are doing things wrong.

If the research manager has been careful in the selection of the scientists and has clearly outlined their areas of responsibility, then he can give the scientists ample range for personal initiative. I like to remind our scientists that what we expect from them is relevance and responsibility and in return we in the administration owe them trust and flexibility.

The foregoing emphasis on participatory management, on concern and attention to the individual, and on trust and flexibility should not be interpreted as giving licence to sloppy, unstructured management. Discipline is also important. Those who do not respond to a concerned and flexible administration with responsibility must be dealt with accordingly. The good research manager is compassionate in relation to personal problems but must be firm when it comes to matters of performance and discipline.

Taking and Making Time

One of the most precious commodities of a research manager is TIME. There are simply not enough days in the week, hours in the day, or minutes in the hour to accomplish everything it seems he should do. And yet I have stressed the importance of making decisions and handling personnel matters in a relaxed, unhurried atmosphere. When a scientist comes to see his director about a problem, which to him is the most important in the world, he must have the feeling that the director has all the time in the world to discuss it.

The effective research manager, therefore, must develop a strategy to make time available. Such a strategy should not be based on merely working longer. I am not impressed by the research manager who consistently works excessively long hours.

Naturally, there are emergencies when certain deadlines must be met, and when evenings or weekends must be devoted to the task. However, this should be the exception rather than the rule. The type of intense concentration which is required for effective research management simply cannot be sustained by most human beings much longer than the normal working day. While most research managers will not be able to adhere strictly to an 8 to 5 day, and clock-watchers are to be avoided, one who works excessively long hours consistently is probably not very productive in those extra hours.

More important than working longer is better using the time available. How can this be done? One way is to delegate responsibility, which has already been discussed above. The other is to improve the organization in the use of time.

In order to have the time to give careful consideration to policy and personnel questions it is essential to set aside sustained periods which will be uninterrupted. I do not believe that a research director can afford to have a totally "open door" policy. He must have a "closed door" and an effective secretary who will keep him from being interrupted (except for emergencies) for a certain period of time each day, while reserving another period for fixed appointments and for ad hoc visits. It is amazing how much more can be accomplished in an uninterrupted hour than in 12 five-minute periods. No doubt there are other ways of improving time management, but the key work is organization, and the research director will never be able to efficiently manage his time unless he finds some way to deal expeditiously with the large volume which crosses every executive's desk. In this regard, I have found the advice the late George Harrar gave me when I first became an administrator, to try and handle any piece of paper only once, very helpful.

Characteristics of a Good Research Manager

The foregoing discussion can probably best be summarized by describing some of the qualities which will characterize a good research leader:

(i) He is fair, honest and consistent;

(ii) He cares about individuals; he is concerned for their welfare, and demonstrates interest in their individual activities. Small things such as going to the office or laboratory to see a scientist,

rather than having him come to the administration office, and being careful to attend seminars, symposiums and conferences given by the scientists, demonstrate such interest and respect.

(iii) He is respected. Everyone wishes to be liked, but this is not always possible and the research manager who tries too hard to be a "nice guy" will not be able to make the inevitable tough decisions. Even unpopular decisions, when made with integrity, will earn the respect of staff, which is more important than their love;

(iv) He is decisive. I have heard that a chicken crossing the road is an example of a poor executive, in that the chicken waits until the last moment to make the decision and then makes the wrong one. Many times even a wrong decision is better than no decision at all. Research managers have to be willing to make mistakes, although it is hoped they would not make too many.

(v) He delegates responsibility and authority and supports the actions taken by his subordinates;

(vi) He is a full-time research administrator who enjoys the art of management and has decided to make it a career. Too many scientists, experts in their particular field, attempt tenaciously to continue their own research activities after having taken on important administrative responsibilities. The insidious danger of trying to keep a foot in both camps, attempting to keep full involvement in the direct conduct of research but reluctant to give up the prestige of an administrative post, must be avoided. The result is usually a poor scientist and a poor administrator. Research institutions should choose as their leaders those who havedecided to make scientific administration a career;

(vii) He is a good communicator. The need for good communication with scientists and other staff members has already been discussed above. In addition, a research manager will need to be skilled in speaking and handling the written word with clarity and felicity;

(viii) He insists on Excellence. The job of increasing agricultural production is simply too important to be done in mediocre fashion. Excellence is not usually more expensive; it just requires better motivation

and organization. One of the other things which impressed me as a Visiting Scientist at IRRI was the emphasis on excellence that resulted in the quality of the work produced. Chandler, describing the history of IRRI since 1968, related how he continuously reminded staff that those who judged IRRI would base their opinions on whatever contact they happened to have with it. If they received a letter with grammatical or typographical errors or if they observed that the grounds were not neatly maintained, or that the drivers were careless and over-relaxed, they might assume that the Institute's research programme was slackly run as well. He stated that he "stressed the importance of doing a quality job in every department and operation and urged all to take pride in helping IRRI establish a first-class reputation." 20/ I believe all our institutions will benefit by such an emphasis on high standards.

Conclusion

In conclusion, I wish to turn from the specifics of managing a research institution to the broader subject of agricultural research in the Caribbean. This workshop presents a rare opportunity to strengthen agricultural research in this region; gathered together here are research leaders, government policy-makers, representatives of international organizations and donors - all of whom have a vital role to play. This timely opportunity presents us all with a challenge to act with boldness and dedication in a spirit of co-operation.

We must act with boldness to challenge existing organizational structures and management procedures to find who will make it possible to establish clear priorities and pursue these objectives efficiently. We must find ways to work together more effectively. Our task is too important - and the resources available too limited - for us to tolerate wasteful duplication. And we must dedicate ourselves totally to the noble task of improving human welfare through increased agricultural production. Too many people's lives and well-being depend on our efforts for us to do less.

20/ Chandler, R.F. Jr.: An Adventure in Applied Science. A History of the International Rice Research Institute. Los Banos, Philippines; Int. Rice Res. Inst. 1982.

B. Organization and Management of Agricultural Research in the Caribbean - A view Point

(Lyndon Mc Laren - CIAT*)

An almost inevitable consequence of many years of work in the Commonwealth Caribbean - the former British territories - has been a constant awareness of the diversity which exists among the countries of this region. During the last five years, working with the Inter-American Institute for Co-operation in Agriculture (IICA) in the wider Caribbean area, that diversity has become more apparent. However, in the process, it has been possible to recognize a number of features shared by many of these countries which are principally island states.

It is against this background and within this framework that I have sought to put forward some views as to possible means by which research co-operation between CDCC members might be designed, nurtured and developed over the next few years.

It is useful to remind ourselves that the countries comprising the Caribbean Development and Co-operation Committee (CDCC) total eighteen; and that they extend from the Bahamas and Cuba in the north, to Trinidad and Tobago, Guyana, and Suriname in the southeast. Within that group there exists a wide diversity in size, population and ecology, as well as differences in language, history and tradition, all of which exert some influence on development patterns.

Despite these differences there are a number of similarities common to many. Dominance of the agricultural sector in their economies is one of the more obvious and indeed more important. The majority have very limited natural resource capability.

The dominance of agriculture in the economic activity of CDCC states is demonstrated by the fact that it provides at least half the value of exports. However, much of the foreign exchange is consumed in the importation of food and other agricultural products. Our governments have recognised the urgent need to revitalize agriculture in order to increase export revenue and at the same time reduce expenditure on food imports.

* Inter-American Institute for Co-operation in Agriculture.

Strategies being developed and applied toward achievement of this goal are known to you. They include crop diversification, new commodity development and production, and higher productivity of traditional crops.

The adaptation and the development of relevant technology and the adoption and application of that technology at farm level are vitally important to that process. An example of research that could be of particular value in poor, labour surplus countries such as ours, is the identification of technology designed to absorb less expensive and more abundant labour inputs.

For development of that technology and, equally importantly, for understanding the "non-technology factors" that affect the adoption of constant flow of new field tested technological knowledge relevant to the needs of the sector, continuity of support for such research is vital. This speaks to the issue of political commitment to the provision of adequate resources for supporting agricultural research, and continuity in funding that research.

During the last few years the increasing interest by Caribbean States in agricultural research has led to several meetings, seminars, and workshops. These have dealt with various aspects of that subject. Such a development is not surprising in a region where, as evidenced by a number of events, the majority of States are passing through an intense phase of political and economic development, and science and technology are being recognised as having an important role to play in their economic and social advancement. The establishment of the Caribbean Council for Science and Technology (CCST) is a practical demonstration of this fact. Adequate public support for education and research, as instruments for economic progress, now needs to be canvassed and sustained.

Investment Returns In Research

In the most recent workshop, "the Puerto Rico Conference on Agricultural Priorities in the Caribbean."[1/] held in August, 1982 the absence of policymakers/advisors from the consultation did nothing to assure consideration of conference recommendations on their

1/OAS 1982. Puerto Rico Conference on Agricultural Priorities in the Caribbean. Final Report.

presentation to national governments nor initiation of action programmes. It is therefore especially significant, indeed gratifying, to have a number of senior administrators participating in the current workshop.

Their presence provides an excellent opportunity for interaction between policy advisors and research scientists/administrators during the process of developing policies and strategies by which agricultural research can more effectively advance the development of national agriculture in our region.

It is also an appropriate forum in which two important agriculture-related considerations should be emphasized. Firstly, there is growing recognition that technological change can be an efficient source of growth in traditional agriculture. Secondly, evidence from many studies of the contribution of research to productivity growth indicates that investment in agricultural research yields high rates of return[2/] [3/]. This is simular in both developing and developed countries.[4/]

Indeed it has been found that returns to agricultural research activity typically exceed 20 percent a year and often are greater than 40[3/] The opportunity costs of capital in developing countries like our own range from 10 to 15 percent, so on the basis of the above estimates there is under-investment in agricultural research; the level of anticipated benefits to investment in research being likely to yield higher returns than many feasible alternatives in the rural sector.[3/]

[2/] Ruttan, Vernon W. 1982. Agricultural Research Policy. University of Minnesota Press, Minneapolis.

[3/] World Bank 1981. Agricultural Research Sector Policy. Paper.

[4/] Reynolds, Lloyds, G. 1975. Agriculture on Developments Theory. Yale University Press, New Haven and London.

Such a situation can be attributed partly to the heavy emphasis being placed by Governments on agricultural development per se. However, it has also to be seen in the context of "the inadequate appreciation by governments of the role effective research plays in agricultural growth and development." Even in the U.S.A. where research has long provided the technology which has made American agriculture so highly productive, it has recently been said in a statement of public policy issues that -

> "Inadequate public understanding of the importance of agriculture to the well being of its citizens leads public officials generally to undervalue agricultural research."5/

As a region the Caribbean can take little comfort from this observation, for it is grouped with countries which spend 0.42 percent of their agricultural Gross Domestic Product (GDP) on agricultural research (compared with 1-2 percent in developed countries).3/ However, I should add that, whilst the percent of agricultural GDP is useful in this instance in demonstrating the low investment in research in our region, it should be used with caution when judging the adequacy of agricultural research systems.

The area also relies to an ever increasing extent on North America and elsewhere for supplies of food, supplies which include several commodities that can be grown on our own land. Although that development cannot be attributed to lack of adequate investment in agricultural research, investment in organization and operation of an effective agricultural research system must be seen as an essential part of the process for the arrest and reversal of this trend.

5/ 1982 "Science for Agriculture." Report on Critical Issues on American Agricultural Research, jointly sponsored by Rockefeller Foundation and the Office of Science and Technology Policy, Executive Office of the President of the U.S.A.

It is fully recognized that, in addition to effective agricultural research, progress towards achievement of a country's development goals requires the pursuit of appropriate policies, and provision of adequate infrastructure. The latter includes the traditional elements such as roads, marketing, and storage facilities, and efficient input and technical assistance services.

Whilst not ignoring the importance of these other elements in securing agricultural development, of necessity my observations will relate more specifically to research.

As our planners and research scientists have grappled with the problems of agricultural development and with the question of effective allocation of scarce resources, measures which could lead to maximization of resource use and minimization of duplication have received special consideration. One of the strategies proposed for attainment of this goal has been inter-country network. For some time this matter has been debated in the CARICOM region, and now its desirability has gained ground in the Caribbean countries beyond. The formation of an Agricultural Research Committee of the Caribbean Council for Science and Technology (CCST) and the workshop organized by ECLAC are in essence a response to this development.

It is a fact of life that the many states of the Caribbean whose economies rely heavily on agriculture, currently do not have the resources to support an effective Agricultural Research Service (ARS). Pooling of the resources for operation of a service to investigate problems of priority interest is perhaps the most practicable means of dealing with this situation. The WINBAN Research and Development Service provides a fine example of such co-operation.

Present Research Systems.

Before considering the network approach in detail, it is necessary to review the research systems now operating or in process of development, to assess the prospects of designing and developing a viable network, since viability will greatly depend on the existence of a core of strong and effective national systems. For example, the success of research co-operation between the "Southern Cone" countries of Latin America has been attributed as much to the presence of viable national systems.

as to the existence of a core consensus on problems where research co-operation could provide a high payoff.

Ruttan, looking at the "small country problems", has observed that "most of the smaller countries in the 2-10 million population range do have resources or have access to donors' resources that would permit them to develop over a 10 to 20 year period an agricultural research and training capacity of 250 - 500 postgraduate level agricultural scientists and technicians capable of staffing the nation's public and private-sector agricultural research, education, planning and service institutions."[2/] Utilizing this as a rough yardstick and drawing on my own knowledge of many of the CDCC countries, certain broad conclusions have been made in the course of my review.

Information available on agricultural research systems in CDCC countries including publications from IFPRI, ISNAR and IICA, among others, have been used in this review, and a feature common to nearly all those reports is the gaps in the information and unreliability of statistics for important matters such as staffing and budget. That is a topic to which I shall return later, in the discussion of a possible approach to developing a co-operative research programme.

It is clear from this examination of existing systems that Cuba has a substantial and well developed agricultural research service (ARS) with a record of achievement over several years, and the ability to stand on its own.

The Dominican Republic currently cannot boast of an effective research network but is moving towards its reorganization and reinforcement. The resources to develop an ARS to serve Dominican agriculture do not appear to be beyond that country's resource endowment.

Jamaica is attempting to establish an effective network, whilst Trinidad and Tobago has had an integrated system on the drawing board for some years. This would involve the establishment of a National Institute of Higher Education, Research Science and Technology (NIHERST) in which a Centre for Agricultural Research will

carry out the research on agriculture of that country. The model is based on the concept that an autonomous ARS, working outside the traditional government bureaucracy, is usually more effective.

Barbados could well reorganize and upgrade its present service to develop a small but efficient national ARS. Their strong tradition in sugar cane breeding and the presence of a university campus with a faculty of science might encourage such a development.

Guyana appears to have the essential elements which with suitable restructuring, reinforcement and appropriate policy guidance could develop into a compact and efficient service.

In Suriname considerable reorganisation and upgrading will be needed for a truly satisfactory national system for applied agricultural research to be established.

The status of agricultural research in Haiti is unsatisfactory and only far reaching restructuring with substantial new resources inputs - personnel and finance - can establish the basis for a competent service.

The Bahamas has a number of the elements of an agricultural research service; such as experiment stations, but still lacks the institutional frame and resources for operation of an effective ARS.

Existing research services in Belize, the OECS countries and the Netherlands Antilles are small or non-existent with an uncertain future as to plans for their upgrading.

Regionally, there are two major units in the CARICOM region, namely the Caribbean Agricultural Research and Development Institute (CARDI), which now does research in all the Commonwealth Caribbean, and more especially the OECS, and the University of the West Indies. In the light of present initiatives to develop substantial national systems in at least two of the larger states of the area, CARDI could do well to examine what its future role should be when competition for resources with these national systems becomes more acute. A role it ought to contemplate is the supply of the agricultural research needs of the OECS.

The Role of the University

The University of the West Indies is being discussed last in order to highlight its not inconsiderable research capacity and capability.

The Faculty of Agriculture "with 40 professional staff and 80 post-graduate students in disciplines ranging from pure and applied to social sciences provides a resource base"[6/] which with advantage could be utilized for applied and basic research for regional agricultural development. Spence, in his paper at the Barbados Workshop[6/], provides an admirable outline of its achievement and potential and argues that it should be utilized accordingly.

That issue and a similar one, the role of universities in other CDCC states in the agricultural research system, warrant serious attention at this workshop. The contribution which the existing units of the Institute can make, towards understanding the factors influencing the adoption of technology, should be another topic for study.

Having reviewed the agricultural research service in the CDCC Region and pointed to the potential benefits of co-operation, what then should be the approach? It is clear that the majority, as small countries, have not the resources to establish a national agricultural research service or are attempting to decide on an appropriate size of organisation for their national agricultural research; a minority, perhaps four, operate or are in the process of establishing potentially viable national systems.

The ARS in Cuba because of its size and strength can well stand on its own, whilst forging links with other research systems in CDCC Countries. The likelihood is that the Dominican Republic will extend its association with CATIE and national agricultural research agencies in Central America through CORECA (Regional Committee for Agricultural Co-operation for Central America, Panama and Dominican Republic). However, this should not prevent co-operation with other CDCC countries.

The Dominican Republic, Jamaica, Trinidad and Tobago and very probably Guyana will pursue the task of building and strengthening

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[6/] IICA 1981. Proceedings Caribbean Workshop on Organisation and Administration of Agricultural Research.

their national agricultural research systems, which in the future could become the basis for a truly co-operative research network.

The Basis for a Regional Network.

At the present time, the most practicable approach towards achieving co-operation in agricultural research in the CDCC region seems to be in the identification and initiation of joint projects between two or more countries. The presence of strong research units within the agricultural research systems of particular countries provides the most favourable starting points for such endeavours. These joint projects must of necessity have priority rating in the participating countries and should be used, as far as possible, to demonstrate the benefits deriving from carefully planned and executed research. In that way strong support may be assured.

These collaborative operations should assist in improving mutual understanding and could lead to identification of further opportunities for co-operation. Because of their relatively closer affinity the CARICOM region seems to be the more appropriate place in which to begin. Co-operation with units outside the area, whilst highly desirable, should follow later. That research by developing and disseminating technology to deal effectively with farmer problems should strive to secure added public and political support. Measures aimed at mobilizing the clientele for determining the research agenda and building political support will be most important in the medium to long-term, and should be explored pari passu with the actions designed to evolve a co-operative network.

Simultaneously with the organization and execution of these collaborative projects, action to strengthen the existing national systems and others now being established in CDCC countries should continue, as well as efforts to organize other systems where desirable.

Assistance to improve research planning, resource allocation, and management capability must be an essential part of that process of upgrading and consolidation. And as national agricultural systems gain in effectiveness and strength, the basis for developing a truly functional co-operative research network will have been established. The inter-country

collaborative project proposal represents the first phase in that development.

In order to secure these ends, substantial technical aid will be needed. To be effective, this phase should extend for five (5) years in the first instance. In view of the assistance being provided to countries in the group by several bilateral and multilateral aid agencies, it is proposed that a consortium of these supply the resources to undertake this task. That consortium could assign responsibility for management of the project to a multilateral agency.

For its execution a small Operation Unit would be required, staffed by two (2) or three (3) specialists. One of these ought to be an experienced research scientist and another an economist with capability in agricultural research planning.

Funds would be needed for:

(i) Personnel emoluments and benefits;

(ii) Operations including travel (for full-time staff), hiring of consultants;

(iii) Organization and hosting of periodic consultations;

(iv) Seed money for collaborative projects.

The Major Functions of the unit would be:

(i) To assist in the identification, planning and financing of co-operative projects.

(ii) To organize information exchange, monitoring and review, and evaluation of those projects;

(iii) To promote the development and improvement of national agricultural research services, paying special attention to upgrading research planning and management capability.

(iv) To facilitate the development and regular updating of physical and human resource inventories (inclusive of manpower surveys) and to design appropriate projects for their continuing improvements.

(v) To organize and host annual or biennial consultations of senior regional research scientists.

In discharging these functions, special effort to facilitate interaction between policymakers and research scientists should be made and means of increasing client input into determining the research agenda explored. Additionally, the study of non-technology factors influencing adoption of new technology should be encouraged.

It is envisaged that the consultations/meetings of research scientists would be structured to provide a steering mechanism for the co-operative research programme which would evolve from the initial collaborative efforts. It is a stepwise approach for building mutual confidence, assuring improved research planning and management and more effective research, including substantial inter-country co-operation.

Publications Consulted

(i) National Academy of Sciences 1977. Supporting Papers: World Food and Nutrition Study, Volume V, Agricultural Research Organization.

(ii) UNDP/FAO 1980. Improving Agricultural Research. Preparatory Assistance AG: DP/RLA:79:00: Project Findings and Recommendations Terminal Report, Rome.

(iii) UNDP/FAO 1981. Improving Agricultural Research, Preparatory Assistance AG: DP/RLA/79/00. Consultant Report. Livestock Research, Rome.

(iv) ISNAR/IFPRI, 1981. Resource Allocation to National Agricultural Research. Trends in the 1970's. A Review of Third World Systems.

(v) ISNAR, 1982. A Review of the Agricultural Research System of Guyana.

Concepts of Alternative Framework and Mechanisms
For Implementation of Agricultural Research in the Caribbean

It has been stated by Ruttan that the present need in the 80's is to establish agricultural reserach planning capacity, to identify research priorities and allocate personnel and financial resources to them, as this will influence the quality and flow of new technology. The premise is fully accepted, and the project idea outlined in my earlier presentation sets out a proposal which seeks to achieve this at national and regional levels.

That same approach also recognises that effective co-operation in agricultural research in the Caribbean and efficient application of resources allocated to agricultural research must have the joint objective of increasing the effectiveness in the use of human and institutional resources with potential for impact on food and agricultural development.

Additionally, any system which is devised, of necessity, has to support national programmes for agricultural and rural development, thus focussing on pursuit of applied research; and in order to be effective, that system, whether regional or national, should possess the capability to borrow both knowledge and materials from the global network.

The CDCC countries are in the majority constrained by size and limited resources, especially trained manpower, which is one of the most critical factors in the successful organization and operation of effective agricultural research. The identification and excution of collaborative projects could be an important means of maximising the use of those scarce resources. These arrangements would still permit the decentralization which the location's specific nature of agricultural technology requires. But, as emphasized in the earlier presentation, strong and successful co-operative programmes have generally been developed when the collaborating units are themselves strong and well organized.

On the basis of all these considerations, a project idea has been outlined, initially to include only Commonwealth Caribbean countries, with some collaboration with CDCC States outside this group. The major emphasis of that should be:

(i) Identification, development and support of collaborative projects with monitoring and evaluation mechanisms as an essential element;

(ii) Promotion of the development and improvement of national agricultural research systems, with ongoing emphasis on training in research planning and management;

(iii) Organization of regular physical and personnel inventory updating with development of appropriate training programmes;

(iv) Organizing and hosting regular consultations of senior research scientists.

Selection of the CARICOM region may be somewhat controversial, since this meeting has been organized by and for a more broadly based group, namely CDCC states. Despite this, it seems the most realistic approach, taking into account the need, in fact the vital importance, to secure agreement and support at the political level for a multi-country collaborative programme.

The initial activities would consist of collaborative projects within a common framework; for example, a number of countries are currently engaged in the improvement of "indigenous" sheep through breeding and the development of more intensive production systems for their exploitation. This, in my view, is an area in which collaboration has the potential of yielding high pay-off. It would well serve as a means of improving mutual understanding and confidence, thus creating a situation in which further opportunities for collaboration will be explored.

During this phase, efforts would be made to improve the research planning capability at the national level, thus facilitating the more effective determination of research priorities based on agricultural development objectives and priorities. Within this context, efforts to identify common high priority areas, shared by several countries, would be intensified and opportunities for developing co-operative projects pursued.

Proposed Secretariat/Operations Unit for Project to Design a Caribbean Agricultural Research Network

Suggested Functions are:

(i) Initially, organisation of Working Party representative of the regional or subregional grouping for identification and development of collaborative projects;

(ii) Organisation of information exchange, monitoring, review and evaluation mechanisms for collaborative/co-operative projects;

(iii) Interaction and consultation with national systems to improve focus of national research priorities (annual or biennial meetings);

(iv) Promotion of the development and improvement of national agricultural research systems;

(v) Securing a project to determine physical and human resource (and institutional) capability (including regular manpower surveys);

(vi) Assisting in undertaking a manpower survey and establishment of long term training programme (on basis of projected needs).

Finance:

Consortium of bilateral and multilateral donors - five year programme.

Location:

UWI or CDB.

Could IDRC lead secretariatand manage project?

Possible sources of Project Funding:

IDRC	USAID
CIDA (Regional + Country)	EDF
IDB	SAREC
IBRD	UK/ODA
UNDP - OPEC Special Fund	

There is a need for core funds as well as project funds.

Staffing:

Minimum of 2, preferably 3 professionals

1 experienced research scientist

1 planner/economist with experience in research planning

1 specialist (whose specialisation should be determined in consultation with the working party).

The Secretariat should:

(i) encourage, by appropriate means, an interaction between senior administrators and research scientists;

(ii) facilitate interaction between scientists with a view to increasing their productivity;

(iii) identify and facilitate ways in which the installed capacity and capability of the Institute of Social and Economic Research of the UWI can be harnessed to investigate the non-technological factors which influence technology adoption as well as those which affect the mobilisation of the agricultural research clientele and to propose means for improvement (this latter is important in determining the research agenda and building political support);

(iv) emphasize returns to investment in agricultural research in projects sponsored by the Unit through use of appropriate indicators; and identify, where practicable, instances in which improved technology can facilitate changes in policy and infrastructure. (By relating the priority areas of research to needs and problems, assist in demonstrating the benefits which derive from well planned and executed research and its potential value in policy development).

C. Toward the Future: An Alternative Framework For Agricultural Research in the Caribbean

(Prof. Lawrence A. Wilson - UWI)

The Caribbean region, as here defined, includes some 17 Sovereign States, 13 of which are English-speaking CARICOM States, two Spanish-speaking and one each Dutch and French-speaking, respectively, with a total population of 27.4 million and a land area of 625,604 km^2 (Table 1). Examination of the existing framework of agricultural research in the region reveals a structural organization based on national and subregional research institutions, with little attempt at regional organization, or, indeed, co-operation. With few exceptions, national and subregional research institutions are based on European models of research management. These models are characterized by development of research institutes separated from Universities as well as by the separation of the functions of tertiary education, research and extension in different institutions.

Caribbean models of Research Institute/Organization and their resulting research output have, so far, not been able adequately to support the rapid development in agricultural productivity and production needed for foreign exchange earnings and local food supply, in support of modest growth in national economies. As a result, all the national economies of the region are experiencing foreign exchange deficits and food and nutrition problems differing from one another only in the degree of severity. Ruttan (1982) proposed that the ability to develop and manage agricultural technology appropriate to a nation's physical and cultural endowments is the single most important variable in achieving increase in agricultural productivity and further suggested that importation of technology was often a poor substitute for indigenous development of technology. Therefore, the relatively low level of agricultural productivity in the Caribbean region might well be a reflection on the performance of institutions concerned with

development of agricultural technology as well as the dissemination and management of such technology to those concerned with the production and utilization of food and agricultural commodities.

In this paper, the constituent components of the agricultural research and development (R+D) system are first reviewed; the existing agricultural research and development system in the Caribbean briefly examined; an alternative framework for agricultural R+D proposed, and an approach towards a regional agenda for research suggested. The paper is presented under the following headings:

(i) Components of the Agricultural R+D system;
(ii) Brief Review of existing Caribbean R+D Institutions;
(iii) An alternative Framework for Agricultural R+D in the Caribbean;
(iv) Towards an Agenda for Agricultural Research in the Caribbean.

Components of the Agricultural Research and Development System

If it is accepted that the R+D system is that sector of society concerned with generation and management of technology for agricultural development, then there are four components (Table 2) of the system as follows:

(i) The management component;
(ii) The human resources development component;
(iii) The technology generation component;
(iv) The technology evaluation and dissemination component.

All components are necessary for agricultural development.

TABLE 1

AREA AND POPULATION OF CARIBBEAN STATES

STATE/SUBREGION	AREA (KM^2)	POPULATION X 1,000	% POPULATION IN AGRICULTURE
CUBA	114,524	9,978	23.3
DOMINICAN REPUBLIC	48,734	5,946	56.1
HAITI	27,750	5,817	66.6
SURINAME	163,265	389	17.6
CARICOM	271,331 1/	5,270	27.2
(OECS)	(2,913)	(518)	(31.0)
	625,604	27,400	38.2

( ) No. of States:

1/ Guyana Area 214,970 KM^2

Belize Area 11,963 KM^2

TABLE 2

COMPONENTS OF THE RESEARCH AND DEVELOPMENT SYSTEM

Management Component

- Ministries of Government
- State Institutions
- Private Sector Institutions

Human Resource Development Component

- Primary and Secondary Schools
- Technical and Vocational Schools
- Agricultural Colleges
- Universities and Institutes
- Non Formal Education Programmes

Technology Generation Component

- Universities
- Institutes
- Farmers and Processors

Technology Evaluation Component

- Ministries of Government
- Universities and Institutes
- Farmers and Processors

The Management Component

The management component includes the system for national management of development of the food and agriculture sector. Such management is critical for the use of technology for development. This component (Table 2) includes:

(i) Development of food and nutrition policy (FNP);

(ii) Education of consumers on FNP;

(iii) Translation of FNP into food production and import targets;

(iv) Translation of FNP into food handling, storage, processing, distribution and marketing policy;

(v) Translation of policy targets and strategies into funded projects and operations;

(vi) Monitoring of project management.

