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OPENING CEREMONY

PRESIDENTIAL ADDRESS

Dr. Basil Springer
(President, Caribbean Agro-Economic Society)

Mr. Chairman, Honourable Minister, our guest speaker, Dr. Hildebrand, Vice President, Conference Participants, Ladies and Gentlemen.

On behalf of the Caribbean Agro-Economic Society it gives me great pleasure to welcome you to the opening ceremony of this our Twelfth West Indies Agricultural Economics Conference. The fine setting in which this conference has been arranged should occasionally remind us of the theme of our conference "Implementing Food Production and Marketing Programmes in a Developing Tourist Economy".

Our conference may be regarded as the continuation of a new experiment where the Society is attempting to play a role in an effort to alleviate some of the problems associated with the development of agricultural production and marketing in the territories of the Caribbean Community. Our focus will be on the Case Study Working Document, a copy of which participants would have received, entitled "An Integrated Production and Marketing System for the Antigua Agricultural Sector". The topic of the Case Study was chosen with the approval of the Antigua Government. After this conference is concluded, we hope to be in a position to make recommendations to the Antigua Government which would reflect the effort of the Caribbean Case Study consultants who prepared the Working Document, and which would reflect an outcome from the high standard of debate usually associated with this Conference series. We hope that these recommendations would be thoroughly examined and speedily implemented in the form that they are presented or, may be, in a slightly modified form. The Society, as before, would continue after the conference to offer whatever assistance is requested, within the constraints of its resources.

After the first phase of our experiment last year in Dominica, we recognised a weakness. This was the lack of adequate pre- and post-Conference activity between the Government and the Society which would minimise the risk of a failure to expedite the implementation of some of our proposals. On this occasion, we have already identified a project on Antigua which is being developed by the Caribbean Agricultural Research and Development Institute and the Canadian Government in collaboration with the Antigua Government. This project is concerned with an integrated approach towards the production, processing and marketing of selected agricultural commodities in the context of their relationship with the overall agricultural economy. It is likely that inputs from the recommendations of this Conference will considerably influence the design of the project proposal and hence we may regard this development, to some extent, as the follow up to Conference recommendations.

The Executive is particularly pleased that the Society, for the second year running, has been able to convene a team of multi-disciplinary consultants from within the Caribbean region who have, at short notice

and under the resource constraints of the Society, been able to provide a document without which we would be unable to achieve the objectives at this conference. The consultants hail from organizations with considerable experience in tackling regional problems. They are Management Consultants Limited of Dominica, the Caribbean Tourism Research Centre based in Barbados, the ECCM Secretariat based in Antigua, the Caribbean Development Bank, and the Department of Agricultural Economics and Farm Management at U.W.I., St. Augustine, in Trinidad.

Some feed back from our last conference in Dominica indicated that, even though the experiment to conduct a Case Study and make recommendations on specific problems in the host territory of the Conference was successful, the original style of the Conference, where a number of invited papers are presented, should not be totally excluded from the programme as it was in Dominica. The Executive therefore invited a number of individuals to present papers at this year's Conference. The scope of these papers is designed to provide useful background information for the workshop sessions. One of the major constraints to agricultural development in the Caribbean today is, undoubtedly, inefficient management and decision-making at all levels. We have, therefore, invited participants from these disciplines in an effort to encourage further thinking as to how these disciplines can be integrated in our general agricultural development programmes.

Last year, we set up a Post-Conference Committee to consider the recommendations from the Conference and to come up with final proposals to the Government of Dominica. However, we had considerable difficulty, primarily because of busy schedules of the members of the Post-Conference Committee but also because of the lack of funds, in satisfactorily convening this Committee in a reasonable time and, as a result, the final document was not presented to the Dominica Government until September last. This year we have attempted to design into our programme a feature whereby the post-Conference activity would be considerably reduced. What we have done is to use the consultants, who would be most familiar with this Working Document, as chairmen of the various workshop sessions. They would then have the responsibility to ensure that all important points are exposed to participants and discussed and that adequate recommendations are made in each workshop. The secretaries of these workshops are in fact members of the Executive of the Society who would have to get together anyway after the Conference and, therefore, the preparation of the post-Conference document, in whatever form we may decide upon, should take place relatively swiftly as compared with our experience last year.

Our effort to continue our experiment using the case study approach could not have been successful, could not even have been initiated without the understanding and support, both financial and moral, of certain funding agencies. These funding agencies are the Ford Foundation, who have been associated with the Conference for a number of years, and Christian Action for Development in the Caribbean (CADEC). We would like to express the considerable gratitude of the Society to these funding organizations. It was not always easy to convince them that our approach should be given a try as a component strategy in the development of agriculture in the Caribbean.

The Rockefeller Foundation also supported us in the presence of our guest speaker at this opening ceremony. The Commonwealth Foundation very

kindly provided a number of bursaries which permitted the Society to ensure that each of the 12 Caricom territories is represented at the Conference by at least one participant. I am not sure whether this is an unprecedented event in the history of the Conference series, but it does increase the chance that the deliberations at this Conference would not only benefit the host territory but also, through the linkages of the participants from the other territories, would ultimately benefit other territories in the Caribbean and elsewhere.

The presence of the Minister at our opening ceremony is testimony to the support which the Government has given to the Executive and to the case study consultants in the conducting of their work over the last few months. The Antigua Government has also been instrumental in providing support, both financially and in kind, to the Local Organizing Committee. We look forward to the Minister participating in our activities, both on and off the field during the Conference and I would regard his agreement to chair one of the important technical sessions as a mark of involvement in and commitment to our efforts.

One of the features in the conference programme is a panel discussion on the regional food programme of which we have all heard quite a bit. Some of us are, however, not too clear as to the objectives and schedules of this programme so we thought that, including a panel discussion among participants who fall into the categories of (i) deep involvement in the programme, (ii) some acquaintance with the programme, and (iii) skimpy knowledge of the programme, would be a useful exercise in the context of the clarification of a number of misconceptions and the ascertaining of the machinery for the development of the programme.

A number of social activities have been arranged. We would hope that this would provide a balance to the activities at this Conference and would contribute to the exposure of overseas participants to the Antigua society in general, even though for a short while.

Because of its projected activities, the Society, some time ago, decided that it should incorporate as a non-profit body at its headquarters in Barbados, so that its relationship with funding agencies as a legal entity would be quite manifest since these agencies have requirements for non-tax status of an institution such as ours which is likely to be applying for money for its development activities from time to time. I am happy to say that, in the past week, the Executive received the Certificate of Incorporation under the laws of Barbados.

So far, the Society has been able to conduct its business with whatever success, owing to the work of the Executive Committee. However, one has to remember that the Executive Committee is a committee of members who already have responsibilities in full time employment, and hence the rate of advancement of the Society is directly proportional to the time that can be spared by these busy people for the activities of the Society. At this point, I would like to acknowledge the keen sense of responsibility of my Executive Committee over the past year. They have certainly kept me under pressure but, with their help, I have survived. In order to ease the day to day pressure from

the Executive, the Society, therefore, is seeking to set up a Permanent Secretariat at its Headquarters. Whether it is staffed by part-time staff or full-time staff depends, to a large extent, on our success in funding the Secretariat.

The achievement of the projected activities, which I have previously mentioned, will be only as fast as we can develop this Secretariat. In my role as President of the Society for the past year, and as the chief fund raiser, I am happy to report that the prospects for funds for a Secretariat are now much brighter.

Now I have said a bit about what we are trying to do at this Conference, but maybe we could now look into the other activities of the Society - what is the real role of the Society?

