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Consultative Group on International Agricultural Research  
Technical Advisory Committee

Study of Training  
in the CGIAR System  
1984

TAC SECRETARIAT  
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL  
TECHNICAL ADVISORY COMMITTEE

REPORT

of the

STUDY OF TRAINING IN THE CGIAR SYSTEM - 1984

TAC SECRETARIAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

February 1986

This report comprises:

- (a) Extract from "Main Conclusions Reached and Decisions Taken", CGIAR Meeting, June 12-14, 1985 (Tokyo)
- (b) Transmittal Letter from TAC Chairman to CGIAR Chairman
- (c) TAC Commentary on the Study of Training in the CGIAR System, 1984
- (d) Comments to TAC by Center Representatives on the Training Study Report
- (e) Transmittal Letter from Study Team Member Professor Bunting to TAC Chairman
- (f) Report of the Study of Training in the CGIAR System - 1984, Submitted in February 1985 by the Study Team appointed by TAC
- (g) Six Country Studies - A Summary

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From: The Secretariat

December 5, 1985

Consultative Group Meeting  
June 12-14, 1985  
Tokyo, Japan

TAC Training Study - Agenda Item 9 1/

Dr. Hugh Bunting reported on the findings of the study that he and Professor Araujo conducted on behalf of TAC. Over 25,000 individuals participated in the various training activities of the centers; 18,000 at the centers and the balance through in-country training.

The TAC Chairman, in thanking Dr. Bunting for a comprehensive report, pointed out that the training study included, in addition to the main report, six country case studies. He mentioned the following three major recommendations of the report: donors should provide greater financial support for higher degree training; mechanisms should be found for the centers to utilize training components of bilaterally funded projects, related to agricultural research; and additional facilities for training should be provided to certain centers as mentioned in the report.

A lively, extended, and wide-ranging discussion resulted in which members of the Group made many comments and observations. In summing up, Dr. Bommer, chairman of the session, stressed the following points: (1) the thoroughness and insights of the study were recognized; (2) the beneficial effect of a joint meeting of the CGIAR centers' training officers was recognized, as was the value of a single training catalogue for the system; (3) the centers were encouraged to coordinate their activities within each country; (4) a development perspective should be introduced to a limited extent; and (5) the report should be published in some form and training should receive the attention of the Group again in the near future.

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1/ Extract from "Main Conclusions Reached and Decisions Taken",  
Consultative Group Meeting, June 12-14, 1985, Tokyo (Japan)

CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH  
TECHNICAL ADVISORY COMMITTEE

The Chairman

6 May 1985

Dear Mr. Husain,

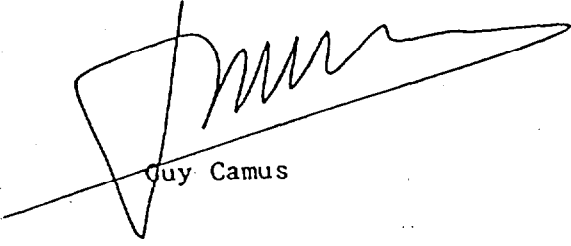
I take pleasure in transmitting to you the report of the Study of Training in the CGIAR System which was prepared in response to a specific request from the Group. The Report is in two parts, comprising the Main Study conducted by Professors J.E.G. Araujo and A.H. Bunting and the Six Country Studies conducted by senior officials in the government services of Bangladesh, Ecuador, Kenya, Senegal, Sri Lanka and Tunisia. The country studies were undertaken with the generous support of Australia, the Federal Republic of Germany and Sweden.

Representatives of the thirteen Centers examined the Report at a meeting prior to TAC 36 and I am pleased to report that both the Center representatives and TAC are in general agreement with most of its recommendations. TAC's commentary on the conclusions and recommendations and the statement prepared by the Center representatives are attached to the Report.

In submitting the Report to the Group TAC takes pleasure in observing that leaders of national institutions and training participants in all twenty-two countries covered by the Study acknowledged the substantial contributions of Centers' training efforts to the development of manpower for agriculture. This visible and much appreciated impact fully justifies the System's investment in training. It is recognized by developing countries as a major factor enabling them to make advances in agricultural production through the application of new and improved technologies.

TAC congratulates the Centers on their achievements and applauds their readiness to make further improvements and efforts in response to the evolving needs of developing countries. It is TAC's judgment that the application by developing countries of the Centers' research results will continue to depend on the System's ability to meet the relevant training and institution building challenges and opportunities of the future.

Yours sincerely,



Guy Camus

Mr. S. Shahid Husain  
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Consultative Group on International  
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TAC Commentary on the Study of Training in the CGIAR System - 1984

In transmitting the Report of the Study to the CGIAR, TAC wishes to thank and commend the Study Team of Professors J.E.G. Araujo and A.H. Bunting for their thorough, clear and stimulating exposition of the achievements, the present situation, and the prognosis in regard to training at and by the Centers, mainly as seen in the perspective of the relevant national institutions and of the participants in the training activities.

TAC also acknowledges gratefully the excellent contributions of senior officials of six countries (Drs. K.M. Badruddoza, Bangladesh; P.E. Larrea, Ecuador; S.N. Muturi, Kenya; M. Toure, Senegal; S. Wijayagoonewardene, Sri Lanka; and M. Lasram, Tunisia) who conducted country studies of training in areas related to agricultural research with reference to the efforts of the Centers, and of Dr. Manuel Pina Jr. of CIP and Dr. Ronald Knight of the Waite Agricultural Research Institute, who assisted in this effort. The findings of the country studies are consistent with those of the Study Team.

Training in the CGIAR System

TAC commissioned the Study against the background of a perceived shortage of trained manpower in scientific agriculture in the developing countries. Since 1962 the Centers have trained over 17,000 individuals in different aspects of agriculture and related fields; several thousands more have participated in Center-sponsored workshops, meetings and conferences. Over 1,800 individuals have conducted M.Sc. and Ph.D. research in the Centers under the guidance of Center scientists.

Many of these people are now national and international leaders who are making significant contributions to the advancement of scientific agriculture in the developing countries.

The individuals themselves and the national institutions to which they belong are fully appreciative and cognizant of the great progress in human resources development that has been achieved by the CGIAR System.

For 1984 the nominal expenditures from the core budget of the System devoted to training is in the order of 8%. However, the actual costs are estimated to be twice or three times as much if all the indirect costs are included.

Thus, training in the CGIAR System is a substantial activity of major significance.

The Study was conducted in close collaboration with the Centers and received their full cooperation. The Center representatives and training officers who met immediately prior to TAC 36 expressed

concurrence in principle with the general spirit of the recommendations and indicated the Centers' readiness to implement the recommendations, many of which reinforce efforts that have already been initiated.

Nevertheless the Center representatives suggested careful deliberation in the implementation of two recommendations which had to do with including in their training activities an understanding of development in the broad sense, and with efforts to integrate the training activities of all Centers in a country. TAC's position on these issues are presented in the following two paragraphs.

#### Training with a Broader Development Perspective

TAC concurs with the Study Team on the desirability of encouraging a broad development perspective in the training experience provided by the CGIAR System. TAC notes however that the objective could be attained without unduly altering the current types of training offered by the Centers, e.g. by providing a production systems background to the commodity production training courses; by encouraging degree training participants to include development courses in their individual programs of graduate study, and by scheduling periodic seminars on broad development issues not only for the participants but also for Center staff.

#### Integration of Centers' Training Activities in Individual Countries

TAC concurs with the Study Team on the need, as expressed by the countries themselves, for better integration and harmonization of the System's training activities at the national level. As a matter of fact, inter-center cooperation and coordination of research and other activities has been on the agenda of TAC and the Center Directors. TAC, therefore, wishes to encourage the Centers to proceed further in their collective efforts to integrate, harmonize and coordinate training activities in consultation with the appropriate national institutions.

#### Relation to Research

In recalling that a major purpose of the CGIAR is to stimulate the development of national capabilities in agricultural research, TAC underscores the importance of efforts to maintain the research linkage in training to take advantage of the mutual reinforcement that derives from such close association. Stated alternatively, the Centers should primarily undertake training activities which have their foundation on center-related research.

The synergism between training and research finds full expression in the continuing association of the participants among themselves and with the Centers long after they have completed their training. This is accomplished through participation in periodic joint research planning exercises; involvement in research networks of all kinds; attendance in workshops and conferences, and through recurrent flow and exchange of genetic materials, publications and information.

This coupling of training with research and continuing follow-up makes training opportunities in the Centers unique and very highly valued by the participants themselves.

#### Evolution of Training Needs

The Study noted the evolution of training activities in the System in response to the needs of the nations. One such trend is the increase of production-oriented courses conducted away from the Centers by the countries themselves with varying levels of assistance from the Centers.

TAC concurs with the Study Team's recommendation to further promote in-country training to expand the reach of the System's training opportunities and to explore further the prospects of some national institutions offering training to countries unable to organize courses on their own (inter-country cooperation). A parallel positive development is the increasing use of regional cooperative networks for training.

In addition there is a greater demand for more specialized and graduate degree training. TAC notes the steps the Centers have taken to respond more effectively to this need and draws the donors' attention to the call for more support for higher degree training to take advantage of under-utilized capacity in many of the Centers.

#### Linkage with National Universities

To the extent allowed by their respective mandates and by the resources at their disposal, TAC agrees with the proposition that the Centers should take every appropriate opportunity to link their training, and research activities as well, with those of national universities responsible for agriculture and related fields. In this way, the Centers could assist these institutions for higher learning in the developing countries to meet a larger share of the needs for highly trained manpower in the future.

#### Postdoctoral Fellowships and Developed Country Participation

The Study Team recommended clarification of the ambiguous status of postdoctoral fellows in the System. TAC is of the view that postdoctoral fellowships are offered primarily to meet specific research needs and to some extent as an instrument of staff recruitment. Postdoctoral fellowships therefore should be open to all regardless of national origin, and appointments should be determined by the needs of the Center and the qualifications of the individual. Moreover, postdoctoral fellowships ought to be treated administratively as part of research rather than training.

#### Linking Donor Initiatives with Training Activities of the Centers

The scientific programs, staff and facilities of the Centers offer unique opportunities for training which could be exploited more

fully for the benefit of the developing countries. CGIAR donors are currently allocating large sums through projects to support agricultural research and university development in developing countries. Where appropriate, the donors may wish to make fuller use of their investment in the Centers by associating them with the training components of such projects.

### Conclusions

The Training Study has provided convincing evidence of the substantial contribution of the System to human resources development in the field of agricultural sciences in the developing countries. The statistical data and other information collected has been made available as an input to the ongoing Study of the Impact of CGIAR Centers and Institutions.

The CGIAR may be pleased to note that the Study Team - in this very thorough study which brought them in contact with over 1,300 individuals mainly from the developing countries and which took them to 18 countries - detected a collective sense of approval of the types and quality of training offered by the Centers. This approval was expressed by the participants themselves and by leaders of key national institutions involved in agricultural research and development.

The Study Team put forward a body of recommendations on training which TAC and the training officers of the Centers accept in principle and endorse to the donors and the key elements in the System for consideration and implementation. A number of the issues are dealt with or highlighted in this commentary.

Moreover the Study Team calls urgent attention to the need of some Centers for capital funds to upgrade their inadequate training facilities at headquarters.

The Study Team recognized the evolution of training needs of the developing countries. The Centers have been sensitive to these evolving needs and have responded accordingly.

Although the System has achieved a great deal of progress in training, major challenges and opportunities remain. The building up of national agricultural research capability, of which training is an important part, continues to deserve high priority support and attention.

## COMMENTS TO TAC BY CENTER REPRESENTATIVES ON THE TRAINING STUDY REPORT

Meeting on Training in the CGIAR System  
Rome, 6-8 March 1984

Representatives of all the International Centers met in Rome to discuss the report of the TAC Training Study Team of Prof. A.H. Bunting and Prof. J.E.G. Araujo. The meeting was convened by the TAC Secretariat, at the FAO Headquarters in Rome, on 6-8 March 1985. A list of Center representatives attending is attached. The meeting benefitted from the presence of selected distinguished observers; their names are also listed.

The group of Center representatives, hereafter called "the group" or "we", wishes first of all to recognize the enormous physical and intellectual effort of the Team and the outstanding quality of its report, which also addresses the relevant issues from the excellent reports on six country studies. The Study Team has produced a clear, timely and stimulating report which deserves commendation also for taking as the measure for evaluation the needs of the national programs and for explaining the stand-point of the national institutions. The report is timely because the Centers are now engaged in strengthening joint and articulated efforts in research and training to serve the collaborating countries. It is stimulating because it is full of ideas and challenges that merit serious consideration and action by TAC and the Centers. The group accepts that these ideas and suggestions derive from the Team's considerable experience and from its perception and analysis of the expressed desires of officials in the countries it visited. The report and the carefully conducted six country studies provide comprehensive and up-to-date information on the national research systems (NARS), their circumstances, past contributions of the Centers and the potential for future contributions to national program building through training.

Prior to this meeting the report of the Study Team had been examined intensively by the members of the group. The issues raised and the recommendations made in the report of the Study Team were reviewed and discussed in many hours of lively discussion at the meeting. Some of the conclusions of those discussions follow.

The group welcomes the recommendations made in the Team's report and wishes to record its concurrence in principle with the general spirit of these recommendations. We also wish to state our willingness to put these recommendations into practice, to the extent that this proves feasible, is in line with the comparative advantages and with the particular nature of the mandates of each Center, meets

with the availability of resources and accords with the specific circumstances and needs of each country or region. In fact, some of the recommendations of the Training Study are already followed or being put into practice in several Centers, i.e. expansion of in-country training, increasing attention to universities and to manpower needs analysis and country training plans, joint Centers' training efforts where there are common interests, graduate degree thesis training and others.

We are in agreement and ready to implement several recommendations, such as issuing a consolidated information brochure listing training opportunities at all the Centers, supplementary (technical) language training, improvement of evaluation and follow-up and production of training materials.

The group was concerned about the implications of two suggestions of the Study Team, involving a development dimension in training and inter-Center integration of activities at the country level. We wish to comment as follows.

There was a consensus that the national institutions have the responsibility to deal in research and training with a broad comprehensive development approach in accordance with the national farm circumstances and development strategies. The Centers can best support them in this approach by means of concentrated and sharply focussed research and training efforts in their particular mandated commodities and production systems. This concentration allows the Centers to conduct in-depth problem-solving research and to accomplish effectively their tasks of assisting national programs in the generation and transfer of improved technologies. To what extent the unique strengths that derive from these characteristics should be compromised for the purpose of a more development oriented and integrated training strategy of the Centers is an issue of fundamental importance.

For these reasons, and others of practicality, the group is concerned about two proposals implicit in several comments in the report and also stated as explicit recommendations:

1. .... that the Centers should consider broadening their training focus taking into account not just research objectives but development as a whole.

This is a very important ultimate aim but difficult to put into practice, especially where it involves areas that are not within the comparative advantage of the Centers.

Acknowledging that the principal role of the Research Centers is strategic and applied research on the mandated commodities and farming systems, the recommendation to broaden the training programs of the Centers to include an understanding of development needs deserves careful consideration. Furthermore, the expansion of training activities suggested in the report will in some cases require substantial increased resources at a time of uncertain future funding. The group recognizes that the ultimate responsibility for training personnel from developing countries lies with national institutions, particularly the universities. However, Centers will continue to provide maximum support

to training activities, and expect to support in particular a substantial increase in in-country training.

2. .... that the training strategies and actions involving jointly all or several Centers in regard to each country be integrated or articulated.

This approach differs radically from past modes of action in which each Center acted autonomously in its relations with each country as dictated by mutual priorities.

The group feels that such a change should be approached with caution. Centers recognize the need for integration in the interest of the nation, but because of the diversity of the mandated crops and ecologies it will be neither appropriate nor practicable to accept that recommendation across the board. Rather, the group feels that Centers should remain free but committed to continue to explore possibilities for joint action in a region or a country.

- - - - -

The participants at the meeting are grateful to the Training Study Team and to the authors of the country studies for the frequent complimentary statements in their reports on the quality of training at the Centers, on the extensive coverage of subject matter, on the excellent relations with the national programs and on the accomplishments of collaboration between national programs and Centers through training.

Accepting these comments on Centers' achievements with pride, we wish to assure TAC of our willingness to continue to improve and be innovative, guided in good measure by the recommendations of the TAC Training Study as these may be found to be appropriate and feasible.

Finally, the group would like to put on record that, given the importance of the recommendations made in the report of the Study Team, it is unfortunate that the timing of events precludes consideration of that report by the Center Directors as a group prior to submission of the TAC Study to the CGIAR.

# The University of Reading

Professor  
A.H. Bunting CMG MSc DPhil LLD FIBiol

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9 April 1985

Dear Professor Camus,

At its 32nd meeting in October 1983, your Committee agreed to the purposes and terms of reference of a Study of Training in the Consultative Group System. At the same meeting it also approved the appointment of Professor Jose Emilio Goncalves Araujo and myself, as a study team, to carry out the principal part of the Study. This included visits to all thirteen of the International Centers and other Institutions funded through the Consultative Group, and to 18 developing countries. The Executive Secretary of your Committee was so good as to designate Dr. Karl O. Herz, Senior Agricultural Research Officer, to serve as secretary to the team. Dr. Herz has worked as a member of the team and has joined fully with us in all our discussions and most of our visits. Though he took a full part in the processes by which we reached our conclusions and recommendations, we bear the prime responsibility for them.

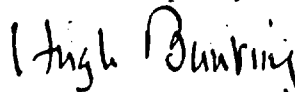
With the help of donors, the Secretariat of your Committee also commissioned more detailed studies of six countries (the Country Studies), which were conducted under the direction of senior nationals of those countries. On behalf of the study team, and in order to ensure that the purposes of the two parts of the TAC study were consistent, I helped to plan these Studies, but neither Professor Araujo nor I was involved in their execution or interpretation.

I now have the honor, on behalf of Professor Araujo and myself, to submit the report of the Study Team. It includes an account of the assessment of the Country Studies, and the reports on the Country Studies accompany it. I am happy to report that the findings of the two parts of the TAC Study agree closely, and coincide at all important points of principle. We believe that this must reinforce the usefulness of the study as a whole in your Committee's work on training in the Consultative Group System.

It is my pleasure to reiterate the thanks we offer, in our report, to your Committee and to yourself, for the opportunity to undertake this task and to learn so much about the International Centers and some of the countries they serve.

Finally, please permit me to offer you the assurance of our warmest regard.

With respect,



A.H. Bunting  
Professor

Prof. Guy Camus  
Chairman  
Technical Advisory Committee  
c/o The World Bank  
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CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH  
TECHNICAL ADVISORY COMMITTEE

STUDY OF TRAINING IN THE CGIAR SYSTEM - 1984

R e p o r t

of the Study Team appointed by TAC

Jose E.G. Araujo  
A. Hugh Bunting  
K.O. Herz (TAC Secretariat)

TAC SECRETARIAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

April 1985

TABLE OF CONTENTS

	<u>Paragraphs</u>	<u>Page</u>
ACKNOWLEDGEMENTS		xxv
BACKGROUND	1-34	1
The Purposes, Terms of Reference and Structure of the Study	1-4	1
Purposes	1-2	1
Terms of Reference	3	1
Structure	4	1
The Study Team and its Field Work	5-21	1
The Team	5	1
Terms of Reference	6	2
Method of Work	7	2
The Field Work of the Study Team	8-14	2
Nature and Limitations of the Field Work	15-20	3
Preliminary Report	21	4
The Country Studies	22-32	4
Preparatory Work	22-23	4
Method of Work	24	5
Description	25	5
Findings and Their Use	26-32	5
Other Resources for the TAC Study of Training	33	7
Scope of The Report	34	7
SUMMARY	35-72	8
Training by CGIAR Centers and Institutions: General Comments	41-46	9
Types of Training	42-43	9
Funding	44	9
Evaluation	45	10
Links after Training	46	10
Training by CGIAR Centers: Assessment	47-68	10
The Nations	47-52	10
The Participants	53-59	11
The Centers	60-65	12
The Donors that Fund Training	66-68	12
Towards the Future	69-72	13

	<u>Paragraph</u>	<u>Page</u>
RECOMMENDATIONS	73	14
A. On Cooperation with the Nations		14
B. On Training at and by the Centers		15
C. On Buildings for Training		16
D. On Donors and Funding		17
INTRODUCTION	74-76	18
SOME DEFINITIONS AND CONCEPTS	77-89	18
Training	77	18
Participants	78	18
Knowledge and Knowledge Systems	79-80	18
Knowledge and Development	81-84	19
The Nations, the Centers and the CGIAR System	85-89	20
TRAINING BY CGIAR CENTERS AND INSTITUTIONS: GENERAL COMMENTS	90-116	21-31
Purposes and Styles of Training	91-97	21
Styles of Training	91-95	21
Residential Training	96	22
Personal Relations between Staff and Participants	97	23
Types of Training Offered	98-110	23-25
Numbers Trained (Table 1)	111	25
Costs of Training (Table 2)	112-114	25
Evaluation of Training	115	31
Continuing Cooperation with Participants and Follow-up	116	31
TRAINING CONDUCTED BY CGIAR CENTERS: ASSESSMENT	117-209	32-69
The Nations	118-148	32-48
Persons Interviewed by the Team	118	32
Past Experience of Training by the Centers (Table 3)	119-123	32-43
Training Needs and Expectations	124-134	43-45
The Centers and the Universities in the Nations	135-142	45-46
The Centers and the National Agricultural Knowledge Systems	143-146	46-47
Effects of Training on the Nations	147-148	48

	<u>Paragraph</u>	<u>Page</u>
The Participants	149-186	48-61
The Participants Interviewed by the Team (Tables 4,5,6)	150-152	48-49
Who the Participants Are	153	49
How People Become Participants	154-155	49
Why People Wish to be Participants	156-158	56
Difficulties Encountered	159	56
Language	160-163	57-58
Length and Content of Courses	164-177	58-59
Effects of Training by Centers on Participants	178-179	59-60
Reasons for these Effects	180-182	60
Some Consequences of Training for Participants	183-186	61
The CGIAR Centers and Institutions	187-202	61-66
Comparative Advantage in Training	188	62
Objectives and Priorities in Training	189-190	62
Achievements in Training	191-192	63
National Needs and Coordination among the Centers	193-196	63-64
Decentralization and Transfer of Training Activities	197-199	64-65
Degree-Related Training	200-202	65-66
The Donors that Fund Training	203-209	66-68
Some Views of Donors on Types of Training at Centers	203-206	66-67
Roles of Donors and Centers in Training and University Development	207-209	67-68
TOWARDS THE FUTURE	210-218	68-71
Relations with the Impact Study	210	68
Towards an Appropriate Agricultural Science	211	68
Meeting Training Needs of the Future As Part of A World Endeavour	212-219	69-70
Towards a Consensus on Training in the CGIAR System	215-218	70-71
 <u>ANNEXES</u>		
Annex 1 - Terms of Reference for the TAC Study of Training in the CGIAR System		72
Annex 2 - Study Team of TAC Study of Training (C.V.)		76
Annex 3 - List of Persons Met by Study Team		77

	<u>Page</u>
Annex 4 - Proposed Table of Contents of Reports of Individual Country Studies on Training in Agricultural Research and Related Areas	103
Annex 5 - Some of the Documents Consulted by Study Team	108
Annex 6 - Study Team Summary Reports on Findings: THE CENTERS (page numbers shown in parentheses)	116
A. CIAT (116)    B. CIMMYT (125)    C. CIP (134)	
D. IBPGR (142)    E. ICARDA (147)    F. ICRISAT (154)	
G. IFPRI (163)    H. IITA (165)    I. ILCA (175)	
J. ILRAD (182)    K. IRRI (189)    L. ISNAR (201)	
M. WARDA (205)	
Annex 7 - Study Team Summary Reports on Findings: THE NATIONS (page numbers shown in parentheses)	212
Mexico (212)    Guatemala (213)    Costa Rica (214)	
Nigeria (215)    Burkina Faso (Upper Volta) (217)	
Liberia (218)    Indonesia (219)    Thailand (220)	
Philippines (221)    Colombia (222)    Peru (223)	
Syria (224)    India (225)    Bangladesh (227)	
Nepal (228)    Ethiopia (229)    Kenya (230)	
Zimbabwe (231)    Tunisia (233)    Ecuador (234)	
Senegal (235)    Sri Lanka (236)	
Statistical Data - Table for Annex 7 (238)	

#### LIST OF TABLES

Table 1 - Participants in Training/Technical Skill Development At/By the International Agricultural Research Centers up to end of 1983, with Supplements A and B	26-29
Table 2 - Expenditures on Training	
A. Training and Conferences Totals Funded from Core Budgets of Centers, 1971-1987	29
B. Training and Conferences Totals Funded from Core Budgets of Centers, 1982-1987, by Center	30
Table 3 - Participants in IARC Training Activities, (Including Technical and Professional Skill Development) in Countries visited by Study Team	
A. Summary Table, by Center and Region	33
B. Latin America	34-36
C. Africa	37-39
D. Asia	40-42
Table 4 - Participants in IARC Training Activities interviewed by the Study Team at time of Visit to the Center, 1984	50

Table 5 - Participants in IARC Training Activities interviewed by the Study Team in Countries Visited (by Visit/Region) 51

Table 6 - Training Activities of Centers Participated in by Persons interviewed by the Study Team in 1984 in the 18 Countries Visited

A. Summary Table, by Center and Region	52
B. Latin America	53
C. Africa	54
D. Asia	55

## ACKNOWLEDGEMENTS

We offer our grateful thanks to our colleagues in the Centers, and particularly to those who are responsible for training, who did so much to help and encourage the study and to organize our travels and work. We owe particular thanks to our friends in the nations, from whom we received overwhelming kindness and hospitality. The participants, past and present, made us welcome. They, more than any others, helped us to see that training in the CGIAR Centers has built, maintains and extends a world-wide "invisible college" of the agricultural science and development profession, linking nations and disciplines. This extended family of the CG system is one of its great achievements.