The management function is variously carried out by different Ministries of Government including:

(i) Ministries of Agriculture;

(ii) Ministries of Industry and Commerce;

(iii) Ministries of Local Government and Community Development;

(iv) Ministries of Finance.

State Institutions of Banking and Trade

(i) Agricultural Development Banks;

(ii) Agricultural Marketing Corporations;

(iii) State Enterprise for Food Production and Marketing.

Private Sector Institutions

(i) Farmers;

(ii) Wholesale and Retail Marketers;

(iii) Input Suppliers;

(iv) Banks.

It is extremely important to note the content of the manangement component because many of the sectors involved are often, not only engaged in survey-type research and product development, but sometimes with conflicting results. Thus, it is not unusual for private sector institutions to develop new processed products based on imported raw materials whilst public funds for research are being, or have been spent to develop similar or identical products from local materials.

The Human Resource Development Component

Development of human resources appropriate for operation at all levels of the Agricultural R+D system is critical for the improvement of the performance of the system. Such resources are usually developed in the training institutions of the country or region (Table 3) including:

(i) Primary and Secondary Schools;
(ii) Technical and Vocational Schools;
(iii) Agricultural Colleges;
(iv) Universities and Institutions;
(v) Private and public sector and Institutional non-formal Education of the Society, e.g. Consumer Education.

At present, there are few attempts to co-ordinate agricultural training at these different levels in the region, nor is the function of development of the human resource sufficiently integrated with the technology generation and dissemination components of the system, notwithstanding examples of the integration of post-graduate University training with technology generation, e.g., in the UWI. Separation of the management of agricultural education and training between Ministries of Education and Agriculture also often leads to unfortunate separation of functions and lack of co-ordination between different levels of training.

The Technology Generation Component.

Agricultural technology, as here defined, signifies such knowledge as relates directly to the production or improvement of food and agricultural commodities and services. This knowledge is usually derived from the findings of physical, chemical and biological scientific research and applied through the process of experimental development to the point of practical applicability. It is very counter productive for technology development to pursue the functions of scientific research and experimental development in isolation, since the solution of the most serious applied problems often demands the practice of scientific research at the highest level of competence.

It is also most cost-effective to combine the functions of scientific research, experimental development and human resource development in post-graduate degree training programmes in Universities. In Scottish and U.S. systems of agricultural technology generation, scientific research and experimental development as well as Under-graduate and Post-graduate training and technology dissemination are integrated into a single system in the National or State University. The British and Continental European tradition inherited in Latin America and the Caribbean espouses the separation of teaching, research and extension functions in separate institutions, i.e., Universities and Technical Schools, Research Institutes and Stations.

TABLE 3

A CLASSIFICATION OF AGRICULTURAL RESEARCH AND DEVELOPMENT INSTITUTIONS AND AGENCIES IN THE CARICOM SUBREGION

	REGIONAL		NATIONAL	
	Public Funds	Private Funds	Public Funds	Private Funds
Multi-Commodity	UWI-FAO		MINAG-B'dos.	
Multi-Disciplinary	CARDI CARDATS CARICOM CDB IICA CDCC CSTCC		MINAG-Guy. MINAG-J'ca. CES -T+T CARIRI-T+T	
Single-Commodity	UWI-CORU	UWI-CORU	CSGRS-T+T	SIRI-J'ca.
Multi-Disciplinary	WINBAN	WINBAN	GRB-Guy. GUYSUCO-Guy. LDC-Guy.	BBRS-J'ca. CIBRS-J'ca.
Mono-Disciplinary		WICCBS		SPAU-B'dos. BBRU-J'ca.

Banana Board Research Station (BBRS)
Banana Breeding Research Unit (BBRU)
Caribbean Rural Development + Technical Services (CARDATS)
Caribbean Agricultural Research + Development Institute (CARDI)
Caribbean Industrial Research Institute (CARIRI)
Central Experiment Station (CES)
Coconut Industry Board Research Station (CIBRS)
Caroni Sugarcane Research Station (CSGRS)
Guyana Rice Board (GRB)
Guyana Sugar Corporation (GUYSUCO)
Livestock Development Corporation (LDC)
Ministries of Agriculture (MINAG)
Sugar Industry Research Institute (SIRI)
Sugar Producers Agronomy Unit (SPAU)
Cocoa Research Unit (UWI-CORU-UWI)
UWI Faculty of Agriculture (UWI-FOA)
West Indies Central Cane Breeding Station (WICCBS)

TABLE 4

MATRIX OF RESEARCH AND TEACHING PROGRAMMES
IN THE UWI FACULTY OF AGRICULTURE

RESEARCH PROGRAMME PERSONNEL	DEPARTMENT TEACHING PERSONNEL					
	BIO SCI	CROP SCI	SOIL SCI	L/STK SCI	AGR. ECON	AGR. EXT
Crops Programmes						
Cereals	-/	-/			-/	
Horticulture	-/	-/	-/			
Grain Legume	-/	-/	-/		-/	
Root Crop	-/	-/	-/	-/	-/	
Soils Programmes						
Soils		-/	-/			
Land and Water MGT	-/	-/	-/			
Livestock Programmes		-/		-/		
Socio Econ. Programmes						
Agric. Economics	-/	-/			-/	-/
Agric. Extension	-/	-/	-/	-/	-/	-/

Departments are managed by heads and research programmes by programme leaders. The Dean and Associate Deans for research and academic affairs are responsible for overall co-ordination.

and Ministry of Agriculture Extension Divisions, respectively.
The phenomenon in Agricultural Development in the Third World.-
The International Centre - which conducts agricultural research with international objectives, had its forerunner in British, e.g., ICTA (Trinidad) and French Institutions of Agriculture Research, which served colonial empires. These Centres could play an important role in development. Farmers and processors are also potential sources of new technology.

Technology Evaluation and Dissemination Component

The function of technology evaluation and dissemination, as here conceived, refers to the socio-economic and technical evaluation of technologies designed for specific committees. The function includes technology packaging and assessment of the possible impact on farming, marketing and consuming sectors of the community, before delivery of the technology to the community. This component requires a considerable measure of collaboration between socio-economic and technology professionals as well as intimate contact with all sectors of the community. The area of work should draw heavily on the findings of the basic social science research in economics, sociology geography and anthropology in order to understand possible impact of applied technology.

The function of evaluation is also interpreted to include evaluation of institutional performance in the areas of management, generation and dissemination of technology as well as of human resource development. The technology evaluation and dissemination component is usually the most poorly developed one in developing countries and is usually scattered in Ministries of Agriculture, Planning Units and extension Departments, University Departments of Agronomy (Crops and Soils), Livestock Sciences, Agricultural Economics, Rural Sociology and Extension. Indeed the role of socio-economic studies in technology evaluation and dissemination for agricultural development has only recently been fully appreciated.

Existing Caribbean Agricultural Research and Development Institutions

Although the existing Caribbean Agricultural Research and Development Institutions have been reviewed earlier, the system is here summarized in order to focus attention on identifiable characteristics which could lead to development of an alternative framework for agricultural research. The system, including Agencies which commission independent research projects, is reviewed in terms of its national and subregional components, source of core funding and number of commodities and disciplines researched, for the English-speaking CARICOM Subregion and the non-English speaking States.

The CARICOM Subregion

Data (Table 3) shows that there are at least 25 research Institutes and Agencies in the CARICOM Subregion. Of these, some 15 are funded exclusively from public funds. It may be significant that all eight (8) privately funded research Institutions are mono-commodity research units, three (3) of the eight (8) are mono-disciplinary and some have extension operations separate from the national extension service. The mono-commodity, privately funded research institutions usually serve traditional and, more recent, crop commodities with foreign exchange earning capacity, e.g., sugar cane, bananas, rice, cocoa, coconuts. It may be assumed, therefore, that the primary role of the other national and subregional research institutions is the development of the food crop sector and/or development of alternative sources of foreign exchange earnings.

The significant feature of these remaining institutions financed from public funds, is the separation of teaching and research in the UWI Faculty of Agriculture from Research and Development in CARDI and the exclusion from both of the extension function. Moreover, individual States of the Subregion each have National Extension Services and in five (5) States (Barbados, Belize, Guyana, Jamaica, Trinidad and Tobago) separate National Research Institutions. However, the UWI, Department of Agricultural Extension plays a significant supportive role in the Extension Services of Belize, the Windwards and Leewards and there are Units of Ministry, UWI and CARDI technology research programmes in Trinidad and Tobago and Jamaica.

A matrix showing the integration of teaching and research programmes under different leadership at the UWI is shown in Table 4.

The Spanish, French and Dutch Speaking States

In the four (4) large non-English speaking States of the Caribbean, research is conducted mainly in commodity or resource-oriented institutions funded either by the State or by the private sector commodity industry.

In Cuba, agricultural research is conducted at the State University of Havana with several crop commodity Experiment and Livestock Breeding Stations. At Las Villas (Central) University, Departments are for the most part discipline-oriented. There are also institutes of Forestry, Animal Sciences and Fisheries. (Table 5).

In Santo Domingo, there are private sector Industry-funded research institutions for sugarcane and rice.

In Haiti, agricultural research investigations are carried out through the Ministry of Agriculture and at the University of Haiti.

In Suriname, agricultural research investigations are conducted in the Ministry of Agriculture and in the University, Faculty of Natural Resources; whilst rice investigations are carried out by the commodity industry.

The major characteristics of the system which could lead to the development of an alternative framework for agricultural research in the Caribbean (Table 6) are as follows:

Research and Development Model

(i) Research investigations on crop and livestock enterprises are for the most part organized on a commodity basis and supported by resource-based, e.g., land, soil and service-based, e.g., extension, economics, crop protection and crop physiology studies.

(ii) Teaching and research, research and development and extension and farmer training functions are separated in three different institutions.

Research Management

(iii) There is no formal registration either of completed or on-going projects in the region except within Research Institutions. In particular, projects commissioned by national or subregional agencies or Governments, e.g., Agricultural Sector Studies are often seen by a very limited audience.

(iv) Nor is there any system for formal professional scrutiny of the results of research either at national, subregional or regional levels, known to the author.

Research Co-operation

(v) Given the limited human and physical resources in the region as well as the chronic shortage of funds for research, little attempt has been made to rationalize the conduct of research either at regional, subregional or, indeed, often at national levels.

(vi) There is no regional forum for indepth discussion of the problems of agricultural research except perhaps for sugarcane, although there are at least two (2) subregional professional agricultural societies and one (1) regional food crops society.

(vii) There is no regional publication of the important findings of agricultural research although subregional, national and international publications do exist.

TABLE 5.

THE UNIVERSITY AND INSTITUTE SYSTEM
FOR AGRICULTURAL RESEARCH IN CUBA

	UNIVERSITY		
HAVANA		LAS VILLAS	INSTITUTES
Departments	Experimental Stations	Faculty/ Depts	
Faculty of Agronomy Plant Technology Plant Protection	Citrus and Other Fruits Trees Pineapple + Fibres Rice Sugarcane Botanic Lab Plant Nutrition	Faculty of Agronomy Basic Sciences Soils + Agri-Chem. Plant Protection Agric. Biology Agric. Engineering Applied Botany Sugarcane Rice	Forestry Development
Institute of Animal Sciences		Animal Husbandry Veterinary School	Animal Sciences
Faculty of Livestock Breeding			Fisheries

TABLE 6.

SOME CHARACTERISTICS OF CARIBBEAN RESEARCH

RESEARCH AND DEVELOPMENT MODEL

Research Teams

Commodity - Focus

Resource - Focus e.g. Soil

Service - Focus e g. Protection

Research Linkages

Teaching/Research

Research/Development

Extension/Farmer Training

RESEARCH MANAGEMENT

Little Project Registration

Little Professional Scrutiny of Research Projects

RESEARCH CO-OPERATION

Little Inter-Institutional Rationalization of Projects at Regional, Subregional and sometimes National Levels.

Little Regional Discussion of Problems excepting sugarcane.

No Regional Publications.

An Alternative Framework for Agricultural Research in the Caribbean

The Caribbean Region with a total land area of 625,624 km^2 embraces a variety of tropical ecosystems within longitudinal boundaries of 55^{o} and $90^{o}E$ and latitudinal boundaries of $3^{o}N$ and $28^{o}N$, and including two continental masses and several flat and mountainous islands of varying size. The region is characterized by similar agricultural enterprises which include an export crop sector of sugar cane, bananas, pineapple, rice, cocoa, coffee, a food crop sector of rice, maize, tropical root crops, legumes and vegetables and a livestock sector with dairy, beef cattle and buffalo and small stock of sheep, goats and rabbits. However, it is submitted that the component ecosystems are sufficiently different to allow for planned cropping to satisfy all year round food consumption and to ensure regional food security. This objective is the single most important imperative for a new framework for agricultural research. However, in order to arrive at this alternative framework, there must be some broad consensus on more specific goals for agricultural research. It is suggested that these goals (Table 7) might be:

(i) Improving the production and productivity as well as the handling, storage, processing, distribution and marketing of selected food crop and livestock enterprises;

(ii) Encouragement of the development of national, subregional and regional trade in food crop and livestock commodities in support of stable and predictable production/marketing performance for each commodity, and realization of food security;

(iii) Increasing the productivity and where appropriate, the production of the traditional export crops so that they could be competitive in world markets, towards maximizing foreign exchange earnings;

(iv) Development of new commodities for foreign exchange earnings on a collaborative basis in an effort to create new sources of foreign exchange.

TABLE 7.

SUGGESTED GOALS FOR REGIONAL AGRICULTURAL RESEARCH AND DEVELOPMENT

1. INCREASING FOOD PRODUCTION AND PRODUCTIVITY IMPROVING METHODS OF HANDLING STORAGE, PROCESSING, DISTRIBUTION AND MARKETING OF LOCAL FOODS.

2. ENCOURAGEMENT OF REGIONAL TRADE IN FOOD.

3. INCREASING PRODUCTIVITY AND PRODUCTION OF EXPORT CROPS.

4. DEVELOPMENT OF NEW RESOURCES OF FOREIGN EXCHANGE EARNINGS FROM AGRICULTURE.

TABLE 8.

PRINCIPLES FOR DEVELOPMENT OF AN ALTERNATIVE FRAMEWORK FOR AGRICULTURAL RESEARCH

1. AGREEMENT ON THE NEED FOR AND EXTENT OF RESEARCH COLLABORATION AS BETWEEN STATES AND INSTITUTIONS.

2. OPTIMAL USE OF ALL TRAINED MANPOWER.

3. RECOGNITION OF NEED FOR CHANGE IN DEVELOPING AN AGENDA FOR RESEARCH.

Construction of an alternative framework for research must also be preceded by agreement on some basic principles for elaboration of the new framework. Again given the limitations of national sovereignty and possible divergence of agricultural policy and strategy, for food production and foreign currency earnings, it is suggested that the following principles (Table 7) may be generally acceptable:

(i) There must be agreement on the need for and the extent of research collaboration as between States and Research Institutions.

(ii) Agricultural research must be conducted in such a way as to make optimal use of ALL trained manpower in the Region for Agricultural Development.

(iii) Recognition of the need for considerable change and improvement in the agricultural system in the Region to meet the challenges of modern agricultural science and technology in the 1980's and beyond, in the development of an agenda for research.

It will be proposed that each of these basic principles could form a segment of an alternative framework.

Regional Research Collaboration

Although effective regional research collaboration envisages exhanges at all stages of project development and implementation it is suggested that such collaboration might be initiated by development of a forum for regular scrutiny and exchange of research information among scientists involved in research investigations. This exchange can be effected by, say, a triennial research meeting with published proceedings, which ideally should lead both to collaboration at earlier levels of research project implementation as well as to formation of a professional society. Such a society might develop Chapters in sub-regional and national centres with responsibility for activities in periods between regional meetings. (Table 8)

It is suggested that the Secretariats for such a Regional Society and its component Chapters might be located and funded in the Universities of the Region, since University facilities, e.g., training permit the most effective storage, use and dissemination of research information.

Regional, subregional and national research meetings might be organized along lines of simultaneous sessions in Agronomy (Crop Production, Crop Protection and Soil Science), Livestock Science and Socio-economic Studies and plenary sessions on general agricultural porblems. It is important that such meetings be coincident with meetings of the management group, e.g., agricultural planners in order to facilitate passage of research information to decision-makers in the agricultural system.(Table 9).

The proposed meetings and the evisaged professional society should take account of existing Societies in the Region e.g., Caribbean Food Crop Society, Caribbean Agro-economic Society, Caribbean Crop Protection Society, Regional Livestock meetings in the process of development of a comprehensive Caribbean Agricultural Research and Development Society.

Effective Use of All Personnel Trained for Research for Agricultural Development.

Personnel trained for agricultural research often represent a small percentage of the trained manpower in a community and such personnel are usually trained at great cost to the community. Therefore, it is imperative that the skills of such a group be continuously upgraded and personnel therein used to greatest benefit of the Community. Members of this group are to be found in all the components of the Agricultural System (Table 2). Effective use of personnel depends on careful development of functional inter-relationships between agricultural R.+ D. Institutions for Training, Research and Extension. Precise definition of discrete double or triple functions for all trained personnel, e.g., teaching/research, research/extension, teaching/extension or teaching/research/extension is also important. It is considered to be counter productive for Institute Researchers and Technical School Teachers to carry single functions unlike their University counterparts who carry at least two (2) functions, viz., teaching and research.

Although it would be invidious to exchange the existing European model of separation of Institutions of training, research and extension for the Scottish/US model of integration of these Institutions under the

umbrella of the University, some mechanism for more effective integration of the functions of agricultural training, research and extension must be found in the Caribbean, towards more effective utilization of manpower. It is suggested that National Governments and subregional groupings thereof must assume the responsibility for effecting this functional integration as the most important clients and sponsors of research, training and extension activities in the Region. The National Governments referred to are those of Cuba, Haiti, Santo Domingo and Suriname and the subregional groupings of the CARICOM States and the Organization of Eastern Caribbean States (OECS).

For National Governments, development of inter-relationships between Departments and Institutions of Agricultural Research, Teaching and Extension would effect the necessary functional integration of these areas of activity. In Cuba, a large measure of this integration has already been achieved within the University system. The problem needs to be addressed in the other National Governments. An approach to effecting such integration is suggested in the following section.

In the two (2) subregional groupings, CARICOM and its subset the OECS, the system includes seven (7) components as shown in Table 10. It seems that there is need for rationalization of this system to increase its efficiency and effectiveness in the achievement of Agricultural Development. It is suggested that such rationalization might proceed along lines (Table 11) with the first objective of functional integration of research and training activities into well defined subregional systems.

The suggestions (Table 11) could lead to establishment of an alternative framework of three (3) research and training systems (Table 12) in the CARICOM Region each with a Common Research and Training Policy Council (CRTPC), as follows:-

(i) The Jamaica/Belize or North Caribbean Systems.

(ii) The Trinidad and Tobago/Guyana or South Caribbean Systems.

(iii) The Barbados/OECS or Middle Caribbean Systems.

It is further proposed that functional integration within each system might be achieved in the first instance by the CRTPC's made up of representatives from component research and training Institutions, Extension Divisions and Government Representatives from Ministries of Agriculture and Education.

TABLE 9.

REGIONAL RESEARCH COLLABORATION BY
DISCUSSION OF RESEARCH RESULTS

INSTRUMENT OF DISCUSSION

- Triennial Research Meeting With
- Simultaneous Sessions in
  Agronomy
  Livestock Science
  Socio Economics
- Plenary Session in General Agriculture
  And
- Published Proceedings

ORGANIZATION

- Proposed Caribbean Agricultural Research
  And Development Society With
- National And Subregional Chapters
- Chapters To Organize Meetings With
  National And Subregional Planners

TABLE 10.

THE INSTITUTIONS OF RESEARCH, TRAINING AND EXTENSION IN THE CARICOM REGION

	INSTITUTION	STATE REPRESENTATION
1	NATIONAL EXTENSION SERVICES	ALL STATES
2	NATIONAL TECHNICAL AND PARA-PROFESSIONAL TRAINING INSTITUTES/SCHOOLS	Belize, Guyana, Jamaica, Trinidad + Tobago
3	NATIONAL TRAINING INSTITUTE AT PROFESSIONAL LEVEL (B.Sc.)	University of Guyana Faculty of Agriculture
4	REGIONAL TRAINING INSTITUTE AT PROFESSIONAL LEVELS (B.Sc., M.Sc., Ph.D)	UWI, Faculty of Agriculture, Trinidad And Jamaica, Belize, Leewards, Windwards
5	REGIONAL RESEARCH AND DEVELOPMENT INSTITUTE	CARDI - ALL STATES
6	NATIONAL RESEARCH UNITS IN MINISTRIES OF AGRICULTURE	Barbados, Belize, Guyana, Jamaica, Trinidad + Tobago
7	COMMODITY RESEARCH INSTITUTES (WITH SOME EXTENSION FUNCTION)	Barbados (2), Guyana (3) Jamaica (3) Trinidad (2) OECS (1)

Although integration of the National Extension Services into the Research/Training systems is more difficult, it is suggested that a major advance towards such functional integration could be achieved by

(i) Assignment of selected Extension Officers to the training/research system on a rotation basis for specific part-time duties of training and research;

(ii) Reciprocal assignment of extension duties, e.g., production of bulletins, and extension personnel training courses to selected members of training/research system;

(iii) Representation of Extension Services on CRTPCs (as mentioned above). (Table 13).

It is also critical for such a re-oriented Extension Service to be organized along subject-matter lines, and to have existing regulatory functions separated from education and technology transfer functions. (Table 13).

Subregional co-ordination of the CARICOM Agricultural R. + D system might be effected by Statutory Meetings of the CRTPC Chairman and representatives from teaching, research and extension of the three (3) systems on the occasion of subregional research meetings organized by Chapters of the proposed Caribbean Agricultural Research and Development Society. Important functions of these Statutory meetings would include:

(i) Rationalization and integration of training at technical and professional levels.

(ii) Rationalization of the Institutional Agenda for non-location and location-specific research projects as between University, Technical College/School, Multi and Single Commodity Institute Research.

Towards Development of An Agenda For Agricultural Research

Development of an agenda for Caribbean Agricultural Research commensurate with the achievements of modern science and technology must take into account the following factors, (Table 14):

(i) The status of local food crop and livestock agro-industries in relation to the role of International Centres, and the research capacity of indigenous research institutions.

(ii) The status of existing foreign-exchange earning agricultural enterprises

Table 11

Suggested Approach to an Alternative Framework
For Research and Training in the CARICOM Region

1. Removal of all research from Ministries of Agriculture to an institute system in which, appointment, assessment and promotion of staff are controlled by management using predetermined criteria.

2. Integration of ministry and CARDI research to form new multi-commodity research and development institutes in:

(i) Belize and Jamaica;

(ii) Guyana and Trinidad and Tobago;

(iii) Barbados and OECS.

3. Functional integration of University, multi-commodity (MC) and single commodity (SC) research, University and technical training under common research and training policy councils in:

(i) Belize and Jamaica;

(ii) Guyana and Trinidad and Tobago;

(iii) Barbados and OECS.1/

4. Establishment of a technical school in Saint Lucia and its integration with University, MC and SC institute research under the Barbados/OECS CRTPC.

1/ Without prejudice to existing institutional autonomy.

TABLE 12

ALTERNATIVE FRAMEWORK FOR RESEARCH AND TRAINING INSTITUTIONS IN THE CARICOM REGION

THE NORTH CARIBBEAN SYSTEM

UWI Jamaica/Belize
Jamaica Agricultural College
MC and SC Institute Research Jamaica/Belize
Belize Agricultural School

THE SOUTH CARIBBEAN SYSTEM

UWI Trinidad
University of Guyana
ECIAF
Guyana School of Agriculture
MC and SC Institute Research (Trinidad + Tobago and Guyana)

THE MIDDLE CARIBBEAN SYSTEM

UWI - Barbados, Leewards/Windwards
Proposed Technical School - St. Lucia
MC and SC Institute Research (OECS/Barbados)

MC = Multicommodity
SC = Single Commodity

TABLE 13

INTEGRATION OF EXTENSION INTO THE RESEARCH AND TRAINING SYSTEM

1. REORGANIZATION OF EXTENSION SERVICES ALONG SUBJECT MATTER LINES AND REMOVAL OF REGULATORY FUNCTIONS FROM EXTENSION STAFF DUTIES.

2. ASSIGNMENT OF SELECTED EXTENSION OFFICERS ON A ROTATION BASIS TO RESEARCH/TRAINING SYSTEM e.g.
   - For Training
   - For Teaching or Research Duties

3. RECIPROCAL ASSIGNMENT OF EXTENSION DUTIES TO RESEARCH AND TRAINING PERSONNEL e.g.
   - Preparation of Extension Bulletins
   - Extension Personnel Training in New Technologies.

4. REPRESENTATION OF EXTENSION SERVICES ON CPC.

TABLE 14

CONSIDERATIONS FOR DEVELOPMENT
OF A RESEARCH AGENDA

1. LOCAL FOOD

   Relative Role of International Centres/National Institutes

2. FOREIGN EXCHANGE EARNINGS

   Increasing Productivity for Competitiveness and Profitability

   Development of New Commodities

3. NEW TECHNOLOGIES

   Biotechnology

4. SMALL FARMERS

   Modern Technology

   Commodity Approach

   Strong Post Harvest Distribution and Marketing Sector

   Cash Economy

in relation to existing resources and capacity for research and possible development of new enterprises;

(iii) The resources available for utilization and development of new technologies in the service of (i) and (ii) above;

(iv) Integration of small farmers into modern systems of agriculture;

(v) Rationalization of location-specific and non-location specific research projects.

Local Food

The existence of International Centres with substantial crop breeding programmes for cereals (rice and sorghum maize) grain legumes (pigeon pea, cowpea, phaseolus beans), root crops (cassava, sweet potato, edible aroids), makes the task of staple food crop improvement one of selection and improvement of germplasm in accordance with the needs of specific ecosystems. However, perhaps more important here is the development of stable production/utilization commodity enterprises. Accordingly much more attention must be given to the areas of handling, storage, processing and marketing for high quality products and realization of regional food security.

In the area of livestock development for local food, considerable attention needs to be given to pasture management for dairy production and improvement of small stock.

Foreign Exchange Earnings

Agriculture is a major source of foreign exchange earnings in the Caribbean and hence research efforts must be directed to increasing the productivity and profitablitlity of existing crop enterprises, with particular reference to intensive production systems and improved commodity quality. However, quality objectives not withstanding, the Caribbaan States are rather insignificant sources of world supply of the traditional export crops, with perhaps the exception of Cuban sugar. Therefore, some research resources must be given to the development of new enterprises for foreign exchange earnings, to achieve the comparative advantage which the Caribbann Region held for sugar, cocoa and bananas at the turn of the century. Development of exotic tropical

fruit and new sources of drugs from topical species seem to offer interesting possibilities.

New Technologies

The new area of biotechnology has, so far, resulted in more significant findings for medicine than for agriculture, but possibilities for crop species improvement, for increased yields, disease resistance and improved quality and rapid multiplication of crop varieties by micropropagation, and livestock breeds by multiple ovulation/fertilized, egg implant techniques are enormous. However, the high cost of such research seems to suggest collaborative efforts in the development of research agenda.

Small Farmers

The numerous small farmers of the Region are by far the greatest human resource for agricultural development in the Region. These small farmers must be introduced to the modern technologies of the 20th Century if they are to contribute fully to agricultural development. It is suggested that the improvement of the small farming system should be in the direction of:

(i) Increasing farm size with tenured land;

(ii) Improving the farming systems practised in the direction of fewer enterprises and more efficient methods to result in significant increases in production and productivity organised on a commodity basis.

(iii) Utilising manpower so released from the production sector in the post-harvest sector which should be developed to accommodate increased commodity production and productivity.

Of course, such an improved system can only be developed after careful study at both technological and socio-economic levels and in carefully conceived and precisely timed stages. In such an exercise, the commodity approach to research and development appears to be superior to more recently-conceived approaches, towards development of rapid improvements in technology transfer and expanding the cash economy of the small farmers.

Rationalization of the Research Agenda

Non location-specific research projects, e.g., breeding programmes, basic mission-oriented research need not be carried out on more than one location,

provided that there is agreement to fund research programmes and to share ALL results of research. Even in location-specific research projects, e.g., testing of varieties, disease control, duplication of experiments in similar ecosystems might be avoided. Such collaborative efforts in the rationalization of a regional research agenda can only be realized after a series of research meetings.

SUMMARY

(i) The components of the R+D system and the existing Institutions for R+D in the Caribbean are briefly reviewed.

(ii) An alternative framework for agricultural research in Caribbean Region is proposed including segments for:

(a) Research collaboration through development of effective scientific exchange by regional, subregional and national R+D meetings and the foundation of a Caribbean Agricultural Research and Development Society.

(b) Effective utilization of ALL personnel trained for research through improvement of inter-institutional collaborative programmes for functional integration of training research and extension functions in North, South and Middle CARICOM systems and similar national systems in Cuba, Haiti, Santo Domingo and Suriname.

(c) Development of an agenda for research based on the imperatives for agricultural development in the region, viz., food supply and foreign exchange earnings, using the modern technologies wherever possible, as well as the germ plasm resources of the International Centres.