The Society is merely three years old, and it has a large number of objectives, but so far we have only been able to accomplish the annual event of organizing a conference. However, the Society seems to be growing from strength to strength, and it is about time we carefully examine the role that we should play as a non-political organization in the development of agriculture in the Region. The role of the Society, in this context, must, therefore, be considered in relation to the role of other regional Caribbean organizations or institutions. The Society is, therefore, interested in convening a meeting of Caribbean regional agricultural institutions but, before we do this, we want to examine current activities of these various institutions and to find out what development programmes these institutions have set for themselves. After this has been done some recommendations can be made, say by a consultant, as to the future roles of these institutions and as to how we can rationalize their various activities in the interest of minimizing any wastage of our precious human and financial resources. So, this inter-agency meeting will be convened, as it were, to consider a document examining the objectives of the various agencies, and to look at recommendations for harmonious operation in the interest of a developing Caribbean region. We are currently seeking funds for this exercise.

The Executive is also actively engaged in making proposals for a Journal of the Society which would allow its members to project and to disseminate their views throughout the Caribbean region and further afield. To this end, the Government of Guyana, two years ago, contributed a sum of money to start the project going. The Editorial Committee of the Society is currently looking at this and we hope that this venture can soon get off the ground.

Mr. Chairman, it is quite natural for participants to come to a conference and to take everything for granted. I hope you do not mind if I single you out as the man behind the scenes, as it were, as Chairmen of the Local Organizing Committee. Your Committee has worked extremely hard over the past few months; you have worked extremely impressively; you have been extremely conscientious in carrying out the tasks through various sub-committees to handle the several portfolios needed in organizing a conference such as this. I should like to end, Mr. Chairman, by thanking you and your Committee for the effort that you have so competently and freely put into the organization of this Conference. Thank you.

FEATURE ADDRESS

Hon. John E. St. Luce
(Minister of Agriculture & Supplies, Antigua)

Mr. Chairman, Distinguished Guests, Delegates to the Twelfth West Indies Agricultural Economics Conference; on behalf of the Government and People of Antigua and Barbuda, let me extend a warm welcome to one and all. For me, it is a great honour and privilege to be called upon in my capacity as the Minister of Agriculture and Supplies to give the feature address and declare this one-week Conference open. Let me take this early opportunity to congratulate the Caribbean Agro-Economic Society on the wonderful work they have done to bring together so many experts here today. Of course, I must also compliment the local organising committees, the various organizations, local and overseas, and individuals who have all contributed to ensure that the Conference is successful.

Before going on to my theme, I believe it is appropriate for me to say a few words about the Caribbean Agro-Economic Society, especially for those of us in Antigua who might not be familiar with this organisation. The Caribbean Agro-Economic Society was inaugurated at the Ninth West Indies Agricultural Economics Conference held in Jamaica from 3rd - 9th April, 1974. In its Constitution, a document approved on the 8th April, 1974, the objectives are listed as follows:-

- (i) To provide a forum for the examination of all agricultural institutions, policies, systems and practices in the Region.
- (ii) To focus attention on the economic problems of agricultural production and marketing with a view to improving economic efficiency.
- (iii) To facilitate exchange and flow of ideas between universities, regional and government institutions, and the private sector, with respect to matters related to the economics of agricultural production and related industries.
- (iv) To disseminate agricultural information throughout the Region.
- (v) To adopt a regional approach to the collection, collation and analysis of agricultural data.
- (vi) To establish a closer working relationship between the public and private sectors in agricultural production and marketing. And finally,
- (vii) To publish available materials for the benefit of the whole Region.

I am sure that all of us here today will agree that these objectives are ambitious and praise worthy.

As we have heard, this is the 12th conference of this nature being held in the Region, and the first time it is being held in Antigua. I should point out that these conferences were started to allow agricultural technicians, planners, etc., to examine topics of general interest for the development of Caribbean agriculture. This Conference, I understand, is the second of its kind in which a particular case study of the host country is examined and a report tabled for discussion with the view of developing definitive recommendations for implementation by the Government of the host country. This year, the theme of the Conference is "Implementing Food Production and Marketing Programmes in a Developing Tourist Economy". Once again, I must compliment the Society for selecting such a topic at such an appropriate stage in the economic development of Antigua and Barbada.

Today, every country in the world - no matter which position is occupied on the continuum ranging from capitalist to communist, no matter whether the country is classified as being in the 1st, 2nd, 3rd or even 4th world - has recognised the hard fact that agriculture, specifically the production of increasing quantities of food, must be given priority rating. Demographers now claim that the world population is approaching 4,000 million and that the annual rate of increase is a staggering 78,000,000. Not so long ago, most experts agreed that although the world population was increasing at a rapid rate, increasing yields per acre, more favourable conversion rates (for meat, poultry) could cope with the problem. But the situation has changed quite rapidly, and to quote from the U.S. Topic magazine issue No. 102 - "The technologies that made the U.S. agriculture a miracle of productivity - the lavish use of fuel, fertilizer, machinery and chemicals, as well as conventional plant and animal breeding - are beginning to reach their natural limits. The number of people fed by American cultivated land has started to level off at about 2.5 persons per hectare. Adding fertilizer no longer raises crop yields per hectare at the rate it did a decade ago; there is a physical limit to how much fertiliser can contribute to plant growth. Average yields on experimental farms in Iowa, that epitome of American ingenuity in maize growing, have remained level for several years because there have been no new break-throughs in technology.

"The flattening indicators of farm output raise serious questions about the United States agriculture's long term ability to keep feeding a growing number of Americans and simultaneously produce surplus food for a hungry world."

Ladies and Gentlemen, I don't have to tell you that this is a serious state of affairs. Antigua and many other countries of the Region import large quantities of foodstuff from the United States of America for both the local population and the thousands of tourists who visit each year. The message is simple - we must produce as much food as possible, or suffer the consequences later.

Everyone of us knows that tourism performs a vital role in our economy. We understand that tourism represents some 40 per cent of our Gross National Product - this is a high proportion. Over the past 20 years, tourism has grown rapidly in Antigua, and it has the

ability to generate quick returns and the multiplier effect, as we all know, is considerable. But we must strike a balance - a balance that would ensure growth in all sectors of the economy. Without that balance, without adequate planning, we could find ourselves in a situation whereby the allocation of scarce resources is not compatible with our overall economic development.

Presently, a considerable proportion of the tourist dollar leaves the island - a dollar leakage. What is the result? Capital which could be accumulated for investment in other sectors of the economy is drained away to pay for an ever-rising volume of imports. When we rely so heavily on imports, we also import inflation, rising costs. If we take a look at other countries that have Tourism as the main industry without other adequate sectoral growth, we will observe that the cost-of-living is high, and rising higher still.

We must produce as much food as possible, and consume what we produce. Antigua has a food import bill of some \$25 million per annum and our trade deficit is huge, to say the least. By producing more, and consuming what we produce, we are curbing the outflow of valuable foreign exchange earned from Tourism. We are also creating more job opportunities in the production and marketing of food, a fact of considerable importance in a country such as Antigua and Barbuda with a high unemployment rate.

It is high time that we realize the simple economic fact, that if growth of incomes occurs without adequate capital investment, and if the increase in incomes has minimum impact on local-use industries such as Agriculture, then the results are temporary. We in the Caribbean glibly speak of industrialization - but it is only a decisive increase in agricultural production and in productivity that can provide the supplies of food needed for better standards of living in conjunction with industrialization. Failing that, the result is an intolerable burden on our balance of payments.

Of course, all this is not easy. There are problems to overcome. The agricultural sector of the economy of most countries suffers when compared to the industrial or tourist sectors from both a lower income per head, and an income which is more variable over time. A part of the problem is that in most parts of the world the farmer has lagged far behind in adopting the improved methods of production which are technically feasible. Again, the production of many agricultural commodities is subject to large variations due to factors beyond human control such as lack of adequate rainfall, as in Antigua, pest invasion, and other natural causes.

Bearing in mind what I have said in my address so far and also taking into account the theme of this Conference, it should be obvious that we have to develop adequate management systems and production methods which would ensure the efficient production of an adequate supply of food. But production is only one side of the coin - we must also develop adequate market and distribution systems which are compatible with our national goals. Bearing in mind the fluctuations in output which I mentioned earlier, we cannot succeed if we do not

develop food processing and preservation methods to take care of surpluses. Again, a point which I have mentioned a number of times during the past year since I have become Minister of Agriculture - our people in the Region, and specifically in Antigua, will have to learn to use an increasing amount of locally produced food. It is the only solution if we expect to achieve a balanced growth throughout the entire economy.