Very many people gave us outstanding help during our travels. Most of them were staff members of the Centers, who evidently combined enthusiasm for the training tasks of their Centers with dedication to the countries they served. We gladly thank them all. In addition, we wish to express our deep appreciation to one colleague in particular, Dr. Carl N. Hittle, IADS, Director of the Integrated Cereals Program in Nepal. What he did, in organizing our visit and in personal kindness, went far beyond the call of duty. Without his knowledge and support, our visit to that country would not have succeeded.

Next, we offer our thanks to our colleagues in Rome, who cheerfully and efficiently added us to their many burdens. We received unstinting help from the TAC Secretariat, and particularly from our Secretary, and fellow-member of the team, Dr. Karl O. Herz, who accompanied us on five of our journeys, and whose deep knowledge of the International Centers and of many countries guided us and preserved us from error on many occasions. Mr. Alexander von der Osten rendered similar services on our remaining journey. Whatever merits our study may contain owe much to them, but they sedulously avoided any influence on our conclusions. The faults and weaknesses of this report are also exclusively our own.

Finally we thank the TAC and its Chairman, Professor Guy Camus, for giving us the opportunity to undertake a challenging task and to learn so much about the International Centers and the countries they serve.

## BACKGROUND

### The Purposes, Terms of Reference and Structure of the Study

#### Purposes

1. Training is not merely a by-product of research at the Centers: it is an important and costly component of the strategy by means of which the Centers, and the System as a whole, contribute knowledge services to support development, especially in areas related to their research. Similarly, training is an important element in the current study of the impact of the System by the Consultative Group itself. This study of training has endeavoured to provide essential factual information for that study.
2. TAC decided in June 1983 at its 31st Meeting to instruct its Secretariat to undertake a study of training in the CGIAR System. The study was seen as an integral part of TAC's work on strategic issues. The purposes of the study were agreed by TAC at its 32nd Meeting in October 1983. They were to evaluate and provide guidance on the place, roles, value and priorities of training in the CGIAR System.

#### Terms of Reference

3. The Terms of Reference for the study, and the issues which TAC considered might be addressed in it, were also agreed to by the same meeting of TAC. They are reproduced in Annex 1.

#### Structure

4. In the event, the TAC Secretariat developed the study through two separate but closely linked activities: (1) the main investigation was to be made by a Study Team of two consultants (specialists in training in agricultural research from outside the CGIAR System) together with a member of the TAC Secretariat serving as Secretary. (2) The second activity, to be carried out if funds were available, was to be a number of more detailed studies of individual countries. This report concerns the work of the Study Team; the country studies are reported separately. However since the country studies were intended to complement and extend the work of the Study Team, the present report incorporates their findings.

### The Study Team and its Field Work

#### The Team

5. TAC appointed a Study Team consisting of Professor Jose Emilio G. Araujo\*, Rector of the Federal University of Pelotas, Rio Grande do Sul, Brazil and A. Hugh Bunting, former Professor of Agricultural Development Overseas, University of Reading, United Kingdom. Brief curricula vitarum are given in Annex 2. The TAC Executive Secretary designated Dr. Karl O. Herz, Senior Agricultural Research Officer on his staff, to serve as Secretary to the Study Team. We have regarded

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\* Present affiliation - 1985: EMBRAPA, Brasilia, Brazil

him (like Mr. Alexander von der Osten, who replaced him on one of our journeys) as an equal partner in our work. The pronouns we, our, us, indicate that our joint efforts and findings are represented.

#### Terms of Reference

6. We took as our formal Terms of Reference those accepted by the TAC for the study as a whole (Annex 1). We summarized them for ourselves, less formally, as:

- (i) to describe the work of the Centers in the field of training;
- (ii) to assess the results of that work in relation to development in the nations which cooperate with the Centers, and in relation to the tasks of the Centers;
- (iii) to offer suggestions for the future.

#### Method of Work

7. The study of training has been conducted from the outset in consultation with the Centers and their training officers. It opened with a meeting of the training officers, organized by the TAC Secretariat, in Rome in December 1983. The training officers described their own work, encouraged the study, and made very valuable comments on its method and content. This meeting foreshadowed many of the topics reviewed in this report, but it differed in one important respect. It was substantially influenced by the scientific purposes, and the activities, hopes and constraints of the Centers themselves. We have been more concerned with the effects of training on those who have been trained, and on the developmental needs of the cooperating nations, which had been represented very effectively in the December 1983 meeting by Dr. K. Badruddoza of Bangladesh. A report on this meeting was provided for TAC 33 as an Annex to the Progress Report on Training, Document AGR/TAC:IAR/84/7.

#### The Field Work of the Study Team

8. Between January and October 1984 we visited all the Centers, and 18 developing countries in Central and South America, West, East and Southern Africa, and West, South and Southeast Asia. These included the 10 developing countries which are the hosts of International Centers, plus Guatemala, Costa Rica, Burkina Faso, Zimbabwe, Nepal, Bangladesh, Indonesia and Thailand. We had hoped to visit Bolivia also, but were unable to do so because of airline strikes.

9. In our visits to the Centers we learned what they are doing in training, the philosophies that underlie the work, how it is organized, the resources employed, and the hopes and intentions of the Centers for the future. We met many current participants, mostly in groups in which interaction and discussion were even more informative than direct testimony.

10. In our visits to the nations, we discussed the participants and their work, in relation to national purposes and needs, with senior staff of public and private agencies and of universities, concerned with agricultural knowledge and its uses for development in the countries.

11. A list of the people we met in the Centers and the nations is given in Annex 3. This does not include the nearly 700 participants in training activities whom we interviewed.

12. All these visits were inevitably very brief, but they were so well organized by our colleagues in the appropriate International Centers, and the nations, that we were able to achieve a great deal in the periods of 3-4 days which were all our timetable would allow for each visit. As we have said above, the TAC owes whatever success this survey has had to the devoted assistance and interest of the Centers, and of our colleagues in the 18 countries.

13. The Centers provided us with lists of their former participants who had come from each of the countries we intended to visit. They sent copies of the appropriate lists to the lead persons, in each of those countries, who were responsible for the arrangements for our visits, to guide them in their consultations with national agencies about the participants we might be able to meet. This was a very substantial task, carried out with remarkable speed and efficiency. In some instances, this may have been the first time when each of the Centers working in a particular country learned what the others were doing to provide training experiences for national agricultural professional workers.

14. The total number of present and former participants we met was 669. We also met about 400 officials of public and private agencies in the 18 nations we visited. We also met some 230 staff members of Centers.

#### Nature and Limitations of the Field Work

15. These studies differ in one important respect from some other studies (such as EPR's and stripe reviews) in the CGIAR System. They are not concerned so much to assess what the Centers do in training in terms of their mandates, programs and budgets, as to estimate the effect of the training on those who have been trained, and on development in their nations. We have tried to assess the work from outside the System, rather in terms of the System itself. We have also seen our task as collegial rather than inquisitorial.

16. We were not able, in the time, to learn much about the size, content and effects of the very large numbers of workshops, conferences, seminars and the like which the Centers organize or support. It may well be that scores of thousands of people have attended such events. Important as these activities are, particularly in maintaining associations with former participants, we felt that we could use our limited time better by concentrating on courses and individual training.

17. Sampling and measurement. The people we met, whether Center staff, past and present participants, or officials of national and international institutions, were mostly those who were available at the time in the places we visited. They were not a sample in any formal sense. Indeed they may have included an undue share of people with whom the Centers are, or have been, in regular contact, or who are well-regarded by their present employers. They included very few

of those former participants who have ceased to be active or have taken up other work. So our sample was neither random nor stratified. The only excuse we and our friends in the nations and in the Centers can offer is that we all did as well as we could in the time available.

18. But in a number of countries we already had, and we also made, contacts and friends of our own, not selected by the Centers or the national agencies. Their testimony did not conflict materially with that of the people whom the Centers and national agencies helped us to meet. Finally, Center representatives were not present at most of our interviews.

19. We did not attempt any formal quantitative measurement of the effects, on individuals, of training at the Centers. To do that, even with a correctly constructed sample in an otherwise homogeneous population, is difficult and time-consuming, and its outcome is uncertain. It would, furthermore, have required far more time than your Committee's schedule allowed. We preferred to meet larger numbers of people, whenever possible in groups, in which, as we have suggested, discussion brought out differences in experience and evaluation.

20. Whatever the defects of our method, the results are broadly consistent over the 18 countries and the many hundreds of participants. We are therefore modestly confident that the report we offer represents sufficiently well the assessment your Committee seeks, and provides a reasonable basis for our suggestions for further consideration and for action.

#### Preliminary Report

21. One of us presented a verbal report on the main study at a meeting in Rome to review plans for the country studies, 2-5 July 1984. A transcript of this account was used as a basis for discussions between ourselves, and with members of the TAC Secretariat. From this, the structure of a preliminary draft was prepared in Nairobi on 23 September and discussed in detail in Harare on 29 and 30 September. This led to a draft preliminary report (included in Doc. AGR/TAC:IAR/84/26), presented to a joint session of your Committee (TAC 35) and Center Directors on Friday 2 November 1984. Center Directors and their staff were the main participants in the brief discussion which followed. The draft was circulated to the Centers, and comments on it have been taken into account in the preparation of the present report.

#### The Country Studies

##### Preparatory Work

22. The TAC Secretariat, with the assistance of an ISNAR working group, prepared the description, method and plan of work for more detailed country studies on training in areas related to agricultural research, with reference to the contributions which Centers have made and are making.

23. With the support of interested donors (the governments of the Federal German Republic, Australia and Sweden, who were consulted about the choice of countries) the TAC Secretariat organized a series of more detailed studies in six nations - Ecuador, Senegal, Tunisia, Kenya, Sri Lanka and Bangladesh. The broad purposes of these studies were essentially similar to those of our survey, but they were designed to present a far more complete and thorough analysis. They were directed by senior nationals of each of the countries (respectively Drs. Pablo Larrea, Moctar Touré, Mustapha Lasram, Stachys Muturi, Stanley Wijayagoonewardene and Kazi Badruddoza), and were made during a period of about six weeks between July and September, 1984. The country studies were supported by two coordinating consultants, Dr. Manuel Pina of CIP, assisted by Dr. Ron Knight of the Waite Institute, Adelaide, Australia. We owe thanks to CIP and the Australian Development Assistance Bureau for making their time available.

#### Method of Work

24. The national collaborators, the consultants, Professor Bunting and Dr. Herz met at the TAC Secretariat in Rome in July 1984 in order to harmonize the approaches of the two parts of the study and to ensure that the separate country studies would be comparable and as complete as possible. A single table of contents (see Annex 4) was proposed for the reports of the six country studies. The work was planned to be done over the ensuing period of six to eight weeks.

#### Description

25. The six country studies were completed under the direction of the national collaborators between early or mid-July and mid-September 1984. Dr. Manuel Pina visited Tunisia, Kenya and Ecuador as work on the studies got under way and again when the report was complete or nearly so; Dr. Ronald Knight similarly visited Senegal, Sri Lanka and Bangladesh. The two consultants then worked during October 1984 at CIP in Lima to complete arrangements for necessary translations of three reports (on Ecuador, Senegal and Tunisia), for editing and printing, and for preparation of an "Executive Summary", (eventually written largely by Dr. Manuel Pina) with the deadline of the meeting of TAC in late October 1984 in view.

#### Findings and Their Use

26. A preliminary summary report (i.e. the "Executive Summary") was distributed to TAC and Center Directors, meeting in joint session at TAC 35 on 2 November 1984, as Annex 2 to the Progress Report on Training, Doc. AGR/TAC:IAR/84/26. Dr. Manuel Pina presented a brief oral report to the meeting, based on the summary report. (See appropriate section in Report of TAC 35, Agenda Item 10).

27. Following TAC 35, the national collaborators were asked to suggest changes, if any, and further editing was done as necessary. The TAC Secretariat decided to prepare and present the six Country Studies "for information" in a separate volume to TAC 36 as a part of the "STUDY OF TRAINING IN THE CGIAR SYSTEM - 1984".

28. Drawing also on the "Executive Summary", Dr. Ronald Knight has contributed a chapter summarizing the activities, principal findings, conclusions and recommendations made by each of the national collaborators and providing selected comments on some of these.

29. Each of the country studies presents an account of the country, of the place of agriculture in its economy, and of the places of the commodities studied by the Centers in the agriculture of the country. It then offers an account of the training provided by each of the Centers which has cooperated with the country, an assessment of its effects, and suggestions for the future. The countries differed from one another in many respects (and indeed were chosen, in part, for this reason), and the senior scientists who directed the studies differed in outlook, position in the national service, and access to local resources. Though they have many similarities, these reports remain distinctly individual documents.

30. The country studies used available data for the more general parts, and questionnaire methods to assemble the experiences and views of national officials and others, and of former participants. They reflect the experiences and hopes of national leaders; and this is one of their strengths. On the other hand, the groups of former participants consulted are hardly comparable from country to country, and they are no more a formal sample than the groups we were able to meet. Finally, some national leaders may have been more interested in what they would like the Centers to do for their nations in the future, and in the weaknesses there may have been in the contributions of the Centers in the past, than in the more positive achievements.

31. In these circumstances it is impressive that on the whole the country studies are so positive about what the Centers have done. It is also satisfactory to note that by and large their findings are not substantially different from ours, particularly in stressing that it is supremely important that the Centers working in each country should cooperate collectively with the national authorities to strengthen national agricultural knowledge systems as a whole (rather than for research on specific commodities and disciplines alone), and to help where they can to meet national manpower requirements for development in agriculture and the rural areas, as well as for research in the strict sense. All the reports include substantial requests for more and better services in the future, which suggests that what has been provided in the past has been acceptable. One or two are worded as if the authors look to the CGIAR System as the sole source of external cooperation in agricultural science - which is flattering for the System but hardly realistic in practice.

32. In the two cases (Bangladesh, Kenya) in which we also visited the countries, the results of the studies have been used to improve our own country reports.

### Other Resources for the TAC Study of Training

33. The records of TAC, the discussion in, and the guidance of the Committee, and advice and comments from past and present TAC members, were of great value to us in pursuing our assigned tasks. So, too, was the guidance and preliminary information from the "impact study", which was offered to us by the CGIAR Secretariat. Among other sources of information, the wealth of documentation available from FAO (including data from the 1984 survey of training of manpower for agricultural and rural development in Africa) and to some extent also from UNDP and the World Bank, provided valuable background material for our work. In our travels we received numerous documents related to our study from the Centers, the national services, and a number of individuals, from whom we also obtained pertinent verbal or written information and opinion. A list of some of the documents we have consulted is given in Annex 5.

### Scope of the Report

34. In this Report of the "Study of Training in the CGIAR System - 1984" we address our findings and suggestions to the CGIAR System as a whole. The Report is based largely on our broad survey but does take account of major relevant findings from the country studies. Lengthy as this Report is, it necessarily omits much detail. Some further detail in regard to the Centers and the countries we visited will be found in the summary reports given in Annex 6 and Annex 7. We hope that these summary reports present the situation in 1984 both fairly and reasonably accurately. We apologize in advance for any errors or misinterpretations they may contain. All such faults are inadvertent: we have done all we could in the time to avoid them.

## SUMMARY

35. Since the International Rice Research Institute began to provide training, 23 years ago in 1962, more than eighteen thousand people have been trained by the International Agricultural Research Centers. Many of these people are now national and international leaders who have made most significant professional contributions to progressive change in agriculture, and in the rural space, in the developing countries. Yet this number, large as it seems, represents no more than a minute fraction of all professionally trained people in the cooperating nations.

36. The former participants in training provide the most important channels of communication between the Centers and the nations with which they cooperate, and so they do much to support and promote the work of the Centers. Consequently all of the Centers accept that they are both research and training institutions and are developing important associations with national institutions for agricultural education, as well as with national research agencies.

37. The costs of training and conferences consume about 8% of the core budgets of the Centers. The real cost, which is not precisely known, must be substantially more, because the training uses staff time and the physical resources of the research programs and services of the Centers, which are met from other headings of their budgets. The nominal cost in 1984 was about US\$ 13.5 M. The true cost may well be two or three times as large. Though financial stringency has tended to restrict spending of core funds on training, the volume of training has been maintained, in many Centers, by training components in special projects.

38. TAC's Study on Training - 1984 was designed to describe and analyze these topics and to offer suggestions for the future. It was conducted in two parts, a broad survey and a set of six Country Studies. In the broad study, our team visited the 13 Centers and Institutions funded through CGIAR, and 18 cooperating developing countries (Mexico, Guatemala, Costa Rica, Colombia, Peru, Nigeria, Burkina Faso, Liberia, Indonesia, Thailand, Philippines, Syria, India, Bangladesh, Nepal, Ethiopia, Kenya and Zimbabwe). The team interviewed 175 current and 494 former participants (total 669). In the nations, we consulted senior persons in the public services of agriculture, in the universities and other teaching institutions, and in the private sector.

39. In the second part of the TAC Study, senior nationals of Ecuador, Senegal, Tunisia, Kenya, Sri Lanka and Bangladesh conducted more detailed studies of the nature and effects in their countries of training by CGIAR Centers. The results of the two parts were generally consistent with each other.

40. The place of research in agricultural knowledge systems, and the relations of knowledge to development, are discussed in paragraphs 79 to 84. Knowledge may be, and usually is, a necessary factor for development, but it is seldom or never a sufficient factor. Many other factors are involved, and in most developing countries they are not in a sufficiently satisfactory state to permit knowledge to make the fullest contribution of which it is capable.

### Training by CGIAR Centers and Institutions: General Comments

41. Virtually all of the participants are qualified nationals employed in developing countries and nominated by their employers, who are usually public agencies. In general, training at the Centers is practical. Most of it is given by active research workers and in research programs. Training at Centers is residential and personal, even in courses provided for groups.

#### Types of Training

42. The chief types and means of training provided or promoted by Centers include:

- a) general and specialized courses for groups, lasting from one week to several months, often through a crop cycle, intended to acquaint participants with the methods and results of research at the Centers;
- b) individual attachments for research workers and other scientists, lasting from a few weeks to two years, in which they conduct research and learn new techniques. This category includes a limited number of postdoctoral attachments;
- c) research of up to 2-3 years, related to the thesis requirements of a degree (usually M.Sc. or Ph.D.) of a university in a developing or developed country. Centers have marked comparative advantage in training of this sort;
- d) "in-country" training in national or regional institutions, conducted increasingly independently and usually by former participants in training at Centers, the content of which is similar to that of group courses at Centers ("a" above);
- e) workshops, conferences and seminars;
- f) library, information and documentation services;
- g) publications of many kinds.

43. This report is concerned mainly with a) to d). Because these broad categories are defined in detail in different ways in different Centers, it is not possible to present the corresponding numbers of participants for the system as a whole, with two exceptions. The total number of higher/degree-related and postdoctoral participants (including in the case of ICRISAT both international interns and research fellows) is 2,483 (13.75% of the total).

#### Funding

44. In the core budgets of Centers, training competes for funds with research. When funds are short, training tends to suffer. If a Center maintains the volume of its training through special projects, the result can distort the program of a Center. Some governments and other agencies pay for the training they want.

## Evaluation

45. In general, the effects of training have not been adequately monitored and evaluated.

## Links after training

46. Centers do as much as they can to support former participants, mainly by working with them in the cooperative programs with their nations, by sending them genetic or written material, and by inviting them back as trainers, or as participants in conferences, workshops and seminars. In this, the Centers differ from virtually all other training agencies. This is the source of one of the most important effects of training on the participants, as well as on the Centers.

## Training by CGIAR Centers: Assessment

### The Nations

47. Though in most nations persons trained at Centers are a small proportion only of all professional workers in agriculture, they are warmly praised and evidently have special value for the nations. The nations want more training by Centers, though the types of training they want tend to change as development proceeds. However, none of the nations we visited has a manpower development plan. It is consequently difficult for each nation to coordinate its responses to the offers of training it receives from the different Centers with which it cooperates. There is considerable demand for more higher degree training, which is costly and has tended to decrease as Centers' budgets have decreased in real terms.

48. Many Centers work in training with Universities in developing countries, but in any one country the different Centers approach Universities separately. We suggest that their approach should become collective and that along with their other training activities it should be articulated under the aegis of an appropriate national agency.