(d) Development of the small farmer human resource in the Region through introduction of such farmers to modern technologies for production as well as storage, processing, distribution and marketing of specific commodities to realize rapid increases in small farmer productivity and production and expansion of the cash economy of such farmers.

(e) An approach towards development of a Regional Research Agenda is suggested.

(f) The System is summarized in Fig. 1.

FIGURE 1

COMPONENTS OF THE AGRICULTURAL SYSTEM
AN ALTERNATIVE INTEGRATED FRAMEWORK

1	MANAGEMENT OF HUMAN RESOURCES	
2	Secondary and Professional Education	Vocational and Para-Prefessional Education
3	Teachers, Researchers, Extensionists	Farmers, Marketeers, Extensionists, Consumers

4 Production and Utilization

3	New Technology	New Skills, Consumer Awareness
2	Research	Extension And Non-Formal Education
1	MANAGEMENT OF TECHNOLOGY	

1. REGIONAL MEETINGS OF CRIPC's.
2. FUNCTIONAL INTEGRATED INSTITUTIONS FOR RESEARCH, TRAINING AND EXTENSION IN THREE SUBREGIONAL SYSTEMS (NORTH, MIDDLE, SOUTH SYSTEM).
3. IMPROVED AGRICULTURAL PRACTICE AND ENLIGHTENED CONSUMER PREFERENCE
4. PRODUCTION/UTILIZATION OF REGIONAL FOOD SUPPLY AND FOREIGN EXCHANGE.

D. Agricultural Research Policy and Management in the Caribbean
(B. Muller-Haye - FAO)

Over the last decade a number of important conferences have been held in Latin America and the Caribbean to discuss problems of agricultural research and more broadly science and technology. I recall the Expert Consultation on Agricultural Research in Panama 1975 (3), which was organized by FAO in collaboration with IICA, the Workshop on Agricultural Research Systems in the Antilles Zone (5) held in Haiti in 1977 and organized by IICA, but also the regional preparatory conferences for the World Conference on Science and Technology for Development in 1979 and here particularly the Symposium on Science and Technology in the Planning of Development (2) which was held in Mexico in 1979 and lately the meetings of the Caribbean Council for Science and Technology (CCST) and the Caribbean Development and Co-operation Committee (CDCC).

These meetings and others which are not mentioned have addressed more general aspects of agricultural research and development and science policies which did not really lead to a substantive follow-up. This may be, because of the usual lack of funds and political will to implement the recommendations, but also because the conferences were primarily concerned with analyses of the status of agricultural research in the region and factors limiting agricultural production.

If one analyses the deliberations and recommendations of the various national, regional and international conferences and meetings concerned with agricultural research in Latin America and the Caribbean which were held in the last decade, a clear picture of the situation, priorities, necessities, limitations, aspirations, etc., of research including socio-economic aspects is at hand. We think that in a second round of consultations during the 80's the focus should be on very specific subjects which have been identified as problem areas. In this context we are glad to note that this workshop will direct itself to specific subjects such as research policy, management and collaboration in the Caribbean. FAO will follow later in the year with an "Expert Consultation on Agricultural Research Monitoring and Evaluation" which also has a clearly marked frame and will bring together research

directors and experts from the Spanish speaking Caribbean and Northern and Central Latin America. The meeting will be held in the Dominican Republic in November.

Turning to the objectives of the workshop, I would like to share some of our views and experiences with regard to the three topics which have been identified as main themes for the meeting. FAO has advised Member Governments in the past in these fields and is very active in network building all over the world.

Relationship between policy, decision-making and research activities

There is no blueprint for a best approach to research and development, each country must determine its own research policy and priorities within the framework of its own social, economic and agricultural development plans. However, there are regional common interests which I hope this meeting will revive, as a large amount of time, money and effort has already been spent on formulating projects of regional character.

A country, particularly when it derives great parts of its income from agricultural production, needs a comprehensive and clearly identified agricultural research policy, because there are normally more requests for support for research than there are resources available. The agricultural research plan is usually embedded in the national agricultural plan which forms part of the general development plan of the country.

The planning and programming for agricultural research is as a rule done in conjunction with the planning of other agricultural sectors in a given format and with a time horizon which is mainly five to ten years in Latin America. Most ministries have a planning and co-ordination body which will provide major guidelines and indicative budget limits.

The research plan should follow the overall policy line for agriculture, which the government pursues, but it is sometimes observed that policies change too often and too quickly with new governments and/or ministers. This is detrimental to a normal research development which should be long-term, persistent and financially well supported.

The research programmes are either determined at the ministerial level and the base has to adjust to what is considered to be a priority area by the top, or they are elaborated on the basis of proposals coming from the research institutions which, under the leadership of the

director, discuss the research proposals and then present them as a consolidated package to the minister. Now the decision-making process starts, which is a function of the policies to be followed, the financial framework for research and last but not least, the preferences of a minister or pressure groups.

Once agreed and formulated, the agricultural research plan will give the directives for the research activities at institutional and field level. Unfortunately, in most countries, developed or developing alike, there is a wide gap and lack of co-ordination between research carried out by the government, universities and private enterprise. This leads to unnecessary duplication and waste of resources. The topic as it is described under objective 1 leaves out, intentionally or unintentionally, two subjects which I think are of importance for the discussion namely, research administration and planning.

While policy-making is done at the highest level, and research activities are at the lower end and are concerned with project implementation, administration of research lies in between. The office of the national research director will normally deal with administration, which is here looked upon under the aspect of carrying out programmes, implementing new projects and collecting information rather than paying salaries and transferring money, but also regional directors and directors of research stations dedicate a major part of their time to administrative matters. A constant exchange of information between the three levels, policy-making, administration and the research base is necessary, particularly when policy formulation and planning are separate functions. Consultations between policy-makers and the research community should as a rule precede any planning activity. Mechanisms for closer collaboration will be the issue of objective 2 of this workshop.

In the following page I have tried to summarize several points which are essential for an optimum relationship between policy, decision-making and research activities. They are probably incomplete, but could be useful for the formulation of recommendations.

(i) An assessment of the situation of agricultural development, if not available, should form the basis for determining the policies for agricultural research and assist in decision-making and resources allocation. The assessment should draw attenion to the importance of agriculture for the national economy and should include quantitative indicators for agricultural production, socio-economic development and the contribution of research to production.

(ii) For decision-making an inventory of institutional facilities, man-power for research and research activities is indispensable. It will also assist in research planning and the determination of resource requirements over a long period.

(iii) The relation between policy and research should be reciprocal and complementary. The research community has the obligation to supply new ideas, information on success or failures and expected output while the policy-makers should make sure that the agricultural research is in line with the overall agricultural and national development policies. They should also provide necessary funding to carry out the approved programmes.

(iv) Researchers should regularly monitor and evaluate how effectively research activities contribute to rural development to an increase in production and the generation of new technologies and inform politicians thereof. These should not inhibit readjustment of policies if necessary.

Mechanisms for consultations between the policy-making and the research communities during the formulation of agricultural research policies.

A widely introduced and experienced model for the formulation of agricultural policies and programmes has been described by Arnon[1/] and I have brought some copies of this FAO publication with me for distribution.

There are a number of different organizational structures of which two are more commonly found:

(i) Research falls under the responsibility of one ministry with

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[1/] Arnon J. - The Planning and Programming of Agricultural Research; F.A.O. Rome 1975.

one department or a semi-autonomous body co-ordinating and planning research for the government.

(ii) Research falls under the responsibility of several ministries and/or specialized institutes.

In the first case where one ministry is responsible for all agricultural research, the mechanism for consultation between the policy-making group and the research group can easily be established. It could take the form of a permanent advisory committee to which institutes of the country should delegate senior scientists in order to represent them and help direct research policies. The minister would appoint a special officer for co-ordination and organizational purposes. It would be the role of the committee to advise the minister on policies, priorities and resource allocation. The rank and file of the scientists would have a possibility to communicate their ideas and research proposals through institutional working groups which would report to their director and/or representative in the committee.

An alternative would be to organize research advisers on subject matter or commodities. The representatives of various institutions would determine the country's research priorities on e.g. livestock, crops, soils, water, rural development and socio-economic problems. Their representatives could voice their suggestions through the advisory body.

The situation is more complicated when research falls under the responsibility of several ministries where the struggle for competence and resources often impedes or slows down a positive research development. An inter-ministerial committee would have to be created which would co-ordinate the different interests and assign responsibilities. To give this committee authority and impact, it would have to have a say in the alloscation of resources otherwise it will remain a planning exercise without any impact.

It is unfortunate, but in practice unavoidable, that there is no direct communication between the policy-makers at ministerial or national level and the research community. Established lines of communications and authority have to be observed and the director of a research institute would certainly disagree if members of his staff would personally try to

influence decisions at the higher level. This lack of communication, through to a lesser degree, can even occur within a single research institution where field staff find it difficult to be heard at the managerial level. It is not by chance that this meeting is discussing "mechanisms for consultations" and not simply "communications".

An important instrument for the dialogue between the policy-makers and the researchers which is outside ministerial hierarchy or inter-ministerial controversies is a National Agricultural Research Council which a great number of countries already possess. Such a council should link all parties concerned with research, such as national planners, representatives from ministries and universities, research directors and scientists, researchers from industry and private groups and, hopefully, the farmers' representatives. Through the council the research community will have a possibility of direct influence and participation in the formulation of policies and planning.

It would also enhance the strength of the base if representatives of national professional associations, together with the delegates of the above groups, would be members of the Council. In Latin America a number of very active regional associations exist of which I recall e.g. ALPA - the Latin American Association of Animal Production, ALCA - the Latin American Association of Agricultural Sciences and ALR - the Latin American Association of Rhyzobiology. These regional associations have national member organizations which are constituted of professionals who work in various fields of their specialization in their respective country and are actively involved in research. If the presidents of such national associations would be members of the National Agricultural Research Council, they could greatly influence research policies.

The mechanisms for closer communication between politicians and researchers which I described, refer only to countries with a sufficiently large research system where the importance of agriculture for the whole economy justifies a top level co-ordination. But what can be done for countries which are small and have limited resources both in land and in manpower? Some member countries of the Caribbean Council for Science and Technology may face this problem. First of all, there is no or a relatively small problem of communication for them as the hierarchy of a big research

system has not been built up yet and secondly, the priorities for research are easily set as they will normally relate to a few important commodities only.

A better use of resources can however, be achieved if politicians and researchers agree to an inter-country co-operation where certain research institutions or groups take the responsibility for selected production problems much as in bananas, sugarcane, coconuts, vegetables, animal production etc., as here in the Caribbean.

In the previous section I have summarized points which focus on the topic and I shall also try to highlight some issues here:

(i) Meaningful policy formulation cannot be done in isolation but should be the end product of an ascending process. It is the responsibility of the top political organs to establish mechanisms which will allow the participation of the whole research community, and representatives of the extension services and farmers.

(ii) Consultations between policy-makers and researchers are useful an and necessary, but difficult to establish in a hierarchical system. Efforts to obtain the participation of research staff in policy determination and priority setting should aim at having representatives of the broad base of researchers in an advisory body.

(iii) Advice from the research community on agricultural science policy will most likely have no real impact if the researchers are excluded from the decision-making process and particularly in the allocation of resources.

(iv) Strengthening links between the governmental research system, universities and the private sector will not only improve co-ordination and co-operation among themselves, but also enhance the position of the research community towards the politicians.

(v) Agricultural science is mainly concerned with commodity or factor oriented research, organized by disciplines and often given a multi-disciplinary approach, but little is known about how research and policy interact. There is need for investigating this relation and a study is suggested which would analyse this interaction with the aim to provide

politicians and researchers with the guidelines which would assist them in their work.

FAO and Agricultural Research with Special Reference to Network Building

FAO is giving assistance to member countries in reviewing and planning their national research systems and programmes and has concentrated its research support activities on strengthening national research capabilities. It also fosters research collaboration at the inter-country, regional and global level. Research manpower training, institution building, development of research programmes and research organizations are elements of activities supported under FAO's Regular and Field Programmes and most of FAO's technical programmes include activities in support of research and technology development in developing countries.

FAO's total expenditure for agricultural research from various sources is in the order of US$50 million per annum compared to US$35 million in 1974. A conservative estimate reveals that at least US$17 million of the regular programme expenditure per annum is directly linked to research and technology development. There are currently 258 field projects which are either full research projects or have a research component with some 400 field experts (4).

In Latin America FAO operates 32 major research projects for a value of US$17,125 million of which 15 are located in the Caribbean with a budget of US$6,097 million. 47 projects with a research component total of US$21,549 million of which US$10,287 million are assigned to 27 projects in the Caribbean.

Under objective 3 the meeting will discuss among other points, the establishment of research networks in the Caribbean. FAO over the years has gained experience in building networks of various kinds, although it can be said that in general there are only few research networks functioning well in developing countries.

A network for research should promote scientific co-operation and pool resources as most countries, developed or not, cannot afford today to undertake all research necessary to advance its production. This holds true particularly for agriculture where the need for new technologies is great.

The scarcity of networks for scientific co-operation is due to the fact that generally they were not able to attract funds for medium, or long-term

periods. Donors and aid agencies were willing to give financial assistance for the establishment of networks, with a view to promoting co-ordination and training activities, exchange of scientific staff and information, but once a network has become operative and shown results, donor funds have tended to dry up. This may have different reasons. One is certainly the present international financial crisis and subsequent stringency of international organizations, but also bi-lateral donors prefer to support projects which can be identified with one institution instead of many in different countries. The mechanism of changing leadership in networks makes it administratively more difficult for donors to finance it, unless funds are channelled through an agency which in a way is contrary to the concept of a network which should be a self-help system. A very important reason for failures is the fact that participating countries often are not willing or unable to support their national institutions to continue to contribute to the network when the international assistance ceases or is too little to match the financial requirements of a growing network.

There are, as a matter of fact, a number of characteristics of a scientific network which should be taken into account when discussing a new one. These can be listed as follows:

(i) Membership in a network should be voluntary, simple and flexible and must have clear objectives. It should preferably be organized in similar ecological areas. Decisions should be taken by consensus.

(ii) It is important to note that in a network, institutions will co-operate which are of different capability and strength. The more institutions collaborate, the better are the prospects for good and quick results, but it is a declared purpose of a network, particularly in developing countries, to upgrade weaker links of the net.

(iii) There may be a difference in motivation for institutes to participate. While some, which are most likely the bigger ones, are actively seeking solutions of their production problems through research there are others which would like to benefit from the network in the transfer of technologies and make use of the results obtained elsewhere.

(iv) Once the research programme is discussed, an appropriate division of labour and costs should be agreed upon for a defined period of time. Out of the participating institutions a lead centre should be selected which will be responsible for the co-ordination of the programme and liaison with the other institutes and information dissemination. The implementation of the research work is the obligation of the institutes.

(v) The participating institutions should meet at regular intervals to discuss progress and on the basis of results obtained determine further work and set priorities. Modifications to the objectives and programme of the network can be introduced at all stages if a change of direction is felt to be necessary by the collaborators.

(vi) Experience has shown that it is more practical and logical to call for meetings and revisions not at yearly or biannual intervals but rather after experimental cycles. As networks are not conceived to last forever, this practice will determine the duration of the network i.e. a network on specific crops will have a considerably shorter life than one on cattle production.

(vii) Apart from the government contribution to the institution which participates in the network and which should be specially earmarked, international agencies or donors could support co-operative research activities through small research contracts as practised successfully by the FAO/IAEA Joint Division. The network should however, be set up in a way that it does not distract major funds or manpower from the normal function of investigations of the lead and co-operating institutes i.e. the network research should not become the overriding acitivity of an institute but be complementary.

(viii) It has been found that the analysis and reporting of research results was usually lacking and behind schedule for various reasons. Provisions should be made for financial assistance and the necessary logistic support to speed up the writing, processing and distribution of documentation and information.

(ix) The advantage of a research network consists in the fact that it provides research results ready to be used as they were obtained in countries with likely the same agro-ecological conditions and tested against comparable situations.

FAO has for many years used networks to promote scientific and technological development and I shall give a few examples.

FAO's Regional Office for Latin America is building up technical co-operation networks, but its main objective is technology transfer to small farmers and training and not research. Starting in 1979 there are now nine networks in natural resources and crop production and five others are progressively being set up.

In Central America and the Caribbean under the co-ordination of FAO, a "Pastures Group" is collaborating in research, technology transfer and extension of which Panama, Costa Rica, Honduras, El Salvador, Nicaragua, Guatemala and Mexico are participating countries. In October this year a first general meeting will take place in Panama where a regional programme for pasture improvement will be discussed and elaborated.

A very efficient co-operative research network is operated worldwide by the FAO/IAEA Joint Division which comprises 25 networks with a total of 350 participating institutions. The mode of operation is by awarding research contracts to national institutions and researchers for a limited period.

Another research network which is co-ordinated by FAO, is the European System of Co-operative Research Networks in Agriculture (ESCORENA) which has grown within nine years to 10 networks and 44 sub-networks with at present 355 participating institutions in 50 member countries, of which 21 are developing countries.

Many more examples for successful co-operation between countries such as, the UNDP/FAO Inter-regional network of Aquaculture Centres, the Near East Cereal Imporvement Programme, the Asia Buffalo Research Network etc., could be given. For the purpose of contributing ideas to a Caribbean network I would like to draw your attention to earlier preparatory work.

In 1979 a FAO/UNDP project (RLA/79/011) was initiated which was to give preparatory assistance in co-operation with IICA and ECLA to agricultural research planning in the Caribbean. A team of five consultants as core members of the mission plus three additional consultants from FAO headquarters and IICA visited eleven countries in the subregion. The report was discussed at "An ad hoc consultative group meeting" in Barbados in April 1980, in which officials of seven organizations and

development banks participated.

Among other items a "Proposal for the establishment of a Caribbean Agricultural Research Co-ordinating Committee (CAREC)" was elaborated which is attached as Annex 1* and maybe useful for the discussions of this meeting. The mission had visited all member countries of the Caribbean Council of Science and Technology (CCST) with the exception of Cuba, Dominica and Suriname, but its findings and recommendations which are at attached as Annex 2* may bear some common interests also for these three countries. The members of the mission had prepared individual reports and papers on the status and management of research, research/extension linkages, animal research and the economic assessment of current and proposed agricultural research programmes in the Caribbean. The consultants wrote project proposals on sugarcane, coconut, banana/plantain research and also on breed evaluation of the Jamaica Red Pool cattle and a Jamaica sheep and goat-research and development project.

A considerable amount of preparatory work has already been done and the above just serves to demonstrate this. To obtain a complete picture of research in the Caribbean, recent studies of other agencies have to be considered which either deal with regional or national aspects of research development such as those from IICA, CARDI, UNESCO, ECLA, ISNAR, USAID, development banks and others.

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*Annex 1 and Annex 2 not reproduced.

E. Policy Considerations Toward Allocation of Resources and the Integration of Agricultural Research Into National Development Programmes

(Dr. Eric St. Cyr - UNECLA)

What follows is an economist's approach to the issue, sketched with severe time constraint. We begin with a few primitive assumptions that:

(i) CDCC member countries would wish, other things being equal, that the level of material welfare of their populations be increased;

(ii) That other things being equal, the agricultural industry, because of its absolute and relative size in their economies, and because of its importance to the social economy, is the key to the objective of assumption (i) above.

The key question is therefore how could agriculture be pressed into service.

Next, we state the orthodox position of the discipline on the role of the agricultural sector in economic development as follows:

(i) Because of the logical primacy of the agricultural industry as a generator of income and wealth, expanded output (the extensive margin) and increased factor productivity of land, labour, capital (the intensive margin) would of themselves be developmental;

(ii) Increased agricultural production would widen the market for goods from manufacturing industry and that both would generate demand for services - thereby stimulating further economic growth;

(iii) That agricultural industries must provide a flow of food and industries;

(iv) That productive resources necessary for use in manufacturing and service industries must be released; through the process of improved factor productivity in agricultural industries.

Thirdly, we assume that the economic actors engaged in agricultural industry are rational and subject to the constraints of their wider social objectives, and taking into account their perceptions of risk, evaluated

in international and historical context, seek to optimise some objective functions. Evidence of the rational behaviour of economic actors in the agricultural industry abounds but we did not permit its documentation.

The discipline captures the productive process in all economic activities by the concept of a production function. Thus in the agricultural industry, productive inputs (land - the original and indestructible properties, of the soil, labour - brain, brawn and experience stored up and institutionalised in various cultural practices, capital - improvement to land, seed, fertilizers, tools and machinery, working capital technology - knowledge embodies in machinery, cropping practices, organization, management systems and enterprise - the drive to do things with the objective of making economic returns) are combined and converted into outputs. The production function is simply the technical relationship between a flow of inputs through a production process and the flow of outputs at the end of the process. However, the process has an economic evaluation since the inputs incur cost (financial costs and opportunity costs) and the outputs earn revenues. An economic productive process is such that revenues earned yield an excess over costs incurred. This and only this is the economic return of the productive process.

The crux of the matter is the assumption that capital injections in the form of research expenditures will raise the level of technology used and yield a higher level of output for the same level of input of the other factors. Put another way, total factor productivity will increase. As with all other expenditures, those expended on research must show a benefit/cost ratio at least as high as the ratio for other capital expenditures. But perhaps in this statement lies the hub of the problem. To begin there is the issue of the accurate measurement of benefits. Because the benefits of research show themselves indirectly through other variables e.g. quality of labour, organization type of tools/machinery or system, separating out the effects of research expenditure is most difficult. The gestation period is also problematic as the time shape of the beneficial impact of research expenditure is unknown and may be characterised by an extremely long tail. But if this is so the time element of the benefits would be heavily discounted. Not unexpectedly on account of these imponderables, policy makers sometimes take a very lukewarm posture on research expenditure and they tend to be grudgingly agreed to in times of plenty, placed under tight control, and if not cut normally in times

of scarcity, at best maintain their nominal but not real levels.

In our attempt to focus on policy considerations, it would be well to recall the broad outlines of agricultural organisation in Caribbean countries which constitute plantation agriculture largely for export, small scale agriculture producing partly for export and partly for domestic/regional consumption.

The ownership structure of the agricultural industry is also of relevance. Increasingly agriculture is passing from being exclusively a private sector owned industry to being partly public sector owned, and there are extremes in the size distribution of holdings.

Trinidad and Tobago

It would be important to grapple with the problems of policy towards agricultural research for CDCC member countries in general. Because however of their diversity as regards size, history, socio-political organization and policy perspective, such an approach should be prefaced by a specific study of each and time did not permit this. For this reason the rest of this presentation draws on the Trinidad and Tobago experience only.

The concrete situation in Trinidad and Tobago is that export agriculture is rapidly on the decline, there have been serious alternative foreign exchange earning industries, the state has recently purchased the sugar industry and parts of the rest of export agriculture, and small farming is exclusively in private hands. Of relevance also is the political structure which traditioanlly has separated on rural/urban/ethnic lines.

Agricultural research in Trinidad and Tobago is conducted by three sets of agents:

(i) The University of the West Indies
(ii) The Ministry of Agriculture
(iii) Private agricultural establishments.

By and large the first does basic and applied research while the last does developmental research.

From a policy perspective there must be effectiveness, clarity and focus in the research effort. Two broad approaches are identified:

Research should solve an existing problem: specific research, or Research should enhance understanding and aid in the formation of a policy towards problems in agriculture; general research.

The first corresponds to a micro-approach while the second is a macro-approach. Alternatively it might be argued that the first type of research should emanate form the production unit and should have very rigid and quantifiable benefits and incur identifiable costs. The second type of research should be a part of the overall planning process, seeking to inform broad developmental policy choices. This latter type of research activity of necessity is more difficult to control, both achievable goals and measurable costs being less amenable to specific identification.

On the assumption that privately funded research will, by focusing more closely on the bottom line in the long run, regulate itself, the rest of the presentation will treat public funded research.

First and foremost is the decision on the importance of the agricultural sector vis-à-vis other areas of economic production, and the social importance of each. Assuming this to have been resolved, the next question is what distribution of resources will there be to various agriculture promoting activities; infrastructure development, direct physical production, support services, research and what is the optional time sequencing of priority treatment of each of these. Despite general statements, the inference must be, from public expenditures, that manufacturing industry has had priority over agricultural industry and that research in agriculture has not had priority over the other ingredients of agricultural promotion, and that such agricultural research as there has been lacked the degree of focus which would enable it to be effective and to be scientifically evaluated.

With fullest cognisance of the fact that agricultural research is but one of several activities vying for public funding and that a judgement on the quantum of resources allocated to this activity might be evaluated comparatively (with countries of similar endowments now or historically, or against the background of the study of the policies pursued in other countries and with their positive or negative consequence) the development of a policy towards funding agricultural research should address the following:

(i) What are the objectives of the research (e.g. to solve a technical production problem, lead to a policy, make a system more effective, or develop the level of skill in the human resource);

(ii) What type of research will attain these objectives and what is likely to be the minmum research effort and the minimum research output and the maximum time in which this can be achieved;

(iii) Research not likely to bear fruit in the foreseeable future or whose minimum cost could not be afforded should be given no support rather than token support. In other words the research effort should be tailored to be effective both from the viewpoint of the use of resources and the attainment of objectives;

(iv) Careful assessment should be made as to the channel of effectiveness of research expenditures, i.e. whether priority should be for developing soft macro-systems (e.g. land tenure, credit or marketing), or hardware (e.g. tractors), or invested in the human resource developing thereby a nation of persons both socially responsive and skilled in the hardware and software of using agricultural industries to meeting material needs/objectives.

F. The Relationship Between Research Policy And Research Activity At The National Level

(Dr. Patrick Alleyne)

Policy formulation in respect of organized research activity is intended to facilitate efficiency in response patterns to situations in which there are multiple choices in research projects, all of which compete for limited financial resources.

Within the general strategy for agricultural development, mechanisms for creating, organizing and funding technological and scientific agencies usually originate from the state which has to examine the relationships between the various social sectors involved in agricultural production and the institutions devoted to agricultural research.

Agricultural research policy has to be formulated at various levels, each level being related to some aspect of the total policy. In practice, three levels have to be considered, viz. the National, Ministerial and Institutional or Departmental levels.

The National Level

At this level decisions are made on what share of the national income is to be devoted to the overall scientific effort and how the allocation will be divided among research programmes in various sectors of the economy, e.g. Health, Industry and Agriculture. The decision here is a purely political one and is based on selection of broad social goals and priorities.

In Trinidad and Tobago a National Council for Technology in Development was established with the aim of co-ordinating scientific and technology research, and to advise Government on national policies affecting science and technology.

Such bodies, however, to be effective, must be vested with the power to implement measures for improvement and co-ordination of research in all fields, and with a budget to strengthen specific areas of research activity.

Some writers, like Arnon[1/], suggest that such bodies could exercise multiple functions as:

(i) Strengthening of certain areas of research;

1/ Arnon, J. - The Planning and Programming of Agricultural Research, F.A.O., Rome, 1975.

(ii) Co-ordination of interdisciplinary research efforts;

(iii) Establishment of major research facilities;

(iv) Organization of scientific information centres;

(v) Review of scientific performance in different sectors of research;

(vi) Stimulation of the development of research findings into technical innovations;

(vii) Improvement of method of research organization and administration, and finally;

(viii) Conducting of surveys of available scientific manpower and estimation of future needs.

The Ministerial Level

At this level concern is mainly with solutions to the immediate problems which confront the farming community as well as those which affect Government's programmes which have to be implemented. Arnon again proposes an organizational structure for this level consisting of a high level Committee consisting of the Chief Technical Officer and the Directors of Research, Extension and Planning. They should focus on:

(i) The research effort necessary;

(ii) Suggest a limited range of activity; and

(iii) Decide on whether research should be maintained at existing levels and what should be terminated.

Commodity Committees could determine the relative emphasis which should be given to specific problems within each branch of agricultural production, and relevant professional farmers and other appropriate branches should be represented on such Committees and cross-commodity committees.

The wider aspects of scientific and technological research as opposed to agricultural research specifically, should be put under the umbrella of an Inter-Ministerial Committee of Ministers directly concerned with research into health, energy, education, etc.

The Institutional Level

At this level, the main policy concern is to fulfil the Institution's obligations in achieving the goals set at the national and ministerial levels. A suggested panel at this level could consist of the Research Director, Departmental Heads, Economists and other appropriate personnel within the Ministry.

This panel would help define the goals of the organization and give them appropriate weighting and assign appropriate research problems to the various departments. In this way the research areas of all departments are planned simultaneously by a number of panels, one for each department, and consisting of scientists, economists and specialists in systems management.

The Minimal Infrastructure for Research

It is important to consider the various models for the organization of agricultural research with a view to ensuring that the resulting activity and product relate to clearly defined national objectives. It is equally important to ensure that dependence on external sources of funding do not distort the national priority concerns.

The appropriate infrastructure for research, according to Mosher[2/]

2/ Mosher, A.T. - Some Critical Requirements for Productive Agricultural Research, International Service for National Agricultural Research, The Hague, Netherlands, May 1982.

must provide for:

(i) An organizational system suitable for the administrative and political climate of the country;

(ii) Adequate physical facilities and an effective style of administration;

(iii) Appropriate training and retraining facilities;

(iv) Effective in-house communications and collaboration between scientists, extension, policy-makers and farmers;

(v) Effective procedures for the selection of research projects including a reward system which fosters the effective application of research resources to critical farmer problems;

(vi) Creation and maintenance of an administrative climate which will foster good science, including project design and evaluation.