Before concluding my talk, I want to emphasize the point that there is a problem which we must face up to. Agriculture in this part of the world has a checkered history. Our people have often associated Agriculture with slavery, with our colonial past. Agricultural work has been shunned by many and even now it is difficult to attract promising young people to take up careers in agriculture or in farming. This attitude must change. Again, too many of our people have grown accustomed to the taste of foreign foods. We must begin now to appreciate and to use as much of our own foodstuff as possible. The hotels too must be persuaded to serve more local foods to the tourists and so cut down on the high import bill.

Mr. Chairman, Delegates to this Conference, Ladies and Gentlemen, I wish you all the best during the week ahead. I trust that all of you, both visitors and locals, will derive some benefit from this exercise. For my part, I am anxiously awaiting your recommendations and I can assure you that they will receive careful consideration and implementation.

I am now pleased to declare the 12th Annual Conference of the Caribbean Agro-Economic Society open. I thank you, Mr. President.

INVITED ADDRESS

GENERATING SMALL FARM TECHNOLOGY: AN INTEGRATED MULTIDISCIPLINARY SYSTEM

Peter E. Hildebrand

*(Coordinador de Socioeconomía Rural, Instituto de Ciencia
y Tecnología Agrícolas (ICTA), Guatemala)*

Introduction

The Guatemalan Institute of Agricultural Science and Technology (ICTA) is a young and dynamic entity, inaugurated less than four years ago to generate and promote agricultural technology.¹ Emphasis has been on the basic grains and the small and medium farm sector. Because this sector is comprised largely of traditional farmers who have remained mostly outside the influence of modern technological innovations, it was envisioned at the time of formation of the Institute that a new method of attack would be required to achieve the goals proposed by the Government.² Included in the conceptualization of the methodology were several key points:

1. Because the conditions and farming systems of the traditional farmer were not known, an understanding of his agro-socioeconomic situation would have to be the starting point from which to generate improved technology appropriate to his needs.
2. Traditional farmers tend to possess inferior land and farm in such diverse conditions that most experimental work would need to be undertaken on farms rather than on experimental stations, most of which tend to be on the better lands.
3. Farmers should be directly involved in the research process to assure the practicality of the technology being generated.
4. Final evaluation should be based on the acceptance of the technology by the farmers and not on its desirability from the technician's point of view; that is, a technology would not be considered "good", or "useful" or "successful" until and unless it was being used by the farmers for whom it was generated.

These points implied the formation of an institute which departed significantly from the usual organization, and would require the incorporation of the social sciences to help identify and interpret the problems of the traditional farmers. Realizing that there was no one model to use

¹ Created by law in October, 1972, and inaugurated on May 10, 1973.

² Emphasis on the traditional farm sector does not exclude realizing benefits for commercial farmers who utilize much of the seed developed, as well as the fertilizer, pest control and other recommendations produced.

as a starting point, rather several models, each one imparting some desirable aspects, the Institute has always operated on the principle of innovation and flexibility in its organization and operational procedures. Hence, what is discussed in this paper at the present time will surely be modified somewhat over the next few months just as this presentation incorporates modifications which took form over the last few months. It should be noted, however, that these changes do not create divergences but rather always help us converge on an organization that we sense is "optimum" but only little by little are able to conceive. An important characteristic of the Institute, and one that has been valuable in maintaining flexibility, is that the top administrators are highly qualified technicians who also have experience at top levels of the national government.¹

The history of the development of the present methodology would, in itself, make an interesting study, but will not be included in this paper.² Rather, an attempt will be made to present the philosophy and structure of this methodology and the theoretical basis (when appropriate) on which it has been based. First, the organization of the Public Agricultural Sector will be presented, and then the general organization and operation of ICTA. The integrated, multidisciplinary system that functions at the regional or subregional level will be discussed in detail and some examples of non-traditional technology for traditional farmers will be given.

ICTA and the Public Agricultural Sector

The Ministry of Agriculture is organized on the concept of a coordinated, regionalized and decentralized public service sector. There are four principal decentralized agencies:

1. Instituto de Ciencia y Tecnología Agrícolas (ICTA), responsible for generating and promoting agricultural technology;
2. Banco Nacional de Desarrollo Agrícola (BANDESA), which provides farm credit;
3. Instituto Nacional de Comercialización Agrícola (INDECA), which administers the price support, crop storage and import programme; and
4. Instituto Nacional Forestal (INAFOR), the National Forest Institute.

In addition, a non-decentralized agency, DIGESA, maintains the extension activities, credit assistance and some other centralized administrative functions. The agrarian reform institute (INTA) operates directly under the President of the country.

¹See Appendix.

²Several steps in the evolution of the methodology are included in the following references: Grupo de Trabajo III, 1971; Congreso de la República de Guatemala, 1972; Waugh, 1973; Hildebrand, 1976; and ICTA, 1976.

Representatives of each of the decentralized agencies form regional committees presided over by the regional representative of DIGESA. These committees coordinate activities at the regional level, and, in many aspects, serve as pressure groups to funnel local needs and problems back to the national advisory committee of the sector, COSUCO, comprised of the Directors of the above agencies. This committee, in turn, acts as an advisor to the Minister.

ICTA Organization

ICTA is governed by a board of directors comprised of the Ministers of Agriculture, Economy and Finance, the Secretary General of the National Economic Planning Council, the Dean of Agriculture of San Carlos University, the head of INTA (Agrarian Reform) and an outside member chosen by the Board. The Manager (Gerente) of ICTA and those of the other entities of the Public Agricultural Sector serve as advisors to the governing board.

The Institute is managed by the Gerente and is organized into three main sections: (i) administrative and financial services, (ii) programming, and (iii) technical production.

The technical production unit (Figure 1) is the heart of the Institute and contains the majority of the personnel. Most of these, in turn, are assigned to regions rather than the central offices. In the technical unit there are no departments or department heads, a designation which tends to create islands, each of which is separated from the others. To avoid this tendency, each group within the technical unit is headed by a Coordinator, most of whom have national responsibilities.

Two distinct kinds of groups are recognized: (i) commodity production programmes, and (ii) support disciplines.

The Corn Programme, for example, assumes primary responsibility for generating corn production technology, and in this task the disciplines provide support activities. At the national level, the coordinators of programmes and disciplines form a technical coordinating committee chaired by the Director of the Technical Unit, which reviews results, coordinates recommendations and approves new projects.