49. In a number of countries, the scientific standards of the Centers are so far ahead of those of the national agricultural knowledge system and institutions that it is difficult for the nations to derive full benefit from the work of the Centers. We believe that it is necessary that the work of Centers should help to advance the standards of the national systems and institutions. This could begin with collective cooperation with the universities in research, teaching and curriculum development, perhaps promoted through the appropriate agency suggested in paragraph 48.

50. In virtually all nations (including most developed countries) the national agricultural knowledge systems are dispersed and fragmented. In their own interests the nations need to articulate these systems. Their parallel need to articulate cooperation between national institutions and the separate International Centers may help to suggest appropriate means of articulating the national systems also.

51. All this would help the Centers to advance from an individual, Center-based and research-oriented stance to a collective, country-based, development-oriented stance - a change which seems essential if the CGIAR System is to have its full potential effect on the development of the nations.

52. Notwithstanding these comments, training at the Centers has clearly strengthened agricultural research and the agricultural knowledge systems in many nations, and has played its part in the increases in output which many of them have realized.

#### The Participants

53. All participants are professionally qualified according to the standards of their own countries; but these standards vary very widely, which can make group training difficult (though the interactions have advantages).

54. In most cases, the Centers select participants who have been nominated by governments or other employers in response to invitations from the Centers. This two-stage process helps to maintain standards. Some degree-related participants are proposed by donors. Postdoctoral opportunities are usually advertised.

55. We suggest that Centers should evaluate the current usefulness for development of participants from developed countries.

56. Some participants initially find the transition to the very new and different environment of a Center difficult and startling, but these reactions are soon overcome. The principal continuing difficulties are those of language. Center staff and participants should be encouraged and helped to learn appropriate languages, and all who wish it should be helped to learn English, which is the principal language of agricultural science internationally and also of the Centers, most if not all of which (and the CGIAR itself) are basically anglophone institutions.

57. The length and content of the courses, by and large, are satisfactory, though some participants find some of the shorter courses too short. Some topics deserving greater emphasis are mentioned in paragraphs 167-177.

58. The effects on the participants of training at the Centers are profound. The training experience increases knowledge and skills, enjoyment of intellectual and physical labour, motivation, determination, purpose and confidence. Continuing contact with the Center afterwards offsets isolation and helps a participant to feel that he is a valued citizen of his professional world.

59. The subsequent careers of participants suggest that through these effects most of them are able to serve research and development in their nations more effectively, even though many are promoted out of practical research and some move to commodities and disciplines different from those in which they were trained at a Center.

## The Centers

60. Though they are both diverse and operationally largely independent of each other, the Centers are all well-equipped, well-funded, well-staffed and professionally advanced. They are international, multi- and increasingly interdisciplinary, and they are among the leading centers of excellence working in or for the developing nations. They are not thought to be projects of limited life, and so they have offered, and are expected to continue to offer, long-term collaboration with the nations and the participants.

61. Centers undertake training to advance their cooperative programs; to build national capability in research and other sectors of national agricultural knowledge systems; and to identify suitable candidates for their own staff and those of other advanced institutions.

62. Each Center has links in training with many nations (up to 80 in some cases) and each of the 18 nations we visited has links with an average of about seven Centers, which approach it separately, even if they are offering training in similar fields. This can lead to difficulties, for example in studies of systems of farming, which the Centers are trying to lessen.

63. Since Centers cannot meet all needs of the nations for training on topics in which they have comparative advantage, they promote "in-country" training. Means have to be developed to offset the tendency in such training to dilute the comparative advantage which is strongest at the Center itself.

64. Nor can Centers meet all expectations with respect to opportunities for thesis research for higher degrees - in which they have outstanding comparative advantage. To do more in this direction they will need more staff, more accommodation and more money. The nations share these expectations with at least some members of the CGIAR. See paragraphs 200-202.

65. Agricultural science in the world, wherever it is taught, has hitherto been a largely Northern and Western product, adapted to temperate environments and systems. The training and research of the Centers now enable them to develop the necessary new variants of agricultural science, which will be adapted to the many different environments - principally seasonally-arid winter rainfall climates (sometimes at high altitudes); seasonally-arid summer rainfall tropical climates (sometimes with winter rain as well); humid tropical climates, often with bimodal rainfall; high altitude tropical climates - and systems of developing countries.

## The Donors that Fund Training

66. The financial stringency which donors have felt compelled to impose on the Centers has tended to lessen the proportion of core funds which the Centers use for training.

67. Some donors feel that training at the Centers should be restricted to research training, but many Centers and all the cooperating nations wish Center training to strengthen other parts of agricultural knowledge systems also. The nations, while interested in

the more advanced techniques and more "basic" work at the Centers, do not wish the Centers to lose touch, in either research or training, with the interface between research and development. Most if not all of them accordingly wish the more general types of training (for example on production and breeding methods) to continue.

68. Some donors who are members of CGIAR are currently allocating large sums to support research and university development in developing countries. The Centers are also active in these directions. Donors should consider associating the Centers with these activities, in order to make fuller use of their substantial investment in the CGIAR System.

#### Towards the Future

69. We have assembled the essential statistical and descriptive data which the CGIAR impact study needs in order to assess the impact of the CGIAR System through training.

70. Both the Centers and the donors confront substantial future tasks in helping to ensure the supply of adequately trained professional manpower for agricultural development in the generations ahead. We suggest that the donors could support their own aims by adding a separate and continuing earmarked training component, based of course on program projections, to the core funds of each Center. This would be intended to eliminate the damaging competition between research and training for funds in the Centers.

71. Finally we refer once again to the need for articulation in the activities of the Centers in their programs in general, in their training and dissemination activities, and in their cooperation with individual nations.

72. The CGIAR System will need increasingly and consciously to work as a system.

## RECOMMENDATIONS

73. In the following, we recommend action to be taken by the appropriate units of the CGIAR System on matters grouped under four broad headings: "On cooperation with the nations", "On training at and by Centers", "On facilities (buildings) for training" and "On Donors and Funding". Because of the cardinal importance, for the use of IARC training, of the state of agricultural development in the nations, we felt the need to address a single and first suggestion in part to the developing countries which cooperate with the Centers. We hope appropriate means will be found to bring this suggestion (i) to attention.

Note: The numbers in parentheses at the end of each recommendation indicate the paragraphs in this report which contain relevant background information or more detailed explanation.

A. On Cooperation with the Nations

i. Nations should review their existing arrangements for articulating the components of their agricultural knowledge systems to ensure that they are as productive as possible for national development. Centers should be prepared to assist in this task if they are invited to do so. (79-84,105,127,139,141,144-145,199,218)

ii. The Centers which assist a particular country in training should work together, in association with the appropriate national agencies, to ensure that their collective contribution is in accordance with national needs for development. For example, the Centers should devise appropriate means of collective collaboration with the universities and other institutions for agricultural research, education and training in the nations; if they are invited to do so, they should contribute to curriculum development; and where it is advantageous to do so, a resident representative of one of the Centers should be enabled to promote their collective actions, and to inform national authorities of the activities and developments in the CGIAR System. (125-127,134-139,142,145-146,187,193-194,205,218)

iii. National authorities should be supplied regularly with information about the training and other activities of all the Centers. A brochure should be issued at the beginning of each year. It should contain all available information about courses to be offered in all Centers in the following year, and about vacancies in courses in the current year. Center directors should consider establishment of a body (standing committee) of persons responsible for information on training within the System. (128)

iv. In-country training should continue to be developed with as much support as the Centers are able to give, and Centers working in one country or region should cooperate in promoting it. To retain as much as possible of the comparative advantage of the Centers in training, the in-country trainers should be enabled to keep in touch with progress in research and training. Increasingly, Centers should seek to ensure that in-country training becomes an in-country responsibility, assisted as needed by the Centers working in the country. (93,105-106,182,198-199)

v. In fields of training which are common to two or more Centers, the content of training, and the concepts and terminology used, should be harmonized between the Centers to ensure that they do not conflict, particularly in in-country training. In some fields of training, it may be advantageous for one or several Centers to provide training on behalf of all. (195,216)

vi. Methods for the formal training by the Centers of trainers at different levels should be studied and tested, perhaps in cooperation with institutions experienced in the training of teachers and extension workers. (198)

vii. In their continuing association with participants in the nations, Centers should ensure that any guidance they may give does not conflict with national policies, attitudes and practices. (194-196)

#### B. On Training at and by the Centers

viii. Types of participant. The CGIAR System should accept that its purposes can only be approached if many classes of people besides research workers and technicians are affected by training, so that they understand the role of research in development more completely, and are able to make appropriate choices among the products of research. (94,123,135,153,204,207)

ix. Postdoctoral workers. The status and responsibilities of postdoctoral workers should be clearly and uniformly defined at each Center. Postdoctoral workers should be regarded as research "colleagues" who are independent up to the limits demonstrated by their own performance, and within these limits they should not be diverted from their agreed programs without their own agreement. (158)

x. Higher degree training. Centers should do all they can, without prejudice to their research, to assist in the training of graduate students from developing countries for higher degrees. Centers should participate in soliciting funds for higher degree training and, where this will increase effectiveness, should appoint advisers to share with the supervisors the work of guiding research students, particularly during thesis preparation. (129-132,200-202,208)

xi. Developed country participants. A study should be made of the current usefulness of degree related and postdoctoral participants who are nationals of developed countries, and Centers' acceptance practices should be modified as may be indicated by the findings of the study. (157)

xii. Training content. The attention of Center Directors is invited to the list of additional topics for training presented in this report. Among these, training in the relation of research to development, and in research management and research program planning are particularly important. (167-177)

xiii. The length of short courses should be reviewed to ensure that they are long enough to enable participants to benefit as fully as possible. (165)

xiv. "In-service" training. Sabbatical attachments, working visits by scientists and others whose participation in the work of the Center will benefit their own work, their institutions and the development of their nation, as well as the work of the Center, should be promoted as vigorously as resources will allow. (129,189,191,193)

xv. Group courses. Group courses on specialist topics which cannot be taught "in-country" should continue at the Centers. So-called "production" courses on agronomy and plant breeding should also continue at the Centers, particularly for participants from countries at early stages of development, provided it is clear that they are related to the research activities of the Center and intended to increase understanding of the methods, achievements and prospects of research. (121,129,153,205)

xvi. In appropriate cases, particularly for longer or more highly specialized training, the participant should receive a formal certificate testifying to successful performance. (183)

xvii. Language. Language capabilities of staff and participants should be developed to the extent necessary for them to train and to be trained effectively. Staff and participants who wish to go further should be encouraged and helped to do so. To this end TAC should investigate language learning methods, particularly methods of self-teaching which do not require special buildings or human instructors and can be pursued at the student's own pace and in any place. Particular attention is needed to the English language; and the availability of means for learning the professional languages of the agricultural sciences should be investigated. If nothing satisfactory exists, the CGIAR System should commission one or more prototype methods for testing. (160-163)

xviii. Monitoring, evaluation and follow-up. The work of a participant or of a group of participants, should always be monitored as it proceeds, and evaluated at the end. Centers should request donors to support, and donors should seek to support, the costs associated with evaluation of training. So far as possible, the Center should inform itself about the subsequent careers and performances of participants as part of the "follow-up". In appropriate cases, Centers should seek means to help former participants to get started with their work when they return to their jobs after training. (115-116,122,181,183,184,188,198,208)

xix. Costs. Centers should estimate and publicize the full costs associated with their training activities, if possible separately from costs of conferences and other meetings. The CGIAR budget study group should recommend corresponding guidelines for presentation of data on training in Centers Program and Budget submissions. (112-114,206,214)

#### C. On Buildings for Training

Improvements in buildings related to training are or may be needed at the following Centers and locations:

- xx. CIMMYT. More accommodation for teaching, for services supporting training, and for individual indoor work by participants (other than laboratory work); some addition to dormitory accommodation. (Annex 6 B)
- xxi. WARDA. Facilities for training in the special programs and in the sub-regions are probably not adequate or may not exist at all; this should be reviewed. Kitchen, refectory and common room facilities should be improved at Fendall, but no other additions should be contemplated there. (Annex 6 M)
- xxii. ICARDA. The present building program may well provide sufficient space for ICARDA's current needs, but as 'in-country' training develops ICARDA may need more space to support the training of national cooperators who will conduct it. (Annex 6 E)
- xxiii. ILCA. More residential accommodation is needed, perhaps 20 rooms, and any consequent reorganization or addition to kitchens, refectory, and 'social' space. (Annex 6 I)
- xxiv. ILRAD. ILRAD will need more accommodation and refectory facilities to support the increase in training away from ILRAD Nairobi which must be anticipated before long, but this problem is entangled with ILRAD's support to the other Centers. The needs for space and facilities for Centers in the Nairobi-Kabete-Muguga area should be investigated urgently and appropriate action taken. The needs of ILRAD can then be considered separately. (Annex 6 J)
- xxv. Other Centers. As more funds become available for training, and the training of trainers actually begins, more space may be needed for it and for the regular support of increasing in-country activities. (Annex 6, A-M)

#### D. On Donors and Funding

- xxvi. Funding for training should be both greater and more secure than it is at present. (See also Recommendation xviii). Although training is an essential activity valued both by the Centers and by the nations, it competes unsuccessfully with research for funding when funds are short. (202-209,214,218)
- xxvii. Donors should consider whether they are able to support training at the Centers from sources different from those from which they support the Centers as research institutions, such as allocations for cooperation in education and training. (202)
- xxviii. Funds specially provided for training should be held as a second, separate, non-transferable core in the budgets of the Centers. (202,204,214)
- xxix. Donors, especially those who are members of the CGIAR, should seek to increase the return on their investments by involving the concerned Centers in their bilateral actions in support of national agricultural knowledge systems in particular countries. (208-209)

## INTRODUCTION

74. Since the International Rice Research Institute began to provide training, 23 years ago in 1962, more than eighteen thousand people had been trained at the International Agricultural Research Centers up to the end of 1983. Many of these people are now national and international leaders who have made most significant professional contributions to progressive change in agriculture, and in the rural space, in the developing countries. Large as this number is, it represents no more than a minute fraction of all professionally trained people in the cooperating nations.

75. The former participants in training provide the most important channels of communication between the Centers and the nations with which they cooperate. Consequently all of the Centers accept that they are both research and training institutions. Important associations are developing between Centers and national institutions for agricultural education.

76. The costs of training and conferences consume about 8% of the core budgets of the Centers. The real cost, which is not precisely known, must be substantially more, because the training uses staff time and the physical resources of the research programs and services of the Centers, which are met from other headings of their budgets. The nominal cost in 1984 is about US\$ 13.5 M. The true cost may well be two or three times as large.

## SOME DEFINITIONS AND CONCEPTS

### Training

77. We regard as training any activity which increases the number and quality of professional workers in agricultural and related sciences, at any level.

### Participants

78. We use the word participants to describe those persons who have taken part as learners in training activities. We have not felt it reasonable to describe a senior visiting research worker or a postdoctoral research fellow as a trainee.

### Knowledge and Knowledge Systems

79. Knowledge includes information, concepts, techniques and skills. These are maintained, increased, disseminated and used in knowledge systems. The agricultural knowledge system has five essential components:

a) the existing stock of knowledge in the minds and memories of men and women (particularly in those of the agricultural

producers), in books and periodicals, in libraries and archives; and in maps and other factual records;

b) the means of increasing knowledge - experience, surveys and other means of collecting information, and particularly experimental research, which is intended to obtain and test new information, to put the information into order by means of concepts, and to improve techniques and skills;

c) the means of testing and developing knowledge (including skills and techniques as well as information) so as to fit it for practical use in new methods and processes, which are often specific to particular circumstances. This is the "development" part of "research and development", and in some countries important parts of it occur in the commercial sector;

d) the practical application of new and improved methods and processes, in the circumstances to which they are appropriate, in order to achieve increases in output, decreases in the cost of products, and adjustments of the production system which are required;

e) the dissemination of information, concepts, techniques, skills, methods and processes to people who need them in order to work more effectively in any parts of the knowledge or production systems. This component includes education, training and extension, whose object is to increase the number and quality of professionally competent people (including producers) in all parts of the system, including the consumers and other end-users of products, and those who work in the dissemination component itself. It also includes publications, information and abstracting services, conferences, workshops and seminars, and spoken or written communication between individuals.

80. In many societies the knowledge system has components in both the public and private sectors. In the public sector, national responsibilities are usually divided between different ministries and parastatal bodies, so that collective action for development is seldom easy. We discuss this matter more fully in paragraph 144. Yet unless some way is found to articulate the components, and link them to the agencies which form national policy for the use of renewable natural resources (in forestry, wildlife, irrigation, fisheries, and so on, as well as in crop and livestock production) the result is all too likely to be wasteful competition and unnecessary overlap, and failure to meet the needs of the nation. A possible role for the Centers in this connection is discussed below (paragraphs 145-146). ISNAR could evidently play a valuable part here also.

#### Knowledge and Development

81. We take development to be a change process intended to make the available resources, plus any others which can be obtained at acceptable cost, more productive of goods and services which both rural and non-rural people, and national governments, require.

82. Knowledge, including the products of research, is often a necessary condition for development in agriculture and in the rural space, but it is seldom or never a sufficient condition. If family, household or community needs, or effective demand off the farm or outside the community, for surplus products, are too small; if the output delivery system (including transport, markets, storage, processing, wholesaling and retailing, exports, financial support) is defective; if essential resources (land, water, labour, capital, equipment, purchased inputs) are too scarce, too costly or too unreliable; and if the policies and practices of governments are inappropriate or negative, rural people may be unable to use new and more productive methods, generated by the knowledge system, to increase output and so to contribute to development. Research, training and extension have never been able for long, if at all, to induce rural people to do things which they do not find to be to their advantage.

83. Conversely, where (as in most developed countries, and a few developing ones) these other conditions are sufficiently satisfied, development may proceed under the stimulus of economic opportunity, using technology already known, without benefit of education, research or extension. In such circumstances, weaknesses in the knowledge system may indeed become the main constraints on development.

84. It follows, from this, that whether or not research is "the engine of development", as many who support the international system hope, depends very much on local circumstances. We must beware of claiming or expecting too much of research, in circumstances where other factors are adverse. It also follows that the type of training which will be most productive in supporting change, in a particular country, will depend on the circumstances of that country. There can be no universal recipe for success.

#### The Nations, the Centers and the CGIAR System

85. One of the most striking features of the Centers, and also of the nations with which they cooperate, is diversity. The Centers and nations are diverse in history, objectives and tasks, size, stage of development, location and environment, type and range of resources and technical capacity, and in organization.

86. In addition, the nations differ in social and economic circumstances, communications, population density, in the relative importance of food, of the food commodities on which the Centers work, and of biological products other than food commodities, in their economies, and in the natures and structures of their agricultural knowledge systems.

87. It follows that, though they slide easily off the tongue, general statements about "The Centers" and what they should or should not do, or about the "the developing countries" and what they do or do not need, are not likely to be useful. Some broad patterns and categories can be distinguished, but broad generalizations are not helpful.

88. For the most part, the Centers act individually to attain their goals, defined in terms of particular commodities or of systems of production for different sorts of environments. Each Center cooperates with a large number of countries, and most countries cooperate with several centers separately. We shall return to the consequences of this below (paragraphs 193-196). Whatever progress the Centers may be making towards cooperation in research, in training the CGIAR System operates as a system only where national authorities are able to induce its components to do so.

89. Finally, the Centers do not stand alone: they are a part of the worldwide agricultural knowledge system, which includes universities and other parts of the dissemination component of both developing and developed countries. Nevertheless, in much of the developing world, the Centers have become a significant part of the leading edge of the agricultural knowledge system. This leads to obligations as well as opportunities, to which also we shall return (paragraphs 141, 142, 201).

#### TRAINING BY CGIAR CENTERS AND INSTITUTIONS: GENERAL COMMENTS

90. As we have remarked, all of the CG Centers are in practice both research and training institutions; and the training task is written into most of their mandates. In this, they pay tribute to the founding fathers in the Rockefeller and Ford Foundations, who began to develop research and training in agricultural science together, 40 years ago, in Latin America and later in Asia.

#### Purposes and Styles of Training

##### Styles of Training

91. We consider "in-country training" at several later points in this report (e.g. paragraphs 105-106, 141, 182, 195, 198-199). Here we are concerned with training at the headquarters of Centers.

92. Training at the Centers is always practical but also always based on research. In all Centers most research workers readily devote part of their time to training. The Centers employ very few full-time teachers: most of this work is dispersed among the research staff. Training is also intended to promote and support research and to increase understanding of what appropriate research can do. Though, for some Centers, training began as a means of developing national manpower to facilitate their cooperative programs with the nations, training (like the research itself) has evolved over time from this somewhat top-down mode to a more reactive and cooperative mode, as the Centers have come increasingly to understand the diversity of national needs, and the nations themselves have formulated their requirements more explicitly.

93. Training is usually related to cooperation between a Center and national programs, so that the trainers are aware of the needs of those programs. Training thus creates an important means by which knowledge, skills, germplasm and ideas flow from the Centers to their national cooperators and from the nations to the Centers. The types of training required by a national program depend on the stage it has reached. For example, Indonesia and the Philippines formerly made great use of rice production training at IRRI. They now provide such training themselves, and look to IRRI mainly for specialized or degree-related training and for sabbatical opportunities. At the other end of the spectrum Bhutan will start its newly-established cooperation with IRRI through production training.

94. Cooperation with a national program in training is not always restricted to research: it often includes other components of the national knowledge system, particularly the universities and other parts of the dissemination element. We shall return to this topic below (paragraphs 135-142).

95. As understanding of existing farming systems and their environment grows, we may expect that participants will become increasingly sensitive to other measures of achievement besides yield and output of the commodities on which the Centers work, such as optimizing the return, through all products, on all resources committed (particularly land in much of Asia and, in much of Africa, labour at times of peak demand), while at the same time decreasing the unit cost of the product. However at present the training of many participants, including their systems training, concentrates on particular food commodities. Except at ILCA, it seldom takes much account of other food and non-food commodities (including timber and fuel as well as export crops). Nor does it pay much attention to activities in other sectors of the life-system of the producers, even though they compete with crop and animal production for labour, land, capital and other scarce resources. This is of course a characteristic feature of much dedicated and successful agricultural research everywhere; and in industrialized countries, or in plantation industries in developing countries, it may be satisfactory enough. However many observers feel that agricultural research in the less industrialized countries will not make its full contribution to development (as distinct from technical information about the production of individual commodities or the promotion of individual technical components of systems) until it has evolved the broader mode of conceiving its tasks, in terms of the return on use of resources in life systems, suggested above. Some Centers have already reached this stage.

#### Residential Training

96. The training at Centers is generally residential; and several Centers have impressive investments in dormitory and refectory buildings and community amenities. This is less the case at CIP, which has a largely decentralized mode of operation, and at ILCA, which is both decentralized and relatively young. Nor is it sufficiently the case at CIMMYT. Everywhere we went the residential facilities, large or small, were being fully used. At most Centers we felt that the limitations they impose may be an important reason for the restrictions on length which many former participants felt made the courses less satisfactory than they had hoped.