Technological Research

Technology for agriculture covers a wide range of activity, including production, processing, distribution, marketing and consumption, but to a large extent research has focused on the productive phase. Technological prescriptions from the research stations are frequently unsuitable with the inevitable result of low adoption by farmers. Moreover, many variables such as tenure farm size, factor and product markets have an effect on adoption rates.

Most analysts[3/] agree on the location specificity of technology which implies that new technology must be implemented in the framework of farmers' production systems, particularly systems of inter-cropping which characterize tropical agriculture, and which indicate that yield maximization is not always the goal of the farmers.

What derives from this diagnosis is the distinction between scientific research and technology development and the need to institutionalize on farm and farming system methodologies. It is therefore important to

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3/ Hunter, Guy - Enlisting the Small Farmer, The Range of Requirements Overseas Development Institute (see Reports on Food Policy, February 1983, 83 pp).

encourage multidisciplinary commodity research teams (as has been done for rice in the Philippines) as distinct from the traditional single discipline research scientist working in isolation.

Agricultural Research in a Caribbean Context

The real world problem for agricultural research in small island systems like the Caribbean, notwithstanding organizational and structural forms is to convince the politicians, planners and administrators that agricultural research is not a luxury, and to demonstrate by results that its contribution to agricultural production and productivity exceeds the investment made in it.

After some fifty years of classical research in the Caribbean, a situation where the decision-makers have now to be convinced of the need for research suggests that a crisis of confidence has to be overcome. In addition, the crisis is exacerbated by the lack of funding, dependency on external sources, and increasing food imports at rising per unit prices.

These seem to be the fundamental issues to be faced and this Conference provides the strategic pathway where the various territories of the region have to recognize that priority attention to strengthening both the base and the performance of the agricultural sector is the only ray of hope. In a word, the task is to reverse the trend which now drains foreign exchange into one which will be a source of foreign exchange. This is the task not only of agricultural research but of a wide range of variables not the least of which is the commercial policy of governments.

G. Decentralised Agricultural Research - The CARDI* Experience

(John Cropper - CARDI*)

Introduction

The paper starts by examining the major issues facing the conduct of agricultural research in a decentralised setting in the English-speaking Caribbean community - CARICOM. Arising from this are particular challenges which face a research system charged with working in this situation.

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* Caribbean Agricultural Research and Development Institute.

While many of the challenges are not peculiar to the Caribbean or to decentralised research, they are more difficult to resolve in the Caribbean due to the diversity of the environment and its agricultural systems.

Research Needs of the Commonwealth Caribbean States

(i) Agricultural research in the Caribbean can only be justified if it is concerned with meeting the needs of people, that is of farmers and consumers. The region cannot afford the luxury of research for its own sake. The Caribbean is characterized by a wide diversity of agricultural systems, resulting from different ecological, social and economic conditions. As a result there are many potential groups of farmers (clients) for research to serve. Examples include the shifting by cultivars of Belize, the 'landless' livestock farmers of the Leeward Islands, the intensive vegetable farmers of North Trinidad and the sugar estates of Guyana.

(ii) In the past, agricultural research was mainly conducted and financed by, and in support of, the primary export commodities. Some support was also received from the public sector, which was then the colonial administration. However, in recent years, priorities for research financed by the public sector have been shifted to food commodities for local consumption. This reflects the relative neglect of these crops in the past, the desire for greater local food security and the numerical importance of small farmers who are the prime producers of food for local consumption. Concurrent with the shift in public sector emphasis has been a fall in the export industries' capacity to sustain their research activity due to declines in the output and prices of the export commodities.

(iii) Since not all groups can be served by the public sector research system when resources are scarce, policy decisions have to be made regarding which groups will have the opportunity to benefit most. Such decisions can have far reaching consequences as, for example, in Barbados in the late 1960s when research on large scale (estate) vegetable production permanently affected the dominant market position previously held by small farmers. National agricultural development plans and now the Regional Food and Nutrition Strategy should be the main sources of guidance. Unfortunately, such documents tend not to assign priorities

to sectors and groups or may state that all have top priority, but as one commentator (Best) has noted "when everything is a priority there are no priorities".

(iv) Priority client groups will undoubtedly have a number of requirements in order to improve their well-being, and to enhance their contribution to society. For the structured, often monocrop, groups identification of needs is often straightforward, but for the groups of small farmers their range of needs can appear legion. It is necessary, however, to recognize that needs are not necessarily best solved by research, even though research may devise ways to ameliorate them. Final incentives, better prices, improved marketing and assured supplies of inputs are only some of the alternative ways to meet farmers' needs. Policy-makers need assistance in determining appropriate strategies.

(v) In the past the research needs of farmers have been determined by those who were often insufficiently familiar with their situation and needs. As a result, much research was conducted which on completion, farmers refused to adopt, even when properly promoted by extension. To overcome the problem some researchers are trying a farming systems approach which treats the felt needs of farm families as paramount except where they are incompatible with the needs of society (e.g. decline in soil fertility). Techniques are still being evolved to determine which constraints can best be handled by research and which by direct action (e.g. policy changes).

The research needs of Clients

(i) The diversity of the Caribbean and its small size result in small 'recommendation domains' that is, the area in which any new technique is appropriate and likely to be adopted by farmers. As a result the benefits from new techniques may be of major benefit to individual farmers but of little absolute value to a country or to the region as a whole. This has implications, both for the selection of client groups and for the research approaches which are adopted. The challenge is to choose projects with a high ratio of benefits to costs, for there is a tendency for projects to

take on a life of their own, often because of the special interest of an individual or group. In such cases it would be wise to terminate projects when the likely benefits are negligible, and even when resources are available.

(ii) There are many agencies in the Caribbean conducting agricultural research. These include private firms/farms; public corporations; commodity associations; commodity boards; development authorities; Ministries of Agriculture; national research institutes; regional agricultural research institutions; international agricultural research institutions. There can be no formal mechanism for controlling the work of these organizations, because each organization has its own mandate, its own target group(s) of clients and its own procedures for selecting projects.

(iii) Attempts are being made at the national level in some countries to co-ordinate some elements of the research system. Thus in Jamaica, the research sections of all the commodity boards have been placed under the control of the Ministry of Agriculture; Trinidad and Tobago is discussing the establishment of the National Institute of Higher Education, Research Science and Technology (NIHERST) and several countries have established agricultural research co-ordinating committees.

(iv) At the regional level where the issues are even more complex, the meetings of agricultural planners convened by the CARICOM Secretariat have so far failed to agree on what procedures to recommend to the Ministers of Agriculture for co-ordinating agricultural research in CARICOM. However, the directors of (Government) livestock research do meet annually to discuss their programmes, and several agencies active in the Windwards, Leewards and Belize have recently held a first meeting under the aegis of the Caribbean Agricultural Extension Project to exchange information. The challenge is to avoid duplication and co-ordinate activities of agencies in order to maximise benefits to clients, and in order to cater to the short-term needs of its client group; research also has a part to play in the restructuring of Caribbean economies, or in other words, in catering to the long-term needs of Caribbean peoples. This, however, does not constitute a licence for unstructured and esoteric projects; rather, it

requires clear guidelines from policymakers as to the desired future structure of the agricultural sector. There would then be a framework for setting research priorities.

(v) The Regional food and Nutrition Strategy offers this promise, but is still insufficiently reflected in national long-term agricultural plans to provide adequate guidance for research. The openness of Caribbean economies and the major external, usually unpredictable forces which affect the region make long-term planning a chancy affair. Nevertheless, guidelines are needed by researchers funded by the public sector on whether to continue to concentrate almost exclusively on food commodities for local consumption, or whether to give added support to the traditional export crops to supplement the reduced level of industry support, or whether to initiate a major search for new export commodities.

(vi) The policymakers need to realise that if research is to be effective it should not be a stop-start affair, but should have some reasonable continuity. For example, the Research and Development programme associated with the CARICOM Corn Soya Project in the intermediate Savannahs of Guyana was beginning to come to terms with the many problems of cropping those infertile soils when the proramme was suspended. For their part, researchers need to appreciate that the world will not wait for the 'perfect' solution to a problem. Furthermore, that failure to appreciate the need for short-term, even modest benefits can cause policymakers to question the usefulness of the entire research programme. The challenge is to have a work programme with a balance of projects, some giving short-term benefits to select client groups and others opening up and supporting longer term changes in the agricultural sector.

Resource Allocation

(i) The conclusions of an IFARD/IDRC workshop on Resource Allocation to Agricultural Research probably hold true for most Caribbean Institutions:

> "...whatever the mechanisms for allocating resources, the process by which resources are actually allocated is still ill-defined and often relies more on historical, personal,

> or political influence than on any formal criteria. Even where specific criteria are defined, they are often not effectively utilized. Research project proposals and budget estimates are usually still prepared by individual research institutes or research departments within a larger organization. Budgets are rarely based on detailed project costings but usually extrapolate past estimates. When aggregated, these estimates form the initial total request for resources. In all four of the resource allocation case studies presented at this session, the initial budget request goes through at least one review process by a higher body. This generally results in revisions of the budget and the manpower request. Because these revisions are usually downward, it was implied by many of the participants that the original requests are inflated in order to compensate for expected reductions. When government budget authorities allocate funds for research without drawing on any scientific review process, budget allocations are often arbitrarily adjusted to meet general fiscal objectives and not specifically related to research requirements and opportunities."

(ii) Although research results cannot be definitely predicted, experience should make it increasingly possible to estimate the likely results from a particular piece of applied research. In fact, the anticipated results will normally be incorporated in the project objectives. The benefits can then be extrapolated into the recommendation domain. Similarly, the research costs can also be estimated from the project design. Little thought appears to have been given to the estimation of benefit, cost ratios and to the marginal rates of return from research. These are concepts with which research managers will have to become more familiar if they are to obtain maximum benefits from their research budgets and if they are to persuade Ministry of Finance officials to maintain, let alone increase, their allocations. Better project planning and subsequent evaluation should result in the better predictability of these parameters. The challenge is to allocate research resources between

projects so that the marginal benefits (opportunity costs) are similar. There is, however, a diplomatic or geographic dimension to resource allocation. Whether resources come from external donors or from within the region, all countries wish to share in the benefits. It is ironic that in the 'Campbell' Report on the RRC it was noted that:

> "In the Windward and Leeward Islands it was felt that MDCs were the principal beneficiaries from RRC activities. On the other hand in the MDC there was the view that they have received insufficient attention and benefits from RRC".

(iii) The region relies heavily on external donor agencies for its research funding at both national and regional levels. Each donor agency wishes to have successful (i.e. beneficial) projects, yet the agencies have their own biases and are not always willing to consult with the local and regional research systems. The problem is compounded by the many new donors which each year solicit for projects in the region. Local research agencies are then placed in a dilemma if they are not convinced of the priority of a project being promoted by a donor but stand to gain urgently needed resources if they accept. The challenge here is to match donor interests with the priority needs of clients. The research community provides the main resource pool of technical expertise in the region. Consequently, research personnel have an important role in other aspects of agricultural development - in extension, technical assistance (firefighting) and training. The region cannot afford the luxury of having separate staff to fulfil these functions, but it is not always appreciated that time spent on these other activities is time no longer available for research, even though participation in extension and technical assistance can help to give focus to research efforts. A detailed audit might well show that less than 50 percent of the time of many 'research' staff is spent on research. The obvious answer to these problems is to allocate resources between research, extension, technical assistance and training for the maximum benefit of client groups.

Research Deployment

(i) A work programme can be designed and implemented only in relation to the resources which are avialable. In the short run, therefore, the im-

plementation of a work plan is constrained by the location of facilities and staff. In the longer term, and at some cost, these resources can be deployed. Factors which sometimes restrict the deployment of personnel include work permit restrictions, social conditions (including personal security), economic conditions, different levels of emoluments and the high costs involved. Research stations have traditionally been sited on the most fertile easily cultivated soils (e.g. UWI Field Station on River Estate Loam) and it is generally agreed that this has contributed to the relative failure of research to benefit the many farmers working on poor soils. Farming systems research, which is conducted mainly on the farms of the client group in order to overcome this problem, demands a decentralized deployment of resources, especially staff. The challenge then is to deploy resources for the optimum implementation of the work programme.

(ii) Many of the facilities and services which research scientists require cannot be provided at all the research sites or even in all the countries. This includes items such as scientific literature, micronutrient analyses, and a whole range of specialist skills. In fact, a major reason for having a regional research system is so that all countries can have access to these facilities and services. The minimum size, or critical mass, of an effective national research establishment continues to be debated, but the arguments usually neglect the services provided to the smaller countries and the opportunities for interaction with peers during interregional travel. Nevertheless, the region is still searching for mechanism(s) to make more effective use of its specialist resources. An encouraging start has been made with the Caribbean Technological Consultancy Services Network - co-ordinated by the Technology and Energy Unit of CDB, although this does not include agricultural production, while CARICOM Secretariat administers a Caribbean Technical Assistance Fund. (The Group of Caribbean Experts recommended establishment of a Caribbean Advisory Service as a 'priority concern'). There is an urgent need, therefore to establish effective support mechanisms for research projects.

Work Programme Implementation

(i) Agricultural development is a complex process of which agricultural research is only a small part. Therefore, in addition to the many agencies in the region conducting agricultural research, the research system must also interact with those organizations involved in extension, marketing and policy, both in the private and public sector. These organizations need to be aware of the work of the research system, and in some instances should be involved in it in order that the work can proceed smoothly. This liaison function places an additional demand on researcher workers, but is essential to their long-term effectiveness. The need remains to initiate and sustain productive working relations with a wide variety of organizations.

(ii) The research process should start with a clear identification of the client's research needs. However, this of itself is not sufficient to ensure the adoption of the research results, but the research programme should be designed so that there is a continuum between research, extension and adoption by farmers. Recognition of this need is seen in the establishment of national agricultural co-ordinating committees and of the Technical Joint Action Committee of CAEP, but it has not yet become a feature of research project design. Too often researchers and extension officers work in separate divisions of their organizations and have little interaction with each other. It becomes necessary, therefore, to address research needs in such ways that adoption of results can readily follow.

Research System Organization and Operation

(i) For at least the past 60 years the need has been recognized for a regional research system to meet with the increasingly complex challenges in the Caribbean. At first the responsibility lay with the Imperial College of Tropical Agriculture (ICTA), then out of recommendations of the Royal Commission of 1938 the Regional Research Centre (RRC) was established in 1955. Twenty years later 12 governments of the Caribbean Community founded CARDI - the Caribbean Agricultural Research and Development Institute. The need remains, however, of designing an organizational structure with operating procedures to meet the challenges of the changing times.

H. The Role of Agricultural Research in the Development Process

(Dr. T. Ajibola Taylor - ISNAR*)

I am pleased on behalf of the Director General and staff of ISNAR to share in the welcome to all of you at this important regional meeting organized by ECLAC. Also, as you are aware, ISNAR is sharing in the sponsorship of the meeting, since we believe that it is an important event for you and for us. While ISNAR has joined in sponsoring this meeting, we view it as your meeting. An opportunity for you, the leaders and representatives of national agricultural programmes, to come together to discuss issues of general concern and to seek ways and means to work more effectively for a more productive and efficient agriculture.

From ISNAR's viewpoint, this meeting is an opportunity to get better acquainted with you, with your problems in agriculture which are of common concern, and to introduce ISNAR and its programmes to those of you who are not yet familiar with ISNAR. Also, it is an opportunity for us to see if there are ways in which we can work with some of you on an individual country basis or with many of you on a regional basis. This is the first opportunity ISNAR has had to meet with leaders in this region. Therefore, let me start by telling you something about ISNAR and its activities.

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in the Hague, The Netherlands, on 1 September 1980. It was established by the Consultative Group on International Agricultural Research (CGIAR) on the basis of a recommendation from an international task force for the purpose of assisting governments from developing countries to strengthen their agricultural research. It is a non-profit, autonomous agency, international in character, non-political in management, staffing and operations. Most of its funds are provided by an informal group of approximately 30 donors; countries, development banks, international organizations and foundations which make up the CGIAR.

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* International Service for National Agricultural Research.

ISNAR is the youngest of thirteen centres in the CGIAR network of which three are located here in Latin America, namely CIAT, CIP and CIMMYT, with which you are familiar.

ISNAR is the only one of the centres that focuses primarily on national agricultural research issues to provide advice to governments upon request on organization, planning, manpower development, staff requirements, financial management, infrastructure requirements, and related matters thus complementing the activities of other assistance agencies. Additionally, ISNAR has an active training and communications programme which co-operates with national agricultural research programmes in developing countries. ISNAR also plays an active role in assisting these national programmes to establish links with the international agricultural research centres, donors and other international organizations in the scientific community.

ISNAR, unlike the centres that are carrying out research on specific commodities such as CIAT, is concerned with the development of systems building for national agricultural research systems. This involves working with national leaders, such as yourselves, to find the best way of organising and managing agricultural research as a whole. In order to find the "best way" there is usually a need for an analysis of the organization, for research, programming, priority setting, financing, staffing and the linkage of research systems to policy measures, extension services, producers and other bodies in a particular country.

The role of ISNAR is not just to try to diagnose the problem or constraints of a particular system. Its true role is to work closely with leaders of the national systems in the diagnosis of the systems, and together with the national leaders try to identify solutions that are within the resource possibility for that particular country. Once recommendations are made and accepted by the leaders and decision-makers of a particular country, ISNAR seeks to maintain a continuing relationship with that country to assist with the implementation of the recommendations. The diagnosis is only the first phase of what is expected to be a continuing relationship.

ISNAR's activities can be grouped in separate and distinct areas, but they are complementary. Members of the inter-disciplinary staff work as a team and all senior officers participate to some extent in all the areas. Programmes in each area help sharpen and extend the growing knowledge base of the national

agricultural research and all activities feed back to that base thereby improving the total capability of ISNAR to help strengthen national agricultural research systems.

There are four main areas of activity at ISNAR which are:

(i) review, diagnosis, planning and continuous co-operation with national agricultural research systems in developing countries;

(ii) research studies on organization and management and performance of agricultural research systems;

(iii) training and conferences;

(iv) communication and information.

In the almost three years since its establishment, ISNAR has had the opportunity to be tested on its structure, programme balance, programme content, and the appropriateness of its objective. A high degree of interest and acceptability is reflected by both national programme leaders and the donor community. ISNAR's interactions with national programmes often relate to the research programme development, research organization, management and staff development changes that require several years to develop and reach measurable results. Thus, it is too early for there to be a visible impact attributable to ISNAR programmes. Steps in the longer chain of events require close and continuous working relationships with national systems. To date ISNAR has established working relationships with approximately twenty national programmes in Africa, Asia, the Pacific and Latin America. In this region we have started working with Costa Rica, the Dominican Republic and Guyana.

Research within ISNAR has two primary functions; the first is that ISNAR obtains a solid information base for its own use in advising national agricultural research programmes; the second is that ISNAR develops an information base which national research programmes can use as guides for themselves based upon the experience of others.

In order to carry out these functions, the programme of the Research section is developing within the guidelines of five generalised objectives:

(i) to test methodologies that measure the output and impact of the research system and determine its productivity;

(ii) to describe forms of organization or structure that

are well adapted to differing circumstances for national programmes;

(iii) to describe resource management practices and procedures used in successful systems;

(iv) to describe productive linkages among elements within national programmes and among national and international institutions; and

(v) to conduct periodic inventory and assessment of financial and human resources used in selected national systems.

The training and conference activities within ISNAR assist national agricultural research systems in the development of management skills for their personnel. They also assist in the determination of manpower needs for efficient programme operation. Its strategy and programme are complementary to, and dependent on, the other three principal ISNAR programme activity areas - review, communication and research. The work is carried out in three main areas: management training, manpower planning and conferences. Management training includes:

(i) analysis of management training needs related to national research systems, and

(ii) support for courses which address those needs.

As a result of discussions with national agricultural research leaders and others, six subjects have been selected for special attention: programme planning, budgeting and finance, personnel administration, information systems, programme evaluation, and station management. ISNAR collaborates with regional institutions in the organisation and presentation of research management training courses and gives considerable emphasis to materials preparation and curriculum development.

Two groups of manpower planning activities are conducted as a part of ISNAR's continuing relationship with national research systems. These include working with national leaders to carry out:

(i) recruitment and career planning within agricultural research systems, and

(ii) analyses of conditions of service for agricultural research staff.

ISNAR organises and supports conferences either on its own or jointly

with other organisations, such as this one today:

(i) to bring together research leaders to discuss common problems, and

(ii) to encourage them to develop common responses to shared challenges.

The staff engaged in communication and information at ISNAR, with the co-operation of other ISNAR staff, work to carry out two important roles:

(i) developing communications materials for ISNAR, and

(ii) working with national agricultural research systems on information management.

ISNAR is a relatively small organization by most international standards and is expected to remain relatively small over at least the next several years.

In the face of virtually limitless needs for strengthening national agricultural research systems, ISNAR recognises it cannot work with all countries nor respond immediately to all requests. Systems building, as you all know, is a complex and often delicate process which must take into account economic, social, cultural, and ecological issues as well as resources - human and financial - to name only a few of the factors to be considered. In order to best serve national programmes, ISNAR with its professional staff of about twenty to twenty-five, plus some consultants, is first trying to build up its understanding of the problem and its institutional memory before expanding the size of its staff and the scale of its activities.

While there are many opportunities represented here at this meeting that are concerned with agricultural research, ISNAR is one of the few international agricultural organisations whose focus is solely on the objective to work with national agricultural research systems to seek ways and means to strengthen those systems for a better national agriculture.

I have tried to give you a picture of ISNAR and its activities. There are some publications of ISNAR available here at this meeting which I hope you will take with you, which recap these activities and expand on some of the points I have mentioned. Let me turn to the topic of The Role of Agricultural Research in the Development Process.

First and foremost, we at ISNAR emphasize that agricultural research is an integral part of the process of agricultural development. Agricultural research in most developing countries, and I believe in the region represented here, should not be looked upon as a separate entity to be carried out on research stations. It must be an active part of the development process. It must be concerned with the problems and the constraints that are vital to the livelihood of the producers of agricultural products. It must also have a concern with the use of the agricultural product.

The role of agricultural research in development is multi-faceted. It is not confined to the planning and execution of research and communication of research results alone. It links back into the national planning and forward to serve the producers. This role is fundamental as the major vehicle by which the agricultural producer represents the majority of the people of developing countries, can improve their well-being and can participate productively in the approved well-being of the country.

In a paper presented to the Fiji Association for Agricultural Scientists, the Director General of ISNAR, Dr. William K. Gamble, commented upon three broad objectives which describe the goals that many nations find desirable for their national agricultural research system. These are:

(i) to make available to governments in an appropriately interpreted form, key elements of information on which reliable agricultural development policies and plans can be based.

(ii) to make available to farmers in appropriately interpreted form and through appropriate channels the detailed agricultural production information (including economic and social implications) on which to plan and implement production of crops and livestock based soundly on adaptive research at the farmers' level, and

(iii) to develop and maintain a group of well-trained, competent scientists, in appropriate disciplines in active research positions capable of collaborative effort, in problem resolution and in interpreting national and international scientific advances for the benefit of national development.

These broad objectives focus on the responsibilities of agricultural research to the government, to the farmers and to itself, but all in the

context of national development. I believe it has been well demonstrated in many places that where the role of agricultural research is duly appreciated, and the programmes of research organised and managed with a focus on national objectives and farmers' requirements for improved technologies, agricultural research can contribute very effectively to the development process. Development may mean different things to different people in different circumstances and in different parts of the world. Often the question is asked, development for WHAT, or development for WHOM? Obviously the concept of development, both in terms of what is developed, and what strategy is adopted, and who is to benefit from such development will vary from country to country.

It can be generalised that in most developing countries development relates to a resource base, the application of science and technology to that resource base, and the benefits in economic and social terms that accrue to the majority of the population. I have included that last phrase to note the importance of equity in a great many countries. Of course, it will be the responsibility of a country to determine the course of its own development and the philosophy that will guide such development, but specifically in the field of agriculture the role of improved technologies and sound policies which emanate from good quality agricultural research is hardly arguable. So also is the need for development to focus on the well-being through improved standards of living, of those engaged in agricultural production.

The size and scope of the national agricultural research system will vary from country to country depending on the country's size, resources, ecology and agriculture and a variety of factors specific to each particular country. Also, organisations for research will be different in different countries. Yet in each country there is an important role for agricultural research. I have tried to present that role not as something separate and special, but rather as an integral and essential part of agriculture, (crops, livestock, forestry, fisheries and environment).

Let me close by stating what is probably well known to you, that a productive agriculture is often the foundation of development in many developing countries and a productive agriculture is itself the product of productive agricultural research.

I. The Job Ahead and Institutional Capacities for Agricultural Research and Transfer of Technology in the Caribbean

(E.J. Wellhausen - Rockefeller Foundation)

Introduction

The Caribbean Basin[1/] is definitely one of the food deficient regions of the world. It is also a region plagued by a wide range of socio-economic problems. Although it is not always apparent, most of the countries of the region have a three-fold agricultural policy, namely:

(i) acceleration of food production to reach and maintain self-sufficiency;

(ii) improvement of agricultural production for export, to generate foreign exchange; and

(iii) the improvement of income and quality of life of the rural inhabitants.

In my visits to various islands of the Caribbean area earlier this year, on a mission for UNICA[2/] I became convinced that the three components are basically sound and feasible. The potential exists and I was happy to find that much, leading to a more efficient and fuller exploitation of soil, climatic and human resources at hand in the area for the realisation of the existing potential, is already underway. I was impressed by the desire and interest in strengthening current efforts. Furthermore, and perhaps even more important, I was impressed by the quality of the existing leadership - the understanding, the concerns and strong desire to do something about the alleviation of the many constraints to progress confronting the people of the various islands. This leadership is exemplified by those of you who are present at this meeting and I, indeed, feel highly honored and highly privileged to have the opportunity to get better acquainted with you and learn more about the agricultural problems of the area. Above all, it is a pleasure to have this opportunity to interact a bit with you in an

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1/ Including the Caribbean Islands, Mexico, Central American Isthmus, Colombia, Venezuela, Guyana.

2/ Association of Caribbean Universities and Research Institutes.

attempt at finding a way to strengthen, speed up and bring into a sharper focus the many researches and transfer of technology activities needed to develop more fully the existing agricultural potentials of the region as a whole.

During the last three decades, world production of cereals (wheat, rice, maize, sorghum) has doubled and I am happy to say that much of this increase has occurred in the tropics. For example, Mexico today is producing five times more wheat than twenty-three years ago, on the same area of land. India, with the varieties and agronomic practices generated in Mexico, increased its production of wheat from about 12 million tons annually in 1966, to 23 million tons in 1973. Wheat production was almost doubled in a short period of six years.

A similar revolution occurred in rice production. The new high yielding, fertiliser responsive, widely adapted varieties of rice developed by the International Rice Research Institute located in the Philippines, have catalysed a rapid increase in the production of this cereal in South and South-East Asia. In Latin America, Colombia presents a well documented case. With varieties and cultural practices adapted from South-East Asia, Colombia raised its average yields from 2000 kgs/ha to 4500 kgs in a short period of ten years. Yield increases in maize and sorghum have been equally spectacular, but in general of lesser magnitude and not so well documented.

During the time I have been allotted on this programme, I would like to briefly review for you:

(i) What I believe we have learned from these rapid increases in production;

(ii) What is the current situation, and

(iii) How can we, in the Caribbean area, better organise our research and extension efforts to extend the so-called green revolution to a greater number of farmers.

What Have We Learned From The Rapid Increases in Cereal Production in the Tropics

The first lesson we have learned is that the rapid acceleration of agricultural production involves an important set of requisites, any one of which, if weak or absent, can render the whole process ineffective.

These, I have discussed repeatedly with my colleagues in Mexico, Central and South America, and would briefly like to mention them here:

Technology

The technology must be adequate at the level of the farmer. Three things are essential:

(i) Varieties or cultivars biologically efficient and well adapted to the environment in which they are to be grown;

(ii) Package of agronomic practices which permit these cultivars to produce at their maximum level under prevailing conditions of soil, water and climate; and

(iii) A combination of materials and practices which clearly are more productive and profitable with a low level of risk.

Instruction

In general, farmers need to be taught how to use new technologies and be convinced that they really are more productive and more profitable for their situations if properly used. This is infinitely more difficult in communities in which small size farms and outmoded traditional methodologies predominate. We urgently need more research for the development and application of new strategies for getting this job done.

Inputs

Inputs such as credit, good seed, fertilizer, herbicides and insecticides need to be available where they are needed and when they are needed, at prices the farmers can afford.

Incentives

If production is to be increased with new more productive technologies, and the available agricultural resources more efficiently exploited, farmers in general must be provided with economic incentives, so they will want to produce more. Above all, there must be a favourable relationship between the cost of inputs and the price a farmer receives for his product. Also there must be a place where he can deliver his produce and receive prompt payment for it. An effort must be made to solve the marketing and crop storage problems, to avoid what in many countries amounts to monumental waste.

The four basic requisites I am sure present nothing new to those of you participating in this meeting. Nevertheless, I think we need to repeatedly remind ourselves of the fact that the rate of increase in agricultural productivity will depend upon our efficiency in bringing these diverse components together in a simple package. If one of the requisites is weak or absent, progress in production may be weak or nil. This thing we all understand, but what is generally not well understood is how to promote the simultaneous development of each one of these requisites as a single or co-ordinated package. How to do this in an efficient way, presents a real challenge to the research and educational institutions within the region. Our inabilities to bring about an integrated co-ordinated development of these requisites, continues to be the major bottleneck to progress.