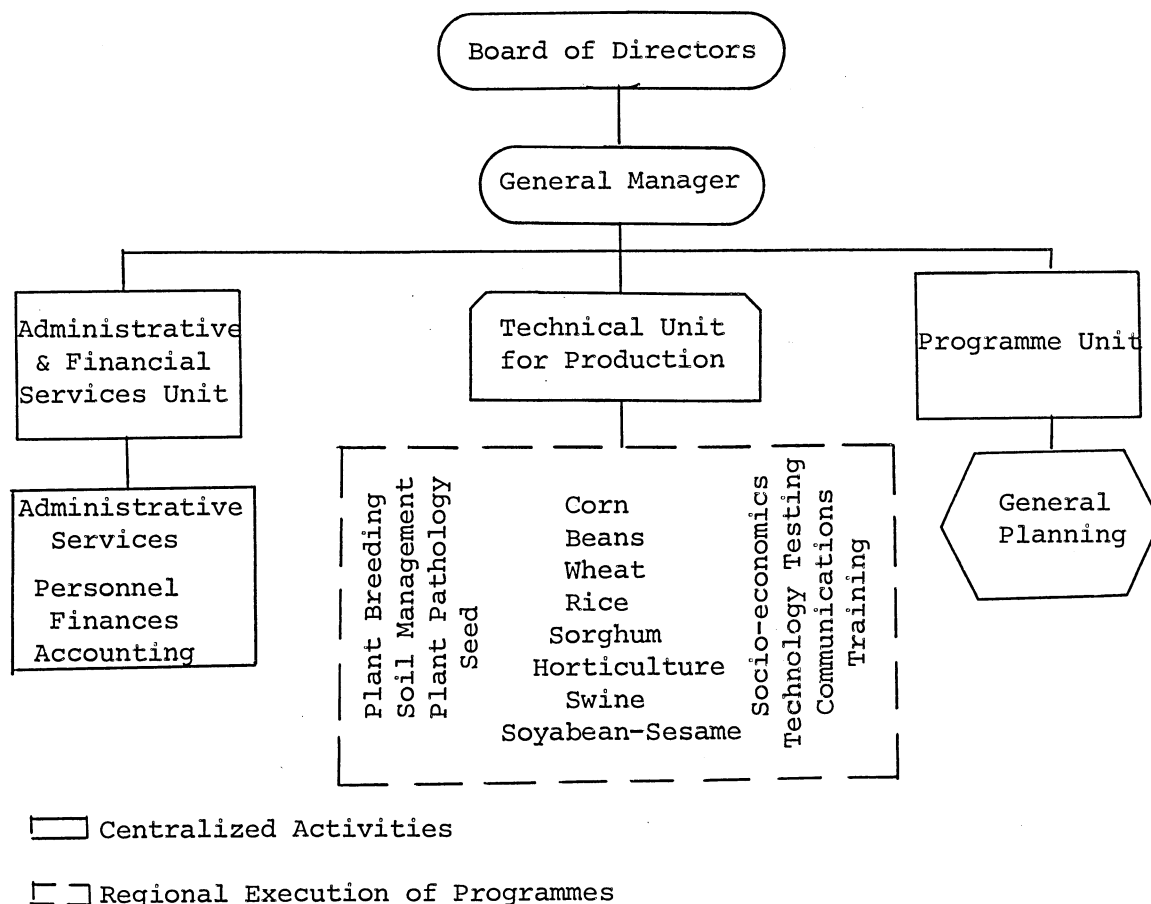
In each region, ICTA is represented by a Regional Director who is responsible administratively to the Gerente and technically to the Director of the Technical Unit. All coordinators of programmes and disciplines who have projects in the region form a coordinating and advisory committee at the level of the Regional Director, Figure 2. Within a region, a representative of the Regional Director (or the Director, himself) is in charge of each project area. Personnel of all programmes and disciplines who work in a project area form an integrated and multidisciplinary "Regional Team" and it is at this level that the majority of the technical work is conducted.

The Integrated, Multidisciplinary System

The work of the regional team - the generation and promotion of technology - is divided into five broadly defined activities: (i) agro-socio-

economic studies, (ii) germplasm selection, (iii) farm trials, (iv) farmers' tests, and (v) evaluation. Except for the early stages of germplasm selection and some basic work in agronomic practices, which is conducted at the regional experiment stations, all of the activities are conducted on farms and mostly with farmer participation.

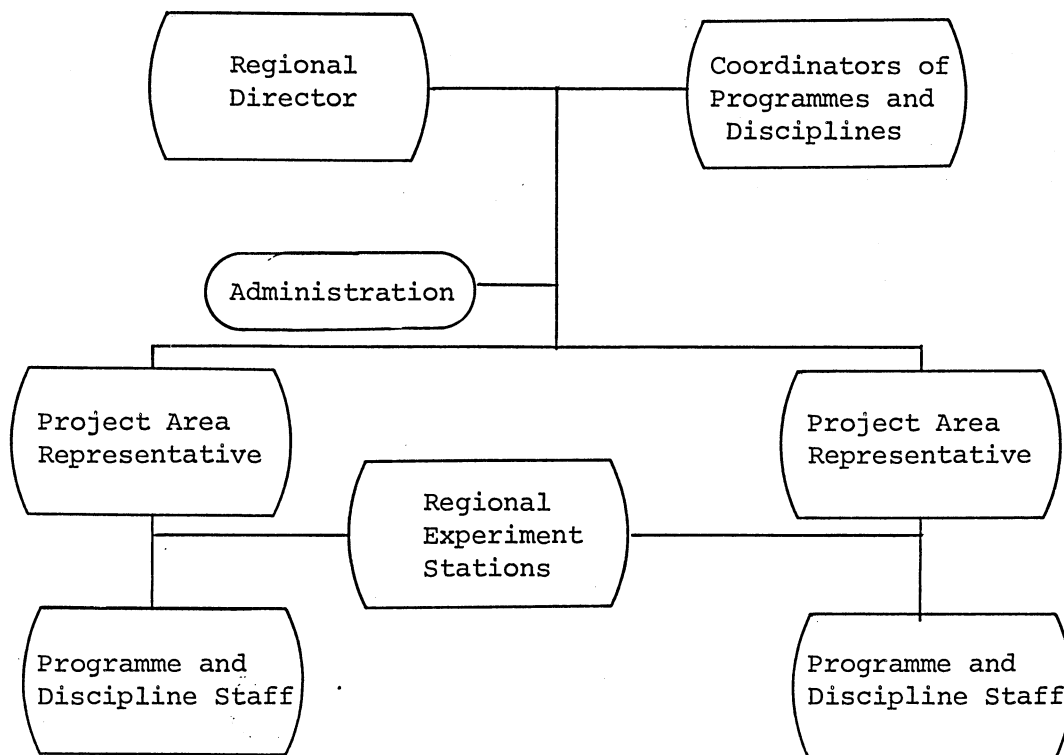
Figure 1. Organization of ICTA



Agro-Socioeconomic Studies

As a regional team is formed to work in a new area, the first activity is a reconnaissance to define a target group of farmers homogeneous with respect to their traditional farming systems and technology (agro-socioeconomic characteristics) and delimit the zone within which this group is an important section of the farm population. The theoretical premise for selecting the target farmers and work area on this basis is that farmers who are homogeneous with respect to their traditional cropping systems have been selected by a long, natural process into a group with common agro-socioeconomic characteristics and are responding in a similar manner to the most important limiting factors they face. The task of the regional team is to identify the common factors or agro-socioeconomic characteristics and then assess the relative importance of each of the generation of improved technology. The obvious advantage of this procedure over choosing a target group by farm size or political boundary or other

Figure 2. Regional Organization of ICTA



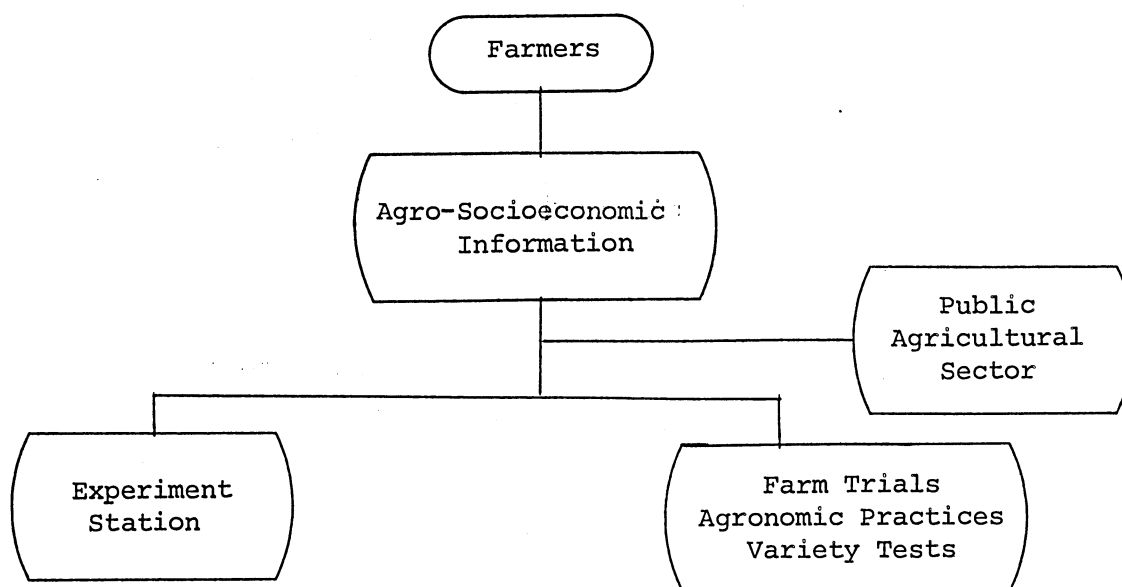
artificial parameter, is that the factors the "homogeneous group" have in common are those that affect their agricultural technology - and those are the ones with which the team must be concerned.