## Personal Relations between Staff and Participants

97. The staffs of Centers seem to come to know many participants individually, even in group courses. When these personal associations are continued after the training has ended, through national cooperative programs or "follow-up", many strong and lasting bonds develop (see paragraph 116 below).

## Types of Training Offered

98. The work of the Centers in training may be classified broadly under seven headings, as follows, though there is considerable variation between Centers in detail and in nomenclature:

99. a) Longer-term participation (from 6-9 to 24 months, or even longer) in research at the Center - postdoctoral training, training related to higher degrees (usually M.Sc. or Ph.D.); longer-term sabbatical attachments. Longer-term training of this sort is usually available for nationals of industrialized countries, but in such cases the costs of stipends do not fall on the core budgets of the Centers except for some postdoctoral attachments. The degree-related work brings the Centers into close relations with universities in their host countries and elsewhere; and university teachers have often been invited to the Centers for sabbatical periods.

100. b) Shorter-term individual training at a Center or in a Center's program in a country or region. Most of these attachments are for less than 9 months. They are intended to enable participants to master specific techniques or to conduct investigations of limited length. Most, but not all, of the short-term individual training is funded by the Centers from core or special project funds. Some is paid for by national or other employers or sponsors.

101. c) Group courses intended to acquaint participants with research methods or techniques, or to learn the methods of experimental and other work related to production or breeding (improvement) of crops or economic animals. These courses may be as short as one week but are usually longer. The production and improvement courses extend, in many instances, through the whole of a production or breeding cycle. Many are conducted at the headquarters of the Center, or at one of its regional bases of operation, but increasingly such courses are offered "in-country" in cooperation with national institutions. This topic is discussed further below (paragraphs 105-106).

102. Examples of subjects for group training are experimental farm management (CIMMYT), design of research programs for the Centers themselves or for nations and regions (all Centers), design and management of national research systems (ISNAR), seed production and management (CIAT), germ-plasm management (several Centers, including IBPGR), rapid disease-free vegetative multiplication including stem-tip culture (several Centers), fistula techniques for digestibility studies (ILCA), virology including electron microscopy (IITA, ICRISAT); immunological diagnostic methods (ILRAD); study of existing farming systems and methods of determining constraints and

testing and promoting possible improvements (OFR, FSR, and so on, many Centers), screening and other methods of evaluation of breeding material of economic plants and related unimproved or wild germplasm (most Centers).

103. In production or crop improvement training the participants produce a commodity themselves. In so doing they learn the procedures and rationale of the relevant methods of investigation which are used at the Center (including studies of existing systems) and the ways in which research results are applied to improve existing methods of production. A well-designed production course is a great deal more than a practical experience in growing the crop: it has more of the character of a course in experimental agronomy. Group course and individual training (c and b) may be combined in one visit to a Center, as for example where an initial period of production training in a group leads on to a further period of more specialized individual ("in-service") attachment to a research program.

104. Longer group training courses have advantages in enabling participants to become more fully acquainted with the Center and its work, and in some cases to experience all or most of a crop or breeding cycle. Shorter courses may allow more participants to benefit. The balance between these alternatives is indicated for different Centers in Table 1 by using the arbitrarily-selected limit of 9 months to divide the numbers of participants.

105. d) "In-country" training. It is general policy to move as much as possible of the training, particularly group course training, into the more relevant (and usually less expensive) environments of the cooperating nations themselves. Ultimately, it is expected that the nations will offer more and more of these courses independently, with arrangements to ensure that innovations developed at the Center or elsewhere are introduced as they become available; and this has been achieved in some nations where the national systems are advanced and self-reliant. The part played by the Center in "in-country" training consequently varies from none to complete management of the design and teaching of the course. Increasingly "in-country" training is becoming "in-country" business, in which the courses are taught by national scientists and other professionals, many of whom are former participants in training at a Center. Moreover some of these courses have become regional or international: they are attended by participants from other nations. We imagine that each nation will wish to see the separate "in-house" courses promoted in the country by different Centers brought together in some way to serve the development interests of the nation as a whole, and not the purposes of the individual Centers only.

106. There is however a price to pay. The comparative advantage of most, if not all, Centers in training is greatest at their headquarters, and it tends to be diluted as "in-country" training becomes more and more independent. The main means of offsetting this is to bring the "in-country" trainers to the Center at appropriate times for appropriate "in-service" courses, so that the links are never broken. CIMMYT and some other Centers deal with this problem in a converse way, by organizing intermittent courses at critical times in the crop season when Center staff attend in order to work with the

participants (the "call" system). In-country training will not, as we see it, eliminate the tasks of the Centers; it may lessen them, but it will also change them, since the in-country work can benefit so much from support by the Center. Conversely, the Centers will benefit by learning more about national needs, circumstances and professional personnel.

107. e) Workshops, conferences and seminars, at Centers or elsewhere.

108. f) Library services, including abstracts and other information and documentation services.

109. g) Publications, including annual reports and summaries, newsletters and bulletins.

110. So far as we could in the time available we have informed ourselves about e), f), and g), which are extremely important means of spreading knowledge about the Centers and their work, particularly among those senior people who form or execute policy for agricultural development and the agricultural knowledge system. Supplement A to Table 1 shows training of type e) offered by two Centers (ISNAR and ILCA) which have concentrated on this type up to now. But in the main we have concerned ourselves with a), b), c) and d).

111. The numbers of people who have received training of types a) through d) since 1962 are set out in Table 1. Supplement B to the table shows that, additionally, more than seven thousand people have been trained at locations away from the Centers. As we have pointed out above, the total can be no more than a small fraction of all nationals of developing countries who have received professional training during the same period.

#### Costs of Training

112. We have referred broadly, in paragraph 37 above, to the costs of training. Except for some longer-term training (particularly of graduate students from industrialized countries) most of the costs of training to the Centers are derived from core and special project budgets, including travel, maintenance, or university fees. The average figure of 8% of core budget for the cost of the organization of training covers a wide range of variation.

113. Table 2 gives some of the relevant data we have been able to assemble. It would be hazardous to draw rigorous conclusions or comparisons, as it is clear that the numbers do not cover identical items in the various Centers.

114. The first priorities for a Center include research, maintenance of buildings, plant and facilities, and management. When core funds are short, training suffers; but Centers and donors have become expert at redressing the balance by including training components in special projects. Moreover some governments and other employers pay for the training they want. At IITA in 1983 the official figure for the proportion of core budget spent on training was less than 3%, but funding by sponsors, employers and special projects enabled IITA to maintain the volume of its training as usual. We return to this topic in paragraph 206.

Table 1 PARTICIPANTS IN TRAINING/TECHNICAL SKILL DEVELOPMENT  
AT THE INTERNATIONAL AGRICULTURAL RESEARCH CENTERS  
UP TO END OF 1983. Source: Returns from the Centers

Notes

a,b

<u>Center period</u>	<u>Total persons</u>	<u>&gt; 9 Months+</u> (inc. degree related & postdocs)	<u>&lt; 9 Months</u>	<u>Postdocs</u>	<u>Degree Related</u>	<u>Individual Programs + Courses</u>	<u>c,d</u>
<u>CIAT</u> <u>'69-'83</u>	2,459	483	1,976	46	179	2,234	
<u>CIMMYT</u> <u>'66-'83</u>	2,913	429	2,484	88	198	2,627	e
<u>CIP</u> <u>'72-'83</u>	2,555	208	2,347	--	208	2,347	f
<u>IBPGR</u> <u>'77-'83</u>	898	182	716	--	182	716	g
<u>ICARDA</u> <u>'78-'83</u>	362	93	269	21	18	323	
<u>ICRISAT</u> <u>'74-'83</u>	825	187	638	69	118	638	
<u>IFPRI</u> <u>'75-'83</u>	80	80	-	--	-	80	h
<u>IITA</u> <u>'70-'83</u>	2,872	347	2,525	85	262	2,525	
<u>ILCA</u> <u>'75-'83</u>	340	45	295	9	36	295	i
<u>ILRAD</u> <u>'78-'83</u>	421	63	358	30	33	358	
<u>IRRI</u> <u>'62-'83</u>	3,451	854	2,597	217	637	2,597	j
<u>ISNAR</u> <u>'79-'83</u>	-	-	-	-	-	-	k
<u>WARDA</u> <u>'73-'83</u>	887	47	840	-	47	840	
<b>Totals:</b>	<b>18,063</b>	<b>3,018</b>	<b>15,045</b>	<b>565</b>	<b>1,918</b>	<b>15,580</b>	see next page

Table 1 Supplement A: Other Training Activities of IFPRI, ILCA and ISNAR Notes

Center (Period)	Description of Activities	Participants	l
IFPRI (1975-83)	Survey Technician Training	760 (est.)	h
ILCA (1975-83)	Workshops, Seminars, Conferences	912	i
ISNAR (1981-83)	Workshops, Seminars, Conferences	536	k

Table 1 Supplement B: Participations in Training Activities Conducted Outside Centers Headquarters or Stations Notes  
b,h,i

Center	Description of Activities (Courses)	Participants	m
CIAT	In-country Center assisted	2,295	
CIMMYT	Regional & national, Center run or supported	1,850	n
CIP	Regional & national, Center run or supported	1,802	o
IBPGR	See footnote "g". Listed in Table 1		g
ICARDA	In-country, Center run or assisted	111	
ICRISAT	In-country, Center run or assisted	423	p
IITA	In-country, Center run or assisted	352	
ILRAD	Regional, Center run	11	
IRRI	Regional and national, Center run	150	
WARDA	In-country, Center run	211	
	<u>Total:</u>	<u>7,205</u>	

Notes to Table 1 and its Supplements A and B

- a) Generally, except for IBPGR, the numbers refer to participants in training at the Centers. Degree-related participants may include a few sponsored by the Centers for study and research elsewhere.
- b) A number of individual participants have had more than one training experience, sometimes at more than one Center. Evidence available to us (lists, Table 6 data) suggests that if multiple activities, other than the first, participated in by the same persons were to be excluded, the total number of 'participants' would be about 10% smaller.
- c) The period covered begins with the year in which training began at each Center. In the case of four Centers (CIAT, CIMMYT, IRRI, IITA) this was before the CGIAR was established.
- d) The duration of training has been classified arbitrarily into more and less than nine months. Participants who work at a Center for

Notes to Table 1 and its Supplements A and B (continued)

- 9 months or more will have a good understanding of the Center and its activities at the time of their stay. It may be that no other useful indication can be derived from this classification, especially as the tendency over the years has been to decrease the lengths of courses.
- e) The total includes about 850 visiting scientists recorded by number and year in past issues of "CIMMYT Reviews".
- f) Numerically, far more participants take part in CIP's training activities away from, rather than in, the Lima headquarters and Peru. No data available on postdocs. Much of the degree-related training included thesis research conducted in places other than CIP headquarters, field stations and country programs or project sites, e.g. at universities in Europe, North America and Australia.
- g) Virtually all training by IBPGR has been organized away from the headquarters offices. Some activities and participants were only partially funded by IBPGR. The total includes 39 "Study Tour" participants. The number of participants who took part in more than one training activity is relatively larger for IBPGR than for other Centers.
- h) The total refers to participants who were research collaborators in IFPRI studies and projects, at the headquarters and (often in part) in the collaborating countries. A large number of persons, at the estimated rate of 9.5 per research collaborator, has received "in-country" training in survey techniques. In other ways, IFPRI has worked chiefly through workshops, seminars and conferences, but the participations in these activities are not recorded in the Table.
- i) ILCA's past training activities have been to a large extent of the workshop/seminar/conference type. Table 1 includes some participations in such activities that had a strong technical training content; the other short duration participations are indicated in Supplement A. Many of these activities were conducted outside ILCA headquarters and stations.
- j) Excludes about 2,000 participants in the regular 2-week Rice Production Training Course and in a few other special courses of similarly short duration.
- k) ISNAR has so far worked chiefly through workshops, seminars and conferences. In 1984 ISNAR began to run also short courses.
- l) Other Centers have also held or supported numerous workshops, seminars and conferences, attended by many thousands of persons. Among these are CIAT, CIMMYT, ICRISAT, IFPRI, IITA and IRRI.
- m) Training of essentially the same type as conducted at Centers. Listings of participants for several Centers may cover also part or all of 1984.

- n) The listing is the sum of certain documented off-Center activities of CIMMYT, i.e. mainly support for training by the Wheat Program and data for 3 regions; it is likely to be an underestimate.
- o) Source: List of courses 1978-83. A number of regional and in-country activities may not be reflected in the list. The stated total is likely to be a very considerable underestimate.
- p) Does not include 3-400 participations in workshops on sorghum improvement organized by ICRISAT staff stationed in Mexico.

Table 2 EXPENDITURES ON TRAINING

A. "Training and Conferences" Totals  
Funded from Core Budgets of Centers, 1971-1987

Year	Thousand US Dollars
1971	764
1972	1,025
1973	1,708
1974	2,300
1975	2,806
1976	3,317
1977	4,325
1978	5,613
1979	6,587
1980	7,504
1981	8,755
1982	8,155
1983	9,896
1984 (est.)	13,840
1985 (proj.)	14,418
1986 (proj.)	15,501
1987 (proj.)	15,825
Total 1971-1983 incl.: 62,775	

Sources

- 1971-81 : CGIAR Secretariat, 15.10.1983.  
 1982-83 : 1986 P&B documents  
 1984-87 : Estimated or projected from 1986 P&B documents,  
 at "1984 Dollars".

**Table 2** EXPENDITURES ON TRAINING (continued)

**B. "Training and Conferences" Totals  
Funded from Core Budgets of Centers, 1982-1987, by Center**

Thousand U.S. Dollars							
	**	Costs		Est. Cost	Projected Costs*		
	%	1982	1983	1984	1985	1986	1987
CIAT	5.0	676	1,035	1,582	1,615	1,615	1,615
CIMMYT	13.8	1,846	2,478	3,551	3,379	4,135	4,260
CIP	11.0	926	1,093	1,250	1,076	1,108	1,142
IBPGR	14.3	371	645	600	650	750	760
ICARDA	2.3	236	319	435	574	574	574
ICRISAT	2.7	410	525	567	915	918	918
IFPRI	2.9	(88)	111	223	88	88	88
IITA	2.2	596	480	448	448	448	448
ILCA	3.1	316	338	656	714	814	914
ILRAD	8.1	526	695	974	1,050	1,095	1,161
IRRI	6.9	1,444	1,458	2,656	2,881	2,893	2,861
ISNAR	10.7	205	354	439	407	407	407
WARDA	4.8	149	129	129	167	167	167
<b>TOTAL:</b>		<b>8,155</b>	<b>9,896</b>	<b>13,840</b>	<b>14,418</b>	<b>15,501</b>	<b>15,825</b>

Sources: 1986 P&B documents.

\* 1985-1987 at "1984 dollars".

\*\* 1983 training expenditure as percent of 1983 total core operations (including transferred projects).

### Evaluation of Training

115. Many individual courses have been evaluated to assess effects on participants and derive suggestions for improvement; but few Centers have evaluated the general effects of their training on development. IRRI has produced valuable descriptions of what it has done including an illustrated catalogue of alumni. CIAT has made a special study of the careers of its former participants in several nations. It also commissioned a special study of former participants by Dr. A.J. Cano, which is more fully discussed in Annex 6. Other Centers attempt to maintain lists of the names, addresses and training experience of former participants. They do not find it easy to keep these essential records up to date. This is an important area of effort for the future. All this will require computerized support for address lists and data bases; and it should be associated with a newsletter, sent to all participants, and including each year a card on which participants can record their news and changes of work and address. All this will cost money, but it will be money well spent, because it will help to ensure the strength of the 'invisible college' of former participants, both for the work of the Centers and for development in the nations.

### Continuing Cooperation with Participants and "Follow-up"

116. Since Centers (unlike most other kinds of training institutions, including overseas universities) are able to see their training participants as future colleagues and continuing cooperators in research and dissemination, they do all they can to keep in touch with them and support them, and so increase the return on their investment of funds and effort in training. One Center has set up a formal association of alumni; and all send as much of their published material as they can afford to as many former participants as they can reach. Participants may be invited back to the Center for workshops or to help in training. These contacts are often very valuable to the former participants, not only for the information they convey, but also because they imply continuing recognition and support. This helps to offset the sense of professional isolation, and the very real risk of obsolescence, which is so common in the small and fragmented agricultural knowledge communities of developing countries, particularly where it is hard to get foreign exchange for books, journals and travel. The annual report of a Center may be the most important information source a participant has. Indeed this continuing contact and support may be one of the significant reasons why the participants have become a distinct and leading group in so many nations.

## TRAINING CONDUCTED BY CGIAR CENTERS: ASSESSMENT

117. We have chosen to assess training at the Centers as we believe it affects, or may be seen by, four groups of actors:

- a) the nations in which the participants work (paragraphs 118-148)
- b) the participants (paragraphs 149-186)
- c) the Centers (paragraphs 187-202)
- d) the donors (paragraphs 203-209).

As we proceed through this list we shall refer again to some topics which have already been discussed above. Several important topics are significant for two or more groups of actors, though they may see them in different ways. We have restricted as far as we can the consequent repetitions in the text.

### The Nations

#### Persons Interviewed by the Team

118. In the course of its travels, the team discussed training at the Centers with 638 persons (in addition to the present and former training participants - see Annex 3). Of 244 Center staff members, we met 198 at headquarters and 46 in many different cooperating countries. We also met 1 staff member of ICIPE. In our visits to the 18 countries, we met 346 nationals, in Ministries of Agriculture, in research organizations, development agencies, extension agencies, agricultural banks, private sector organizations and universities. Seven were farmers. We also met 16 staff members of two Latin American international institutions, CATIE and IICA. Finally we spoke to 31 members of donor governments or agencies (19 from USAID).

#### Past Experience of Training by the Centers

119. Table 3 indicates, for each country we visited, the total numbers of participants trained in each of the main categories by the different Centers. They do not include the numbers of people who have participated in conferences, workshops and seminars, important as they are in disseminating the results of the work of the Centers. Nor do they indicate the very important, even if unintended, contributions Centers make to the stock of professional manpower, especially in the host nations, by staff turnover, particularly (but not exclusively) in less senior grades.

120. Most professionals in agricultural science in the nations have been trained in the national institutions, including universities, of their own countries; and in addition a good deal of training has been provided in other countries, particularly in Western Europe and North America. Indeed, while the Centers have been training 17,000 people, other institutions must have trained many hundreds of thousands. Yet it is evident that many of these 17,000 make special and distinctive contributions. The unique qualities of training by the Centers, their comparative advantages, and the relation between training by the Centers and training by national and other institutions, have turned out to be particularly important in our study.

Table 3. PARTICIPANTS IN IARC TRAINING ACTIVITIES (INCLUDING TECHNICAL AND PROFESSIONAL SKILL DEVELOPMENT) IN COUNTRIES VISITED BY STUDY TEAM

A. Summary Table, by Center and Region

	Latin America	Africa	Asia	Center Total
CIAT	977	14	70	1,061
CIMMYT	300	92	238	630
CIP	449	79	432	960
IBPGR	81	52	273	405
ICARDA	-	6	94	100
ICRISAT	3	130	286	419
IFPRI	-	-	-	71
IITA	9	1,216	64	1,289
ILCA	-	65	-	65
ILRAD	3	150	14	167
IRRI	29	44	2,056	2,129
ISNAR	-	-	-	-
WARDA	-	240	-	240
<b>Grand Total</b>	<b>1,851</b>	<b>2,078</b>	<b>3,527</b>	<b>7,537</b>

Notes: (Tables B, C, D)

- a) In addition, a proportion of the about 850 visiting scientists who came to CIMMYT over the period 1966-1983 will have come from these countries.
- b) Covers period 1978-1983 only. Includes 'in-country' training in these countries.
- c) Does not include training by ICRISAT staff stationed at CIMMYT.
- d) Breakdown by country not available. See also footnote i) to Table 1.
- e) No data available. See also footnote k) to Table 1.
- f) Does not include training by ICRISAT staff stationed in Upper Volta (Burkina Faso).

121. There was widespread praise (and continued demand) in the nations for production and crop improvement courses, for "refresher" attachments for more experienced workers, and for higher degree and postdoctoral training. Whatever their hopes for the future (and whatever less positive attitudes may have existed in the past), the nations we visited are genuinely satisfied with that they have received.