The second lesson we have learned is that if all the basic requisites are fulfilled, new technology is first applied by the more sophisticated or more advanced farmers tilling land in the more favourable agricultural areas, where risks are the lowest and profits are the highest. In spite of the fact that world production of cereals has doubled in the last 30 years, I doubt that the

available technologies in the tropics are being applied, with varying degrees of success in more than 25-30 per cent of the total acreage dedicated to agricultural production. Furthermore, I doubt that the new technologies available today have affected the lives of more than one out of every four farmers. The majority of those favoured are tilling their land in areas where soil, water and climatic conditions are highly favourable for agricultural production and where the profits from the application of available technologies are the highest and risks are the lowest. High yielding varieties and improved agronomic practices have been rapidly adopted by these kinds of farmers without any special effort in the synchronisation of the other requisites. But what is the situation with the other four?

In the agricultural sector where relatively little progress has been made, the majority of the farmers live and farm under less favourable conditions, where rainfall is often poorly distributed - either too much or too little, and often coming at the wrong time. Also many may be tilling problem soils that may be very shallow or too acid, or too alkaline, poorly drained or contain a toxic element. Under such conditions, yields are lower and risks are higher. The risks involved often are major deterrents in investments in inputs, such as good seed, fertilizer and insecticides.

Also, a higher proportion of these farmers are poor, with limited resources and dedicate their time and energy to a subsistence or semi-commercial type of agriculture on small plots of land.

At least 75 per cent of the agriculture in the tropics falls into this category. Up to now these kinds of farmers and their families have been left behind in the development and application of modern technologies. This, in spite of the fact that in many parts of the world they are the principal food producers. Every day it becomes more evident that these kinds of farmers, operating under unfavourable conditions, can also benefit from an adequate package of modern technology. They represent an enormous under-developed potential for the acceleration of food production. An improvement of their production and income will also help to solve many of the social problems confronting us today.

Unfortunately for this category of farmers, in many cases we do not as yet have a technological package available that will economically

improve their production and income. Frequently, the improved varieties of rice, maize, beans and sorghum at hand, are not adequate for their situations. We urgently need to devote a greater effort to the formation of higher yielding varieties that will resist or tolerate the vagaries of weather and that are better adapted to problem soils. Also we need varieties that are better adapted to the production systems to which the farmer may be obligated in making maximum use of the soil, water and climate at hand.

Furthermore, we know very little about the management of agronomic practices and the efficient use of fertilizers, herbicides and insecticides in unfavourable situations. Separate technological packages will need to be developed for each of the many different ecological niches.

Also, it is becoming increasingly more evident that the mere availability of a suitable technological package will not bring about a rapid acceleration of production in unfavourable areas. Adequate technology does not extend itself as has been the case in the more favourable areas. We urgently need to develop and apply new strategies for gaining a more rapid and widespread adoption of new and adequate technologies, especially by small and medium-sized farmers.

The Job Ahead

I strongly believe that if we are going to develop the enormous potential for food production that exists in the less favourable agricultural areas (which comprises about 75% of the agriculture in the Caribbean Basin, or the tropics in general) we will need to do something different. We will need a new procedure, a new organisation and a new focus of agricultural research and technology transfer. We will need to organise ourselves for a more efficient effort.

If the job is to be done, more than ever before, biological and social scientists must work together. They must work as a single team with each other, both in more basic and applied sciences, and with farmers, government officials, bankers, businessmen, teachers, etc., in the development and application of appropriate technologies for all kinds of agricultural producers. As scientists and educators, more now than ever before, we need to leave our offices, laboratories and experimental stations and go to the fields, live with the farmers, learn what they know and what they are doing and why; and with this as a base, make plans together with them for a more productive agriculture and work with them in the realisation of such plans. If the job ahead is to be done, we as scientists, farmers, government officials, industrialists, or whatever we are, will need to organise ourselves better than ever before, to bring about the desired synchroni-

sation of efforts required for a flourishing agriculture.

In the Caribbean countries most of the farms are small, falling within a range of about 1-10 hectares; and to me, it is clearly evident that most of these semi-subsistence operators are economically viable in the sense that they have land, water, climatic and human resources at hand to produce two, three or four times more than they are now producing. There is, however, a striking difference between the small farmer of the Caribbean and his counterpart in Central America. The Central American "Campesino" has a long history of subsistence food production, whereas the Caribbean subsistence farmer previously was a plantation labourer. In either case, they have, in general, been left alone to try to make a living with outmoded traditional methods, with little or no professional help. So far, most have benefited little, if any at all, from the accomplishments in agricultural research within and outside the area. Agricultural extension programmes in most countries of the Caribbean are ineffective or non-existent.

The future of the area will depend, in large part, on improvement in production and income from small size farms. This is not an easy task, but urgently needs to be done. If it is to be accomplished, it will require a stronger effort and some new approaches, research and education, both from within the area and from the outside. The current extension philosophy is not working. If we are to get the pay-off (both socially and economically) from national and international research now underway, that we know is possible, some more effective way must be found to extend the benefits of the new materials and methodologies to a greater number of farmers. All the available experiences to date, indicate that the job can best be accomplished from the grass roots up.

A Proposed Organisation of Research and Technology Transfer Activities for the Caribbean

Based on what I saw and heard on my visits to the Caribbean earlier this year, I have drawn up a scheme (Figure I) which attempts to demonstrate what I believe we have to do, or at least try to do. This scheme or model basically is an attempt at the synchronisation of applied research, the transfer of technology and the agricultural services in a simple co-ordinated programme. I am not going to say that this scheme is the only way to do it. I accept that there may be other ways of realising what I would like to emphasise and each country will need to

develop its own procedures in accordance with its prevailing rural socio-economic situations and its agricultural and rural development policies, but I think we will need something to shoot at. One needs to remember that it is easy to make changes, but difficult to improve.

The scheme includes three types of action:

(i) Action by defined areas of districts;

(ii) Action by individual commodities or problem/complexes;

(iii) Administration.

On the basis of current needs in the Caribbean basin as a whole, I believe the major emphasis must be placed on action by defined area or districts. In my concept, a good distribution of personnel, percentage wise, among the three types of action would be:

75% in Action (i)

20% in Action (ii)

5% in Action (iii)

The District or Defined Area Approach in the Transfer of Technology

In view of this situation, the major focus of a new agricultural development effort must be on a district or community level approach, based on the principle that the people of the agricultural community must be involved actively in planning and executing programmes designed to improve their agricultural production, income and living standards.

They must be directly involved in adapting available modern technologies to the unique requirements of their locals. Also, community leaders, farmers, bankers, distributors of fertiliser - insecticides and herbicides, and those involved in marketing enterprises must all be involved in the development and application of strategies for gaining a more rapid and widespread adoption of adequate technologies by all kinds of food producers.

In the implementation of the defined area approach, the country concerned would be divided into zones on the basis of climate, soils, kind of agricultural production, etc., and each zone, if large, may be further sub-divided into smaller areas, perhaps on a community basis. In one form or another, most countries have already done this.

A multi-disciplinary team of professionals (broadly trained subject matter specialists) would be assigned to each zone, in accordance with activities to be carried out. These professionals must work together as a single team, inspired and guided by an enthusiastic and competent leader. They must go to

the communities within their zone, live with the people, so to speak, learn what they are doing and why, help them identify their problems and determine their priorities. Their first job will be to help them to do better what they are now doing.

In short, the team would be expected to catalyse and inspire two kinds of integrated activities: one: leading to the synthetisation of the information and materials which the farmers themselves may have developed, and that which the national and international centres may have produced, into economically, sound and profitable packages which the farmers of a given zone or area can apply; the other: leading to the development and application of strategies for promoting a more rapid and widespread adoption of such packages by small and medium-size farmers, in both activities; they would inspire the participation of the farmers concerned and pertinent personnel of all agencies having a bearing on the agricultural development of the zone.

This will require some special capacities. The professionals assigned to the task must work with a strong philosophy that change can come only internally and not externally as has been tried so often before. Their main objective must be to convert key individuals within the community itself, into change agents. Experience has taught us that these kinds of change agents are readily accepted by the community as a whole, and even more important, they generally remain in the community.

The defined area approach places the action where the problems need to be solved. It gets the ball rolling where changes have to take place, and it identifies the kinds of backstopping actions needed from higher up.

Generally, the kind of assistance needed at the grass-roots level, has to come from different institutions, both governmental and private. I believe the best way to bring it altogether is through the establishment of a "Productivity Centre" within each zone. Although this kind of centre might facilitate the development of commodity research programmes, or the solution of certain problem complexes (Action (ii)), basically it would not be a research centre, but more so a centre for the promotion and co-ordination of all the activities necessary in the areas of influence. Its principal objective would be to provide a mechanism by which personnel of different institutions or agencies involved in the development process, could be brought together to work as a multi-

disciplinary team in the planning and execution of needed activities in a given zone.

In my travels, I found various activities essential to a defined area approach already underway. For example, on-farm research, to define the technology and farming systems most indicated for improving the production and income in a given area, is one of the essential ingredients of a defined area approach. This, like many of the other area agricultural development activities, will require farmer participation and institutional interactions. In this respect, I was glad to find that CARDI (the Caribbean Agricultural Research and Development Institute) has a regional co-operative production system research programme well underway - co-operative with the Ministers of Agriculture and other interested institutions within its area of operation, (with the help of a USAID grant). This is a holistic approach, taking into consideration the problems of land, soil, climate, labour, markets, etc., that a farmer in a particular area may be confronted with, and it is exactly the kind of research needed at the community level, to determine how a farmer can get the most out of his resources. This is a good start in the defined area approach and needs to be further strengthened.

It must be pointed out, however, that if this kind of effort is not coupled with a dynamic strategy for gaining a rapid and widespread adoption, such as outlined above, little impact will be made. The CATIE farming system programme in the Central American Isthmus, aimed at improving the production of the small farmer, has done an outstanding job in identifying new more productive systems, but little impact has resulted because of the almost complete absence of an effective methodology for gaining a more widespread adoption of the new techniques by small farmers. Furthermore, technology and teaching farmers how to use it, represent only two of the major requisites for accelerating agricultural production. For complete success, these must be coupled with an improved system for the flow of inputs such as credit, fertiliser, and insecticides and the necessary production incentives such as a ready market and a favourable relationship between the production costs and the price the farmer receives for his product.

Along this line, in my discussions with Dr. Henry, Director of CARDATS, I was very pleased to learn that this institution was very much concerned with the development and application of strategies for gaining a more rapid adoption of adequate technologies by small size farmers.

Furthermore, I would be amiss if, at this point, I did not mention the "Plan Sierra" in the Dominican Republic. According to Antonine and York[3/] this plan has a three-fold objective (i) to improve the quality of life of the inhabitants of the Sierra; (ii) to manage soil, water and forest resources, and (iii) to promote the effective participation of local people in the development process. The plan is designed "to marshall and co-ordinate public and private development efforts in the region through six sectors of activity; agriculture, livestock, credit associations, handcrafts, university programme, and natural resources management."

"Collaborating institutions include the State Secretariats of Agriculture, Education and Public Health, autonomous government agencies concerned with water supply and hydraulic resources, farm co-operative credit and banking institutions, community development office, forestry and public works agencies. Private institutions include the Catholic Church, the Agricultural Vocational School at Santiago, the Development Association at Santiago and the Association of Caribbean Universities and Research Institutes."

I was personally involved in some of the early stages in the design of this project, but have had little contact with it in recent years. I am sure, however, that we could all learn a lot in regard to strategies from this and other similar types of plans in other parts of the world such as Plan Puebla (Mexico) and the Farmer Scholar Programme (Philippines).

(a) Implementation of the Process

Since there is very little concrete research and experience in the defined area approach in the Caribbean region, I would like to suggest that any attempt at its implementation start with an experimental programme in each interested country to determine how the task can be accomplished. Agricultural situations vary from country to country and the most effective procedure might very well be different for different countries.

As a first step in getting started, it might be well to divide the region as a whole into two sub-regions irrespective of

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3/ Antonine and York - Integrated Rural Development and the role of the University in the Caribbean; the case of Plan Sierra, Dominican Republic. Revista Geográfica 90, Julio-Dic. 1979.

differences in languages or political organisation; namely, (1) the Eastern Caribbean countries, and (2) the Northern countries comprising for example, Jamaica, Haiti, Dominican Republic, and Puerto Rico.

A second step would be the composition of a small multidisciplinary sub-regional team of developed-minded individuals to work with an appropriate institution or institutions within each interested country in the establishment of a research and experimental programme. This team, when completely staffed, might consist of six specialists in the following disciplines: (1) Team Leader; (2) Crop Production, (3) Animal Production, (4) Technology Transfer, (5) Socio-economics and (6) Training. It could initially begin with a lesser number.

A third step would be concerned with the orientation of this team in what is going on inside of the region and in what is already known about strategies for gaining a more rapid adoption of adequate technologies. It is important to start with what is already known. It is not necessary to start with the invention of the wheel. During the last ten years much has been learned about the operation of defined area projects.

A fourth step would be to assist interested countries with (1) the selection of a pilot research area; (2) the establishment of the goals; (3) the composition of a multidisciplinary research staff; (4) orientation of this staff on what we now know about operational procedures or what others have learned about successful strategies in rural area development programmes. In getting the programme under way, the sub-regional team would, of course, take into consideration activities already going on and incorporate these into the area research programme insofar as possible; (5) finding ways to adequately support the initial staff and give them the flexibility and freedom of operation to reach the goals set and (6) the promotion of interaction with other programmes in the region as a whole through periodic workshops.

Progress or accomplishments of each team would be measured in terms of what happens to the well-being of the people in the experimental areas. If the right professionals are picked and the project properly organised and supported, usually after a couple of years students can be brought in as research participants. Thus, professionals and students and people of the community can learn together about what works and what does not work.

After two or three years of successful operation in an experimental programme, plans should be made with both public and private agencies for the application of the type of operation found to be effective throughout the country, in a stepwise fashion, as fast as, but not faster than well oriented and experienced professionals become available.

The establishment of at least three experimental area research programmes within each sub-region, should be considered. This would give some competition and an opportunity for interexchange of ideas and experiences. They could serve as the beginning of a new science for the effective transfer of modern technology to small and medium-size farmers.

Every effort should be made to establish the sub-regional teams with professionals selected from within the Caribbean area. In the beginning, however, a few well-oriented and experienced consultants may be needed from the outside, to help with the training and orientation of these teams. Similarly, insofar as possible, the professionals needed to staff the experimental area teams, should be selected from within the interested country.

(b) Training

I believe the number of professionals initially needed to get the ball rolling can be identified from within the area. These professionals, however, right from the beginning will need to think about how the effective strategies they may identify can be rapidly and widely applied in gaining a more rapid adoption of adequate technologies by all kinds of farmers throughout the country. They will need to get involved in training as soon as they have something to teach.

The success or failure of the defined area approach, will largely depend upon how effectively the professionals involved, catalyse the co-ordinated action of all major agencies that have something to do with agricultural development, such as research, credit, flow of inputs and marketing. It is not likely that we will get very far with this type of action without a special effort in the formation of additional teams that understand what has to be done and have some experience in getting it done and can extend the programme to other areas.

The expansion process, therefore, becomes one of the human development. I found that much of the training and research on rural development topics is supported at the level of the universities and the vocational agricultural schools. These kinds of activities urgently need to be strengthened. However, if the Universities and vocational agricultural schools are going to prepare the kinds of students needed for agricultural and rural developments, the professors must get involved with successful rural development programmes and learn what to teach and how to teach it. Also the students themselves, as part of the learning process, must participate directly and gain experience in strategies that work. The area experimental programmes proposed above should provide opportunities for, and encourage, the agronomic facilities to get involved.

Development of Regional Commodity Research Programme

Experience is rapidly teaching us that research in farming systems at the defined area level is an excellent methodology for synthesizing the materials and information produced - by national and international research institutions and by the farmers themselves - into technological packages that the small farmers can apply. It operates primarily on materials and information already available which, of course, is substantial. Its basic philosophy is that if you look hard enough for the information and materials you need to make a production system more effective, you will find it somewhere. Nevertheless, in the long run its effectiveness and dynamism depends upon a group of researchers dedicated to the continuous development of more productive disease and insect resistant cultivars, agronomic practices and the further improvement of the various components of a good production system. Therefore, for a production systems research programme to be fully efficient and dynamic, it needs the backstopping of commodity research programmes organised on a regional basis for the development of cultivars and agronomic practices more specifically adapted to the needs of a particular region. There must be a continuous feedback from those who try to bring it all together at the farm level, to those engaged in the improvement of individual commodities, or the solution of problem complexes at more fundamental levels.

The major food crops of the Caribbean may be grouped as follows:

Cereals	Root Crops	Fruits
Rice	Yams	Bananas (Plantains)
Maize	Sweet Potato	Cirtus
Sorghum	Taro	Native Tree Fruits
Amaranthus		
Food Legumes	Vegetable Crops	
Pigeon Peas	Tomatoes	
Cow Peas	Onions	
Beans	Egg Plant	
	Pepper (California Wonder)	

It is suggested that serious consideration be given immediately to the initiation of a number of regional research networks based on individual or groups of commodities and problem/complexes.

Although research organised on an individual commodity basis in the International Research Centre network has produced extraordinary dividends in the case of rice, wheat and maize, I doubt that in view of the many crops involved in the Caribbean, we can afford a regional research on each specific commodity. I believe, therefore, that with the possible exception of the cereals, we need to think in terms of a regional team for a specific group of commodities such as the legumes, root crops and vegetable crops. Nevertheless, a team in getting started might concentrate on a specific commodity within a group; for example, in the case of the food legumes, the initial concentration might be on pigeon peas, in the case of the root crops, it might be on sweet potatoes and in the case of vegetable crops, an initial concentration on tomatoes may be indicated.

In the case of cereals, two separate regional teams may be needed, one on rice and the other on maize and sorghum. Rice, without doubt, will steadily grow in importance as a basic food crop. By the turn of the century, the basic food of the Caribbeanos will probably be rice. A regional programme focus, specifically on the improvement of rice, is highly warranted.

Similarly, a separate programme in maize and sorghum would be highly desirable. These two grains are not only valuable for animal feed, but also could be used directly as human food. Last year, the Dominican Republic improved 50 million tons of maize and are well on the

road to 100 million. CIMMYT's maize population 28 is well adapted to the Caribbean region, outyielding local varieties by a big margin. Regional research based on the further adaptation of this variety, could produce a big pay off. In regard to sorghum, the new high yielding white grain, low tannin, food and fat grain variety developed by ICRISAT-CIMMYT, introduced into the area, has an excellent potential and adaptive research leading to a wider use of this variety would pay equally well.

Other crops worthy of consideration as lead crops in regional programmes are as indicated below.

(i) Amaranthus

This is a high protein cereal readily adapted to the tropics (yields up to 3 tons per hectare have been obtained): it is easily grown and has a multiplicity of uses. Leaves are now commonly used as spinach. Seeds could be used to enrich bread and other foods. A small research team assigned to improve the produce and use of the crop, perhaps first in the Eastern Caribbean, would pay large dividends.

(ii) Pigeon Peas

A high protein legume crop with multiple uses. The seeds can be eaten dry or green and can also be canned. ICRISAT has produced varieties unaffected by changes in photoperiod - varieties that can be planted any time of the year. It could become a very important crop for small farm production systems and the constitution of a small team at some appropriate centre, to further the co-operative genetic improvement and production of this crop in the Caribbean, is highly warranted.

(iii) Sweet Potatoes

Whether one should first emphasise sweet potatoes or yams in the root crop group, is debatable. I am inclined to recommend sweet potatoes because of its wide adaptation easy production and use both as a food and feed. By taking the sweetness out of it, and selecting for a "mouth feel" similar to what we have done with the Irish potato, this root crop could become the basic food crop of the Caribbean. Definitely, a regional research team should be constituted for the improvement of this crop. Some excellent work along these lines is under way in Mayaguez. Perhaps the central axis of a co-operative

regional programme could be established there.

(iv) Tomatoes

The vegetable most widely used in the Caribbean is the tomato. It is not the most nutritive, but one in great demand. It fits in excellently with small farm production systems. Varieties that can be grown year round, are badly needed. The International Vegetable Research Centre, headquartered in Taiwan, has made a good start in the development of such varieties. No doubt they would be glad to backstop a small team in the Caribbean, dedicated to tomato improvement. I would recommend that this is considered.

The regional commodity teams obviously must work closely with the regional production systems team working at the grass roots level. For maximum efficiency, there must be a close interaction between them.

Up to now I have said little about livestock production. Based on my own observations, there is considerable emphasis being placed on livestock research in the area, leading to the greater production of animal proteins and more complete utilisation of natural resources. Here, like in the case of crops, there is a lot of research capacity that could be more efficiently exploited on a regional basis.

As evident, there are many commodity research programmes that may be warranted, but the important point is to get some of them started now. There is no way in which the individual countries alone can develop what they need. It must be a collaborative effort. Collaboration leads to understanding and understanding leads to trust. A few regional research programmes got underway and successfully executed, would open the way for others.

I believe that a number of regional commodity research programmes could be got underway fairly easily with the backstopping of the International Centres. A dynamic leader for each commodity or group of commodities is the first essential. He is the key to success. One man well chosen and adequately supported for travel, workshops, etc., with the help of the International Centres, could rapidly build a thriving co-ordinated network of national research scientists focused on a well defined objective, useful to all.

Administration or Management of the Actions Proposed

If you know what you have to do and how you have to do it, administration or management becomes easier. Nevertheless, it is still going to be a difficult task and an efficient administrative system is not going to come overnight. It will have to evolve along with the two main actions proposed. How it evolves will, no doubt, vary from one country to another, in accordance with its political framework.

For example, how might the model function in the East Caribbean region. The key unit, in my concept, is the "Productivity Centre" (Centro de Produccion in Figure 1) in the defined area approach - an area centre for applied research and technology transfer. The establishment and operation of a productivity centre is definitely a function of National governments or more precisely, the Ministers of Agriculture. Each island in the East Caribbean region could be considered as a defined area within the model. Each would have its productivity centre and its defined sub-areas. The larger islands may need more than one centre. The Director of a Centre must be a highly versatile individual - a co-ordinator, a facilitator, a converger, all in one - and, above all, an individual that knows how to handle people. You will recall that earlier in my paper I proposed a regional team (or two teams, depending on how the Caribbean region may be divided), to assist interested governments in the development of a Productivity Centre. This team, if formed, will need to be anchored to some appropriate institution within the region. Some regional or international agency will need to employ and administer this team.

Success or failure of the entire model, will depend upon how effective the national centres carry out their mandates.

One of the main purposes of the regional commodity programmes (or programmes organised to solve a particular problem complex) would be to backstop these centres through the regional development of varieties and agronomic practices adapted to the different areas on the solution of a particular problem common to the region. The actions of the commodity (or problem complex) teams would be greatly influenced by the feedback from the productivity centres.

The success or failure of a co-operative regional commodity programme would depend upon its leader. The leaders, once they are jointly identified by all concerned, could be employed by the International Centre complex or by some other international agency.

The initiative for the development of a blueprint for the operation of the various components of the model must come from the area itself. The model proposes two distinct, although closely related actions, in regard to agricultural research and technology transfer. I believe that in the successful administration of the two kinds of action, we must keep in mind that there are four basic principles involved in the success of any programme:

(i) It must have a definite clearcut focus. What the programme is supposed to accomplish must be clearly defined.

(ii) The team to carry out the established focus must be selected and composed precisely as needed, to realise the objectives desired.

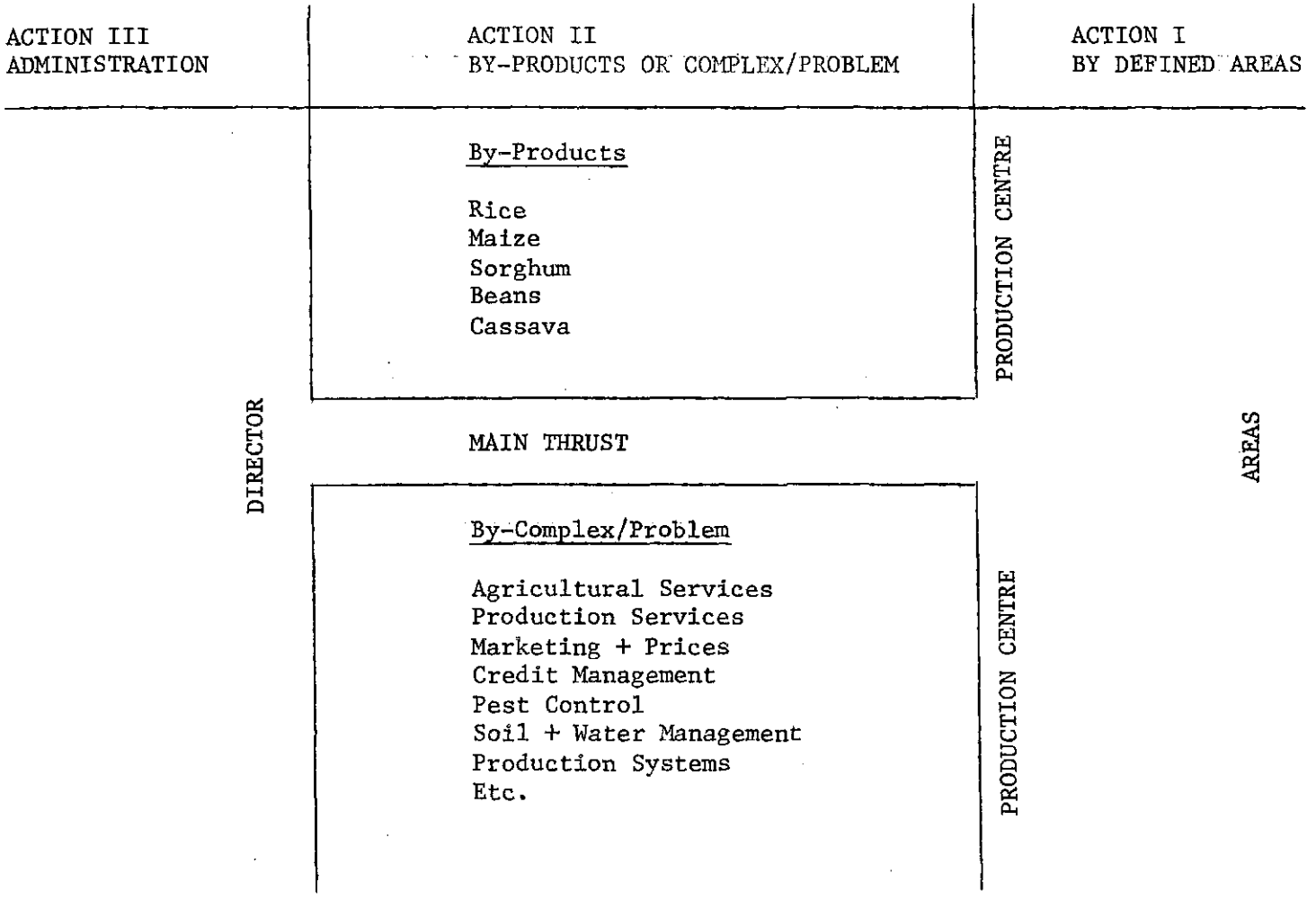
(iii) The team must be adequately supported; their operational support must not only be adequate, but also flexible.

(iv) If the previous three principles are satisfied, then the team must be given freedom of operation. If you can't give it freedom of operation, then you have not correctly composed the team.

As you may have noticed, although I have spent a great deal of time in the Caribbean this year, under the auspices of UNICA, I have said very little about the role of this association. Some agency will need to take the initiative for the development of the blueprint and for keeping it on track. UNICA, for sure, will definitely have a key responsibility for the development of the manpower resources at the professional, sub-professional and farm operator levels.

I hope to have my report to UNICA ready in the very near future. This report will deal in detail with my observations on the institutional capacity research and transfer of technology within the region as a whole and with the role of UNICA and other regional or international agencies in the strengthening of the various activities needed or underway in making the Caribbean region a better place for people to live and work.

Figure 1: A MODEL FOR THE SYNCHRONISATION AND CO-ORDINATION OF ACTIVITIES IN AGRICULTURAL RESEARCH AND TECHNOLOGY TRANSFER



J. Research and Technology in Latin America

(Mariano Segura - IICA)

Introduction

The evolution of agricultural research in the more advanced countries of Europe and the United States of America helped to shape the basic orientation of agricultural experimental stations in Latin America, especially during the first part of the present century. The domestication of the plants and animals which accompanied the colonizers intensified the relations between the continents of America and Europe, and in the process, led to a wide exchange of genetic materials adapted to the new ecological conditions. By the same token they took from America, particularly Latin America, several species of domesticated plants which are basic food today. All these processes involved some sort of adaptive research at that time.

Basic Concepts

The concept of the liaison between the generation of technology and its transference operates in a great number of Latin American countries and can be considered as a continuum of identifiable stages, viz. knowledge, generation, validation, diffusion, adoption and finally, evaluation of the degree of impact produced.

"Knowledge", which is the first stage, refers to the existing information in various forms; written, oral or existing in the field known by the farmers in each locality. This knowledge should be carefully evaluated prior to projecting the actions for the generation of new technology.

The "generation", the second stage, is the mechanism which provides new alternatives or procedures which originate efficient technologies that contribute to the improvement of agricultural productivity. The generation in turn could be grouped in generation of isolated technology, generation of technological packages and generation of technology at the level of the farm unit. These technologies could be called technology of first, second and third order respectively.