The reconnaissance and survey are usually completed in the period between crop seasons and depth of interview rather than number of interviews is stressed. The purpose of the survey is not to obtain benchmark information but to identify factors and problems important in generating technology. Although some preliminary cost information is obtained in the survey, it is based on recall and is not sufficiently accurate to use in economic analyses of farm trial data. For this and other reasons, a minimum of 25 collaborators are chosen to initiate farm records immediately after the survey is completed. This number is increased to at least 50 in the second and succeeding years and the information serves as a basis for monitoring change and the acceptance of technology. The farm records are simple forms on which the farmer notes each day, for each crop, the work he has done, on what area, with what contracted and family labour, and the inputs which were used. Other information such as planting distances, populations, varieties, etc., are obtained in discussions on the frequent visits made by ICTA personnel. Through these periodic visits, the farmers become permanent contacts for the technicians and are useful sounding boards on which to test new ideas or to provide information on general problems which in less personal situations may never be discussed.

Farm Trials (Ensayos de Finca)

The survey information is analyzed by the regional team who use it to plan farm trials in which existing varieties are tested and agronomic practices are explored and to orient plant breeders in their germplasm selection process, Figure 3. In the first year, one of the primary purposes of the farm trials, for which ICTA and the farmers share expenses, is for the members of the team to familiarize themselves first hand with the farmers' systems and to continue the process of identifying problems and limitations. For this reason, the number of trials should be small, the design should be flexible to permit changes when they seem desirable, and the technicians should work very closely with farmers from the target group, using them as advisors and not just workers. A limited number of the most promising varieties can be screened in the first year and preliminary fertilizer response work can also be included. But the nature of these latter activities should not interfere with the primary purpose of the first year's trials - becoming thoroughly familiar with the target farmers, their traditional technology and the project area.

Figure 3. Utilization of Farm Survey Information

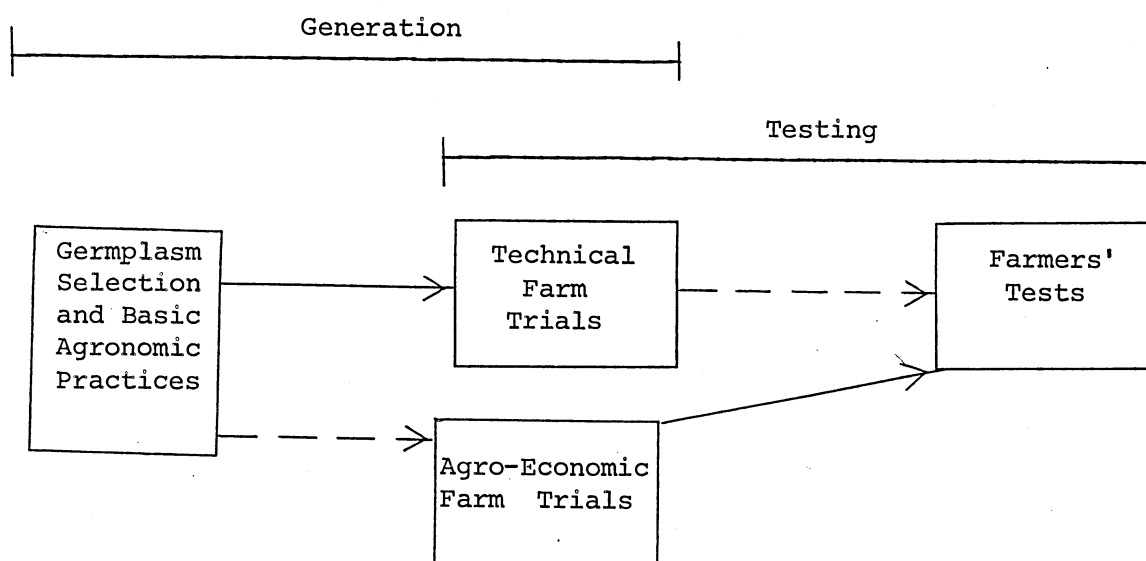


Two different types of Farm Trials are used. The first, which could be termed Basic Farm Trials or Technical Trials (Ensayos Agrotécnicos), are used when the trial needs to be replicated to provide information on response for each specific site. These are usually, though not necessarily, conducted in more than one location within the zone and include variety trials as well as work on agronomic practices. In most cases the check treatment is a representative, traditional technology of the region.

Before a practice or "technology" can be passed to farmers for Farmers' Tests, Figure 4, the ICTA technicians (Regional team, Coordinators and Regional Director) must be satisfied that the practice works, that it

is practical for the target farmers of the area, and that it is economical (in the broad sense of the term). To satisfy these criteria, promising practices and/or materials usually will be subjected to "Agro-economic Trials" (Ensayos Agro-económicos). These trials are designed to provide economic as well as agronomic information on a region (rather than a site) basis; hence, there should be many trials, well distributed throughout the area but they are not replicated at each location. The number of treatments is usually quite limited and one of them must be the traditional technology (usually the technology of each farmer rather than one standard, representative technology, more often used in the technical trials). Economic as well as agronomic records are maintained and both economic and agronomic analyses are made. Estimates of risk associated with each treatment or practice are calculated to aid in assessing potential effect on farmers who may adopt the technology.

Figure 4. Procedure for Testing Technology



Farmers' Tests (Parcelas de Prueba)

In the Farm Trials, the ICTA technicians evaluate the technology being produced. A critical aspect of the Farmers' Tests is that the farmer is the prime evaluator. The technician becomes an interested spectator who obtains what information he can from the trial, but the information obtaining procedure should not interfere with the farmer's capability to judge the practice for himself. It is important that the practice be conducted strictly by the farmer with only the technical advice of the technician. This is different from the Farm Trial in which it is the technician who is responsible for conducting the work. Another very important aspect of Farmers' Tests is that the farmer pays for all costs except technical assistance. In other words, he is a full partner in the testing procedure.

The ideal Farmers' Tests include two, three or at most four equal and similar sites on the farm. Each should be large enough to be

significant for the farmer, to ensure he gives them the attention they merit. On one, the farmer plants in his accustomed manner and on the other or others, he plants according to the technology being tested. This technology must be simple enough that he can comprehend and conduct it himself.¹ Where possible, differences in time requirements and inputs used, both on the farmer's own plot as well as actual use on the "ICTA" plot, should be determined and recorded. Yield information should also be obtained. These data provide much more realistic information on how the practice or technology will work in the hands of the farmers and, in particular, provide much better estimates of the risk factor than is available from the farm trials. But if the farmer indiscriminately harvests the two plots and yield data are not available, the test should not be considered lost because the farmer obviously has made up his mind about the practice. Whether his decision is positive or negative, he has evaluated the technology and the following planting season, his decision will be evident in what he does.

Although ICTA does not have extension responsibilities (they are in DIGESA) it is obvious that farmers' tests (and to some extent farm trials) initiate the process of technology transfer. As it is recognized that the Institute must promote the use of its technology over a sufficiently wide number of cases to validate its evaluation process, this amount of promotion or transfer is considered appropriate for research purposes. The coordination of this activity with extension is covered in another section.

Evaluation

It is in the year following the farmers' tests that ICTA again becomes the evaluator. This time, the evaluation is with regard to the acceptance or rejection of the technology by the farmers who conducted the tests.² If a high proportion put the technology into practice over a large part of their land, it can be considered well accepted. In this case, it can be recommended to the Extension Service as a technology that will be readily received. When the farmers reject the practice, attempts are made to determine why, and then, if it still looks promising, it will go back to one of the previous steps in the technology generating process for further development. If the practice has been rejected for reasons which cannot immediately be corrected, it joins the pool of basic information for future use and reference.