Table 3. PARTICIPANTS IN IARC TRAINING ACTIVITIES (INCLUDING TECHNICAL AND PROFESSIONAL SKILL DEVELOPMENT) IN COUNTRIES VISITED BY STUDY TEAM

B. Latin America

Center	Center Total	Colombia	Costa Rica	Guatemala	Mexico	Peru	Notes
<u>CIAT</u>	977						
Postdocs		9		1		1	
MS/PhD (degree rel.)		60	5	6	2	8	
Individual, > 9 mos.		110	3	19	5	11	
Group & Individual, < 9 mos.		334	61	103	110	129	
Country Total		513	69	129	117	149	
<u>CIMMYT</u>	300						a
Postdocs		2			7		
MS/PhD (degree rel.)		10	1	9	54	5	
Individual, > 9 mos.		3					
Group & Individual, < 9 mos.		28	12	31	85	53	
Country Total		43	13	40	146	58	
<u>CIP</u>	449						b
Postdocs (n/a)							
MS/PhD (degree rel.)		8	2		3	196	
Individual, > 9 mos.							
Group & Individual, < 9 mos.		57	24	15	34	110	
Country Total		65	26	15	37	306	

Table 3 continued

B. Latin America

Center	Center Total	Colombia	Costa Rica	Guatemala	Mexico	Peru	Notes
<u>IBPGR</u>	80						
Postdocs							
MS/PhD (degree rel.)		2	1		1	4	
Individual, > 9 mos.							
Group & Individual, < 9 mos.		21	5	5	7	34	
Country Total		23	6	5	8	38	
<u>ICARDA</u>	-						
<u>ICRISAT</u>	3				3		c
Country Total	3				3		
<u>IFPRI</u>	6						d
<u>IITA</u>	9						
Postdocs		1					
MS/PhD (degree rel.)		1					
Individual, > 9 mos.							
Group & Individ. < 9 mos.		1	1			5	
Country Total		3	1			5	
<u>ILCA</u>	-						
<u>ILRAD</u>	3						
Group & Individ. < 9 mos.		1			1	1	
Country Total		1			1	1	

Table 3 continued

B. Latin America

Center	Center Total	Colombia	Costa Rica	Guatemala	Mexico	Peru	Notes
<u>IRRI</u>	29						
Postdocs		3				1	
MS/PhD (degree rel.)		7			5	1	
Individual, 9 mos.							
Group & Individual, 9 mos.		6	1		5		
Country Total		16	1		10	2	
<u>ISNAR</u>	-						e
<u>WARDA</u>	-						
Grand Total	1,856	664	116	189	322	559	

Table 3 continued

## C. Africa

Center	Center Total	Ethiopia	Kenya	Liberia	Nigeria	Upper Volta (B.F.)	Zimbabwe	Notes
<u>CIAT</u>	14							
Postdocs								
MS/PhD (degree rel.)			1		3			
Individual, > 9 mos.								
Group & Individual, < 9 mos.			4		2		4	
Country Total			5		5		4	
<u>CIMMYT</u>	92							a
Postdocs		1						
MS/PhD (degree rel.)			1				1	
Individual, > 9 mos.								
Group & Individual, < 9 mos.		33	22		32		2	
Country Total		34	23		32		3	
<u>CIP</u>	79							
Postdocs								
MS/PhD (degree rel.)		1	1					
Individual, > 9 mos.								
Group & Individual, < 9 mos.		12	49	3	8	2	3	
Country Total		13	50	3	8	2	3	
<u>IBPGR</u>	52							
Postdocs								
MS/PhD (degree rel.)		3	5		5	1	1	
Individual, > 9 mos.								
Group & Individual, < 9 mos.		8	10	2	14	2	4	
Country Total		11	15	2	19	3	2	

Table 3 continued

C. Africa

Center	Center Total	Ethiopia	Kenya	Liberia	Nigeria	Upper Volta (B.F.)	Zimbabwe	Notes
<u>ICARDA</u>	6							
Group & Individual, < 9 mos.		6						
Country Total	6	6						
<u>ICRISAT</u>	130							f
Postdocs						1		
MS/PhD (degree rel.)		2	5		1	1		
Individual, > 9 mos.								
Group & Individual, < 9 mos.		19	33		40	25	3	
Country Total		21	38		41	27	3	
<u>IFPRI</u>	14							d
<u>IITA</u>	1,216							
Postdocs		1			14		1	
MS/PhD (degree rel.)		3	2	3	51	2		
Individual, > 9 mos.			1	6	2			
Group & Individual, < 9 mos.		24	54	37	943	45	5	
Country Total		28	57	52	1,010	51	19	
<u>ILCA</u>	65							
Postdocs			1	1				
MS/PhD (degree rel.)		2						
Individual, > 9 mos.					1			
Group & Individual, < 9 mos.		24	11	3	14	4	4	
Country Total		26	12	4	15	4	4	

Table 3 continued

C. Africa

Center	Center Total	Ethiopia	Kenya	Liberia	Nigeria	Upper Volta (B.F.)	Zimbabwe	Notes
<u>ILRAD</u>	150							
Postdocs			5					
MS/PhD (degree rel.)			18		1			
Individual, 9 mos.								
Group & Individual, 9 mos.		12	92	3	10	3	2	
Country Total		12	115	3	13	3	4	
<u>IRRI</u>	44							
Postdocs					2			
MS/PhD (degree rel.)				1	6			
Individual, 9 mos.								
Group & Individual, 9 mos.			5	6	22	2		
Country Total			5	7	30	2		
<u>ISNAR</u>	-							e
<u>WARDA</u>	240							
Postdocs								
MS/PhD (degree rel.)				1	3	2		
Individual, 9 mos.								
Group & Individual, 9 mos.				98	66	70		
Country Total				99	69	72		
<b>Grand Total</b>	<b>2,102</b>	<b>150</b>	<b>320</b>	<b>170</b>	<b>1,242</b>	<b>164</b>	<b>42</b>	

Table 3 continued

D. Asia

Center	Center Total	Bangladesh	India	Indonesia	Nepal	Philippines	Syria	Thailand	Notes
<u>CIAT</u>	70								
Postdocs				1					
MS/PhD (degree rel.)				1					
Individual, > 9 mos.				2				10	
Group & Individual, < 9 mos.			1	23	2	11		19	
Country Total			1	27	2	11		29	
<u>CIMMYT</u>	238								a
Postdocs		1	4			1	1	2	
MS/PhD (degree rel.)		1			3				
Individual, > 9 mos.									
Group & Individual, < 9 mos.		58	28	5	43	35	10	46	
Country Total		60	32	5	46	36	11	48	
<u>CIP</u>	432								
Postdocs									
MS/PhD (degree rel.)									
Individual, > 9 mos.					6	3			
Group & Individual, < 9 mos.		104	95	37	10	150	7	20	
Country Total		104	95	37	16	153	7	20	
<u>IBPGR</u>	273								
Postdocs									
MS/PhD (degree rel.)									
Individual, > 9 mos.									
Group & Individual, < 9 mos.		3	6	10	3	8	2	2	
Country Total		17	38	54	11	53	11	42	
Country Total		20	47	66	16	61	13	50	

Table 3 continued

D. Asia

Center	Center Total	Bangladesh	India	Indonesia	Nepal	Phillipines	Syria	Thailand	Notes
<u>ICARDA</u>	94								
Postdocs									
MS/PhD (degree rel.)							6		
Individual, 9 mos.			1				1		
Group & Individual, 9 mos.		6	4				76		
Country Total		6	5				83		
<u>ICRISAT</u>	286								
Postdocs			25	2		1		2	
MS/PhD (degree rel.)		3	46		3			5	
Individual, 9 mos.									
Group & Individual, 9 mos.		6	139	7	1	2		44	
Country Total		9	210	9	4	3		51	
<u>IFPRI</u>	51								d
<u>IITA</u>	64								
Postdocs			9					2	
MS/PhD (degree rel.)			4	1		2			
Individual, 9 mos.									
Group & Individual, 9 mos.		3	15	15		10		3	
Country Total		3	28	16		12		5	
<u>ILCA</u>	-								

Table 3 continued

D. Asia

Center	Center Total	Bangladesh	India	Indonesia	Nepal	Phillipines	Syria	Thailand	Notes
<u>ILRAD</u>	14								
Postdocs			1						
MS/PhD (degree rel.)									
Individual, 9 mos.									
Group & Individual, 9 mos.			8	2	1		1	1	
Country Total			<u>9</u>	<u>2</u>	<u>1</u>		<u>1</u>	<u>1</u>	
<u>IRRI</u>	2,056								
Postdocs		9	84	2	2	24		5	
MS/PhD (degree rel.)		91	27	42	17	161		68	
Individual, 9 mos.									
Group & Individual, 9 mos.		195	242	382	40	387		278	
Country Total		<u>295</u>	<u>353</u>	<u>426</u>	<u>59</u>	<u>572</u>		<u>351</u>	
<u>ISNAR</u>	-								e
<u>WARDA</u>	-								
Grand Total	3,578	497	780	588	144	848	115	555	

- Notes:
- In addition, a proportion of the about 850 visiting scientists who came to CIMMYT over the period 1966-1983 will have come from these countries.
  - Covers period 1978-1983 only. Includes 'in-country' training in these countries.
  - Does not include training by ICRISAT staff stationed at CIMMYT.
  - Breakdown by country not available. See also footnote i) to Table 1.
  - No data available. See also footnote k) to Table 1.
  - Does not include training by ICRISAT staff stationed in Upper Volta (Burkina Faso).

122. The nations value training at the Centers for a wide range of reasons, some of which were also given by participants (paragraphs 178-181). Of course most nations want all the training they can get, particularly if somebody else meets all the costs, but we do not believe that cost is a primary consideration. It is not always easy for a hard-pressed service to release staff for training, even if it is free, or to guarantee a participant a job when he returns. But we have concluded that, for the nations, training by the Centers has certain unique characteristics. It provides a continuing link, through former participants, with the Centers and their work, and through them with the continuing advances, world-wide, of agricultural science. It improves the quality and performance of the participants (except in those few cases where people may have been trained beyond the capacity of their countries to use their training). In these ways training by the Centers has improved national agricultural research capabilities in many developing countries. It has also had effects on development, which we shall consider in paragraphs 147-8.

123. Some nations have used training at the Centers to strengthen the links between the different parts of the national agricultural knowledge system. When Indonesia began to cooperate with IRRI, she sent research workers, extension leaders and district managers to IRRI together. Before, they had not known or cooperated with each other. "They came back from IRRI hand in hand". Evidently Indonesia felt that she needed research-related training in other areas of the agricultural knowledge system besides research itself. Moreover, this led very soon to "in-country" rice production and improvement courses in Indonesia, assisted by IRRI. The output of rice (supported by appropriate actions outside the domain of knowledge) began to increase; and it seems that the unit cost of that output decreased. Indonesia is today self-sufficient in rice.

#### Training Needs and Expectations

124. As we have pointed out (paragraphs 75-77) the nations are diverse in very many respects, including the size, tasks and financial resources of the agricultural knowledge system, the needs for its further progress, and the stage of national development. Consequently, they have different aspirations and needs for training.

125. These needs cannot be realistically determined by purely qualitative considerations ("we need more cassava workers"). In none of the nations did we see an official manpower projection for agricultural science, though one nation is about to adopt one (which we saw in draft) and others told us that they are preparing projections. If, as this work proceeds, the Centers and donors active in each country become involved in it, their endeavours in training are likely to be more effective, both individually and collectively.

126. However it is far from easy to do. The rate and pattern of development are inherently difficult to predict. A further difficulty in many such projections is that in many developing nations the services are not stable. Even without political upheavals, many trained agricultural knowledge professionals move all too early to management posts, to development work, to education and training, from food to non-food crops, to administrative or political posts, often

outside agriculture (which may be no bad thing), to the private sector, to international agencies, or out of their countries altogether. Both the growth and the attrition rates are consequently very difficult to estimate, and this must make phased planning doubly difficult.

127. In the absence of a more or less reasonable projection of numbers, properly supported by prospective budget provision, it is difficult for a nation to state its training needs to the Centers and to the donors. This is probably why many nations seem to respond passively to offers and do not make specific, logically structured, phased requests. So, although the determination of priorities should be the sole prerogative of the nations, the initiatives at present tend to rest with the Centers and donors. These initiatives do not necessarily add up to coherent plans to meet the total needs of each nation for research and scientific services for both food and non-food commodities. We return to this matter when we consider the training policies of the Centers (193-194).

128. Moreover, many of the national leaders do not know enough about the Centers and what they have to offer. We were asked, in one country, by an able and senior official, whether the CGIAR were some sort of secret society. This suggests that the nations need more information (which we have supplied in general terms to those individuals who asked for it), but unless information about training opportunities is related to manpower plans, the result could be an avalanche of uncoordinated requests for training which the Centers could not hope to meet.

129. All national services wish to upgrade their existing staff members by in-service training, if possible at a Center. Most wish production training to continue at the Centers, even in those nations which can provide it for themselves. But the most common concern we encountered related to higher degree training. Demands for more higher degree training are widespread and substantial, and the fear that Centers were decreasing their support for degree-related training was also widespread.

130. This fear is of course also well founded: the System has to spend limited resources as best it can, and no Center nowadays can afford to send a significant number of participants to developed countries for higher degree training. Nor should the Centers be expected to do this. Their characteristic role is now to provide well-equipped opportunities for thesis research on developing country problems and in developing country environments, but their capacity to do this is limited. We shall return to this topic (paragraphs 200-202).

131. The aspirations of the nations may not be realistic, either operationally or financially. We heard of one developing country which has 150 Ph.D.'s, is training 100 more, and seeks training for yet another 100, but already spends so much of the research budget on personnel costs that there is very little left over to do any research: the Doctors sit in their offices. But these aspirations are nevertheless real.

132. However, the demands are, in many cases, justified. Some of them are for training to no more than M.Sc. level. But no research service can be expected to succeed unless a sufficient proportion of the leaders are competent, original, independent research workers - which is what Ph.D. training is supposed to produce. We feel that the Centers can correctly be expected to help to meet part at least of these needs, where they are backed by realistic manpower and budget plans.

133. Putting all this together, we feel that the Centers must expect an increasing flow of demand for training at all levels.

134. Table 3 indicates that none of the eighteen countries we visited cooperates in training with fewer than four Centers. One cooperates with ten, and the median number is seven. The Centers act separately in offering training opportunities to each nation, and they take no account of needs other than those related to their own purposes. This can all too easily distort the pattern of manpower development unless the national authorities have some overall conception of future manpower needs for different purposes in agriculture and are determined enough to ensure that the offerings of the Centers are consistent with it. We shall return to this question in a broader context (paragraph 193).

#### The Centers and the Universities in the Nations

135. Each Center in a developing country was established close to a university in which agricultural sciences were important, in the hope that they would increasingly work together and strengthen one another. This has been realized in most cases and is developing in others, particularly for cooperation in higher degree courses in which the project work is carried out at, or in association with, the Centers. In some cases formal reciprocal arrangements have been made, in which university staff have opportunities to work at the Centers and Center staff teach, supervise students and help to examine in the university.

136. Several Centers have reached such arrangements with two or more universities in their host countries, and some also cooperate with universities in other countries, both developed and developing. To oversee relationships of this sort, which extend outside Southeast Asia to India, Bangladesh and Sri Lanka, IRRI has recently established an Academic Council of which the Director General is Chairman. We were privileged to meet some of its members. We see this as a valuable development, but it raises a most important series of questions for the CGIAR System as a whole.

137. Several of the many universities which cooperate with IRRI already have, or may be expected in future to have, associations with other Centers. For example eight of the Centers are active in training in Indonesia and several work with the Agricultural University of Bogor (Institut Pertanian Bogor). Is each of those Centers to establish a separate Academic Council for each country or for the region? Either alternative offers evident difficulties.

138. The increasing cooperation between Centers and universities in East and Central Africa, and in Latin America, suggests that similar questions will soon need to be resolved there also.

139. Since the units of development are the individual nations, it seems appropriate to explore this question from the national side. By what means are the eight Centers which are active in Indonesia to organize their relations with the Institut Pertanian Bogor and the other universities of the country, particularly when their relationships with Indonesia as a nation are all separate from each other and the Government is likely to be an interested party? Maybe it is important to articulate the degree-related activities of all the Centers which work with universities in Indonesia, perhaps under the aegis of an appropriate national agency, so that they can collaborate collectively with the universities of the nation. The same means might serve to articulate all the training activities of the Centers (paragraph 136 above). It might also help the nations to overcome the difficulties which flow from the fragmentation of the national agricultural knowledge systems (see paragraph 144 below).

140. Our questions outline the most important set of issues which have emerged in our study. At this point we offer no solution, because there are other relevant matters to consider.

141. In many regions we believe that the Centers have in recent years advanced more rapidly than the universities, and other components of the national agricultural knowledge systems, in the countries they exist to serve. It is not too much to say that the Centers are now a very significant part of the front line of agricultural science in the developing countries, and that in spite of their efforts in training there is a growing gap, in many countries (though certainly not in all), between the standards of the Centers and the standards of the national agricultural knowledge systems. This must make it more difficult for nations to use the output of the Centers, to develop comparable activities of their own and become more self-sufficient in research, and to define for themselves the questions on which they need service from the Centers.

142. This leads us, mandates notwithstanding, to suggest that the Centers should interest themselves in the curriculum contents and academic standards of the universities (as the apex institutions of the national knowledge systems), whose standards powerfully influence all other parts of the national agricultural knowledge systems. Indeed we were asked by the responsible officials in Nigeria whether the Centers, and IITA in particular, could not cooperate in curriculum development, particularly for first degrees, with the agricultural universities of the country. The question may have been influenced by the help IITA and the University of Ibadan have given to the establishment of the faculty of agriculture at the University of Benin.

#### The Centers and the National Agricultural Knowledge Systems

143. A stated purpose of the CG System is to strengthen national agricultural research systems. Through their work with the universities and other agencies, the experience and actions of the Centers are tending to broaden this to strengthening national agricultural knowledge systems - a reasonable, indeed inevitable, but very substantial and complex change, whose consequences and outcomes will require very careful study.

144. The complexities are compounded by marked differences between nations in the structures of their national agricultural knowledge systems. In some nations, all of agricultural research, education, training, and extension may be managed by one Ministry or Government agency, and is usually separated from the related basic ("pure science") disciplines. At the other extreme, crops research may be in an autonomous parastatal, animal production research in a separate ministry; and cooperatives, rural development and irrigation in three other ministries. More "basic" biological and environmental sciences may be in the charge of a Ministry of Science and Technology. Agricultural education below degree level may be divided between the Ministry of Education and the Ministry of Agriculture; the University, with its autonomous charter, may be funded direct from the Treasury; and agricultural extension may be attached to the Office of the Prime Minister, or to a lower tier of Ministries of Agriculture in individual states or regions. Fortunately, most countries lie between these hypothetical extremes, but the task is never easy and there is no theoretically "correct" solution. It may be that when the need is met to articulate the activities of the Centers working in a country, in relation to training, and to their relations with the national universities and other agencies which conserve, create and use knowledge, means of articulating the national agricultural knowledge systems may also suggest themselves.

145. One possible method might be to establish in each nation an Agricultural Science Council including representatives of the relevant agencies, with a Secretariat strong enough to assemble information, suggest areas where articulation and cooperation could be improved and made more productive, and consult with the agencies in the implementation of the Council's recommendations. It is worth reminding readers that the agricultural knowledge system in the United States is substantially articulated through the Science and Education Administration of USDA and its relations with the agricultural universities. It is partly articulated in the Republic of India through the Indian Council of Agricultural Research/Department of Agricultural Research and Education and its relations with the State Agricultural Universities, but extension is in general separate, as a state responsibility over which ICAR/DARE has, as yet, little control. The Philippines Council for Agriculture Research and Resources Development (PCARRD) is designed to perform a similar function.

146. It seems to us that the Centers working in any one country might come together to discuss these matters among themselves and with the responsible national officials. But, as we have indicated, they will need also to consider a broader spectrum of activities than research on particular commodities. The Centers are interested in research and applied science, and their application to the production of their commodities and to the systems in which they are produced; the governments are interested in development in their nations and the knowledge needed to support it. These two approaches have to come together if the work of the Centers is to be as successful as we know it could be. Perhaps the Centers will need to develop from a scientific and research orientation in the global execution of their mandates to a developmental orientation in the service of the individual nations with which they cooperate, and to an interest in national agricultural knowledge systems as a whole.

## Effects of Training on the Nations

147. The effect of the work of the Centers on national production is the business of the CG impact study, and we have not investigated it specifically. But our information in several instances assured us that people trained at Centers have played leading roles in increasing output in India, Bangladesh, Colombia, and the Philippines; and other information leads us to conclude that this has been so in Pakistan and Zimbabwe. Of course some of these effects can be traced back to the earlier efforts of national, multilateral and bilateral agencies, and of the Foundations from whose work the Centers arose: we must beware of claiming too much for the Centers.

148. It is also clear, as we have indicated above, that training at the Centers has had very substantial effects on national research systems for particular commodities. It is also beginning to influence strongly research in the nations on systems of production, and on the development of appropriate technical options to improve them. It has had important effects on the Universities in many nations. It has also advanced cooperation between nations by enabling national scientists to participate in regional and other research and training networks which link the efforts of different nations in fields of mutual interest.

### The Participants

149. The most immediate and essential effect of any training is on the persons who are trained. Only through them can any other effect be produced.

#### The Participants Interviewed by the Team

150. Tables 4 and 5 give the numbers of participants we met in our visits to the Centers and the countries. The total is 669. A foot-note to Table 5 records that we also met 26 persons in agricultural professions or occupations who had not participated in training activities of a Center. We do not claim that this small number represents anything like a "control group" in our "sample population", and we refer to our earlier discussion (paragraphs 17-19) of the limitations of the study in regard to sampling and measurement. We were, however, able to get from this group a feeling that the experience of participating in Centers' training activities is highly regarded by people who have not had it, but know about it from their colleagues.

151. More than 90% of the participants met were male. However, in this Report, terms implying male gender are to be read as including female gender also (Tables 4 and 5). 16 out of 175 participants (9%) in the Centers and 34 out of 494 (7%) in the nations were female. The Philippines and Thailand accounted for 25 of the 34 women in the nations. No conclusions should be drawn from these numbers regarding the importance or roles of women in performing the tasks for which the training offered by Centers is meant to improve skill and knowledge. The Centers do not currently appear to influence in any substantial way the process by which nations choose potential participants to be

nominated to the Centers - though where a country or regional representative works closely with a government, he may have an unseen influence. We have the impression that in a number of countries, particularly in Africa, the governments are deliberately attempting to increase the proportion of females who are trained for agricultural professions and occupations.

152. Table 6 lists for each Center the duration of training which the participants we interviewed in the 18 countries had received and provides foot-note reference to degree-related training. This is intended solely to indicate the sorts of people we met in each country. Since these participants are unlikely to have constituted a representative sample of all participants in each nation, Table 6 does not indicate the pattern of the activities of each Center in each country.

#### Who the Participants Are

153. Most participants from developing countries nowadays, including those following production or improvement courses, have degrees or other first professional qualifications. Some are fully qualified, with M.Sc. or Ph.D. degrees. Others may have no more than intermediate level schooling plus field experience. From countries where agricultural education has not yet evolved to the level of the university, or where there is no university at all, Centers are accustomed to accepting people with very slender previous training; and we believe that it is proper for them to do so. These nations have, after all, the greatest needs for training. But this makes it difficult to design a curriculum or set a pace which will not be too elementary for some, yet too demanding for others, as a number of participants told us. But to offer separate courses would require more resources, emphasize educational disparities between nations, and lose the valuable interaction between participants of different backgrounds. The decision is difficult. It may sometimes be eased, at least temporarily, where the educational difference is associated with a language difference, so that it becomes more convenient to teach different language groups separately. We return to the question of language below (paragraphs 160-163).

#### How People Become Participants

154. In general, whoever funds the training at a Center (and we have not analyzed this topic in detail) a participant is first nominated by his government, employer, or other agency and then selected by the Center. It may be that some are nominated as a reward for good service, or by friends and relations in high places. Few countries we visited have a quantitative manpower policy or an in-service program for manpower enhancement (see paragraph 124 et seq.): most of them wait for the coconut to fall into their laps and respond more or less passively to invitations from the Centers. Where a Center is actively working in a region or cooperating with a country its representatives may often be able to advise on appropriate people to be nominated. But few countries have the confidence to tell individual Centers what they want, and even fewer address the Centers and other cooperators collectively. (But some countries do; and some pay for the training they want).

**Table 4 PARTICIPANTS IN IARC TRAINING ACTIVITIES INTERVIEWED BY THE STUDY TEAM AT TIME OF VISIT TO THE CENTER, 1984**

Center*	Total**	Training Activity				
		Indiv. Progr. or course***	Degree related*** M.Sc. Ph.D.		Post doctoral***	Staff
CIAT	15(3)		7(2)	8(5)		
CIMMYT	20(3)	13 <u>a</u> /(1)		2(1)	5 <u>b</u> /(1)	
CIP	3		3			
ICARDA	7(1)	3(1)		2(1)		2 <u>c</u> /
ICRISAT	35(1)	15	4	4(3)	12(3)	
IITA	19(2)	1	2(1)	3(1)	5	8 <u>d</u> /
ILCA	8	2	1	2(1)	3(1)	
ILRAD	26(4)	8(2)	3 <u>e</u> /	6 <u>e</u> /(2)	9(7)	
IRRI	22(1)	8	5	4	5	
WARDA	20(1)	20				
<b>Total</b>	<b>175</b>	<b>70</b>	<b>25</b>	<b>31</b>	<b>39</b>	<b>10</b>

\* The Study Team did not specifically interview participants in training activities of IBPGR, IFPRI or ISNAR while visiting these Centers.

\*\* Number of female participants is shown in parentheses.

\*\*\* Number of participants from "developed" countries shown in parentheses.