The "isolated technology" of first order is that which provides results or achievements one to another, and contribute to increased productivity on a limited scale. These are the cases of the development of a new variety, or the control of an insect in a given crop, or the determination of a formula of fertilization for a specific crop and place, but which are not connected among them.

The "technological package" provides synchronized results for a determined crop and specific place, complemented with ecological and socio-economic information. In this way, the results obtained through the investigations are systemized for the crop including the related cost/benefit.

Finally, the "technology of the farm unit" provides the total or integrated results, considering the farm as a unit in terms of management and production and whose operating mechanisms are of an integral nature.

This focus is even more important when the farm is smaller and diversified. There the "isolated technologies" are important inputs but not sufficient by themselves, since the small farmer normally utilizes his farm in a diversified manner; therefore, all and each of the crops are important, as well as his animals, which as a whole constitute his operating universe. Considered in this way, we go from the simplest to the more complex operation in the matter of generation of technology. We know that the three forms of technology exist in Latin America, with circumstantial variations in accordance with the policy of each country, in the matter of generation and transference of technology.

The "validation" which is the fourth stage - is the process of transmission of results of the new generated technology, proved or validated in an authentic and ample way in lands of potential users or farmers.

The "adoption" which is the fifth stage - is the utilization of the new technology by the farmers. The degree and extent of adoption of the technology is in direct proportion to the degree of usefulness of the technology itself.

Finally the "evaluation" or the sixth stage is the mechanism through which the degree of the impact produced by the new technology is measured or determined in terms of productivity and benefits for the farmer.

The "feedback" is the process which may take place in any of the indicated steps or stages in relation to the preceding ones, as a mechanism of screening and improvement of the technology, which is to be put to the service of the farmer. In this context any of the technologies typified as of first, second and third order, operates on the same basis. Under this conception of the sub-system, the research organizations usually cover the first three stages, although they participate indirectly in the subsequent phases, especially in reference to the evaluation.

The extension services assume a primary responsibility for the diffusion and induction to the adoption, which are the fourth and fifth steps; ideally, they should participate principally in the validation and evaluation, cooperating in all other phases. The farmer, who is, in the final analysis, the one who produces the agricultural commodities, ideally should participate in the overall operation, with greater emphasis on the last three stages in order to give more fluency to the operational agencies in all the processes of generation and transference of technology.

Operational Structures

In the early days of the establishment of research and extensive services, the economic resources originated primarily from the stage, with very small participation by the private sector; this contribution is increasing but is not significant yet in the region. The majority of the institutions and organizational structures in some way are analogous in spite of ecological variations. In some countries the research and transference of technology are part of the same institution. Such is the case in Argentina, Bolivia, Colombia, El Salvador and Peru. In other countries they are in separate organizations as in Brazil, Costa Rica, Ecuador, Guatemala, Panama, Paraguay and the Dominican Republic. In another group of countries, in addition to being in separate institutions, research and transfer of technology, either or both are in various organizations. Such is the case in Chile, Honduras, Mexico, Uruguay and Venezuela.

This diversity of organizational structures responds to the necessities of each country at a given time, but the history of the organization of the

generation and transfer of technology indicates that the organizational structures are unstable, responding as they do to transient political decisions. The situation points to the necessity to develop within the national institutions the capacity to analyse the different structural and functional arrangements, to introduce the adjustments necessary, and to adapt them to the diverse and changing conditions in each country.

The advance of science, the emergence of new problems, the demands to produce more food and raw materials show clearly that the complex problems in agricultural research and extension urgently require the development of specific management and administrative capabilities, which can be met by diversified training and intensifying the exchange of experience acquired in Latin America.

Ecologically Complex Region

Latin America constitutes an ecologically complex region, a complexity which assumes greater proportions when the socio-economic and technological aspects are taken into account. It is difficult to extrapolate schemes from one country to another, particularly with the transfer of technology because of political, social and ideological barriers. However, there are prospects for functional co-operation between various countries, particularly those with complementary systems, common objectives and geographic proximity.

Constraints

The persistent and restrictive factors of lack of definition of technological policies, inoperative organizational structures, inadequate physical human and economic resources, lack of planning and scheduling of priorities as well as deficient diffusion mechanisms and the evaluation of results, all have to be rectified for the generation and transfer of technology.

Future Prospects

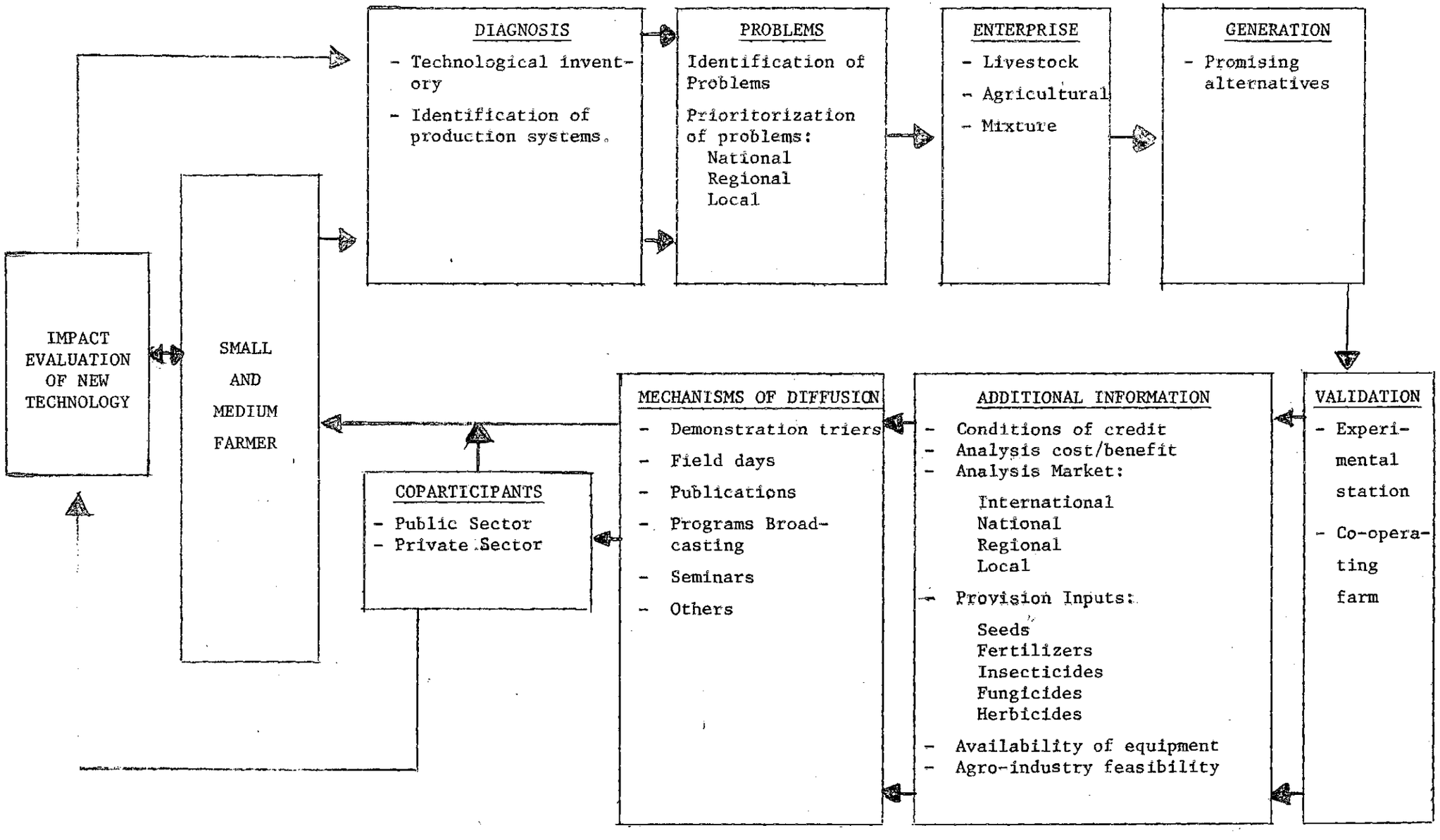
The transfer and application of technology at the farm level must be effected and made compatible within the constraints imposed by the organiza-

tion and resources of the farm and within the capability of the farmer. These farmers are most important when dealing with the small and medium size farmers in Latin America.

Conclusion

The history of scientific agricultural research in Latin America covers approximately a century of effort, which was followed later by Extension Services. The style and type of organization for research and transfer of technology has been conditioned largely by variable government policies which have to be responsive to each country's needs. Notwithstanding immense obstacles to be overcome, there is considerable scope for regional co-operation in research and transfer of technology, particularly between countries with similar ecological conditions. The conception of the farm as an integrated operational unit is essential to the successful transfer of technology to its operations.

OPERATIONAL PROCESS OF RESEARCH AND TRANSFER OF TECHNOLOGY



Note: 1. Feedback operates at any stage with respect to the precedent.
2. Training takes place along the diagram whenever is desired.

K. Regional Policy Perspectives For Agricultural Research*

Current Status and Problems of the Agricultural Sector

The importance and potential of the agricultural sector for the development of the regional economies are well-established. Despite its importance, however, the sector has been unable to realize its full potential as reflected by the region's declining production, a serious food deficit, and a growing inability to finance food import requirements.

The serious nature of the current situation is indicated by the following considerations:

(i) In 1979, food imports into the region were some US$550 million and the food trade deficit was US$95 million, when ten years earlier the region was a net exporter of food. It is projected that the food import bill will double by 1990 if present trends continue;

(ii) Though the agricultural sector continues to be the largest sectoral employer of labour, declining production, accompanied by reduction of agricultural land under cultivation, has contributed in large measure to growing unemployment, increased urban congestion and high levels of malnutrition. In the last regard nutritional studies have indicated that some 44 percent and 56 percent of the population do not obtain minimum recommended levels of protein and calorie requirements respectively.

The Report of the Caribbean Group of Experts and other studies, have implicitly and explicitly indicated the causes of the poor performance of the region's agricultural sector. These can be summarized as follows:

(i) The uncompetitiveness of traditional export commodities in international markets and the failure to diversify the export subsector;

(ii) Generally weak marketing infrastructure and institutions;

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* Prepared by Dr. W.J. Phillips, CARICOM Secretariat.

(iii) The inability at the national level to bring to bear effective programmes for the stimulation and growth of small and medium sized farms; in particular, the failure to use land reform to adjust farm sizes to the changing structure of demand;

(iv) Inappropriate pricing and import policies which provide little scope for productivity or consumption adjustments;

(v) An unacceptably high level of post-harvest losses;

(vi) Lack of concert between regional and national arrangements; and

(vii) Lack of development of human resources.

It is quite clear that the countries of the region must revitalize their agricultural sectors towards reducing food imports, improving nutritional standards from domestically-produced food, and increasing export earnings.

Areas for urgent national level consideration are:

(i) A recognition that agriculture must be science-based with attention to research, increased use of technical input packages and storage conditioning and preservation facilities. Since substantial investment is required to establish infrastructure, increase and move production, the agricultural sector must be given more importance in national budgeting, and project implementation mechanisms must be strengthened;

(ii) Small and medium-sized farm productivity improvements will be critical to improved food production in the future. As such, appropriate methods, including Land Reform and Tenure, must be used to develop and provide these farms with packages of services;

(iii) Commodity pricing policies have served to curtail production levels and new investment in agriculture. In this regard, such policies should be monitored and reviewed from time to time;

(iv) Definitive decisions need to be taken concerning uncompetitive traditional export crops in relation to diversification and productivity improvements;

(v) Educational and information systems should play a greater role in changing consumption patterns towards utilization of nutritionally important domestic products as against imports;

(vi) Measures must be taken to substantially reduce post-harvest losses;

(vii) Firmer measures need to be taken to curtail praedial larceny, in recent years an increasing depressant on agricultural production.

The Regional Food and Nutrition Strategy

In 1974, the four MDC Governments of CARICOM, towards activating the process of rationalization of the agricultural sector, established a Working Party charged with the task of:

> "developing a specific plan for the increase of food production in the entire CARICOM area to achieve within the shortest possible time the greatest measure of self-sufficiency in the region..."

The proposals of the Working Party, subsequently known as the Regional Food Plan, revolved around the concept of combining complementary regional resources in a concerted effort to meet the region's food needs. Inter alia, the proposals recommended the establishment of a commercial corporation (the CFC) to undertake production programmes and a work programme for the Corporation involving some eleven project areas. Initially, the Food Plan was conceived as developing a "master plan" for the regional agricultural sector. However, the experience in developing same and the conditions underlying its development, as well as the need to conceptualize a framework and methodology for identification and integration of projects led the Standing Committee of Ministers responsible for Agriculture (SCMA) in 1975 to devise certain guidelines for its derivation:

(i) The Food Plan represented the continuing evolution of a strategy of development of the regional agricultural sector through the co-ordination of national policies and the implementation of national level projects (country programmes) to satisfy regionally-defined objectives;

(ii) Bulk purchasing and distribution of agricultural inputs

(iii) Production of seed and other propagating materials;

(iv) Oils and Fats subsector.

The evolution of the Regional Food Plan has been against a changing political, economic and social environment. In practice, a "Plan" will perhaps never be finalized; rather, underlying approaches will be periodically

updated and modified in face of change and expertise. Of major importance, however, is the framework which is provided for establishing priorities and identifying major issues to be resolved towards the objectives of meeting the needs of the agricultural sector.

This framework has now been provided by the Regional Food and Nutrition Stragety (RFNS) adopted in 1982 by the Member Governments of CARICOM. The Strategy adopts a multisectoral approach incorporating Agriculture, Health and Nutrition, Education and Communication components. The objectives of the Strategy are consistent with regional objectives for the agricultural section and can be summarized as follows:

(i) Increased regional food production;
(ii) Reduced expenditure of foreign exchange on food imports;
(iii) Increased foreign exchange through exports;
(iv) Increased employment; and
(v) Increased nutritional status of the region's population.

A summary of agriculture component of the RFNS is reproduced at Appendix I. Essentially, the approach begins with current and proposed national and regional activities under the various subsectors earlier mentioned, and seeks over time to identify and encourage implementation of those projects and programmes which would impact on the areas of domestic production, post-harvest losses; improved marketing infrastructure; improved processing infrastructure; and export earnings. Associated activities on a regional basis like in the areas of Training, Research and Development, Agricultural and Trade Information Systems; and Financing and Credit.

Agricultural Research And The RFNS*

Increasingly, one can detect four strands of agricultural policy perspectives predominant in the region. These are drawn from national plans, and underlie the thrust of the RFNS in its overall objective of increasing regional food production and food security:

(i) Diversification of the sector - new commodities to form part of the food system; new exportables; development of local underutilized plant species for direct consumption or industrial uses; new uses for traditional products; by-product utilization;

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* Regional Food and Nutrition Survey.

(ii) Nutrition improvement - utilizing as far as possible domestically produced foods;

(iii) Productivity increases, especially on small and medium-sized farms;

(iv) Employment and income growth in the sector.

It is not clear to us that these considerations in themselves comprise sufficient considerations for the development of research programmes. Obviously, much more detail would be required in terms of identifications, priorities, etc., and for planning and programming purposes. Insofar as they accrue in any one country, some perspectives may be conflicting, but this really raises the point that they need to be considered together. Yet, apart from specific identification of commodities or projects, they can form the basis of preliminary identification and provide the scope for researchers in the region to work out packages towards influencing goals for agricultural policy.

Within the work currently being pursued under the Agriculture component of the RFNS, several areas have been identified for research activity under the various subsectors. Given the perspectives outlined above, research clearly has a significant role to play in the short and long term towards successful implementation of the RFNS. Specific areas are outlined below:

Crops

(i) Disease resistant varieties especially in the area of vegetables, optimally multiresistant varieties;

(ii) Drought resistant varieties, especially for countries where water supplies are limited;

(iii) Identification of crops and systems appropriate to multiple cropping;

(iv) Selection of crops and cultivation systems which facilitate harvesting;

(v) Pest and disease control practices;

(vi) Development of spice cultivars and other plant species from which essential oils can be extracted;

(vii) Development of seed - varietal selection; breeding programmes;
(viii) Improving storage life of crops.

Livestock

(i) Animal breeding for both adaptability and productivity;
(ii) Animal health;
(iii) Forage based systems utilizing indigenous feed materials;
(iv) Milk/meat production systems for small farmers;
(v) Appropriate crop/livestock mixes on small farms.

Other

(i) Systems of irrigation suitable for small farms;
(ii) Use of food trees for soil conservation purposes; soil terracing.

Some Other Considerations

(i) If research in the physical, biological and engineering sciences is to be successful at the point where the results are most important, it must be associated with two other types of research, often neglected, but necessary for successful adoption of new practices.

(a) Sociological and economic research - either as part of the technical research programme or in tandem with it. Such work is critical to determine which technologies are likely to be acceptable to farmers; which products to consumers; what particular resistance to innovation is probable and what special efforts are required to encourage the use of technical research results. These inputs would serve well the design of appropriate technical research strategies especially in relation to small farmers. Similarly, technical research on non-traditionals must be continuously supported by market research;

(b) Research on methods of preventing outbreaks of pests and diseases - methods of diagnosis and control; establishment of early warning systems.

(ii) Given the importance of mixed cropping in the region, there is a need for intensifying basic research to obtain varieties which would adapt efficiently in mixed or multiple cropping systems;

(iii) Increased agricultural production must be accompanied by adequate product conservation systems both in field and post harvest. Production fluctuations within the region may well in practice be due to climatic and pathogenic factors making for irregular supplies. Storage and conservation should, therefore, feature in any research programme geared towards ensuring regular harvests.

(iv) If agricultural production is to increase to meet growing demand, much greater financial inputs than currently provided would be necessary. While it may be claimed that this is not sufficiently appreciated by policymakers, especially those involved in allocating resources, it is also true that researchers themselves do not sufficiently sell the necessity and utility of their product. Consequently, they find themselves unable to influence research policies or decision-making. The challenge to researchers is to convince policymakers of the contribution of research to policy objectives and goals. To do this, the researchers need to constantly evaluate their work and its contribution to the society.

(v) The need is now urgent for the establishment of a system which allows for effective collaboration of research organizations within the region and between the region and international research institutes. Within the region, there are a diverse group of institutions engaged in agricultural research at the national and regional levels, including international agencies. Rationalization of the activities of these organizations seems most desirable to avoid duplication of effort, reduction in wastage of resources, pooling of resources directed towards the solution of common problems, and better dissemination of results. Appropriate organizational arrangements for co-ordination must be determined involving the body of research personnel in the region.

APPENDIX I

PROGRAMMES OF STRATEGY

This chapter presents summary analyses of the nine programmes of the Strategy. The overview of each programme is presented within the context of a Food Chain Matrix in the following sequence:

(i) Major problems to be addressed;
(ii) Approaches proposed for the solution of these problems;
(iii) Anticipated targets;
(iv) Executing agencies; and
(v) Supporting agencies.

Programme I: Increased Production and Availability on Food

Major Problems

The increased availability of food at the regional, national and household levels is crucial to the correcting of the nutritional imbalances identified in the earlier sections of the document. Not only must an increased quantity of food become available, but it must be of the right type and be available at the appropriate time, place, price and form. It will be necessary not only to raise the levels of food availability but also the levels of domestic food production. The proportion of local food production in local consumption must be raised, since this will serve to improve rural incomes, employment and development, expand domestic output and reduce foreign exchange expenditure on food imports. Indeed, it is very unlikely that the Caribbean Community as a whole, would be able to increase its food intake without raising the level of domestic food production.

Additionally, it is recognized that certain critical food commodities, in particular cereals, as well as production inputs will need to be imported. As such, it will be necessary to export food commodities which will earn foreign exchange to pay for these imports and also investments in other areas of the economy, since many of the economies of Caribbean countries are largely agricultural.

This programme is therefore designed to address the problems of inadequate domestic food production and the low and declining exports of traditional and non-traditional food commodities.

The programme also addresses the problems associated with the marketing of these food commodities domestically, regionally and extraregionally. The major marketing problems are the poor domestic distribution of food commodities, inefficient intraregional trade, the unfavourable terms of trade (relative prices) for traditional export crops and the expansion of exports of non-traditional commodities.

Approach

The approach adopted in the design for increased food production and availability in the region is based on two considerations:

(i) Development of a general framework within which increased production and efficient marketing will take place; and

(ii) Within that general framework, the identification of various programme components leading to the development and implementation of production and marketing activities at the regional and national levels.

Considerations at (i) would lead to the development of a framework in which land, human and other resources can be allocated to the production of food, especially those of nutritional importance (high calorie/protein density and high nutrient/cost ratio) in order to satisfy current and projected demand, giving due consideration to the need to maximize foreign earnings, net farm-gate income and total employment.

The general framework is based on a resource allocation model which provides information on the relative benefits and costs that could accrue to the region if it chooses, for example, to pursue a policy that maximizes foreign exchange savings as an alternative to one that pursues maximization of total employment. In essence, it gives quantitative notions about the respective trade-offs among the various policy/development objectives and therefore allows the determination of production patterns which satisfy demand and nutritional criteria. Similarly, the framework should also allow for the efficient distribution of food through the market mechanism.

The programme components identified in respect of (ii) are presented below:

(i) Increased domestic production of food, especially nutritionally important commodities.

This will be indicated by a 2 percent per annum increase in the production of agricultural commodities (including fish products) for the local and export markets. Achievements of this target depends on the speed with which the following activities can be implemented:

(a) The provision of an effective extension service, viz. improvement in the farmer/agent ratio as well as adequate credit supervision;

(b) An increase in supply of inputs to farmers, including seeds, feed, fertilizer, insecticides and effective credit;

(c) The provision of more effective incentive schemes. Important areas for emphasis are - a change in the basis of the price support system and subsidy programmes to favour nutritionally important commodities, development and implementation of agricultural, insurance schemes, as well as the reduction of praedial larceny;

(d) Accelerated land reform programmes as well as programmes to increase efficiency of production through the application of appropriate technology within the framework of an integrated rural development programme.

(ii) Reduced post-harvest food losses

Considerable losses occur along the food chain. Estimates range from 20 - 48 percent and vary according to the particular food type. Significant reductions in the magnitude of these losses require action in the following areas:

(a) Development of methods and techniques for identifying post-harvest losses;

(b) Improvement in control measures for storage pests and diseases;

(a) Increase in efficiency of production through the application of improved technology. In those countries where land is limited, it is not envisaged that additional land would be allocated to the production of traditional export commodities for extraregional markets;

(b) Efforts at increasing the stability in the export market. This would involve negotiation of commodity agreements which include price indexation and quantity guarantees;

(c) Increase in the supply of labour available to the agricultural sector. Increased intraregional mobility of labour and a reduction in urban/rural migration, among other things, are desirable in this regard.

The other major programme component to be tackled here is increasing the volume of exports of the non-traditional export crops. Since these crops are to a large extent, produced for domestic consumption, the success of this activity is closely linked to the rate of increased domestic food production.

Targets

With the effective implementation of this programme, it is expected that a minimum of 80 percent of the energy and 60 percent of the protein consumed would be supplied from regional sources by 1990 and that there would be available on a daily basis in the regional market by 1990, the recommended per capita dietary allowance of protein and energy in the appropriate energy/protein ratio (2,600 k calories/65 grams).

Executing and Supporting Agencies

The national Ministries of agriculture will have the prime responsibility for this programme. A range of other supporting agencies will execute various activities in support of the objectives of the programme.

L. Regional Networks: The Southern Cone Project in South America

(John A. Pino - I.D.B.)

The purpose of this session is to deal with some concepts of regional co-operation and collaboration in Agricultural Research.

Beginning with the first day of these meetings, we heard the presentation of the provocative and stimulating paper of Dean Wilson, and in addition, many other ideas since then that could (and should) be built into the conceptual framework of an operative and productive regional interaction. I am reminded too of the forceful admonishment of the words of the Honourable K. Mohammed to the agricultural research community, that research must deal with urgent as well as future problems - that research expenditures must have a payoff, and that the state of Food and Agriculture in the Caribbean countries will require making some difficult policy decisions and structural changes.

Even though this is not my first exposure to the Caribbean research community, one cannot help but be impressed, if not overwhelmed, by the large number of institutions which have varying responsibilities for one or more functions related to agricultural development. However, therein lies a richness of talent and resources upon which to draw. Perhaps, out of this mosaic, this plurality of agencies, can be structured a clear design for cohesive effort. But that design must originate from within the countries themselves.

Another observation that needs to be made concerns the funding and technical assistance agencies. The multiplicity of these agencies in the region, each wishing to identify their own "key successful" projects most without relationship to one another are perhaps doing a disservice to the countries of the region. Each one demands the time and energy of the best available talent. We, the funding and assistance agencies, could do a much better job of being responsive to country and regional needs particularly with regard to priority issues and continuity of effort.

I would like to say a few words about priority issues. Everyone would agree with the observation that research and technology alone will not resolve the food, nutrition and production problems of the several countries.

There is a continuum which extends from basic national goals, as perceived by the people and their leaders, through the definition of policies and laws, regulations and procedures.

The issue of human talent is vital and well recognized. The issue of institutions and institutional relationships including research, teaching and extension is highly important. The issue of support structures such as credit agencies, seed fertilizer and other input sales organizations is also important. The issue of marketing, processing, storage, etc., is also important. If this group focuses its attention on research policy and management and identifies some manageable objectives, perhaps we can achieve some progress. Similar groups addressing the other issues and with some interaction, perhaps at the ministerial level should be formed. A management principle is to dissect a complex problem into its component parts and bring potential solutions together. The key here is management dissection at the ministerial level. Since the task of this group is to find ways of strengthening the research activity not limited only to biological research, my comments are directed toward that end.

Our charge in this session is to describe certain activities which may be useful in defining workable mechanisms for regional co-operation in agricultural research. There have been many efforts at regional co-operation, and I do not pretend to be familiar with all of them. The PCCMCA, an informal association, goes back more than 25 years. Of more recent vintage are: the Southern Cone Project sponsored by IICA, the IADB and the countries of Brazil, Argentina, Chile, Paraguay, Uruguay and Bolivia; the regional programmes of CIP - Precodepa and Procipa; the REDINNI project which is in the stage of becoming operational encompasses the Amazonian region. The most recent regional initiative in this hemisphere is the Andean Zone project. Research directors from Peru, Ecuador, Colombia, Venezuela and Bolivia met last week in Lima and have set in motion the formal process for research co-operation in maize, legumes, potatoes and oil seed crops. The headquarters for the operation will be in Quito. The project will be funded by IADB and IICA and the participating countries.

The Southern Cone Project has now been in operation for 4 years. It is about to enter a second cycle of 4 years which has been called the consolidation phase. During this second phase, some additional commodities will be added to the

original group of four, but limited to approximately 20 percent of the total effort. More importantly, financial responsibility for the activity will largely be assumed in the fourth year by the participating countries.

The basic conceptual framework of the regional co-operative project rests on the premise that the sharing of scarce human and other resources in the resolution of common problems is desirable and possible. There has to be agreement among the participating parties to support agreed-upon programmes, each identifying existing strengths which are complementary to those of the others. The mutual interaction horizontally is strengthened by the vertical infusion of knowledge, experience and resources from agencies outside of the region.

The general objective of the programme is to strengthen agricultural research capacity of the participating countries through active co-operation and exchange among institutions of that region. Specifically, the objectives are:

(i) To promote the sharing of human resources to address common problems through a division of labour;

(ii) To establish a permanent mechanism to facilitate co-operative interaction;

(iii) To strengthen linkages with the International Centres;

(iv) To strengthen national research programmes and methodology;

(v) To assist in building additional human resources;

(vi) To develop and deliver useful technology to assure growth in the agricultural sector.

Characteristics of the Programme

The Southern Cone Project originated with the initiative of the participant countries who have assumed responsibility for its direction and future continuation. Some characteristics of the programme are the following:

(i) Structure

(a) The Directive Council is composed of the Directors of the National Research Institutions of the participating countries;

(b) The Programme Director is chosen by the Directive Council. He is an agricultural scientist who is a native of one of the member countries, and is an experienced research manager;

(c) The Commodity Programme Co-ordinators: There are four Commodity Programme Co-ordinators at the international level. Each is a full-time person and is located in his country of origin. In the Southern Cone Project the Co-ordinators have been provided by Brazil and Argentina;

(d) The National Programme Co-ordinators: Each commodity programme has a national co-ordinator who is the national leader of the research programme in his country for that commodity;

(e) The Research Scientists are the staff of the country programmes.

(ii) Programme Priorities

The programme priorities are determined by the Directive Council. Generally, these are chosen on the basis of:

(a) Commonality of interest based on the importance of the commodity;

(b) Availability of human and other resources to carry out the programme.

(iii) Programme Activities include:

(a) Research;

(b) Scientist exchange;

(c) Training;

(d) Workshops and seminars;

(e) Information and documentation exchange.

(iv) Project Administration

(a) The Programme Director is responsible for the administration of the project;

(b) Administrative support and services are provided by IICA.

(v) Funding

(a) Participant country funding includes costs of:

i. In-country programme staff salaries;
ii. Commodity programme co-ordinators salaries;
iii. Research and training facilities;
iv. In-country research programmes.

(b) International funding:

i. IDB provides for support of scientist exchange, training, seminars and workshops, consultants and experts;
ii. IICA provides for salary of Programme Director and logistical support.