The farm records provide information which is used for longer run

¹This simple technology is a choice of one, two or at most three alternatives such as a new variety alone or a new variety plus fertilizer. We have found in testing complete and complex "technological packages", that the farmer may select two or three not necessarily complementary parts, and may be worse off than before. Simplified technology can also have an important influence on credit policy. Technological packages are sufficiently complex that credit programmes tend to lend for almost all expenses. With simple technology, only the small additional cost needs to be considered.

²Two reports on evaluations have been published: Busto Brol, et al., 1976 and Ruano, et al., 1977.

evaluation on changes in practices and yields, and comprise a more representative sample than of only those farmers who participated in the Farmers' Tests. Ultimately, a completely randomized sample of all target farmers will need to be conducted to determine adoption of technologies, but this has not been undertaken in any area to date.

Coordination with Other Entities

Figure 5 shows a more complete picture of this integrated, multi-disciplinary approach to the generation and promotion of technology for small, traditional farmers. Three factors in this figure were not discussed previously: (i) the inputs to the system from international centres, universities, industry, etc.; (ii) the product from the agro-socioeconomic studies which goes to the other entities within the Public Agricultural Sector; and (iii) the relationship to other entities, both public and private, with respect to the transfer of the technology to the target farmers and for other purposes.

The two public agencies with which ICTA has the closest relationship are DIGESA (extension and credit assistance) and BANDESA (credit). Coordination at the interinstitutional level has been weak, but should strengthen considerably this year. The area of greatest emphasis is to create closer cooperation between ICTA's Farmers' Tests and initial extension tests or demonstration plots. Beginning this year, some DIGESA personnel will work under ICTA supervision in the Farmers' Tests so they are familiar with the technology before it is placed in their control. At the same time, the DIGESA personnel will be familiarized with the technology generating process and the new technology being evaluated in the Farm Trials.

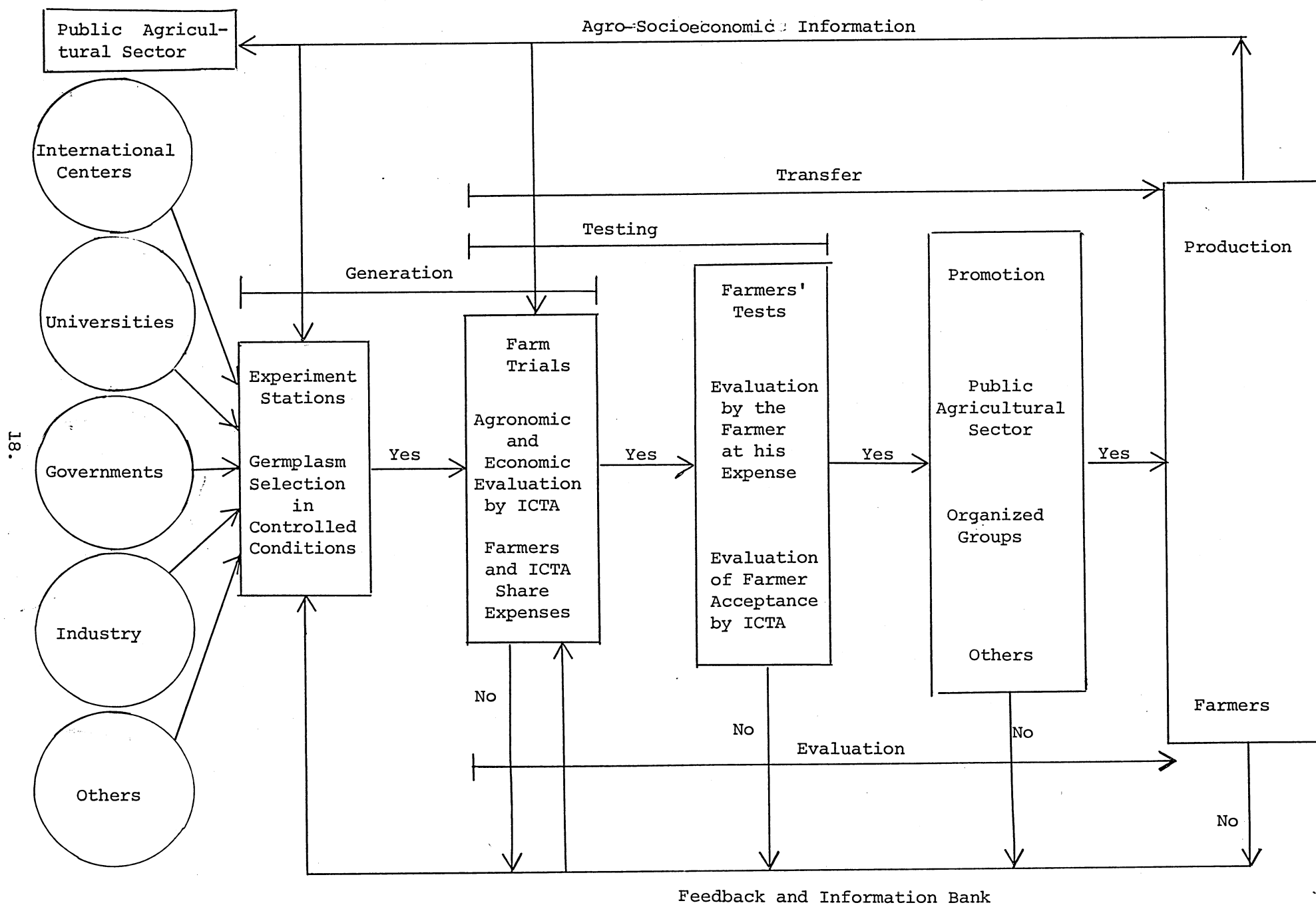
Both DIGESA and BANDESA coordinate technology recommendations with ICTA in the regions where ICTA has regional teams, but because ICTA is still expanding, and working with rather severe budget restraints, this is not yet effective throughout the country, nor for all commodities. The Institute is working with some cooperatives to help generate technology for their members, an activity that will probably expand in the future as the cooperative movement receives more widespread and coordinated support.

Except for the use of ICTA's farm record information as an aid in determining price support levels, the coordination with INDECA in the marketing area is very weak. The nature of INDECA is such that their focus is macro (production estimates, price reporting, etc.) rather than micro, and the needs felt by ICTA are more the reverse. However, because INDECA is the institute charged with marketing activities, ICTA has not entered into this field. As a result, little effort is being undertaken on farmers' problems of sales, storage, and transportation, or on commercial aspects of the marketing process. Occasional private or semi-official studies are made by students or interested domestic or foreign entities but, in the absence of incorporated participation by local agencies, these have little effect.

Examples of Non-Traditional Technology for Traditional Farmers

One of the most difficult aspects of understanding the methodology presented here is to visualize the types of technology that can be generated

Figure 5. An Agricultural Technology System



for traditional farmers who lie outside the influence of modern technological advances as we know them today. It is particularly difficult for many agronomists to conceptualize the conversion of agro-socio-economic information into guidelines for designing agronomic technology, with the notable exception of the criterion of profitability. Indeed, this criterion is still one of the most important we have in judging the applicability of a technology for any farmer but, alone, measures productivity only in terms of one possibly limiting resource. In order to increase the probability of adoption, the productivity of the other resources which are limiting must be considered for each specific group of farmers.

Generally, there are four broad approaches in designing or developing crop technology: (i) plant nutrition, (ii) plant architecture and yield components, (iii) pest control, and (iv) other agronomic practices including topological arrangement or plant distribution. Examples of each of these classes will be given as they have evolved in the work in the Institute, but it must be remembered that because the methodology is just being developed, all of these examples have not necessarily resulted from the completely integrated, multidisciplinary effort.