- a/ Includes one participant in an ICRISAT training activity at CIMMYT.
- b/ Includes one Ph.D. staff member with M.Sc. and Ph.D. degree work at IRRI/UPLB.
- c/ Includes two staff members who participated in courses at CIMMYT.
- d/ Includes one Ph.D. staff member with degree work at IRRI and two Ph.D. staff members who participated in CIMMYT training activities conducted in Africa; also includes one Ph.D. staff member of ILCA at IITA with Ph.D. work completed at IITA.
- e/ Includes one M.Sc. and one Ph.D. candidate doing thesis research with ILCA at ILRAD.

Table 5 PARTICIPANTS IN IARC TRAINING ACTIVITIES INTERVIEWED\* BY  
THE STUDY TEAM IN COUNTRIES VISITED (BY VISIT/REGION)

<u>Country</u>	<u>Participants**</u>
<u>North and Central America</u>	
Mexico	30
Guatemala	18 (1)***
Costa Rica	34
<u>Andean South America</u>	
Colombia	40 (3)
Peru	<u>34</u> (3)
Total Latin America	<u>156</u>
<u>Western Africa</u>	
Nigeria	11 (1)
Burkina Faso (U.V.)	12
Liberia	0**
<u>East and South Central Africa</u>	
Ethiopia	5 (1)
Kenya	38
Zimbabwe	<u>4</u>
Total Africa	<u>70</u>
<u>Western Asia</u>	
Syria	36
<u>Southern Asia</u>	
India	38
Bangladesh	40
Nepal	35
<u>Eastern Asia</u>	
Thailand	28 (6)
Indonesia	16
Philippines	<u>75</u> (19)
Total Asia	<u>268</u>
<hr/>	
<u>Total Latin America:</u>	156
<u>Total Africa:</u>	70
<u>Total Asia:</u>	<u>268</u>
GRAND TOTAL:	<u>494</u>

\* The Study Team also sought the views of persons trained elsewhere in subject areas covered by training at IARCs. A total of 26 such persons, mainly in Asian countries, were interviewed. These are not counted in the table.

\*\* Excludes nationals (and others) working in the country who are participating in training at an IARC during the visit of the Study Team; some of these may be included among the numbers given in Table 3.

\*\*\* Numbers in parentheses indicate female participants.

**Table 6 TRAINING ACTIVITIES\* OF CENTERS PARTICIPATED IN BY PERSONS INTERVIEWED BY THE STUDY TEAM IN 1984 IN THE 18 COUNTRIES VISITED**

**A. Summary Table, by Center\*\* and Region**

	Latin America	Africa	Asia	Grand Total
CIAT	89	4	10	103
CIMMYT	54	8	62	124
CIP	41	10	37	88
IBPGR		2	5	7
ICARDA		1	38	39
ICRISAT	5	7	13	25
IITA		26	6	32
ILCA		10		10
ILRAD		8		8
IRRI	2	2	131	135
WARDA		1		1
	191	79	302	572

\* Some persons interviewed participated in more than one IARC training activity. Each of these participations is counted in the tables. For number of participants interviewed see Table 5.

\*\* The Study Team did not interview participants in training activities of IFPRI and ISNAR.

Table 6 (continued)

TRAINING ACTIVITIES OF CENTERS PARTICIPATED IN BY PERSONS  
INTERVIEWED BY THE STUDY TEAM IN 1984 IN THE 18 COUNTRIES  
VISITED, BY CENTER

## B. - Latin America

	Total	Colombia	Costa Rica	Guatemala	Mexico	Peru
<u>CIAT</u>	89	35	23	6	13	12
< 2 mo		14	8	1	5	4
2-5 mo		9	5	2	7	2
> 5 mo		12	10	3	1	6
<u>CIMMYT</u>	54	6	9	10	22	7
< 2 mo		-	1	2	9	-
2-5 mo		-	1	2	3	-
> 5 mo		6	7	6	10	7
<u>CIP</u>	41	11a/	8	2		20b/
< 2 mo		7	8	2		16
2-5 mo		2	-	-		2
> 5 mo		-	-	-		1
<u>ICRISAT</u>	5		2	1	2	
< 2 mo			1	-	2	
2-5 mo			1	1	-	
> 5 mo			-	-	-	
<u>IRRI</u>	2		1		1	
< 2 mo			-		-	
2-5 mo			1		1	
> 5 mo			-		-	
<b>Total</b>	<b>191</b>	<b>52</b>	<b>43</b>	<b>19</b>	<b>38</b>	<b>39</b>

a/ Includes two persons who completed advanced degrees under CIP sponsorship.

b/ Includes one person who completed M.Sc. degree work at CIP.

Table 6 (continued)

TRAINING ACTIVITIES OF CENTERS PARTICIPATED IN BY PERSONS INTERVIEWED BY THE STUDY TEAM IN 1984 IN THE 18 COUNTRIES VISITED, BY CENTER

## C - Africa

	Total	B. Faso (U.Volta)	Ethiopia	Kenya	Liberia	Nigeria	Zimbabwe
<u>CIAT</u>	4					1	3
< 2 mo						-	2
2-5 mo						1	-
> 5 mo						-	1
<u>CIMMYT</u>	8		1	7			
< 2 mo			-	3			
2-5 mo			-	-			
> 5 mo			1	4			
<u>CIP</u>	10			10			
< 2 mo				9			
2-5 mo				1			
> 5 mo				-			
<u>IBPGR</u>	2			2 <sub>b/</sub>			
< 2 mo				-			
2-5 mo				-			
> 5 mo				-			
<u>ICARDA</u>	1		1				
< 2 mo			-				
2-5 mo			-				
> 5 mo			1				
<u>ICRISAT</u>	7	3		2			2
< 2 mo		-		-			-
2-5 mo		-		1			1
> 5 mo		3		1			1
<u>IITA</u>	26	10 <sub>a/</sub>		4 <sub>c/</sub>		11 <sub>d/</sub>	1
< 2 mo		7		2		4	1
2-5 mo		1		-		2	-
> 5 mo		1		1		-	-
<u>ILCA</u>	10		2	8			
< 2 mo			2	5			
2-5 mo			-	3			
> 5 mo			-	-			
<u>ILRAD</u>	8			8			
< 2 mo				6			
2-5 mo				1			
> 5 mo				1			
<u>IRRI</u>	2			2			
< 2 mo				1			
2-5 mo				-			
> 5 mo				1			
<u>WARDA</u>	1					1	
< 2 mo						-	
2-5 mo						1	
> 5 mo						-	
<b>Total</b>	<b>79</b>	<b>13</b>	<b>4</b>	<b>43</b>		<b>13</b>	<b>6</b>

a/ Includes one person who completed M.Sc. degree work at IITA.

b/ Includes two persons assisted by IBPGR to obtain M.Sc. degree.

c/ Includes one person who completed Ph.D. degree work at IITA.

d/ Includes three persons who completed Ph.D. degree work at IITA and two persons who held post-doctoral staff positions at IITA.

TRAINING ACTIVITIES OF CENTERS PARTICIPATED IN BY PERSONS INTERVIEWED  
BY THE STUDY TEAM IN 1984 IN THE 18 COUNTRIES VISITED, BY CENTER

## D - Asia

	Total	Bangladesh	India	Indonesia	Nepal	Philip.	Syria	Thailand
<u>CIAT</u>	10			1	1			8
< 2 mo				1				1
2-5 mo					1			4
> 5 mo								3
<u>CIMMYT</u>	62	12	15	1	16	3	5	10
< 2 mo			2	1	4		2	4
2-5 mo		4	5		7			2
> 5 mo		8	8		5	3	3	4
<u>CIP</u>	37	8	5	8	3	13 <sup>i/</sup>		
< 2 mo		6	3	7	3	5		
2-5 mo		2	2	1		4		
> 5 mo								
<u>IBPGR</u>	5	2 <sup>a/</sup>	1 <sup>c/</sup>		1 <sup>g/</sup>	1		
< 2 mo		1				1		
2-5 mo								
> 5 mo								
<u>ICARDA</u>	38	3	4				31	
< 2 mo		1					15	
2-5 mo			1					
> 5 mo		2	3					16
<u>ICRISAT</u>	13		5	1		1	6	
< 2 mo			2			1	2	
2-5 mo							3	
> 5 mo							1	
<u>IITA</u>	6		2	3 <sup>e/</sup>		1		
< 2 mo				1				
2-5 mo			1	1		1		
> 5 mo			1					
<u>IRRI</u>	131	17 <sup>b/</sup>	9 <sup>d/</sup>	12 <sup>f/</sup>	18 <sup>h/</sup>	67 <sup>j/</sup>		8 <sup>k/</sup>
< 2 mo					2	4	5	2
2-5 mo		1	1	1	4	14		3
> 5 mo		10	3	6	2	31		1
<b>Total</b>	<b>302</b>	<b>42</b>	<b>41</b>	<b>26</b>	<b>39</b>	<b>86</b>	<b>42</b>	<b>26</b>

a/ Includes 1 person assisted by IBPGR to obtain M.Sc. degree.

b/ Includes 4 persons who completed M.Sc. and 2 who completed Ph.D. degree work at IRRI; also includes 1 person who held a post-doctoral staff position at IRRI.

c/ Includes 1 person assisted by IBPGR to obtain M.Sc. degree and 1 person sponsored by IBPGR for training at IARI (India).

d/ Includes 5 persons who held post-doctoral staff positions at IRRI.

e/ Includes 1 person who completed M.Sc. degree work at IITA.

f/ Includes 2 persons who completed M.Sc. and 1 who completed Ph.D. degree work at IRRI.

g/ One person assisted by IBPGR to obtain M.Sc. degree.

h/ Includes 6 persons who completed M.Sc. and 2 who completed Ph.D. degree work at IRRI.

i/ Includes 1 person who completed M.Sc. degree work at CIP, 1 person sponsored by CIP for Ph.D. training, and 2 staff members trained and working at CIP's Philippine Station.

j/ Includes 11 persons who completed M.Sc. and 4 who completed Ph.D. degree training at IRRI; also includes 2 persons who held post-doctoral staff positions at IRRI.

k/ Includes 1 person who completed M.Sc. and 1 who completed Ph.D. degree work at IRRI.

155. Nonetheless, by and large, the participants we met were mostly impressive people. The two-stage process of nomination and selection could doubtless be improved, but it appears to us, on the whole, to be well done.

#### Why People Wish To Be Participants

156. There seem to have been very few unwilling participants who underwent training solely because someone ordered them to do so. To take the less positive aspects first, most people like to travel and see strange countries, especially when someone else pays all the expenses, and particularly when they hope to accumulate savings from their per diem allowances, though we think this hope is seldom realized in the present hard times. We met a very few participants for whom training, especially conferences and workshops, seemed to have become a way of life. For others there is the hope of a long-term well-paid post at one of the Centers; for yet others it is the first step down the brain drain. But most participants want training to advance their qualifications, knowledge and skills; and they value the prestige and the long-term support which association with an international Center can confer. In general participants were not unrealistic in their expectations of higher degree training: most seemed satisfied with what they were receiving or had received.

157. Some of the degree-related participants have been nationals of developed countries, and some of these are no longer working in developing countries or for development. We shall return to this topic (paragraphs 200-202), but we propose to ask Centers to make special studies of the current usefulness of these people for development. The donors who fund them feel that they have a right to do so in return for their support; and the participants from developed countries are valuable to the Centers because they are usually well-trained and motivated. They do not seem to take up facilities or staff time that could have been used for participants from developing countries. A few seemed to us to have unreasonably elevated expectations, and some were querulous, demanding, and even negative, in Centers where their peers from developing countries were fully contented. Politically as well as personally this is a potentially sensitive point, and will have to be studied further.

158. Some postdoctoral participants, particularly from developing countries, feel that they are treated as technicians rather than as responsible professional research colleagues; and some seem to expect, unrealistically, to go on automatically to more permanent staff posts. Postdoctoral participants are so valuable in the Centers that such misunderstandings (which may be fewer than they formerly were) must be carefully avoided.

#### Difficulties Encountered

159. Many new participants at Centers come for the first time, after a long and difficult journey, to a foreign country, a strange language, a different culture, and a dauntingly large, prestigious, well-equipped and well-organized multidisciplinary international institution. They leave their families behind (which appears to be a particular difficulty in some Asian countries), and they are separated

from their accustomed work environment. They meet very senior people in their disciplines, many of whom have international reputations. All this is difficult at first, but the difficulties seem to be overcome surprisingly soon, particularly if the courses are not too short. The material conditions appear generally to be acceptable to all but the most senior participants, who may find it unusual to share accommodation with a stranger. We were particularly impressed by the cheerful way in which participants at CIP's germplasm Center for Region VII in the Philippines accepted the rustic storage which is provided for them there.

#### Language

160. The biggest single difficulty appears to be in respect of language, particularly for francophone Africans and for Spanish and Portuguese speakers. The Centers in Latin America are, on the whole, dealing well with Spanish. Both CIP and CIAT seem to be effectively bilingual, and CIMMYT uses translation to supplement the efforts of the teachers. WARDA, IITA and ICARDA do well enough with interpreters and translators for French, and ICARDA also for Arabic. ICRISAT, IRRI, ILCA and ILRAD are largely English language institutions (except for ICRISAT in West Africa), probably because in their regions of interest there are many different languages and English is widely used. ILCA is only now confronting the use of French at headquarters. None of the Centers has developed training in Portuguese or Chinese.

161. The CGIAR System is essentially anglophone; and English is the principal language of the international world of agricultural science. The People's Republic of China is entering that world through English, as India, Pakistan, Bangladesh and Sri Lanka did long ago. Between them, these nations contain very nearly half of all the people in the developing world. The longer-term future of agricultural science in the developing countries seems clearly to lie with the English language; and many initially non-English speaking visitors to the Centers welcome, with hindsight anyway, the challenge or opportunity of learning to use English. We believe this trend is bound to continue and increase. Nonetheless, though we must prepare ourselves, the future is not yet. In the meantime, it could be useful in appropriate circumstances to require spoken Spanish as a contract condition or a route to accelerated advancement in the Latin American Centers, French in IITA, ILCA, ICRISAT in francophone West Africa and WARDA; Arabic or French in ICARDA, and Portuguese for staff working in Brazil or the Portuguese-using nations of Africa.

162. Conversely, all participants who wish to do so should be helped to master spoken English. We believe that this may best be done, not by methods based on formal class or tutorial instruction, but through self-teaching language-learning tapes, using the modern equivalent of the Tandberg double track reversible tape system, which is available already in some of the Centers. Such systems do not necessarily require a purpose-built, dedicated language laboratory, or the continuous presence of a teacher. The essential equipment is easily portable, so that it can be used at any time and at any place where power is available. It may even be battery driven.

163. In addition to tapes and texts to teach conversational English, which have been available for many years it is, we believe, essential to prepare teaching tapes for more specialized professional English conversation in the main fields of interest at the Centers. So far as we know, this has not yet been done in the agricultural sciences, but the need and potential demand inside and outside the CGIAR System are both substantial. Our advice is that the means and costs of producing and providing such tapes and texts be investigated urgently.

#### Length and Content of Courses

164. Some longer sequences of training (from 9 months up to 3 or 4 years), particularly in a developed nation, can separate a participant so far from his country that he may find it difficult to go back into his national system when he returns. In this respect training in the Centers has advantages over training in temperate countries, which is still the source of the great majority of externally-trained M.Sc. and Ph.D. graduates for developing countries. It also has advantages because both the environment and the subjects of study are more likely to be relevant to the future work of participants.

165. A few former participants on courses shorter than 9 months feel that their courses were too long. It may be that some of them lacked initiative or guidance to fill usefully the times when they were "waiting for the plants to grow"; and that some were less attracted than others by the unaccustomed and intensive field work at other times. The main comments on length related to courses of from one week to 3 months, which many felt were too short and too compressed. We think they were often right; but we recognize that with limited funds a Center may feel bound to provide as much as it can for as many people as possible. This is perhaps a case where the best can be the enemy of the good.

166. We have not been able to review critically the curricula of the many different training experiences offered by 13 very different Centers. However, participants felt that the professional content of all the courses we were able to review with them was at least satisfactory and often very good. There is however a special problem about training on farming systems, to which we return in paragraph 195.

167. Certain topics, which a number of informants felt to be important, seem to need stronger emphasis in the training offered by Centers. They include the following.

168. Some socio-economic topics for natural science-based participants. A few topics on which research or practice is well developed in one or more of the Centers do not appear to be represented in their training programs. None of the following suggested topics is intended to apply to all Centers; indeed each might be offered by one Center on behalf of others:

169. The nature and content - technical, social, economic - of past experiences of development in general, and development in agriculture and the rural space in particular - including the contributions of women, and of non-food as well as food products. See also paragraph 95. (Most staff members at Centers are natural scientists who are interested in science and its applications, as they conceive them, to

development, but some of them also have substantial experience or knowledge of the development process itself, which they can pass on to natural science-based training participants. Many participants, on the other hand, even though they come from developing countries, have not had to consider the real development problems - as distinct from the development aspirations - of their own nations. Training by discussion of real-life experiences of development, and of the parts played in them - positive, negative, even zero - of research and other sectors of the agricultural knowledge system, seems to us to be potentially valuable.)

170. Agricultural adjustment in the past in traditional rural societies, the parts played in these changes by traditional producers and new investors, and the consequent effects on the structure of rural society, and on output and equity.

171. Some technical topics. Agricultural climatology and agro-ecological and land use surveys, remote sensing (perhaps ILCA and ICRISAT Niamey, together with AGRHYMET Niamey).

172. Statistical methods in agricultural research. (Not all agricultural faculties in developing countries teach this subject well; it can be very effectively taught from current real-life examples in an international Center, as some already do.)

173. Various topics related to the management of research, including design of research programs on specific problems, commodities or discipline fields or to serve specific development actions, as well as the management of research institutions and national research systems.

174. Seed production and management as an industry, including legal requirements, standards and control, production, storage and marketing, relationship with plant breeders. (CIAT is possibly the only Center which systematically trains participants in this essential downstream requirement of plant breeding.)

175. Plant and animal quarantine, related particularly to the international movement of breeding and genetic resources materials.

176. Communications and information services including the storage, retrieval and dissemination of information, and the use of computer-based systems for these purposes.

177. Documentation, report writing, library organization.

#### Effects of Training by Centers on Participants

178. As we have said, most of the former participants we met were impressive. Of course, they are a highly selected group, but it became clear to us that the effects of training on most participants are profound. Many of the participants told us that the experience had changed them as people and as professionals. They spoke not only of advances in knowledge and technical skills, but also of dedication to both intellectual and physical work, motivation, determination, purpose and confidence. Many, particularly those who had attended production courses, had become trainers themselves, and had organized such courses in their own countries.

179. These assessments of the effects of training at a Center were consistently confirmed by supervisors in most of the nations - often using virtually identical language. A very few, while recognizing these general effects, suggested that work at a Center could accustom people to techniques and equipment which could not be used or were not available when they returned home, but we found that such remarks were sometimes coloured by experiences with students who had followed higher-degree courses in universities in developed countries. We have no doubt that the Center participants include many leaders in agricultural science and development, clearly different, in many countries, from the majority of professional workers in those fields. Of course, many developing countries have produced distinguished leaders in other ways, but even in those cases the CGIAR participants significantly add to their human resources for agricultural science and development.

#### Reasons for these Effects

180. Many reasons were given for these effects. One of the most general was that much of the experience was practical, particularly in production and breeding courses. To work with a crop in the field from sowing to post-harvest, or to learn a specialized technique in the field or laboratory, turns theoretical knowledge, acquired from reading and listening (from "the study of agricultural science as a branch of literature" as one senior observer remarked) into practical competence and understanding. Such an experience provides a basis for genuine confidence; and it makes a far more effective research worker. Few research workers seem able to do effective research on a commodity unless they also know how to produce it.

181. Other reasons given included the experiences of travel, and of life and work in the new and different environment of another developing country, the opportunity to concentrate one's effort for a time away from the pressures of an official service and from the telephone; the international environment and the exchanges with participants from different backgrounds and disciplines; the multi- and inter-disciplinary character of the work of the Center as a whole and usually of the participant's own program; the experience of working long hours in the field on practical tasks alongside not only their own peers, but also with senior people with advanced degrees and often with international reputations, who treated them as colleagues; the advanced ideas, facilities, equipment and libraries; the flow of research results that succeed in the real world; the experience of working (often for the first time) with real-life producers of crops and stock. Maybe the most important factor for many, where it is maintained, has been the continuing link, after the training experience, with a prestigious and successful institution, which confers individual prestige and, by making the participant feel himself to be a valued part of a world-wide effort, counters the tendency to professional isolation which affects so many agricultural scientists in developing countries. To an extent, many former participants feel that they are now citizens of their professional world.

182. Many of the special features of training at Centers are diluted in "in-country" training, which is already important and must increase. We have discussed this effect (paragraph 106) and possible ways of offsetting it.

### Some Consequences of Training for Participants

183. We were interested in the effects of training at Centers on the careers, status and rewards of participants. These were usually positive in the case of training related to higher degrees. Many other participants have been promoted since their training; but there are cases where the experience has not yet been recognized by employers in terms of pay or promotion. This may turn on whether or not a successful participant receives a formal certificate recognized by the national public service commission or other manpower authority; but where a course has occupied no more than a few weeks, it may not be realistic to expect specific recognition without some clear evidence of subsequent improved performance. Some participants have found themselves unable, for political or other reasons, to return home, at least for a time; and others have clearly seen their training as a step towards a future in a developed country.

184. Some participants have not been able to use their training for lack of essential equipment or funding. To some extent, Centers can offset this by discussing a participant's further work with his employer, and even by providing small support grants for equipment or field work (particularly where the work is associated with a cooperative program with the country concerned); and some recent higher-degree participants have been set on their way by grants from the International Foundation for Science, with which the Centers could usefully cooperate more explicitly.

185. It was not possible, except in a few cases, for us to study the "losses" among participants - those who have fallen out because they have lost morale, or have not had effective leadership, or have moved to another field of work, sometimes in the private sector. The little evidence we have suggests that perhaps four-fifths of the participants who have not retired are still engaged in work which is useful for development.

186. Some of our colleagues in the Centers feel that, if a former participant ceases to work on the commodity, discipline or other field for which he has been trained, he has been lost and the Center's resources have been wasted. We, on the other hand, have not restricted our thoughts to the activities specified in or derived from the mandates of the Centers; and in this we are supported by those of our senior colleagues in the nations with whom we have discussed this matter. So long as a participant is helped by his training to contribute more fully to development, we, and our national colleagues, regard the outcome as positive. A participant may, for example, learn how to identify virus particles in maize or cassava, and then go on to apply his knowledge to cocoa. The Center which trained him may regard this as a loss and a waste of money, but if cocoa is an economically significant crop in his country the outcome may well be a gain for development.

### The CGIAR Centers and Institutions

187. Much of what we have to say in relation to the Centers in general has been covered in preceding sections. We have referred to

the diversity of the Centers in paragraph 75 above. Some are environment-based with commodity responsibilities (IITA, ICARDA, ICRISAT); some are commodity-based across many environments (IRRI, CIMMYT, CIAT, CIP, WARDA); some are concerned with policy and organization (IFPRI, ISNAR); IBPGR and ILRAD can be seen as discipline-based; and ILCA is increasingly systems-based across many environments. They have different backgrounds and are of different ages; and they exhibit varying degrees of decentralization and cooperate in different ways with different numbers of countries. Finally they act largely independently of each other in what an observer, unaware of all the recent trends, might describe as friendly but competitive anarchy. They all tend to be driven by their own purposes, and they are consequently more concerned with following their mandates than with the overall development of the nations which are supposed to be the ultimate beneficiaries of their work.