(vi) Project Evaluation

(a) Independent external evaluation;
(b) Periodic internal evaluation and definition of accomplishments.

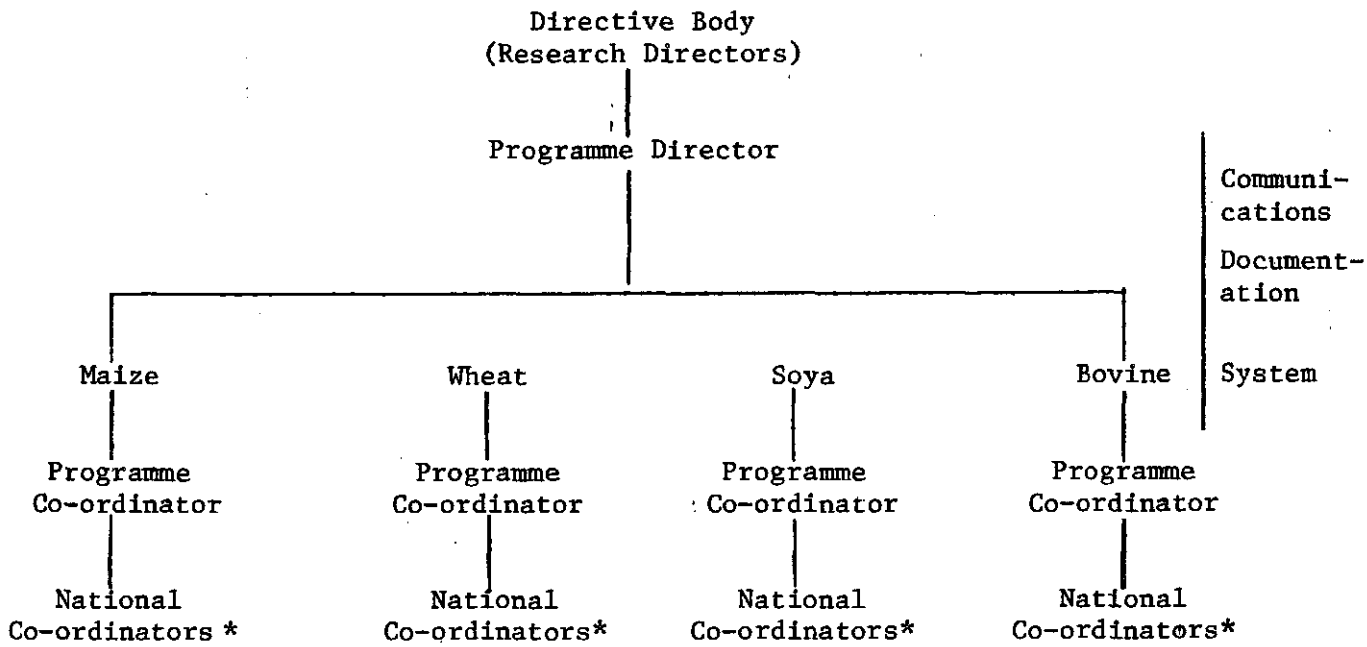
Advantages and Expectations of Regional Programmes

(i) The pooling of human resources leads to expanding the information base and the need to facilitate handling of information and documentation;
(ii) Facilitates rapid exchange of scientists and materials;
(iii) Improves linkages to other research systems, re IARCS, others;
(iv) Gives a great boost to morale of scientists and provides great stimulus to do better research;
(v) Provides a focus for problem solving and attention to technology transfer.

Finally, it is necessary also to point out that regional co-operative programmes pose some major decisions and cannot be entered into lightly. They are not a substitute for a well-structured national programme, appropriate for the particular country. Regional co-operative programmes can be complementary and supportive to national programmes. Regional programmes place demands on scarce talents. They require adequate local support. There must

be agreement on the activities to be included which while visionary should be modest and realistic. All partners must be prepared to give as well as to receive benefits. The members of the Directors' Council must take a special interest in the programme because they are the key decision-makers. The programme co-ordinators play a vital role in giving strength and cohesiveness to the effort. Careful planning, clearly defined objectives, aggressively executed programmes and periodic refinement of project operations should be the hallmarks of regional co-operative programmes.

Organizational Scheme Southern Cone Project



Activities:

1.	Research Priorities	
2.	Workshops/Seminars	30
3.	Professional Exchange	70
4.	Specialist support:	
	National	42
	International	12
	IARC's	24
5.	Training:	
	In-service	40
	Awards Special-ized Centres	40

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* National Co-ordinators in each participating country: Argentina Brazil, Bolivia, Chile, Paraguey, Uruguay.

M. The Role of the Commonwealth Institute of Biological Control in the Caribbean and Latin America

(F. D. Bennett and M. Yaseen - CIBC)

Introduction

The Commonwealth Institute of Biological Control (CIBC) is one of the four Institutes and ten Bureaux comprising the Commonwealth Agricultural Bureaux which has provided services to world agriculture since it was set up in 1929 to co-ordinate and administrate agricultural information, identification, biological control and other services to agriculture on behalf of the then British Empire. CAB is presently supported by twenty-eight Commonwealth countries.

While all other CAB units are U.K. based, CIBC with its Headquarters in Trinidad since 1962 operates a network of strategically located stations and sub-stations to obtain biocontrol agents on a global basis as efficiently and economically as possible. Its main stations are in India, Pakistan, Kenya, Switzerland, England and Trinidad.

As part of the recent and ongoing restructuring of CAB, CIBC has developed a unit at Silwood Park, England, with plans for a gradual transfer of administrative matters to the U.K. and the broadening of the scope of CIBC activities to include other aspects of Integrated Pest Management. To provide added expertise, links have been forged with the Silwood Centre for Pest Management, the Glasshouse Crops Research Institute and the Institute of Virology.

The U.K. Government has now accorded CAB status as an International Agency, thereby increasing the scope of CIBC which is free to contract biological control and IPM activities on a global basis.

CIBC Services

Under its terms of reference, the CIBC provides information and advice on biological control, undertakes research and implementation programmes on biological control of insect pests and weeds and participates in integrated pest management programmes in association with other agencies. It also holds training courses and has a role in other training activities including the supervision of M.Sc. and Ph.D. students from universities such as UWI, which recognises its stations and staff as competent for this purpose.

The CIBC receives half of its core funding from the contributions of member countries to CAB and the remainder from payments for its services.

CIBC retains a relatively small permanent core staff. This enables us to recruit the most appropriate specialists to undertake contract investigations. In addition to its own staff, the CIBC is able to call on assistance from the Commonwealth Institute of Entomology, the Commonwealth Institute of Parasitology and the Commonwealth Mycological Institute. Similarly, CIBC units based in other countries collaborate and co-operate with local government and other scientific organisations. For example, mycologists from CIM assisted CIBC by undertaking exploration for pathogens of Russian thistle in Pakistan, and of another composite weed Parthenium Hysterophorus in Mexico during 1982.

CIBC has an Information Officer based at CIE to provide information on biological control in addition to its main duties of producing "Biocontrol News and Information", a quarterly abstract journal on biological control and initiating work on a computerised catalogue of natural enemies of pests and weeds which can be continuously updated.

CIBC services are well-recognised and projects or consultancies have been supported by various international funding agencies including IDRC, CIDA, ODA, USDA, FAO, CFTC, GTZ.

The Role of CIBC in the Caribbean

Within the Caribbean, CIBC under earlier titles commenced activities about 1930 when J. G. Myers undertook exploration, and discovered the so-called Amazon fly which led to the successful biological control of the sugar cane borer in Guyana. In 1947 CIBC opened its West Indian Station at ICTA, built its own laboratory in 1961 and a new laboratory office complex with CIDA funding ten years later.

Since its inception, the West Indian Station has been actively engaged in biological control of insects and weeds of the region and also in "exploiting" natural enemies of the region to control pests and weeds in other countries. With the Caribbean region, CIBC has achieved a considerable measure of success. Its activities have led to the successful biological control of sugar cane borer in Barbados, to the highly successful control of citrus blackfly in Barbados and Jamaica, the cottony cushion scale in St. Kitts, prickly

pear cactus in the Leeward Islands, and of puncture vine in St. Kitts, etc.

CIBC collaborates with local, regional and international organisations operating in the Caribbean. While CIBC in the past has been engaged mainly in classical biological control, its present mandate permits it to pursue other aspects of past management. For several years the CIBC West Indian Station has participated in a joint project on IPM of vegetable pests funded by the Ministry of Agriculture, Lands and Food Production of Trinidad and Tobago. It has supplied nucleus cultures of parasites of sugar cane pests of SAC members including Caroni. CIBC has supplied cultures of natural enemies and served in an advisory capacity on biological control matters to CARDI. We welcome this co-operation and collaboration and wish to be more closely involved with other regional research organisations such as CFTC, CARDI, UWI, Universities, etc., and execution of agricultural programmes in the region.

An annual account of its activities can be found in the CIBC Annual Reports. The most recent for 1982-83 can be obtained by writing to the Director, Commonwealth Institute of Biological Control, Gordon Street, Curepe, Trinidad.

Recent CIBC Successes

Biological control overall is a highly cost effective method of control. Cost-benefit analysis indicates overall a very favourable return. However, all pest and weed problems are not amenable to biological control, and hence when negotiating for funding, there can be no absolute guarantee that success will be achieved. Nevertheless, each decade has seen several outstanding examples of biological control, where following an initial investment, perennial control has resulted.

For example, a CIBC study of oil palm pollination in West Africa resulted in the introduction of highly specific pollinators into Malaysia in 1980, and has led to spectacular results. Hand pollination has been discontinued and yields have been raised by 20 percent in the Malaysian Peninsula. Benefits with no further inputs required, have been assessed to more than U.S.$13 million per annum. The success has since been repeated in several other oil palm producing countries in South East Asia and the Pacific.

As a result of the introduction of specialised insect enemies from the Neotropics, water hyacinth, a major scourge on the Nile in The Sudan, has disappeared over long stretches of the river, where previously it blocked boat traffic.

CIBC has located and supplied natural enemies of cassava mealybug, a

Neotropical pest which in recent years has devastated cassava production in West Africa. Under a collaborative agreement signed by IITA, CIAT and CIBC, these are being distributed throughout infested areas in West Africa. Encouraging establishments of natural enemies has been achieved and successful control should ensue.

N. Collaborative Activities of CIAT* With National and Regional Institutions in the Caribbean: Proposed Strategy

(Gustavo A. Nores)

Introduction

The urgency to develop improved food production technology in the tropics led to the establishment of the International Agricultural Research Centres to serve and complement the actions of national agricultural research and development institutions. The Consultative Group for International Agricultural Research (CGIAR) was formed in 1971 to provide a mechanism for mobilising broad-based financial support for the international centres. Although four international centres had already been formed and were being supported at that time, creation of the CGIA signified the desire of donor agencies to continue long-term support of agricultural development in the tropics through a co-ordinated international centres' mechanism. A total of nine research centres (IRRI, CIMMYT, IITA, CIAT, CIP, ICRISAT, ILRAD, ILCA and ICARDA) and four research/research support institutes (IBPGR, IFPRI, ISNAR and WARDA) exist today.

Upon proposals by the Centre's Board of Trustees and acting on the advice of its Technical Advisory Committee - a panel of top-level scientists which broadly oversees the technical programme of the Centres - the CGIAR has approved the mandate of the individual centres and institutions so they complement each other in commodity coverage, geographic scope and institutional role. Within this arrangement covering most staple food crops in the tropics, CIAT has global responsibilities for common beans (Phaseolus vulgaris) and cassava (Manihot esculenta), and regional responsibilities in Latin America and the Caribbean for rice and tropical pasture species for acid-infertile soils. This paper aims at presenting and discussing CIAT collaborative research activities on these four commodities in the Caribbean region, and at analysing current limitations and the proposed strategy, with the main objective of benefiting from the comments of all workshop participants.

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* Centro Internacional de Agricultura Tropical

Objectives and Role of CIAT

CIAT's objectives are:

> "To generate and deliver, in collaboration with national and regional institutions, improved technology which will contribute to increased production, productivity and quality of specific basic food commodities in the tropics - principally countries of Latin America and the Caribbean - thereby enabling producers and consumers, especially those with limited resources, to increase their purchasing power and improve their nutrition."

This statement was developed to provide a condensed overview of CIAT's philosophy and operating objectives. While the Centre expects to be flexible in responding to future needs for agricultural production technology, the statement's points should be applicable over future years.

CIAT plans to continue concentrating on the generation and transfer of agricultural technology. This does not negate the importance of institutional, social and political changes, but does imply a confidence that modern science and technology can contribute significantly to solving food production problems.

The statement of objectives emphasises the Centre's strong conviction that accomplishing the desired results involves strong collaboration of national, regional and international agencies.

Effective agricultural research is a continuum encompassing activities from conducting basic research to monitoring farmers' adoption of improved varieties and cultural practices. This research continuum includes many interacting institutions conducting basic and applied research and extension activities. National agricultural research institutions and the international centres play important roles in this institutional complex.

Of the various institutions in the research continuum, none is more important than the national agencies involved in agricultural research and development. Only through strong national programmes can the new technology be jointly developed and evaluated under varied local conditions, modified as necessary and transferred to farmers along with the essential support services required to make the tech-

nology useful. CIAT strives to maintain cordial and productive collaboration with its primary partners, the national institutions. Moreover, the Centre works to strengthen the capacity of these institutions to carry out their functions as full and effective partners in the research continuum. Complementarity and co-operation are basic premises of the strategy.

It is essential that national programmes be strengthened and that international centres be involved in only those activities in which they have a clear comparative advantage and can most effectively provide a useful service to national programmes. CIAT's role in helping overcome technological and institutional constraints in its mandate commodities must be examined in this context.

Figure I displays the agricultural technology development process as four successive but inter-related stages - basic research, applied research, adaptive research and production. It also indicates the approximate extent to which CIAT and its principal counterparts, the national institutions, are involved within the process. Given CIAT's place between the more basic research institutions and collaborating national programmes, the Centre's activities must take two directions. First, CIAT must relate its technology generation efforts to developments in basic research conducted by other institutions.

Second, all of CIAT's interlocking activities, whether in research or in international co-operation, must be designed to support and supplement collaborating regional and national research/development institutions.

While there are understandable pressures for national institutions to spread their research efforts over a broad range of export, plantation and food commodities, the international centres concentrate on basic foods, and because of the division of labour among individual centres, have the luxury of devoting their efforts to only a few commodities. Thus by working with only a few crops, CIAT can make more rapid progress in developing technology for these commodities.

The Centre's role in relation to the four commodities of its mandate must aim at being additive and complementary as well as stimulative and catalytic. Explicit recognition must be made of the role and activities of all national, regional and international institutions operating in a given region. This is particularly true in the case of the Caribbean. Avoiding unnecessary duplication among the many institutions operating in the region certainly will

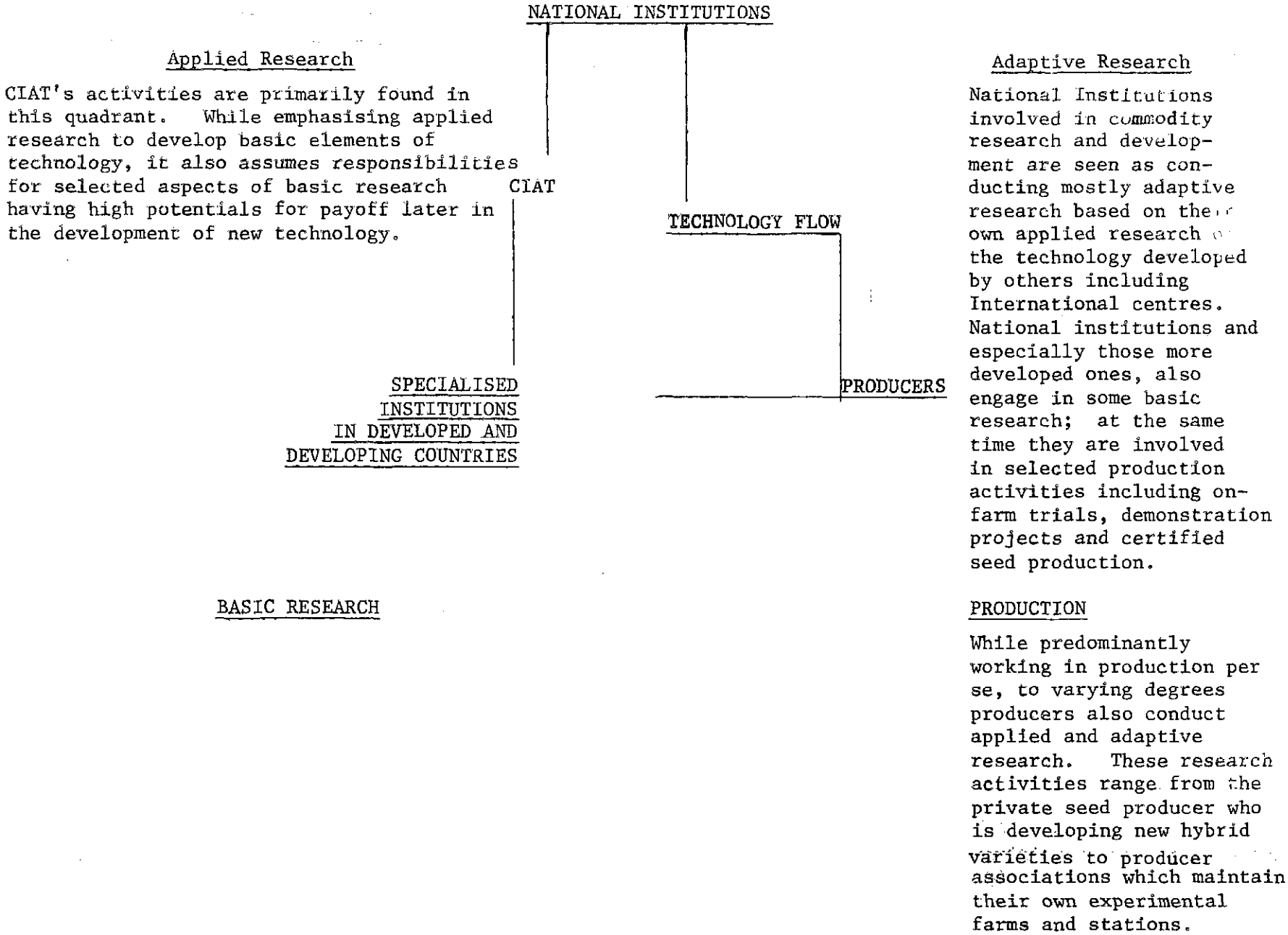

Figure 1: CIAT's location in the agricultural technology development process.

allow for a more cost-effective utilisation of the total limited resources available. CIAT's activities in the region, and the proposed strategy for the future, should be analysed within the existing institutional context.

Having analysed CIAT's nature, objectives and roles as we see them, let me now briefly summarise past activities in the region in order to be able to identify the limitations to be overcome through future collaborative activities.

Summary of Past and Current Activities

Collaboration with national and regional programmes could be expressed in terms of research (via germplasm transfers and evaluation), and training and information/documentation activities aimed at developing and consolidating research capabilities and research networks.

Germplasm Development and Evaluation

Analyses of production constraints of CIAT's commodities have indicated that of the possible research strategies, the largest impact on production would be generated by increasing the availability of improved germplasm adapted to environmental conditions and prevailing production systems, CIAT is involved in technology generation based on collection, customised development and supply of new germplasm. Development of non-site-specific agronomic components are co-ordinated with germplasm development activities. Site specific agronomic components are the responsibility of national programmes.

Table 1 summarises the number of accessions of beans, cassava (clones) and tropical pastures from CIAT's germplasm bank sent upon request to collaborating institutions. Table 2 summarises the number of specific nurseries of beans, cassava, rice and tropical pastures sent to countries in the region for evaluation. Results of these nurseries are normally evaluated jointly by national (or regional) programmes and CIAT scientists in special visits to the trial sites and in the periodic network workshops held at CIAT headquarters.

Even though the figures are significant, there is a long route to be covered inasmuch as all countries in the region have not been covered nor have improved varieties as yet reached, farmers' fields in significant magnitude although these are a few outstanding exceptions. Rather than listing the advances made through the collaboration between CIAT and the national and regional programmes in the Caribbean, and the ones to come from present collaborative activities which are indeed many and obvious to those of us familiar with these activities, I have purposely decided to emphasise in this presentation the need to strengthen and reorient them through more effective regional mechanisms of co-operation.

TABLE 1: NUMBER OF ACCESSIONS FROM CIAT GERMPLASM BANK SENT TO CARIBBEAN COUNTRIES. 1978-1982

Country	Beans	Cassava[1/]	Tropical Pastures	Total
Barbados		8		8
Cuba	302	179	133	614
Curacao	6			6
Dominica		2		2
Dominican Republic	658	46		704
Grenada	15			15
Haiti	29	88		117
Jamaica		15		15
St. Lucia		3		3
Trinidad and Tobago		1		1
Virgin Islands		32		32
Total Caribbean	1,010	374	133	1,517

1/ Clones

TABLE 2: NUMBER OF NURSERIES/TRIALS AND ACCESSION/VARIETIES INCLUDED IN COLLABORATIVES TRIALS IN THE CARIBBEAN, 1976 - 1982

Countries	Beans		Rice		Tropical Pastures		Total	
	Trials	Varieties	Trials	Lines	Trials	Accessions	Trials	Accessions
Belize	5	109	57	1,779	1	28	63	1,916
Cuba	17	256	43	1,819	5	130	65	2,205
Dominican Republic	18	243	29	1,883	5	132	52	2,258
Guyana			68	2,942	1	28	69	2,970
Haiti	11	126	27	1,203			38	1,329
Jamaica	8	110					8	110
Suriname			10	495	1	19	11	514
Trinidad + Tobago	3	33			2	38	5	71
Total Caribbean	62	877	234	10,121	15	375	311	11,373

Building Human Capital

A central strategy of the Centre since its beginning has been the strengthening of commodity research groups within national agricultural research institutions. By providing research training opportunities, CIAT can make an important contribution to strengthening its national counterparts. At the same time, training provides an efficient vehicle for the transfer of improved research and production technologies. Insufficient qualified manpower is one of the most serious limiting factors in development of new technology. Available data support the belief that many countries in the Caribbean have a low level of human resources available for research and extension, in relation to the value of agricultural products produced and consumed. Major responsibility for multiplying trained agricultural scientists continues to lie with universities in the region. Providing scholarships for advanced degree training should remain the responsibility of national programmes with the support of donor institutions. Some research institutions, particularly universities, emphasise academic, publication-oriented disciplinary research. This affects the orientation of professionals trained in these institutions. Joint efforts emphasising problem-solving, production-oriented, interdisciplinary research, can demonstrate that practical research is also highly stimulating and intellectually rewarding. CIAT has a comparative advantage in providing postgraduate training in specialised commodity areas and helping increase the available human resources in these particular areas.

Tables 3, 4 and 5 summarise the number of professionals from the region trained at CIAT since 1971. Even though numbers are significant, and in balance with the population of the region vis-a-vis the rest of Latin America (see Table 6) present needs exceed them by far. This is due to a number of reasons among which, institutional and job instability are, no doubt, the most important ones.

Information and Documentation

The linking of individual researchers and research groups through the establishment of research networks is a major mechanism for creating and maintaining research and development momentum for any given commodity. Commodity based research networks not only facilitate the exchange of information and materials between national and international levels, but

TABLE 3: NUMBER OF PROFESSIONALS TRAINED IN POST-GRADUATE COURSES AND IN-SERVICE AT CIAT, 1969-1983

Country	1969 1976	1977	1978	1979	1980	1981	1982	1983*	Total
Belize			4	3	1		3		11
Cuba			10	15	11	18	2	6	62
Dominican Republic	29	5	9	20	8	7	15	5	98
Guyana	3	1	2	1			2		9
Haiti	1			5	7	2			15
Jamaica	1	1		1			2		5
Suriname							1		1
Trinidad + Tobago			1				5		6
Total Caribbean	34	7	25	45	27	27	30	11	207
Total CIAT	667	186	285	301	266	212	214	126	2,257
% Caribbean	5.10	3.76	8.77	15.00	10.15	12.74	14.02	8.73	9.17

* January - August 1983

TABLE 4: NUMBER OF PROFESSIONALS TRAINED IN POST-GRADUATE COURSES AT CIAT BY COMMODITIES, 1971-1983[2/]

Country	Beans	Cassava	Rice	Tropical Pastures	Seeds	Other	Total
Belize	1		3	4	2	1	11
Cuba	13	12	9	20	5	3	62
Dominican Republic	16	18	6	16	22	20	98
Guyana		4	2	1	2		9
Haiti	3	4	4	1	2	1	15
Jamaica			1		3	1	5
Suriname					1		1
Trinidad + Tobago		1			5		6
Total Caribbean	33	39	25	42	42	26	207
Total CIAT	449	410	277	411	318	392	2,257
% Caribbean	7.35	9.51	9.03	10.22	13.21	6.63	9.17

2/ January - August 1983

TABLE 5: MAN/MONTH OF PROFESSIONALS TRAINED AT CIAT FROM CARIBBEAN COUNTRIES

Country	1969 1976	1977	1978	1979	1980	1981	1982	1983*	Total
Belize			10	15	6		4		35
Cuba			21	62	56	66	6	20	231
Dominican Republic	248	39	24	52	31	23	38	17	472
Guyana	4	2	2	1			3		12
Haiti	12			10	22	8			52
Jamaica	4	1		2			3		10
Suriname							1		1
Trinidad			1				7		8
Total Caribbean	268	42	58	142	115	97	62	37	821

* January - August 1983

TABLE 6: CARIBBEAN POPULATION, COUNTRIES AND ISLANDS, 1980

Country	Population	
	'000 Persons	%
Antigua	75	0.27
Bahamas	230	0.83
Barbados	252	0.91
Belize	162	0.58
Cuba	9,970	35.84
Dominica	83	0.30
Dominican Republic	5,947	21.38
Grenada	111	0.40
Guyana	884	3.18
Haiti	5,809	20.88
Jamaica	2,172	7.81
Montserrat	12	0.04
Netherlands Antilles	267	0.96
St. Kitts	74	0.27
St. Lucia	118	0.42
St. Vincent	97	0.35
Suriname	491	1.77
Trinidad + Tobago	1,062	3.82
Total Caribbean	27,816	7.56
Total Latin American + Caribbean	368,138	100.00

SOURCE: Celade. Centro Latinoamericano de Demografía. "Boletin Demográfico". Afio XII. No. 24. Santiago de Chile, Julio de 1979.

also serve to transfer technology between national programmes.

Appropriate backstopping of networks through production and distribution of information and documents plays a key role in their development and consolidation. CIAT develops and produces technical message packages that include the following series:-

(i) Technical annual reports; publications that describe CIAT and network research advances in each commodity.

(ii) Periodic commodity networking oriented news letters.

(iii) Technical publications, including conference proceedings, monographs, production manuals and field problems guides, aiming at providing relevant technical information to networks participants and interested professionals.

(iv) Audiotutorial units on specific relevant field problems and methodologies. These units have proven to be highly efficient communication means for reaching larger audiences of researchers, extensionists and students.

In addition, documentation services provided to subscribers include periodic publications of pages of contents of journals, periodic publications with abstracts per commodity, and literature search services.

Table 7 summarises the distribution of these materials in the Caribbean countries. Again, even though the numbers are large, we feel that there must be a larger relevant audience yet to be reached with selected materials. Identification and updating of such audience could be best done in collaboration with national and regional institutions through effective and continued networking.

Commodity Research Networks

In agriculture, joint and co-ordinated research efforts around common problems in various locations provide for much more significant advances than individual research projects in a single location. This is particularly true in the case of rainfed agriculture and in uncontrolled environments (e.g. without plant protection and high fertility treatments). These gains are commonly labelled "economies of scales."

While there are significant economies of scale to be gained through commodity based research networks, some of these economies could be lost when networks become too large and deal with many different problems. Scientists

TABLE 7: NUMBER OF PERSONS AND INSTITUTIONS INCLUDED IN THE DISTRIBUTION LIST OF CIAT PUBLICATIONS AND/OR DOCUMENTATION SERVICES, SEPTEMBER, 1983

Country	Exchange	Free Distribution List			Total
		Spanish	English	Subtotal	
Antigua			2	2	2
Barbados	2		6	6	8
Belize	1		15	15	16
Cuba	18	129	5	134	152
Dominican Republic	13	132	2	134	147
Guadeloupe	2	1	2	3	5
Guyana	1	3	14	17	18
Haiti	1	7	18	25	26
Jamaica	2	2	17	19	21
St. Lucia	2		1	1	3
Suriname	3		9	9	12
Trinidad + Tobago	14	4	18	22	36
Virgin Islands			1	1	1
Total Caribbean	59	278	110	388	447

from most countries in Latin America and the Caribbean participate in CIAT's sponsored research networks. While being very enthusiastic about network accomplishments up to now, a felt need is shared among the participating scientists to further decentralise the activities of these networks along common technical problems, often associated with subregions. Even though homogeneity of problems to be faced by network participants is the overriding criteria for organising research networks, there are other conditions required for them to operate effectively. The main ingredients for successful networking were distilled in the Second Review of the CGIAR in 1981, and summarised by Plucknett and Smith[3/] as follows:

"Networks function effectively when:

(i) The scope of the research is well defined;

(ii) The problem is shared by all the participating countries;

(iii) Activities are restricted to a geographic region, thereby facilitating communications;

(iv) Participating institutions are involved as equal partners;

(v) Each participant gains from the association and therefore enthusiastically supports it;

(vi) Participating institutions have funds to collaborate fully;

(vii) The local institution has sufficient capability to provide strong and enlightened scientific direction."