Fertilization

In one of the first areas in which the Institute initiated work, the farmers in a land parcelization project complained of little or no corn response to fertilizer even though it was included in the complete credit package. Previous experiments conducted by the predecessor to ICTA were not consistent, so this became one of the first priority items to be investigated. Results from farm trials indicated responses in some cases, especially in some of the hybrids tested, but in none was it profitable. Conventional wisdom, coupled with the natural tendency to consider fertilizer necessary in any complete recommendation, had created a situation in which the farmers were being forced into unprofitable investments. Fortunately, because of the widespread evidence (which was repeated the second year), consideration for the farmers' opinions, and an open attitude on the part of ICTA, the recommendation not to fertilize has been accepted by BANDESA and DIGESA and, in the first evaluation of acceptance of technology, only two percent of the area in corn among farmers who participated in the Farmers' Tests the previous year was still receiving fertilizer (Busto Brol et al., 1976).

Varieties

In generating technology, we are beginning to recognize the need to differentiate between subsistence and commercial crops, even on the same farm and for the same farmers. This is most easily seen in the Highlands, where corn and beans have been the subsistence crops of the area for hundreds of years and wheat is a relatively recent introduction and almost never consumed in the home. There is a much greater tendency to accept new technology for the commercial crop than for the corn and beans. Evidence of this is available from the evaluation study made in the Western Highlands (Ruano et al., 1977). Among the collaborators, 97 per cent of the wheat was improved varieties while only 31 per cent of the corn was one of the recommended varieties even though there is a high response from variety in the area (Schmoock et al., 1976). We have also established that on the South Coast where corn is primarily a commercial

crop sold at harvest, farmers readily accept hybrids, while in the Highlands, where they have historically saved their own seed, open pollinated varieties are necessary.

Another interesting development resulted from a corn variety produced early in the life of the Institute from work initiated previously. A high yielding hybrid with a broad range of adaptability was promoted, but it was not being widely accepted even by commercial growers. The plant is low in stature with a heavy stalk that resists lodging in high winds, but the husk did not completely cover the ear and the cob was much larger than the local corn varieties (the last two characteristics resulted from attempts to enlarge the size of the ear). Without a heavy and complete husk covering, bird damage was unacceptably high in corn that was left in the field to dry. Also, with the thick cob, less corn was shelled from each "netfull" of ear corn carried out of the field, and it is on the basis of these "netfulls" that labour is paid at harvest time, thus increasing harvesting costs of shelled corn to levels that were also unacceptable to the farmers. An additional negative factor of the thick cob, coupled with the scant husk, was a tendency for the ear to hold moisture and begin sprouting in the higher rainfall areas. These factors were discovered in a special evaluation study (Busto Brol *et al.*, 1975) and verified through the contact of ICTA personnel with farmers, and these defects are now being corrected in the breeding programme.

Pest Control

On the surface, pest control practices would seem to be fairly straight-forward, but they are some of the most difficult to analyze from the point of view of the small farmer. In the first place, on farm experiments, it is difficult to achieve sufficient experimental control to obtain accurate information on insect control benefits. Secondly, the investment for many small farmers is too great to warrant control. They prefer to plant higher populations and suffer whatever damage nature brings. A third problem for the small farmer has been overlooked previously. That is the availability of water in sufficient quantity and under safe conditions to be able to use liquid pesticides.

On the south coast, we found a rapid acceptance of granulated insecticides that can be applied easily with virtually no purchased equipment and without the need for water except for washing hands after use. This same area faces an acute and increasing shortage of labour, and herbicides should be very advantageous. However, herbicide use is not common, partially because of the difficulty of application and the need for sources of water and equipment. If recommendations for the use of granulated herbicides can be developed, it should be a readily accepted technology because the yield potential has already been demonstrated, and the need as a substitute for labour exists.

In a similar area near the one described above, there is not a labour shortage and the farmers are accustomed to using horses for cultivation. Even though agro-climatic conditions are nearly the same, it is doubtful that herbicides will find ready acceptance in this project area.

Other Agronomic Practices

More latitude exists for ingenuity and ability to adjust to the peculiar conditions of the small, traditional farmer with respect to agronomic practices than, perhaps, any of the other approaches with which we have to work. At the same time, one of the primary reasons that modern technology has not penetrated traditional agriculture to any marked degree is that it has mostly been designed with the larger, commercial and mechanized farmer in mind. It has been much more convenient and has shown more rapid results to work with the farmers for whom mechanization has been the great homogenizing factor. Mostly, all modern technology including high populations in monoculture, close row and plant spacings, high levels of fertilization, rigid pest control schedules and costly seed that must be newly purchased every year, is designed for conditions in which machinery is available, capital is abundant, the entire crop is sold, and labour is a scarce resource. In most situations, these are exactly opposite to the conditions faced by the traditional farmer who produces with little or no machinery and almost never with a tractor and who has very little capital to spend on his agricultural enterprises, utilizes the majority of his crop for family consumption and farms mostly with his own family's labour on farms so small that labour is usually an abundant factor of production.

Historically, it has not been necessary to work in the difficult and site-specific conditions of the traditional farmer. However, as land becomes scarcer, food production reaches critical levels and rural poverty threatens the well being of the established economic and social system, it is becoming essential for the agricultural scientists to get involved with these farmers who have been largely ignored in the past. It is ironic that just at the time when the world is running out of fossil fuels that have supported the modernization of agriculture, we now turn our attention to that segment of the economy that has been living outside the high energy consuming sphere. Thus, it is extremely challenging to today's scientists to generate technology that the traditional farmer can adopt in his agro-socioeconomic conditions without making him newly dependent on a source of energy that may not exist at an acceptable price level for very many years into the future.

In designing agronomic practices, agricultural economists and other social scientists can contribute significantly to help agronomists generate appropriate technology for the traditional farmer. In an area in eastern Guatemala, the survey provided information indicating that the two controllable factors most important in limiting production of the traditional farmers on the steep hillsides were the availability of labour in the short planting season and the amount of bean seed the farmer had left to plant. Subsistence farmers in this area normally plant corn, beans and sorghum together at the same time in a number of similar arrays. Through the use of twin or double rows of corn and sorghum¹ and a reduction in the population of beans which consume the majority of planting time, productivity of planting

¹Details on the use of double rows can be found in: Hildebrand, 1976 Multiple Cropping Systems ...; Hildebrand et al., 1977; Hildebrand and Cardona, 1977; and French and Hildebrand, 1977.

labour and of bean seed was raised significantly by allowing each farmer to plant more land than he previously had been able to with his traditional cropping system. This non-traditional technology is possible because amount of land is not a limiting factor for most farmers in the area.

Results from the Farmers' Tests in 1976 indicate that, on the average, each farmer could plant about 40 per cent more land using the same amount of planting labour and somewhat less bean seed and produce 75 per cent more corn, 40 per cent more sorghum, the same amount of beans and 33 per cent more income (Hildebrand and Cardona, 1977). The system allows him to work about 60 more days on his farm than otherwise would be the case and earn about \$1.25 per day which is slightly under what he has to pay for hired labour. Risk of loss is very low and there is no requirement for pesticides or fertilizer that the farmer normally does not use in these conditions. This year, as the Farmers' Tests are being conducted on a wider scale, emphasis is being given to conservation practices which must accompany a higher proportion of cultivated area on these rocky slopes.

In the Central Highlands, another survey showed that land was the most limiting factor and capital was very scarce, but labour was relatively abundant throughout the year. In addition, three classes of subsistence farmers were defined. One class cannot produce enough corn to sustain the family for the year, a second class achieves self-sufficiency at times, but not always, and a third class always produces enough to satisfy family needs (Duarte et al., 1977). Each of these three classes has different requirements even though their cropping system is basically the same, and a special technology was designed for each.

For the first class, and again, using the concept of double rows, the population of corn was increased 50 per cent without changing the form of planting within each row and using the same amount of fertilizer and seed per hill that the farmers are accustomed to using. The system, in effect, gives them 50 per cent more land on which to plant, but because of some economies in labour utilization, such as not needing to prepare the extra land, labour costs increase only 30 per cent. Corn production increased 45 per cent and profit, after charging opportunity cost for all labour, rose from \$7 per hectare to \$60 (Hildebrand et al., 1977). More important, it would permit the average farmer in this group to achieve self sufficiency in the production of corn.