#### Comparative Advantage in Training

188. At the same time they have established essential international bases, which did not exist before, for research on food commodities in tropical, subtropical and winter-rainfall environments. Collectively, as we have said, they are a most significant part of the front line of agricultural science in the developing countries. They are among the leading centers of scientific excellence working in or for the developing nations; they are international, multi- and increasingly inter-disciplinary; their staffs include many scientists of outstanding quality and reputation. They are linked with universities and other centers of excellence in both developing and developed countries. Notwithstanding their annual distress when budgets are fixed, they are far better funded than most institutions in developing countries. All can reasonably expect that their work will continue. None is seen as a short-term project of limited life. They can consequently offer long-term collaboration with nations, and with the community of those whom they have trained and who are their most important working links with the nations. These features are important elements of the general comparative advantage of the Centers in training.

#### Objectives and Priorities in Training

189. The Centers undertake training in order to produce a cadre of well-qualified professionals who can:

- (i) build national capability in research and other sectors of national agricultural knowledge systems, particularly, but not necessarily exclusively, in the food commodities specified in their mandates;
- (ii) advance the cooperative programs of the Center with the nations, and
- (iii) be considered for vacancies on the staffs of Centers and other advanced institutions in the developing world.

190. Because these training objectives are directed to diverse nations by a diverse group of institutions, the "strategies" Centers adopt to achieve them are individual and often locale specific. It is

difficult, consequently, to identify realistic priorities in training for the CGIAR System as a whole. Indeed, following the discussion in paragraphs 135-146 it may be thought that the search for commonalities and points of articulation, particularly at the level of the individual nation, is more important than the search for general priorities.

#### Achievements in Training

191. Table 1 (page 26) shows the total numbers of persons trained by the 13 Centers since IRRI began training in 1962. The total is around 25,000 if training outside the Centers is included. About one-tenth of these participants have been post-doctoral or higher degree students. The remainder have been individual "in service" participants, or have attended group courses. In general, the Centers have recognized that in most developing countries it is essential to build up the body of the army, the people who do most of the work, but they have done well with respect to higher degree training also.

192. Table 3 (page 33 et seq.) shows for each Center the number of participants of different types it has trained in the 18 countries we visited. Each Center has links with many developing countries. Among the 18, CIP and IBPGR have trained people from all, CIMMYT from 16, IRRI and IITA from 14, ILRAD and CIAT from 13 and ICRISAT from 12. ILCA and ICARDA have smaller numbers, and WARDA, which is regional, 3 only. (ISNAR and IFPRI are not included in the table). These numbers are partly a reflection of the age of the Centers; and many of them are most concentrated in the regions in which the headquarters of the Centers are situated - reflecting a tendency in some Centers to accept particular regional responsibilities. There are hard practical reasons for this also: it saves money and staff time, and may lessen language difficulties.

#### National Needs and Coordination Among the Centers

193. Table 3 also shows that each country works with several Centers in training. The smallest number of Centers working in any one country is four, the largest is ten, and the median number is seven. In each country, the cooperating Centers work individually, even when they are located in the same places or offer training on similar topics. Moreover, each is concerned to promote scientific work on its own commodities, or on disciplines and other fields of interest, in execution of its mandate. Further, the individual programs within a single Center usually approach the nations separately. The nations, however, are concerned less with science than with development; and they do not always find it easy to articulate the diverse offerings of the Centers to promote their own national progress. Our colleagues in the nations feel that the Centers must move from their individual mandate-based, applied science-oriented stances to collective, development-oriented stances based in particular countries; and we are bound to agree.

194. As we have indicated earlier, in any one country the Centers generally work separately, and this applies to in-country training as well as to research. In general, this may often be the most convenient way for them to work, since the most suitable locations and

seasons for field training on different crops are unlikely to be the same. But it has two weaknesses. First, it does not address, or help the governments to address, the training needs of the national agricultural knowledge system as a whole (see paragraphs 144-146 above). Second, the prestige and influence of the Centers, and their tendencies to a promotional style of operation, may distort not only the national staff development but also the national programs themselves, unless the national agricultural knowledge leaders are strong enough to withstand the pressures and assume the leading role. We believe that this problem calls for positive action by governments as well as by Centers. The Governments know that they must work out their future needs for manpower and training of different kinds and at different levels. They could then well call together the representatives of the Centers and of the donors and other cooperating agencies, present and discuss their needs, and work out appropriate plans with them for budget and action. The Centers working in a country, acting together, could do much to promote developments of this sort.

195. The uncoordinated expansion of the training activities of Centers within one country has other potentially difficult consequences. Different Centers may present the same topic, in relation to different crops, in different ways, using different terminology and methods. Moreover, they may not pay sufficient attention to commodities other than those specified in their individual mandates. This is particularly the case in work related to the existing systems of rural life and production, and to experimentation in producers' fields; and one of our correspondents told us that the differences between Centers in this area cause chaos in the national programs. This problem was discussed in October 1984 at a joint meeting of representatives of several Centers in Nairobi, but it may not yet have been sufficiently resolved. One possible likely outcome is that in particular countries or regions training on these topics may be provided or promoted by one Center acting as lead agency on behalf of, and in cooperation with, all the Centers involved. This would be a positive and useful step.

196. We have referred above (paragraph 171) to the support which Centers give, as best they can, to former participants. Since this is not necessarily linked to the agricultural development objectives and priorities of the nation, it may induce former participants to move in directions which do not accord with the strategies or priorities of their directors. This is of course not intended: it happens by default, but it can give rise to friction. This will doubtless be overcome as the work of the Centers in the nations moves from an individual commodity-based mode, derived from the separate mandates for the different Centers, to a more collective or collegial farmer- and development-based mode, responsive to the purposes of governments. This is reinforced by the topics which emerged from our consideration of relations with universities (paragraphs 135-142).

#### Decentralization and Transfer of Training Activities

197. We have outlined the main categories of training in paragraphs 98-109. The arrangements made by the individual Centers are outlined in Annex 6. It may be enough here to say that all Centers have found

it necessary to develop training away from their main bases, and increasingly to decentralize it to regions and countries through in-country training and cooperative networks. (See also supplement B to Table 1).

198. "In-country" Training. "In-country" training with cooperation from the Centers is of course essential and must clearly be encouraged, until the nation's agricultural knowledge system is strong enough to manage training for itself. Indeed, it must be an objective of the Centers to speed the day when in-country training becomes in-country business. But in the meantime "in-country" training must often dilute some of the special effects of training at a Center which we have considered in paragraphs 170 and 171 above. The "call system" (by which trainers from the Center call on participants at critical stages of the crop cycle) and the systematic training of trainers (which is the exception rather than the rule at present, even though the phrase itself has been fashionable for nearly ten years) are means of offsetting this potential loss. Some Centers support in-country training by bringing the in-country trainers to headquarters from time to time as visiting scientists or as trainers; and we hope that this will become systematic and general.

199. We imagine that each nation will wish the in-country contributions of the different Centers to be harmonized; and it will also wish them to meet its priority needs. As in-country training becomes in-country business, the nation may designate one of its institutions as the lead agency and support base for all training of this type; and it may wish to associate one or more universities with the work. Each nation will need to work out its own answer in consultation with the cooperating Centers.

#### Degree-Related Training

200. The contributions of the Centers to degree-related training have been modest and appear to be declining. But the Centers are potentially able to offer unique opportunities for advanced training, on topics important for developing countries, and in appropriate environments, and conversely graduate students have made valuable contributions to Centers' programs. The Centers are held back by lack of funds and of the senior staff time required to provide adequate supervision, particularly when theses have to be written.

201. They cannot fairly relinquish their tasks to their university partners, who are usually at least as busy as they are, unless these partners are involved in the supervision of the work as practical collaborators in the Centers. But for many academics, and for some Centers, this route offers difficulties. In some Centers many of the scientific staff are dedicated to their research responsibilities, and not all of them see the supervision of higher degree candidates as a natural extension of these tasks. This is a question of attitudes, from the senior management down, and it is unlikely to be resolved solely by including academic supervisory tasks as part of the contractual responsibilities of Center scientists. If the Centers are to provide more degree-related training, as some believe they should, additional posts, additional accommodation and additional funds will all be needed. In some cases it may be useful to appoint experienced academics, where possible from the cooperating universities, as

sabbatical workers whose duties include academic supervision, and some appointments have indeed had this character in the past. Post-doctoral workers may also assume part of the task, as they do at ILRAD. The Centers are not universities, but they need some characteristics of university institutions if higher degree work is to be increased.

202. But behind all this lies the question of funding. Members of the CGIAR who believe that higher degree work at the Centers should be increased will no doubt be prepared to support their views by helping to pay for it. They may consider doing so by incorporating the Centers in their bilateral plans to promote higher education in particular nations. In many of the countries we visited we were told of substantial plans to support higher education, involving also what we were told were very substantial funds; but few if any of these plans took account of the possible contribution of the Centers. No doubt some of the funds come from sources earmarked for bilateral technical cooperation in education and training, rather than from sources intended for multilateral support for agricultural research. It should be possible to resolve this dilemma - particularly if the recipient countries themselves insist that the Centers be used for higher degree training in appropriate cases. For their part, perhaps the donors should re-examine the current practice of regarding their national institutions as the main scene of higher degree training for students from the recipient nations - especially where the staffs of their own universities do not include a sufficient proportion of persons who have relevant overseas experience.

### The Donors that Fund Training

#### Some Views of Donors on Types of Training at Centers

203. Although we have only been able to consult donors or their representatives in a few instances, it seems clear to us that all donors support training by the Centers in general. Their appreciation may differ in detail, but they have continued to provide both core and special project funds for training, and they have accepted the reports of TAC and the EPRs, which, without exception, commend training by the Centers. However the current financial stringency in the CGIAR System has tended to decrease significantly the proportions of the Centers' core budgets that are devoted to training, because the Centers, pursuing their agreed mandates, have even more urgent priorities. The legal principle, that a reasonable man is presumed to intend the foreseeable consequences of his actions, may lead some observers to conclude that the donors are not in favour of training at the Centers. Yet this is not what the donors say. Perhaps the seeming inconsistency will bear closer examination.

204. We are told that some donors, perhaps unaccustomed in their own nations to a close relation between the research, education and extension components of the agricultural knowledge system, have tended to criticize Centers which accept, for training or extended professional visits, persons who are not research workers: managers of

development in agriculture and the rural space, university teachers and other workers in national agricultural knowledge systems. We, on the contrary, have concluded that the Centers are right to do this, provided that it is clear that the experience offered is not a training in extension or development management, but a refresher course on the objectives, methods and achievements of international research and its potential contributions to development. For people of these sorts, as was suggested in paragraph 113 above, the experience of the effective applied research environment of the Centers cannot but help their work for development. Moreover, in most cases participants of these sorts come to the Centers because agencies of their governments wish them to do so, and nominate participants accordingly.

205. All this should give pause to those who believe that the Centers should move "upstream" to more "basic" research. It is not our task to comment on the research policy of the System, though we are bound to point out that most of the Centers have never hesitated to work on "more basic" topics where this has been necessary in order to solve practical problems. If the move "upstream" means that the Centers, within limited budgets, should be less involved in the interface between research and development in the nations, the CGIAR System runs the risk of becoming less effective and less able to respond in training to all of the felt and expressed needs of the nations. The view generally expressed to us in the more developed of the nations we visited was that while they did indeed want more degree-related training by the Centers, it was even more important to them that the Centers should work collectively with them to support practical development. Indeed most of them also wished production and breeding (improvement) course training to continue in support of this aim.

206. We feel sure that many donors share this view. Indeed one of us has suggested elsewhere that if the Centers were to be seen to be acting in this way, the reservations which some donors appear to have about the System, and which are expressed in the levels of their financial support, might be lessened. We have been told that these levels are constrained by shortage of resources, but everywhere we went we found that these same donors are allocating, to agricultural development, both multilaterally and bilaterally, sums so large that the fifteen or so millions of dollars of the shortfall in their collective support for CGIAR is miniscule by comparison.

#### Roles of Donors and Centers in Training and University Development

207. Bilateral and multilateral donors have for many years provided substantial support for the training of nationals of developing countries in the agricultural sciences. They have supported far more degree-related training than the Centers, and in this way they have helped to build much of the capacity of the developing nations in agricultural research, education and training. But most of this support has been and is still provided in institutions in developed countries with temperate environments, often in the donors' own countries; and all too often on topics unrelated to the students' later professional tasks. It frequently accustoms a student to equipment and other resources which are not to be found in his own

country, or if they are, are probably out of commission for lack of foreign exchange to buy parts or of technicians to repair or replace them.

208. The Centers are seldom able to offer appropriate course work, but (subject to the provisos in paragraphs 200-202 above) they can offer opportunities for degree-worthy research on appropriate problems with appropriate resources in appropriate environments. Most of the donors whom we have in mind in paragraph 207 are members of the Consultative Group and support the Centers. We believe that they should make fuller use of their investment by using the Centers for higher degree training, funded as part of their support for particular nations. In this, it is essential that the Centers should be consulted in the selection both of the students and of their thesis subjects. Where donors wish to use institutions elsewhere, the staff of Centers working in the recipient country could usefully assist in the selection of candidates. Donors may also feel it appropriate to support the evaluation of training, a necessary but often neglected phase.

209. Several donors, the United States prominent among them, are helping to advance University education in agriculture in countries in which the Centers are also working. What we have already said about the Centers and the Universities leads us to ask whether it is appropriate that the University of (a) in the United States, for example, should be using AID funds to develop the agricultural university in developing country (b), without the cooperation of the six or seven Centers already working in country (b) - when the US is a 25% shareholder in the CGIAR System.

## TOWARDS THE FUTURE

### Relations with the Impact Study

210. With the help of the Centers, we believe we have assembled the essential statistical and descriptive data on the size and scope of the training activity of the Centers which produces an important component of the impact of the System. We have, however, found it impossible to separate training clearly from the rest of the activity and impact of the Centers. Much of the training is conducted by the research workers; the participants are part of the Center and contribute to its work while they are there, and they continue to be associated with its work afterwards. Training provides the principal link by which the offerings of the Centers reach the nations and by which the needs of the nations and of the producers (who have to do the real job at the end of the day) are made known to the Centers. So training is not a separate activity which can easily be isolated from the rest for study: it is an integral part of the whole.

### Towards an Appropriate Agricultural Science

211. Agricultural science as we know it is largely a Western and Northern product, since that is where the subject first emerged and

some unifying concepts were developed. These concepts are essentially derived from the environments and systems of regions of temperate climate. The curricula of agricultural faculties in all developing countries are largely derived from this source - because in fact there is no other. Of course many of its generalizations are indeed universal. But much of this material is less than fully appropriate to the environments and systems of developing countries. We may hope that research and training in the Centers, cooperating with universities in developing countries, will help to generate a series of adapted variants of agricultural science appropriate to the specific conditions (environmental, biological, economic and social) which are typical of different developing country environments - for example, the humid lowland tropics, tropical highlands, seasonally arid tropics, and seasonally arid winter-rainfall regions. The training manuals and the many scholarly publications of the Centers are already providing much essential material for this very significant task.

#### Meeting Training Needs of the Future As Part of A World Endeavour

212. In tropical and subtropical countries, the System, with all its imperfections, now has a leading role in generating and disseminating new knowledge, concepts, skills, methods and processes to support the considerable increases in the output of food and other rural products that have already been recorded and will have to continue in the generations immediately ahead. Particularly significant developments will be needed in Africa, the Indian subcontinent and the Far East. China has already begun to enter the world agricultural science community in association with the CGIAR System, and through the English language. The needs for training for these countries and regions will be far larger than the Centers can be expected to meet, but nonetheless the Centers have a unique contribution to offer. The Group, which includes all the sponsors and donors who are likely to make this contribution, will have to consider how best it can guide the Centers to make contributions, and how its members in their separate capacities can articulate their efforts and make best use, in their cooperation with the developing nations, of what the Centers have to offer.

213. We do not feel able to offer detailed general suggestions, because so many of the objectives, needs and tasks are specific to particular countries and particular donor agencies, but our thoughts turn first to the growing collaboration between Centers and universities which we have considered in paragraphs 135-142. We have also asked ourselves whether it would not be useful to explore the prospects of practical collaboration in research-related training with the members of the International Federation of Agricultural Research Systems for Development (IFARD) and with those units of FAO which are concerned with research-related training. Put another way, we feel that the CGIAR will wish to be appropriately engaged, as the guardian of a large and successful training activity, in the international development endeavour as a whole, and not solely in applied science and the development of new technical methods.

214. But all of this will have to be funded. We believe it should not be funded as at present in ways which create competition in the

Centers between research and training. Perhaps donors could establish, from their funds for education and training, a second barrel of core funding, earmarked for agreed training purposes, and not transferable to other purposes. This would not prevent them from purchasing training for their bilateral purposes also: indeed it would strengthen the capacity of the Centers to respond to such requests. Donors might find it easier to contemplate a separate core fund if the true costs of training were known and publicised. We understand that these costs are difficult to estimate precisely, but as close an approximation as can be reached is bound to be more useful than none.

#### Towards a Consensus on Training in the CGIAR System

215. The most significant conclusions we have reached, at the end of this substantial endeavour, concern the articulation of the training activities of the Centers in support of the development of individual nations. Articulation is needed at two points - among the Centers in general, and among the Centers working in particular countries. The CGIAR System will need to work increasingly and consciously as a system.

216. Between the Centers, articulation is needed in the treatment, in training, of methods, techniques, topics and subjects which are common to two or more of the Centers. Obvious examples are in studies of existing systems of farming and related questions of survey, experimentation and the development of appropriate options; in the design and analysis of experiments and surveys; in agro-climatology; in methods of chemical and physical analysis; and in macro-economic studies of countries and regions. There are no doubt many more. The first stage is evidently for the scientists concerned to work out what needs to be done and how to do it. The next task is presumably for the training officers, who will have to understand what is needed and help their research colleagues to achieve it.

217. The next area is in communications and dissemination. We have not been able to study these topics in detail. All of the Centers are active in preparing and publishing materials of many kinds, some more transient, others substantial works of enduring value. The suggestion that a common publishing system should serve all the Centers is of great interest and we hope it will be pursued despite the difficulties in deciding how much standardization is likely to be useful to so many diverse consumers of the products, and how it should be approached. Through this activity the Centers should be able to bring their knowledge and experience together to build up the variants of agricultural science (paragraph 211) appropriate to different agro-ecological, social and economic circumstances in the tropics, sub-tropics and winter rainfall regions. Our colleagues in national and regional institutions have much to offer here. No doubt the cooperation between CIMMYT and also ICARDA and the Commonwealth Agricultural Bureaux (CAB) to produce special abstracts series will be carefully evaluated by all the Centers. The CAB has vast resources for work of this sort. Centers will wish to take advantage of them, and help to make them even more useful and relevant, rather than to duplicate them unnecessarily.

218. Articulation within individual nations is more difficult. First, the Centers, and their separate programmes, working with each nation, will wish to review their collective activities and their cooperation with the many agencies, public and private, with which they collaborate. But the stage after that involves the nation and all the relevant components of its agricultural knowledge system. The Centers acting collectively may often be one of the few external agencies that know enough to help the nation to articulate the components of the national agricultural knowledge system and so make it more effective, but they cannot do this themselves. The leadership must come from within the nation, and it will not be easy to determine how this is to be done. But it must be done if the support which Centers give to national agricultural knowledge systems is to be translated into effective action for development.

Terms of Reference for the TAC Study of Training in the CGIAR System

(Extracted from the Progress Report on "Strategic Considerations: Training in the CGIAR System" to TAC 32, Document AGD/TAC:IAR/83/31)

Purpose

10. The study is undertaken to provide for the CGIAR System an evaluation of and guidance on training:
- its place in the System;
  - its role in furthering the aims of the System and the mandates of the Centers;
  - its value to the System (cost, support, performance and impact) in the past and at present;
  - the demands which may be made on it and will be expected to be made on it in future; and
  - its set of priorities.

Terms of Reference

11. Following are the terms of reference for the study:
- (a) Review past and current training efforts at IARCs and assess their relevance and impact.
  - (b) Examine short-term and long-term training plans of IARCs and assess their viability in relation to:
    - (i) training needs and capacities;
    - (ii) IARCs' comparative advantage.

Issues to be addressed

12. Among the issues to be covered in the study are the following:

Training programmes

- (a) Direction and contents of training programmes
  - Categories of training

- Location of training; duration; facilities and arrangements
  - Identification and monitoring of training contents for relevance to needs of NARS 1/ and trainee
  - Method (problem solving); balance of theoretical and practical training
  - Provision of training aids
  - Language bias and efforts at its removal
  - Mechanisms for planning, monitoring and evaluation of training programs
- (b) Trainee focus of program
- Trainee selection criteria and procedures
  - Depth vs. breadth in program design (degree of specialization)
  - Levels of training
  - Specificity of training programs
  - Evaluation of effectiveness of training
- (c) Relations to other sources of training
- Complementarity vs. duplication of efforts
  - Developments over time (changing needs, phasing out of activities, handing over to other institutions, transfer of training programs, etc.)
  - The roles of other international, regional, national institution, particularly universities and other training institutions
- (d) Organizational aspects
- Relation of training programs to IARCs' research programs (balance of IARC programs)
  - Internal organization of training programs and its effect on IARC structure (training staff; methods and motivation for training by research and other technical staff)
  - Feedback mechanisms

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1/ NARS = National Agricultural Research System

- (e) Cost and funding
- Costs of training activities
  - Funding of training (by activity, by source of funding, by trainee)
  - Allocation of funds (by area of activity, by region in terms of beneficiaries, etc.)
  - Particular aspects regarding IARC/donor relationships in terms of overall funding of the System
  - Core vs. non-core funding of training activities
  - Contributions by beneficiaries
- (f) Constraints
- Identification of key constraints (financial, logistic, program, etc.)
  - Measures taken in the past to overcome (some of) these constraints

#### Impact

- (a) Problems of impact measurement
- (b) Impact achieved in terms of IARCs overall objectives
- Institution-building of NARS; linkages; awareness and access
  - Transfer of technology
- (c) Indicators of impact
- (d) Follow-up mechanisms and procedures (if any)

#### Training strategies and their evolution

- (a) Assessment of needs (at NARS level)
- Evolution of needs at NARS level. Present requirements. Projections
  - Identification of the limiting factors (in order of priority)
  - Identification of the limitations which can be removed by training by IARCs
  - Alternative sources for training
  - Views on the above of NARS leaders, the Centers and Donors
- (b) The response to identified needs (at IARC level)
- The IARCs' potential for training and their limitations

- Matching of needs and potential; application of "comparative advantage" principle
  - IARCs' objectives in the field of training (in function of the System's overall objectives)
  - The evolving roles of IARCs' training programs
  - IARCs' constraints (including program balance)
- (c) Design of training strategies in the light of the above considerations.