Before presenting CIAT's proposed strategy for the Caribbean, I will attempt to briefly analyse some of the characteristics of the region regarded as limitations to be faced in regional networking.

Limitations

The territorial status of many of the islands is regarded by some as politically sensitive and limiting to the involvement of regional and international institutes aiming at supporting developing countries. While this may be a political fact, it is also true that segregating such territories from collaborative agricultural research will not solve the political problem but rather increase existing distances. Furthermore, to the extent that the home country is willing to support agricultural research activities in the respective territory, the overall network could benefit from their scientific participation.

3/ Networks and Networking in the CGIAR, Draft 22 July 1983. To be included in the 1983 CGIAR Integration Report.

From the technical point of view CIAT, as a non-political institution, does not regard the political status of any island or territory as a limitation, provided that the network co-ordination is hosted by a regional research institution.

The wide heterogeneity in country size and in degree of development of national research programmes is viewed by many as a limiting factor of networking. In my view this is not a serious limitation, provided that the above set of conditions are met, particularly number 6. That is, either the respective country or a regional institute must fund the in-country research activities independently or the network in order to provide for the desirable partnership environment. The fact that some countries can contribute their experiences and knowledge to the network in the benefit of others is, after all, one of the main objectives of networking. The network should, however, provide opportunities for everybody to have net gains and for this even the smallest participant national programme should contribute with its research.

Effective communication is a necessity in networking. Different languages could be a barrier to full participation of scientists that are not fluent in the network's official language. Two or more official languages are feasible but rather costly. I am not suggesting that a common language should be the criterion to define the scope of the network, but rather commonality or reasearchable problems. A common language will facilitate communication and thus it should be an additional criterion to be considered. Decentralised sub-networks by language, with strong links are alternatives that merit consideration. CIAT's dual language policy - Spanish and English, helps in this regard.

Country membership in regional institutions such as IICA, CARDI and University of West Indies - UWI, varies. This is sometimes regarded as a potential limitation in the ability of such institutions to serve in co-ordination roles for regional network activities. These limitations must be overcome to avoid duplication of efforts and dilution of activities and resources. Competitiveness among bilateral programmes, regional and international institutions is sometimes healthy for them, but no doubt diluting for national programmes

that have only limited human resources to devote to the many goals and tasks before them. When the plan of work of these institutions involves the same commodity(ies), co-ordination of these efforts into a single thrust is crucial.

Finally, a fact to be faced is that not everyone of the CIAT mandate commodities is important in every country. Undoubtedly, a given commodity is of more immediate or potential importance in some countries than in others. The comparative production advantages of each country, and its assigned research and crop development priorities, need to be fully recognised by the organisers of each commodity network. After all, there is plenty of room for specialisation and trade within the region. The current balance of trade problems faced by most countries in the region could conceivably be managed by diversifying agricultural production, with each country specialising in those commodities for which it has comparative intra-regional trade advantages vis-a-vis the other countries. As in the case of sugar cane, total specialisation is highly risky, but aiming at full self-sufficiency in all commodities, even where feasible, could also be rather inefficient in social terms.

Proposed Strategy: A Summary

CIAT aims at decentralising the existing Latin American and Caribbean networks it sponsors into four regional commodity research networks for beans, cassava, rice and tropical pastures. These Caribbean networks are to be conceived and developed jointly with regional institutions in close consultation with interested national programmes. These networks are to be initially arranged around previously identified common production constraints and problems, and grow in geographic scope as research advances. They are to be based around existing institutional, human and infrastructural resources, and be guided by principles of complementarity and additiveness, in order to be catalytic, stimulative and cost-effective.

The networks' co-ordination should be based at a regional institution in a location (a) easily accessible to all participating countries by air travel; (b) where there exists an ongoing regional and/or national research programme with reasonable government support and trained personnel, and (c) where environmental conditions are reasonably representative of production zones in the region. The network co-ordination should operate under the policies and orientation of a Steering Committee formed by one representative from each co-sponsoring institution including CIAT and by scientists selected by the initial group of network participants.

The institutions co-sponsoring the network should be able to commit their own funds/resources to network support activities. CIAT could assume responsibilities for short courses training, specialised in-service training and post-graduate dissertation research at CIAT. In addition, CIAT could provide some information and documentation services to network participants. Besides backstopping support of specialists from its commodity programmes CIAT would provide for interlinks with the other regional commodity networks. Given CIAT headquarters location and the limited number of flights from Colombia to the region, there is a need to post liaison staff to service the different proposed commodity networks in the region. Backstopping field consultation visits of specialists from CIAT commodity programmes could then be better organised by the respective liaison staff.

The remaining activities of each network should be funded through a long-term special project. The project should provide, in general, sufficient funds for:

(i) A CIAT research scientist with appropriate support staff to conduct collaborative research in selected locations and act as liaison with CIAT programmes;
(ii) A few degree training (MS level) fellowships;
(iii) Opportunities for specialised in-service training;
(iv) Short regional courses;
(v) In-country commodity production courses;
(vi) Full workshop and multi-locational workshops;
(vii) Publishing workshop proceedings, monographs and production manuals;
(viii) Strategic research support of high region-wide interest with immediate application in several countries integrating the network; and
(ix) Travel for a few short-term consultants from participating and other institutions.

Conclusion

It is within CIAT's objectives and mandate to assist and foster national research programmes in the Caribbean in beans, cassava, rice and tropical pastures. We believe that we have a lot more to offer

than hitherto in terms of improved germplasm, new germplasm custom-developed for overcoming the major production constraints in the region, in post-graduate training opportunities, in short courses, in-service specialised training and dissertation research, and in reinforcing and backstopping research, and networking activities through opportune information and documentation services.

We also believe that the most cost-effective and appropriate way to capitalise these possible contributions and to achieve a high degree of research co-operation in the region is through the decentralisation of the existing CIAT sponsored networks into, in this particular case, commodity research networks for the Caribbean, jointly sponsoring them with regional research institutions. Last but not least, inasmuch as CIAT is a donor funded institution, and the proposed strategy implies additional activities, we can only commit to this end a similar amount of resources to those currently dedicated to the region, and thus, special project funds ought to be sought for this specific purpose.
We look forward to your suggestions.

O. The Role of the Universities in Developed Countries in the Agricultural Research Activities Of Developing Countries

(Dr. Denis G. Howell)

For a great many years now and indeed almost going back to the immediate decade following the end of World War II, and with it the progressive end of the colonial era, the role of the universities of developed countries in promoting development in the Third World is clear and obvious. With the coming of independence and the withdrawal of expatriate colonial officers, the need to replace them with native competence became a top priority issue. In a number of instances this eventuality had been anticipated by some of the more enlightened colonial powers as witnessed by the earlier creation of indigenous universities in a number of colonial territories. Indeed the University of the West Indies is probably one of the best examples of this.

However, it became quickly apparent particularly in the fifties and sixties that very much more had to be done. New universities had to be created and existing ones strengthened across a wide disciplinary front. Agricultural faculties featured quite prominently, and properly so, in considerations of this kind. Bilateral arrangements were negotiated and funded usually under the aid programme of the developed country concerned. This involved development of specific projects, the secondment of expatriate faculty, the training of counterparts and the provision of capital resources. Fellowship programmes sponsored by the international agencies also played a very considerable role and as indeed did those of some of the treaty organizations. All this is of course well known to those present and no useful purpose will be served at this workshop if I merely recite a catalogue of past achievements.

It is my view that we are now moving into a second stage in this overall programme, the second act if you like, and one which is principally concerned with consolidation, the development of durable relationships both personal and institutional, and which clearly must

include the promotion of scholarly and research activity.

Universities are built on scholary competence which can only come about as a result of indigenous endeavours organized and financed as circumstances allow from both within and without. This is the stage we are now at in many of the universities in the developing world and one which can be considerably helped by the development of relationships with institutions in the developed world which have related or similar programmes. These relationships are facilitated of course if language and culture are similar, and clearly Canada and the Caribbean afford a good and practical example of how these relationships can be promoted in a very real and practical manner. Furthermore, there is a growing desire on the part of universities in the developed world to promote relationships of this kind, since, in many instances, international activity now features as an integral part of their own programmes. For example, at my own university an international dimension is included in its stated aims and objectives from which I quote:

> "The University has repeatedly affirmed its intention of making such contributions toward the welfare of other peoples, and to international peace and understanding, as its capabilities might permit. This affirmation has come from the realization that in our interdependent world what happens anywhere is eventually reflected everywhere. We who have been more fortunate materially than most have an obligation to help others in such ways as they may desire when we believe we can do so constructively. It is implicit in this purpose that every segment of the University should contain in its activities such international content as may be appropriate for its overall objectives."
>
> "If there is any one lesson to be learned from past experience in technical assistance programmes it is that they succeed only when developed within the context of the culture and needs of the recipients. Adaptation to that context is the primary responsibility of social sciences and humanities, which must play a vital role in identifying the ways and means in which technical assistance can be harmonised with indigenous values and ways of doing things, lest this help in the end by only being destructive. This is no less true in the international field than we have found it to be in the resolution of our

domestic problems."

"The international enrichment of our own campus life must, however, go far beyond what we receive from our foreign guests and the experience of our members who have been involved in technical assistance. A pervasive international content in the curriculum can be achieved only when faculty members make a conscious effort to include it wherever appropriate in our instruction. This really is not something which can be decreed; it happens naturally only as faculty members genuinely believe that all knowledge is universal and that all men and all cultures have something important to say to everyone. If teachers can help their students to find this out for themselves, they will also have helped them to find the common humanity in all men, as well as the stimulating and rewarding diversity in human cultures and experiences."

This was written in 1972 and has been recently confirmed and strengthened.

The essential ingredient necessary for successful bilateral relationships must be a manifest desire on the part of the university in the developed country so to do. While the enthusiasm of individual faculty is essential, without strong institutional dedication, then relationships of the kind we are discussing at this workshop will lack the most vital element on which their success depends. Furthermore, within the framework of university faculty policies for such matters as promotion, tenure and merit, salary increments, etc., international activity must be considered as part of the faculty member's proper activity. How often have we heard that Professor X has suffered at the hands of his departmental colleagues who usually constitute the body adjudicating as to his future because he has been "too heavily" involved in international activity. Thus, the two essential ingredients for a successful relationship between a university in a developed country and a counterpart institution in a developing country are firstly a declared institutional commitment and secondly, but equally important of course, a cadre of dedicated faculty members.

I would like to turn now to a consideration of what I perceive to be the three essential phases in developing an ongoing scholarly and research relationship. The first phase involves the training of counterpart faculty and the acquisition of familiarity with the problems of the developing country by the institution in the developed country. The second phase involves the identification and execution of specific research programmes. The third phase is one designed to ensure that the fruits of that research get into the hands of the farmer which often means the smallholder or peasant farmer.

(i) Phase I of Research Relationship

In general, and in most instances, this first phase is well underway, and in a number of instances, has been accomplished. We thus find in a considerable number of agricultural facilities in developing countries that we now have a significant group of well-trained young faculty members. These have received training through a multiplicity of aid and sponsored programmes in the U.S.A., Canada, the U.K., Western Europe and Australasia. Indeed, in one or two instances, universities in the more advanced developing countries are taking in people from other developing countries for post-graduate study. I was recently in Malaysia at the agricultural university there and was delighted to learn that its veterinary faculty was now taking young people from Indonesia into its Master's programme. Canada contributed substantially to the development of the veterinary faculty in Malaysia, and it is most gratifying to see the great progress which has been made in the ten years that have elapsed since its inception. I am sure those present here today will be able to cite similar instances.

What of the problems that have been encountered in carrying out this phase? First and foremost we have to look at the quality of the basic education and language capability in the individuals concerned. In other words, we have to ensure that there is a basic level of education in both a technical and cultural sense. In many instances this has not been so and has resulted in frustration and a lack of willingness on the part of departments in the host country to take further nominees. If this seems likely and it has to be avoided, then the secondment of host country faculty to the institutions concerned may be an essential first step since the quality of the

baccalaureate programme from which the trainees will be drawn has to be appropriate if a successful programme is to be concluded. Language can be a problem although it is probably of little concern in relationships between countries where English is the first or second language. However, where it is not, then appropriate steps have to be taken. At some universities in developed countries English as a second language is taught and in a way which can be specifically directed to the needs of the individual concerned. Concordia University in Montreal, Quebec, has developed such a programme to a high level of sophistication.

(ii) Phase II

This is the phase at which in many instances we are now at, and is at the heart of the matter with which this workshop is concerned. It is a difficult one, particularly at the present time. Research costs money and university budgets are extremely tight, particularly in the research sector. Furthermore, a more conservative attitude is gaining ground in many industralized countries which expects that their own economic problems will receive priority when it comes to mission-oriented research. I have recently been involved in a United Nations-sponsored programme to develop an International Centre for Genetic Engineering and Biotechnology - the ICGEB.

Of the seven economic summit powers - Italy is the only one who has agreed to support it - the others preferring to put their resources into their own national laboratories. Regrettable but understandable! Fortunately, in most industrialized countries and I am including Canada in this category, specific steps have been taken to promote research activity in the developing world. Canada is also one of the very few who has taken positive steps in this direction. I am of course referring to the International Development Research Centre - the I.D.R.C. Most here today will be familiar with the work of the I.D.R.C. However, it is so important to the matter in hand that any paper on this subject must include more than a passing reference to it.

The Centre was established in 1970, is national in its charter and financing but international insofar as its policies and programmes are concerned. Policy is set by its twenty-one person board, ten of whom are non-Canadian. The universities are well represented on the board. The objectives of the Centre are:

> "to initiate, encourage, support and conduct research into the problems of the developing regions of the world and into the means for applying and adapting scientific, technical and other knowledge to the economic and social advancement of those regions, and in carrying out these objectives, (a) to enlist the talents of natural and social scientists and technologists of Canada and other countries; (b) to assist the developing regions to build up the research capabilities, the innovative skills and the institutions required to solve their problems; (c) to encourage generally the co-ordination of international development research; and (d) to foster co-operation in research on development problems between the developed and the developing regions for their mutual benefit."

The Centre does not carry out in-house research, but it supports and promotes research in developing countries and more recently joint research between developed and developing countries. The latter aspect is a new I.D.R.C. programme and one which, I believe, will very strongly promote the kind of relationships we are discussing today and I wish to refer to it more fully. The following is an extract from its promotional literature:

> "At the United Nations Conference on Science and Technology for Development (UNCSTD), one of the proposals made by the developing nations was for "the application by industrialized countries of a portion of their domestic research and development capacity to the solution of developing country problems." In the context of that proposal, developing countries urged that "direct linkage should be established between the research and development systems of developed and developing countries through co-operative arrangements." Canada's

> response was to pledge additional funds - on top of the existing official development assistance budget - to such a programme of linked research. Because of its unique structure, experience, and credibility in the field, I.D.R.C. was invited by the Government of Canada to serve as the "focal point" for this new activity. It was stressed that this was to be an additional responsibility that would in no way divert the Centre from its primary emphasis of supporting developing country research."

Since the programme came into being in 1980 some forty projects totalling 3.9 million dollars have been funded. These have all been jointly carried out by Canadian universities acting in partnership with a sister institution in a developing country, and matters related to agriculture and food have featured quite prominently. In preparing this paper I naturally turned to the most recent I.D.R.C. annual report and I was pleased to read the following:

> "The Latin America and Caribbean Regional Office (LARO) services a region made up of 32 countries with a population of some 300 million people. In its most recent report, LARO states that the most pressing research needs are being found in the food and energy sectors. Since 1970, I.D.R.C. has supported 527 research projects in this region, totalling more than $70 million. The projects undertaken by the Agriculture, Food and Nutrition Sciences Division (AFNS) have concentrated on two programme areas within the region; animal sciences and crops and cropping systems. The latter has contributed to changing traditional agricultural research that has predominated in the region and has tended to limit the appreciation of the farmers' environment and reality. The cropping systems approach favoured by I.D.R.C. substantially increases the possibility of addressing the farmers' problems more directly."

In drawing attention to the significant role which Canada and the I.D.R.C. is fulfilling, it would be churlish not to mention some of the activities of other major donor countries. For example, we have the Title 12 programme of the United States, which is destined to enhance the capability of U.S. universities in agriculture and food as related to development. The Overseas Development Ministry of the U.K. provides funds for British universities who have joint programmes with the International Agricultural Research Laboratories and the Netherlands has a programme designed to foster relationships between its universities and those of developing countries. The programme of the Swedish Agency for Research Co-operation with developing countries (SAREC) encourages Swedish researchers who wish to work in co-operation with developing countries.

In discussing the mechanisms available to us in delivering what I have described as Phase II, I must draw attention to a further Canadian activity, namely the International Development Office (I.D.O.) of the Association of Universities and the College of Canada (A.U.C.C.O.) The I.D.O. was created in 1978 to foster and promote the desires of Canadian universities in development programmes. Most Canadian universities have named a responsible officer to act in a liaison capacity with the I.D.O., and with the Canadian International Development Agency (C.I.D.A.). As Michael Oliver, the Director of the I.D.O. said in the preface to the I.D.O. Directory:

> "Universities are one of Canada's most valuable sources of new ideas and qualified manpower. Not only do they share with their counterpart institutions in the Third World, but they also stand to gain unique insights from collaborating with men and women from countries undergoing profound change. The understanding and mutual respect gained through the process of sharing knowledge and learning can only further the basic goals of development efforts everywhere."

Now, what of the Canadian universities themselves? How are they developing an appropriate scenario? Clearly I am most familiar with my own institution at Guelph where in 1970 due to the wisdom of its then President, the Centre for International Programmes was established to co-ordinate its international activities. This Centre has grown considerably since then and has developed linkages not only with C.I.D.A., and the I.D.R.C., but with the World Bank, Asian Bank, Inter-American Development Bank and with the Inter-American Institute for Co-operation in Agriculture (I.I.C.A.). Incidentally,

I.I.C.A has recently opened an office in Ottawa and we can assume there will be increased activity between Canadian universities and those in Central and South America. Three other Canadian universities have centres comparable to that at Guelph; at McGill in Montreal, at Carlton in Ottawa, and at Dalhousie in Halifax.

Thus we have a growing scenario for the effective execution of Phase II and I naturally am proud to report on the notable efforts of my own country in this context.

In considering this matter I would draw attention to an excellent publication by the Science Council of Canada dated August 1980, entitled "Partnership for Development" written by my friend and colleague William E. Tossel of the University of Guelph. It describes the role of Canadian universities in this respect and in its foreword written by the Executive Director of the Science Council of Canada, there appears the following statement:

> "The universities (of Canada) can play a major role by assisting people in the developing countries to acquire the scientific and technical skills necessary for self reliance on food, provided the universities' scope of expertise includes familiarity with the needs of developing countries."

(iii) Phase III

It is this phase which must give us the chief concern since without its successful implementation all our efforts are pointless. A comment of this kind is not without substance and equally applies to developed countries. Some years ago at the annual price review conducted between the U.K. Ministry of Agriculture, Fisheries + Food and the National Farmers' Union, the Minister of Agriculture attempted to defend his proposals by drawing attention to the considerable sums of money being spent on agricultural research only to receive a rejoinder from one of the farmers present "What research?" How many times have we heard comments to this effect? I would like to submit that the agricultural facilities at our Canadian universities with their long history in extension have a growing role in this overall con-

text and I would like to see priority attention being paid to exploiting this competence to the needs of developing countries. Canada, strange as it may seem, is essentially a country of small farmers and particularly is this so in my own province of Ontario, where the University of Guelph provides a considerable extension service to the farmers of the Province as part of a contractual situation with the Ontario Ministry of Agriculture + Food (OMAF). I have had discussions with the World Bank and the regional banks on this topic and I suspect that we shall see considerable attention being paid to it by the banks when it comes to providing loans for sectorial development in agriculture.

What we therefore need now is to build up adequate extension services which will ensure that the fruits of research do indeed reach the farmer. In a number of instances of course this is under way, but in my view we have a long way to go. It requires the training of extension workers, the preparation of promotional material, the effective use of the media and, most importantly, the ability to co-ordinate the overall programme of research. This may involve the setting up of appropriate administrative structures such as research councils, agricultural co-ordinating committees, etc. It may also involve training in research management to ensure an optimal use of research resources, an attribute sometimes lacking even in developed countries.

In this context a recent Guelph development will be of interest namely the Developing Countries Farm Radio Network (DCFRN). This programme which is a joint effort of C.I.D.A., the University of Guelph, and the Massey Ferguson Corporation involves the preparation of radio tapes on a variety of topics which are then sent to local farm radio broadcasters in a number of languages. It is an exciting programme and one which has been well received.

P. The U.S. Department of Agriculture and Agricultural Research and Management in the Caribbean

(Douglas Coutts - USDA*)

Under the recently approved Caribbean Basin Initiative (CBI), the U.S. Department of Agriculture (USDA) will make a concerted effort to:

(i) Promote increased regional understanding of U.S. agricultural health and sanitary regulations;

(ii) Provide technical assistance on plant inspection procedures and on operation of fumigation facilities;

(iii) Offer training in enforcing health and sanitary regulations;

(iv) Facilitate the involvement of U.S. agri-business in the area through investment missions and the collection of information on investment opportunities and potential joint ventures;

(v) Expand agricultural training activities through special courses; and

(vi) Co-operate in developing agricultural research activities in the Caribbean.

Specifically, the last two points are discussed below:

Caribbean Research

The Tropical and Subtropical Agricultural Research Programme of the USDA supplies the link between basic and applied research and technical needs in the tropical and subtropical areas of the United States and its territories. Funds for this programme are administered by USDA's Agricultural Research Service (ARS), which co-operate closely with participating land grant universities in the Caribbean and Pacific Basins.

For the Caribbean programme, policies are formulated by a National Administrative Group (NAG) chaired by the ARS Administrator or his

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* The U.S. Department of Agriculture.

designate, and comprised of USDA personnel, representatives from participating universities in the Caribbean Basin including the University of Florida, University of Puerto Rico, and College of the Virgin Islands. The tropical and subtropical research programmes are administered through the Caribbean Basin Administrative Group (CBAG). Historic programme objectives for U.S. tropical and subtropical research are:

(i) To develop, evaluate, and make available crop germplasm resources for use in tropical and subtropical environments;

(ii) To develop optimal crop and animal production and protection systems for the tropics and subtropics with special attention to small farm needs;

(iii) To develop technologies for efficient use and conservation of soil and water resources in tropical and subtropical environments; and

(iv) To develop technologies for better handling, storage, processing, and export of crops in the tropics and subtropics.

This research programme is relevant to increasing food production in developing countries throughout the tropical and subtropical regions of the world. The Tropical and Subtropical Agricultural Research Programme is the USDA's only independent legal authority for this type of work.

Because agricultural productivity is generally lower in tropical areas than in temperate areas, there is a great need to expand knowledge on tropical environments and productivity factors that are not now well understood. New knowledge and new technology are necessary if we are to meet human needs on a sustained basis without destroying the productive potential of tropical and subtropical ecosystems.

Small Farms Research and Technology

As an example of this co-operation, there is an USDA/OICD-sponsored linkage that supports a co-operative effort between the University of Nebraska, Oklahoma State University, and the Institute of Agriculture in Colombia. Technical assistance to small farms in Colombia is an important mission of this institute. These small farms are defined as operated by one family living on and having legal access to a farm having less than 20 hectares, less than 1.5 million pesos in available capital, and providing at least 60 per cent of the family income.

There are approximately 1 million such farms in Colombia. The factors and criteria used by farmers in selecting and adopting new technology is an

important factor in the economic success and well-being of these farm families. Resources available to these small farmers varies significantly between individual farms and geographical areas.

Data analysis on small farms technology adoption has been completed and is near publication. The co-operators are currently exchanging ideas on the research results and discussing alternative programmes, including incentives to encourage adoption of advanced technology. New technology-adoption research projects in the Rio Negro region and possibly in the Cauca Valley region will be initiated.

USDA/Agricultural Research Service (ARS) in co-operation with Puerto Rico conducts agricultural research at the Mayaquez Institute of Tropical Agriculture where emphasis is given to fruit, vegetable, and grain production; winter nurseries; and tropical tick eradication. Work at Rio Piedras focuses on effective soil, water, fertilizer, and crop management systems for increasing yields. Plant disease and insect control research is also conducted at Kingshill, St. Croix, in co-operation with the Virgin Islands.

ARS also conducts or administers a $4 million programme on small farms research which includes work on fruit and vegetable production and protection; production and protection of sheep, goats, and swine; production systems; food processing and storage; and market quality.

The USDA Extension Service has educational programmes for small farms in Puerto Rico and the Virgin Islands as part of ongoing work aimed at providing educational assistance and extension information to both small and large farms.

The Economic Research Service addressed small farms issues as a part of a continuing assessment of the structure of U.S. agriculture. This includes research on the economic characteristics of farm populations, with emphasis on dual on and off-farm work patterns.

Forestry research in support of small scale agriculture is important also, particularly in water resource preservation. Areas of research opportunity include improving woody plants adaptable to the Caribbean environment, improving species to capture rainfall, and opportunities to mix agricultural and forestry crops to increase overall productivity.

The International Research Division (IRD) of the office of International Co-operation and Development operates a "collaborative research" programme. The purpose of the programme is to foster co-operation between U.S. and foreign scientists in research areas of mutual interest. Elements of collaborative research projects would be as follows:

(i) Research idea or hypothesis;

(ii) A workplan to conduct interdependent research;

(iii) A time frame of 1 to 3 years to conduct the workplan;

(iv) A commitment to analyse the experimental results;

(v) A commitment to present the experimental results and conclusions to professional meetings and in scientific publications. American and foreign scientists are invited to prepare collaborative research proposals incorporating these elements.

Training

Expanded training opportunities are envisaged through the Caribbean Basin Initiative in areas, including research management. Two types of opportunities are available:

(i) Regular ongoing training programmes held in the U.S.

(ii) Custom-designed seminars or training courses held either in Washington or in-country based on the needs of the universities, institutes or governments requesting the course. A list of courses and other opportunities for research is attached.

A list of Technical short courses in Animal Science and Natural Resources, Economics and Policy Planning and Formulation, Management, Education, Human Resource Development, and Production and Technology is available on request.

In addition, Research opportunities for foreign agriculturists exist in the fields of Biological Control, Plant Pathology, Forage Breeding Genetics, Entomology, Livestock, Poultry and Engineering.

General Information on Research Opportunities

Research Opportunities

Opportunities exist for participation in research in over 200 subject areas. These opportunities are available both in USDA's Agricultural Research Service laboratories as well as in other research facilities. This programme allows scientists from around the world to update, increase, or refine their research skills while

contributing to ongoing research. Participants will work alongside U.S. scientists on research projects in areas of mutual interest. Examples of research opportunities are listed in the following pages.

Location

Research projects will be conducted in geographical areas of the United States appropriate for the nature of the research.

Programme Length

Acceptance into the programme and the length of the research will be determined by an agreement between the applying scientists and the director of the research laboratory. Placements normally are for 6 to 12 months, depending on the research involved.

Co-ordination with Technical Courses

Applicants may wish to co-ordinate their participation in laboratory research with attendance in a USDA technical course. This would allow them to make optional use of the time they spend in the United States.

Sponsorship

Organizations sponsoring participants include the following development organizations: the Agency for International Development, the Food and Agriculture Organization of the United Nations (UN/FAO) international development banks, home country governments, foundations and private organizations.

Cost

Costs vary according to the type of placement and the research involved. Cost information will be forwarded on request.

Application Procedures

For additional information, or to nominate candidates, cable or write to:

Dr. Frank A. Fender
Acting Deputy Administrator for International Training
Room 3529 South Building
Office of International Co-operation and Development (OICD)
United States Department of Agriculture
Washington, D.C. 20250
Cable address: AGRI/WASH 64334, Fender, OICD

Q. The Association of Caribbean Universities and Research Institutes

(Dr. Luis Marcano)

The Association of Caribbean Universities and Research Institutes (UNICA) was founded on the initiative of Sir Phillip Sherlock in 1967 by some sixteen organizations of higher learning in the Greater Caribbean Area. Now the Association has grown to include some thirty-five universities and ten research institutes which actively participate in Association affairs by paying an annual membership fee to sustain the operational costs of the organization. In total, the Association represents some thirty-five thousand professors and half a million University students. Within the Association membership, there are fifteen schools or Faculties of Agriculture, and five agricultural research institutes.

The major financial contributions for specific projects have come from the OAS, CIDA, IDRC, Carnegie, Ford and USDA. The activities of UNICA are planned and carried out by Commissions. Presently there are three of these:

(i) The Commission on Science and Technology presided over by Dr. Juan Bounet;

(ii) The Commission on Education; and

(iii) The Commission on Agriculture over which I preside.

This last Commission held a seminar in Kingston, Jamaica, in December 1982, which identified and recommended three projects. The first recommendation was to carry out a workshop on agricultural education to explore ways of enriching the teaching of agriculture in the region. This workshop will be held in December of this year in Montego Bay with funds from the OAS. The second project will relate to the development of special projects such as pigeon peas, sweet potatoes, and amarynths. The third project will relate to the small farmer in several of the islands of the Eastern Caribbean following the technique outlined by Dr. Edwin Wellhausen in his presentation earlier.

ANNEX I

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