For the farmer in the second category who desires to diversify and has a little capital to invest (mostly earned by his wife weaving local cloth) we were able to plant 40 per cent of the land to wheat (the least risky alternative) and at the same time plant the normal population of corn on the same land using the double rows. This system, with a one meter bed of wheat, traditionally broadcast by hand, between each set of twin corn rows, presents some very useful labour efficiencies and also increases labour use only approximately 30 per cent over the traditional corn system used in the area. Corn production dropped slightly (though it was not statistically significant) but 1266 kg/ha of wheat was produced and profit increased to \$219 per hectare.

In another system, cabbages were planted in the wheat about two weeks before the wheat was planted and provide a great potential for the

third class of farmer who has some risk capital to invest in crops with more potential (and risk). Nearly 14,000 cabbages can be planted per hectare without having a negative effect on the wheat (there was a small, though significant increase in wheat yield probably due to utilization of the fertilizer applied to the cabbage). Although demand does not exist for large additional amounts of cabbage, nor could they be absorbed by the present marketing system, there is potential for the production of broccoli and cauliflower for freezing as well as the incorporation of other crops into the system.

In all three systems, only the traditional amounts of fertilizer were used and no insecticides were applied, in accordance with the findings of the survey. Additional advances can, of course, be achieved with the incorporation of these factors as well as the use of improved varieties, all of which can be included in the longer run. In the meantime, the farmers can benefit from the results of this initial Farm Trial.

Summary

In this paper, an agricultural technology system is discussed as it exists in its present state of development at the Guatemalan Institute of Agricultural Science and Technology (ICTA). This system is an integrated and multidisciplinary approach to the generation and promotion of technology for traditional farmers, who are the primary producers of basic grains and have been outside the influence of most modern technology. The integration of social and biological sciences and the direct and continuous incorporation of farmers in the generation and promotion process are two of the most significant features of the methodology. At the same time, these features present unique challenges to the technicians who are involved in the work.

Conducting research in less than optimum conditions on farms and under the watchful and critical eye of the farmer is an experience that few researchers have, but one that creates a special awareness of the farmer's problems. One is immediately aware that the technician is not the source of all knowledge; the farmer knows much more than the technician about the conditions he faces in production. Because the traditional farmer is affected not only by bio-climatic conditions, but also by socio-economic and cultural factors much different from those that affect the mechanized, commercial producer, the participation of social as well as biological scientists in the process is critical. Yet, historically, there has been little harmony and less cooperation between these two groups of scientists; hence, the system requires a special orientation of the individuals who participate in it.

A factor of utmost importance is that the individuals understand the significance of socio-economic as well as biological factors in applied research for traditional farmers. The social scientists must have sound knowledge of agriculture and be acquainted with agricultural research needs and the biological scientists must be prepared to participate in and interpret socio-economic research. These are not common characteristics and, in most cases, both types of scientists need to be specially trained. Training in the technology system is an important part of the ICTA programme and has helped to contribute to the success which we have had to date. But most important has been the dedication of the technical staff to the

challenge of surmounting all obstacles in order to generate appropriate technology for this too-long ignored sector of the rural population of Guatemala.

APPENDIX

The General Manager (Gerente General) is an Ingeniero Agrónomo who has occupied the following positions:

1. Head, Dept. of Statistics, Agricultural Research Division, Ministry of Agriculture.
2. Deputy Director, Agricultural Research Division, Ministry of Agriculture.
3. Professor, Agronomy Faculty, San Carlos University.
4. Director, Department of Agricultural Research, Agronomy Faculty, San Carlos University.
5. Vice Minister of Agriculture.
6. Minister of Agriculture.
7. Member of Board of Directors of CATIE AND CIAT.

The Deputy General Manager (Subgerente) is an Ingeniero Agrónomo who has occupied the following positions:

1. Director, Experiment Station Labor Ovalle, National Agricultural Institute, Ministry of Agriculture.
2. Head, Wheat Programme, National Agricultural Institute, Ministry of Agriculture.
3. Director General, Agricultural Research and Extension, Ministry of Agriculture.
4. Deputy Director General, Agricultural Services, Ministry of Agriculture.
5. Guatemalan Representative on the Board of Directors of IICA.

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VOTE OF THANKS

Mr. Ronald Baynes
(Vice-President, Caribbean Agro-Economic Society)

Mr. Chairman, Hon. Minister, Mr. President, Mr. Guest Speaker, Distinguished Guests, Ladies and Gentlemen, Fellow Conference Participants:

My task this evening is a pleasure and a privilege. A pleasure because it is always reassuring to be back in the island of one's birth even though it is only for a few days; further, I am always delighted to participate in gatherings of Caribbean people particularly when the objects include self-improvement, economic development and the fostering of Caribbean brotherhood.

On behalf of the Caribbean Agro-Economic Society, I would like sincerely to thank and pay tribute to the Government of Antigua and Barbuda for inviting the Society to hold its 12th Annual Meeting here in delightful Antigua, for its tangible financial support of the Conference and for the Government's sustained interest in the Society, thus permitting a number of senior personnel to contribute of their valuable time and talents to the organization of this Conference. Let me emphasize that the Society is very appreciative of Government's unswerving endorsement, without which this Conference would not have been possible.

To you, Mr. Minister, the Society is deeply indebted, not only for warm words of welcome and your display of quiet confidence in the Society, but also for the active encouragement of its work in the interest of the continuing development of agriculture in Antigua in particular and the Caricom partners, in general. We feel particularly honoured by your presence here this evening to formally open proceedings and for your inspiring address which will, no doubt, be long remembered by all of us.

I would like, on behalf of the Society and on my own behalf, to say a special word of "thank you" to the President of the Society, Basil Springer, for the untiring and dedicated manner in which he has conducted the affairs of the Society over the past year. I can assure you that running a Society with membership spread from Belize to Guyana is no mean task.

It would be very remiss of me if I did not say a word of thanks to our guest speaker, Dr. Hildebrand, and to his sponsors, the Rockefeller Foundation. I think this message on appropriate technology is very well taken. I think we all agree that his presentation was informative and provocative. I trust that he will find it convenient to be with us for further discussions both formally and informally.

To you, Mr. Chairman, may I on behalf of the Society formally thank you for the patient and calm manner in which you shepherded us through this session. We knew we were in capable hands.

While speaking in your direction, Mr. Chairman, may I through you thank the members of the Local Organizing Committee for a job very well done. I notice the membership stood at something like 18 on that Committee.

I think this attests to the thoroughness and attention to detail with which you were able to inspire your membership.

We are particularly pleased at the large presence of distinguished guests and sincerely thank you for gracing these proceedings with your attendance here. We in agriculture often feel isolated and it is indeed very encouraging to see such a large support from the general public.

The Society is also indebted to the many in the private sector who have supported us by their many contributions. These include:- Antigua Commercial Bank, Kelprint, Antigua Distilleries Ltd., West Indies Oil, Brysons & Co., Joseph Dew & Sons, and Barclays Bank International. International agencies include:- The Ford Foundation, The Rockefeller Foundation, Christian Action for Development in the Caribbean, Commonwealth Foundation, The University of the West Indies, and Caribbean Agricultural Research & Development Institute. Let me assure you all that your gifts are in capable hands and that our community will be a better place for all of us to enjoy because of your continuing support.

To the Management and Staff of the Anchorage Hotel, the Society appreciates the extent to which you have exerted yourselves to satisfy our every want. I am certain that we will always remember this very enchanting setting at Dickenson's Bay.

Finally, I would like, on behalf of the Society, to thank the many folks - too numerous to mention - who in one way or another have contributed to our efforts. For instance, those responsible for the floral arrangements, transportation; also the secretaries and the many behind-the-scenes people who are often forgotten.

CASE STUDY REPORT