Study Team of  
TAC Study of Training in the CGIAR System

Professor Jose Emilio G. ARAUJO, Brazilian, b. 1922

Rector, Federal University of Pelotas, Pelotas, R.G., Brazil

Education: Agricultural Engineering Degree from National School of Agronomy, Rio de Janeiro. Doctorate in Agronomy from Brazil's Southern Rural Federal University. Postgraduate studies at Cornell University, USA.

Experience: Titular Professor, Faculty of Agronomy "Eliseu Maciel", Southern Federal University of Brazil; Director, Southern Agronomic Institute, Brazil; Director, Southern Centre of Training and Information, Brazil; Agricultural Engineer and Technical Adviser, Ministry of Agriculture and its Planning Commission, and Ministry of Planning and Economic Coordination of Brazil; Director, Interamerican Centre of Rural Development and Agrarian Reform, IICA-CIRA, Colombia (1965-1969); Director-General IICA, Costa Rica (1970-82).

Author of 5 books on rural development and over 100 scientific and technical papers.

Professor Arthur Hugh BUNTING, British, b. 1917

Professor of Agricultural Development Overseas, University of Reading, U.K.

Education: B.Sc., B.Sc. (Hons.), M.Sc. in Botany and Chemistry from the University of Witwatersrand, Johannesburg. Doctorate in Botany from Oxford University.

Experience: Chemist, Rothamsted Exp. Sta.; Human Nutrition Research Unit, UK Medical Res. Council; establishment and direction of agricultural research stations in Tanganyika (1947-51) and Sudan (1951-56); Professor of Agricultural Botany, University of Reading and Dean of Faculty of Agriculture and Food; Governor, (UK) Grassland Res. Inst.; Governor (UK) Plant Breeding Inst.; Chairman, Adv. Comm. UK-ARC Weed Res. Org.; Foundation Member, Vice Chairman and Chairman of IITA Board of Trustees; Foundation Member of Board of Trustees of IBPGR.

Author or editor of books and a journal (J. Applied Ecology) and numerous papers on botanical, ecological, agronomic and development in agriculture topics.

List of Persons Met by Study TeamDuring Period 11 January through 5 October 1984USA, 11 - 12 January 1984International Food Policy Research Institute (IFPRI) - Washington, D.C.

J.W. Mellor, Director  
 R. Bordonaro, Head Policy Seminars Program  
 P. Hazell, Research Fellow  
 S. Wanmali, Research Fellow  
 R. Ahmed, Director, Food Production Policy and Development Strategy Program  
 C. Delgado, Research Fellow  
 J. von Braun, Research Fellow  
 S. Kumar, Research Fellow  
 N. Edirisinghe, Research Fellow  
 P. Pinstrup-Andersen, Director, Food Consumption and Nutrition Policy Program  
 H. Bouis, Postdoctoral Fellow  
 B. Huddleston, Research Fellow

United States Department of Agriculture - Washington, D.C.

L. Lynch, Short Course Program Coordinator, International Training Division

United States Agency for International Development - Washington, D.C.

N.C. Brady, Senior Assistant Administrator, Science and Technology Bureau  
 J. Eriksson, Assistant to Senior Assistant Administrator

USAID Office of International Training - Rosslyn, Va.

T.H. Ball, Deputy Director  
 D.S. Terrell, Assistant Director  
 F. Method, Program and Policy Coordination

MEXICO, 15 - 20 January 1984International Maize and Wheat Improvement Center (CIMMYT) - El Batan

R.D. Havener, Director-General  
 R.D. Osler, Deputy Director-General, Administration

W.C. James, Deputy Director-General, Research  
 G. Martinez, Public Affairs Officer  
 R. Cantrell, Director, Maize Program  
 R.L. Paliwal, Associate Director, Maize Program  
 B.C. Curtis, Director, Wheat Program  
 A.R. Klatt, Associate Director, Wheat Program  
 D.L. Winkelmann, Director, Economics Program  
 H.S. Cordova, Program Coordinator, Guatemala  
 W. Villena, Regional Program Coordinator, Central America  
 T.G. Hart, Maize Program Liaison, Pakistan  
 A.F.E. Palmer, Maize Program Training  
 F. Kocher, Maize Program Training  
 J.M. Prescott, Wheat Program, Pathology  
 R. Knapp, Wheat Program, Training  
 H. Hepworth, Wheat Program, Training  
 G. Kingma, Wheat Program, Training  
 J. Ransom, Wheat Program, Training  
 P. Malvoisin, Wheat Program, Training  
 C. Dowswell, Communications Coordinator, Information Services  
 R. Tripp, Economics Program, Training  
 A. Hibon, Postdoctoral Fellow, Training  
 E. Villegas, Head, General (Nutrition) Laboratories  
 A. Amaya, Head, Laboratories for Wheat Industrial Quality  
 J. Stewart, Head and Executive Officer, Experiment Station Program  
 H. Muhtar, Experiment Station Program, Training

ICRISAT Staff located at CIMMYT Headquarters

Vartan Guiragossian, Head, Latin America Sorghum Program  
 Compton Paul, Latin America Sorghum Program

Instituto Nacional de Investigaciones Agrícolas (INIA) - Mexico City

R. Claverán, Director-General  
 A. Crispín, Deputy Director, Training  
 E. Samayoa, Deputy Director, Research - Northern Zone  
 E. Elias-Calles, Deputy Director, Research - Central Zone  
 A. Ramos, Deputy Director, Research - Southern Zone

Fondo de Garantía y Fomento para la Agricultura, Ganadería, Avicultura y Fideicomisos Agrícolas (FIRA) - Mexico City

A. Baca Díaz, Director-General  
 G. Vázquez Rodríguez, Deputy Director-General  
 C. Ricardez, Deputy Director, Technical Assistance  
 M. García Santibañez, Head, Technical Training  
 R. Corona Cázares, Deputy Director, Foreign Field Offices  
 L. Lauro González, Coordinator, Maize Production Program  
 G. Cuevas Ramos, Production Specialist  
 J. Díaz Avelar, Head, Agricultural Division  
 C. de Alba, Seed Production Program

Colegio de Postgraduados - Chapingo (Mexico)

E. Casas Diaz, Director-General  
 D. Téliz Ortiz, Academic Director  
 L. Jiménez Sánchez, Research Professor (Director CECAIDAR)  
 E. Nino Velásquez, Director, State Rural Development Center  
 M. Anarya Garduno, Research Professor, Director, Centro de Edafologia  
 R. Rodriguez Montessoro, Research Preofessor, Centro de Fitopatologia  
 R. Nunez Escobar, Research Professor, Centro de Edafologia  
 J. Vera Graziano, Reearch Professor, Centro de Entomologia  
 A. Ruiz Barbosa, Research Student, CECAIDAR (CIAT supervision)  
 J. Huerta, Research Student (INIA staff, CIMMYT supervision)  
 M.A. Urias, Research Student

CIMMYT - Retired

H. Hanson, former Director-General

GUATEMALA, 22 - 24 January 1984Institute of Agricultural Science and Technology (ICTA) - Guatemala City

C. Pinto Minera, Director (Gerente)  
 A. Fumagali, Deputy Director  
 P. Masaya, Acting Technical Director, Coordinator Bean Program  
 A. Fuentes, Coordinator Maize Program  
 R. Castillo, Chief, Communications Section  
 S. Hugo Orozco, Agronomist (CIAT Guatemala)  
 G.E. Gálvez, Coordinator, C.A. Bean Program (CIAT Regional)  
 Mario Antonio Dardon (ICTA Maize Breeder)

Nutrition Institute of Central America and Panama (INCAP)

R. Bressani, Director, Food Technology Department

COSTA RICA, 24 - 28 January 1984National Council of Production (CNP) - San Jose

E. Quirós, Executive Director  
 H. Zúñiga Ch., General Manager  
 V. de Molina, Deputy General Manager  
 R.A. Flores Galarza, Manager, Administration  
 U. Ugaldi Vaula, Manager, Development  
 J.I. Vargas Araya, Assistant to Executive Director

University of Costa Rica - San Jose

Oscar Arras M (on behalf of the Dean, Luis Carlos Gonzales), Sub-Dean  
 W. Loria, Director of Experimental Station Fabio Baurit (University  
 Experimental Station); 10 staff members of several faculties  
 W. Villena, Program Coordinator (CIMMYT Regional)

Ministry of Agriculture - San Jose

F. Morales, Minister for Agriculture (Board Chairman, CATIE)  
 J. Saenz Pacheco, Deputy Director, Agriculture  
 R. Alfaro, Assistant Director, Agriculture  
 G. Araya Soto, Production Specialist  
 Ing. A. Vasquez, Coordinator, Programa Incremento de Produccion  
 Agricola, PIPA

Interamerican Institute for Agricultural Cooperation (IICA) - San Jose

F. Morillo, Director-General  
 Q.M. West, Deputy Director-General  
 J. Soria, Assistant Director-General, Program Development  
 G. Grajales, Director, External Finance  
 C.E. Fernández, Director, Central Area  
 R. Bazán, Project Evaluation Division  
 F. Matos, Natural Resources Specialist  
 A. Palencia O., Chief, IICA-PROMECAFE  
 E. Andrade M., Agricultural Communications, IICA-PROMECAFE

Visitors to IICA or CATIE

L. Richard, Director, Centre de Recherche et de Documentation Agricole,  
 Haiti  
 A. Bonilla Contreras, Chief, Department of Agricultural Research,  
 Ministry of Natural Resources, Honduras  
 R. Martinez Richiez, Director, Agricultural Research Department, Ministry  
 of Agriculture, Dominican Republic  
 R. Tarté, Representative of Panama to IICA and newly elected Director of  
 CATIE

CATIE Staff

C.F. Burgos, Chief, Department of Plant Production  
 J. de Alba, Chief, Department of Animal Production  
 G. Budowski, Chief, Department of Renewable Natural Resources

Center Staff in Attendance at IICA \*

G.E. Galvez (CIAT)  
 D.L. Winkelman, W. Villena, M. Babic (CIMMYT)  
 M. Pina (CIP)

\* Note: Center Staff frequently present at meetings with national  
 agencies; not normally listed more than once, i.e. in relation  
 to the Center or the initial contact.

NIGERIA, 5 - 10 March 1984International Institute of Tropical Agriculture (IITA) - IbadanIITA

E.H. Hartmans, Director-General  
 W.H. Reeves, Director, Training Unit  
 A.P. Uriyo, Training Officer  
 D.W. Siriyanake, Training Officer  
 E.R. Terry, Director, International Programs and Training  
 B.N. Okigbo, Deputy Director General  
 C.H.H. ter Kuile, Director, Farming Systems Program  
 A.S.R. Juo (future) Director, Farming Systems Program  
 S.R. Singh, Director, Grain Legumes Improvement Program  
 S.K. Hahn, Director, Root and Tuber Improvement Program  
 F.E. Caveness, Root and Tuber Improvement Program  
 Y. Efron, Director, Cereal Improvement Program

Met at IITA

M. Bjarnason, CIMMYT Regional Representative, W. African Maize Program  
 Kwesi Atta-Krah, ILCA Program (at IITA)  
 Kaung Zan, IRRI Liaison Scientist for Africa

Mr. Barnigadel, Farmer, Ofiki, Oyo State  
 Mr. Lawal, Farmer, Oro, Ilorin, Kwara State

J.A. Ayuk-Takem, Coordinator NCRE Project, IRA, Bambul (Cameroon)  
 F. Nwekke, University of Nigeria, Nsukka  
 J.O. Akinola, Dean, Faculty of Agriculture, Ahmadu Bello University,  
 Samaru-Zaria  
 N.M. Fisher, Lecturer, Ahmadu Bello University, Samaru-Zaria  
 R.A. Eniang, Planning & Programming Department, Federal Ministry of  
 Education, Science and Technology, Ikoyi, Lagos  
 P.H. Haynes, Consultant, UNDP Roots and Tuber Project Evaluation  
 P. Mills, UNDP Inter-Regional Projects  
 E. Stahn, Delegation Comm. European Communities, Lagos  
 J.M. Menyonga, Coordinator, SAFGRAD, Ouagadougou  
 Dr. Bezuneh, SAFGRAD

At Lagos

Alhaj Ibrahim Yerima Abdullahi Mahmud, Federal Minister for Education,  
 Science and Technology (FMEST)  
 Dominic E. Iyamabo, Director Agricultural Sciences, FMEST  
 Bukar Shaib, Federal Minister for Agriculture and Water Resources  
 O. Awoyemi, Director Agricultural Services, FMAWR  
 P.E.A. Onuorah, Assistant Director Agriculture, FMEST  
 O.A. Oloko (Livestock) FMEST

University of Ibadan

M.O. Adeniji, Dean, Faculty of Agriculture  
 H.R. Chheda, Head, Agronomy Department  
 F.S. Idachaba, Agricultural Economics  
 F.O. Olubajo, Head, Department Animal Science  
 J.K. Egunjobi, Head, Department Agricultural Biology  
 Akinola A. Agboola, Soil Fertility and Farming Systems  
 D. Okali, Forest Ecology  
 K. Olusa, Faculty Officer (Agriculture & Forestry)

IART - University of Ife - Ibadan

E.A. Olaloku, Director, Institute of Agricultural Research and Training  
 R.A. Sobulo, Assistant Director Research, IART

UPPER VOLTA, 11 - 14 March 1984

Kamboinse Experimental Station (Ouagadougou area)

V.L. Asnani, Project Manager (IITA Project Staff)  
 J.B. Suh  
 N. Muleba  
 V.D. Aggarwal, SAFLAAD Cowpea Breeder  
 K.V. Ramaiah, Sorghum Breeder (ICRISAT Project Staff)  
 P. Matlon, Economist (ICRISAT Project Staff)  
 I. Drabo, Station Director  
 I. Hema, Assistant (IVRAZ Staff)

Institut Voltaique de Recherche Agronomique et Zootechnique (IVRAZ) - Ouagadougou

N. Sedego, Director  
 A. François, Coordinator, Research Program

DSA - Ouagadougou

G. Tatieta, Director, Direction des Services Agricoles (DSA),  
 Ouagadougou (DGRST)  
 N. Bosso, IBRD Resident Adviser to Director, DSA-DGRST

USAID - Ouagadougou

R.A. Blum, Resp. Officer, Agricultural Projects  
 R. Zigler, Director of Training  
 A. Fleming (prosp. SAFGRAD/USAID Project Manager)  
 Mr. Becker, Program Officer

IDRC (met in Ouagadougou)

Andrew Ker, Repr. IDRC, Ottawa

LIBERIA, 14 - 17 March 1984West Africa Rice Development Association (WARDA) - Monrovia

A.M.B. Jagne, Deputy Executive Secretary  
 D.K. Awute, Director, Training Department  
 K.M. Conteh, Chief, WARDA Training Center, Fendall  
 Amadou Maiga, Training Officer, WTC, Fendall  
 E.T. Cole, Training Officer, WTC, Fendall  
 L. Zanoni, Assistant to Director of Training Department  
 A.O. Abifarin, IITA/WARDA Research Liaison Scientist  
 P. Quasso, FAO/WARDA Farm Mechanization Expert, WTC  
 J.N. Nketsiah, Interpreter, WTC  
 S.K. Seddoh, Interpreter, WTC  
 H. Leroux, Executive Secretary (met at airport)

FAO

E.O. Bayagbona, FAO Representative in Liberia, Monrovia

Agricultural and Cooperative Development Bank (ACDB) - Monrovia

S.R. Divine, General Manager  
 Arul Rayan, Credit Advisor  
 N.N. Nemah, Assistant Manager, Head Projects & Marketing Dept.  
 J.M. Hodge, Manager, Research and Planning

USAID - Monrovia

Mark A. Smith, Officer Respons. for WARDA support

Ministry of Agriculture - Monrovia

James W. Coleman, Deputy Minister (Administration)  
 Carlos Smith, Coordinator, Training  
 E.R. Buckle, Director, Training

Central Agricultural Research Institute (CARI) - Suakoko, Bong County

A.F. Paye, Director  
 J.Q. Subah, Research Coordinator

FAO/UNDP Project at CARI - Suakoko

H.Y. Kulkarni, Project Manager  
Samuel Cooper, WARDA counterpart

Cuttington College - Suakoko

Evelyn Kandekai, Dean

Rural Development Institute of Cuttington College (RDI - CC) - Suakoko

U.S. Jones, Director  
Alfred Tubman, Deputy Director  
L.B. Carter, Consultant

INDONESIA, 1 - 5 April 1984IRRI Liaison Office - Jakarta

Dr. Walter C. Tappan, IRRI Liaison Scientist

Directorate-General for Food Crops, Ministry of Agriculture - Jakarta

Suhaedi Wiraatmadja, Director-General  
Ir. Nuryadi, Directorate of Food Crops (Multiple Cropping)  
Ir. Cahyantati, Directorate of Food Crop Protection  
Ir. Handakra, Directorate of Food Crops Management (Post-harvest Machinery)

Agency for Agricultural Extension, Training and Education (AAETE),  
Ministry of Agriculture - Jakarta

Salman Padmanegara, Director-General  
Samedi Sumintaredja, Secretary

Agency for Agricultural Research and Development, Ministry of  
Agriculture - Bogor

Sadikin Sumintawikarta, Director-General

Institute Pertanian Bogor (IPB)

Andi Hakim Nasution, Rector  
Eddie Guhardja, Dean, Graduate School  
Yayah Koswara, Associate Dean, Graduate School

Central Research Institute for Food Crops (AARD) - Bogor

Bernard H. Siwi, Director  
I.N. Oka, Director for Entomological Research, CRIFC  
Subijanto, Director, Central Research Institute for Horticulture  
Saul E. Camacho B., Fruits Specialist (IADS)

National Biological Institute, Indonesian Institute of Sciences - Bogor

Setijati Sastrapradja, Director National Biological Institute  
Mien Achad Rifai, Assistant Director of Scientific Affairs

National Library for Agricultural Sciences - Bogor

Prabowo Tjitropranoto, Head, Information Center

Agricultural Information Center (CIAWI) - Jakarta

O'oy Sunarya, Director  
Yusip Supriaman, National Library for Agr. Sciences

United Nations Development Program (UNDP) - Jakarta

F.W. Mumm von Mallinckrodt, Deputy Resident Representative

FAO Representation in Indonesia - Jakarta

D.B. Reddy, FAO Representative

Ministry of Agriculture - Jakarta

Syarifuddin Baharsyah, Secretary General of Agriculture

THAILAND, 6 - 10 April 1984Bangkok

B.J. Cochran, Agricultural Engineer, IRRI (USAID/Louisiana State  
Regional Mechanization Project)  
D.W. Puckridge, Agronomist (IRRI Representative)  
B.L. Renfro, Plant Pathologist and Asian Regional Maize Coordinator  
(CIMMYT)  
L.W. Harrington, Regional Economist (CIMMYT)  
K. Kawano, Plant Breeder and Representative (CIAT)  
H.D. Catling, Entomologist (IRRI)  
E.E. Saari, Plant Pathologist (Wheat) and CIMMYT Liaison Officer  
C.E. Mann, Wheat Breeder, (CIMMYT)  
D. Saunders, Wheat Agronomist (CIMMYT)  
Derk Hille-Ris-Lambers, IRRI Deep Water Rice Breeder

Department of Agricultural Extension - Bangkok

Narong Minanandana, Deputy Director-General, Training and Extension  
Operation  
Ananta Dalorom, Director, Planning and Special Projects Division

The Graduate School, Kasetsart University

Krisna Chutima, Vice Rector  
Yongyut Chiemchaisri, Associate Dean

Department of Agriculture, Ministry of Agriculture & Cooperatives

Yookti Sarikaphuti, Director-General  
Vijai Nopamornbodi, Project Manager, National Agricultural Research  
Project

PHILIPPINES, 10 - 17 April 1984International Rice Research Institute (IRRI) - Los Banos, Laguna

M.S. Swaminthan, Director-General  
 D.J. Greenland, Deputy Director-General  
 M.D. Pathak, Director, Research and Training  
 D.R. Minnick, Training Specialist  
 W. Barsana, Senior Administrative Assistant  
 S.S. Virmani, Plant Breeding  
 T.R. Hargrove, Communication and Publications  
 L.M. Vergara, Library  
 T.T. Chang, International Rice Germplasm Center  
 M. Tamisin, Agrometeorology Station  
 K.A. Gomez, Statistics  
 I. Watanabe, Soil Microbiology  
 F.J. Zapata, Phytotron and Tissue Culture  
 Celestino Rivera, Phytotron and Tissue Culture  
 C.W. Bockhop, Farm Machinery  
 F.V. Ramos, Farm Superintendent, Experimental Farm  
 E. Mendoza, Plant Breeding  
 R.T. Rosales, Agronomy  
 J.L. Gonzales, Training Assistant  
 R.C. Pascual, Manager, Food and Housing Services  
 E.A. Heinrichs, Entomologist  
 Ching Necesito, Training

University of the Philippines at Los Banos (UPLB)

E.O. Javier, Chancellor  
 Dolores A. Ramirez, Dean, Graduate School  
 B. Mabbayad, Chairman, Department of Agronomy  
 H.A. Ables, Vice Chancellor for Academic Affairs

South East Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)

Suraphol Sanguansri, Deputy Director  
 Saguiguit, Deputy Director  
 R.O. Obordo, Project Manager

Philippine Council for Agriculture and Resources Research and Development (PCARRD)

R.V. Valmayor, Executive Director

Meeting with Selected Members of IRRI Academic Council

M.S. Swaminathan, Director-General, IRRI  
 O.F. Sison  
 C.B. Perez, Jr.  
 Suraphol Sanguansri  
 P.A. Bernardo  
 V. Agbayani  
 Dolores A. Ramirez

Visit to CIP Office (near PCARRD) and to CIP Germplasm and Training Center, Region VII, St. Lucia Potato Research Station - Mount Banaham, Quezon

R. Alasio, Assist. Scientist  
 P. van der Zaag, Regional CIP Representative  
 J. Kloos, Head, Project Mindanao

Ministry of Agriculture - Manila

E.Q. Quisumbing, Deputy Director, National Food and Agriculture Council  
 and Director, Agricultural Research Office  
 J.M. Corpuz, Project Officer, Agricultural Research Office

Bureau of Plant Industry - Manila

D. Panganiban, Deputy Minister  
 Hipolito A. Custodia, Chief Field Trial Services

Asian Development Bank - Manila

M.E. Tusneem, Agric. and Rural Dev. Dept.

COLOMBIA, 2 - 10 May 1984

Centro Internacional de Agricultura Tropical (CIAT) - Palmira

J.L. Nickel, Director-General  
 D. Laing, Director, Crops Research  
 G. Nores, Director, Resources Research and International Cooperation  
 F. Fernandez, Coordinator, Training and Conferences  
 A. Caldas, Training and Conferences  
 F. Kramer, Assistant to Director-General  
 D. Evans, Head, Food and Housing  
 J.H. Cock, Coordinator, Cassava Program  
 Aart van Schoonhoven, Coordinator, Bean Program  
 S.R. Temple, Plant Breeding, Bean Program  
 P.R. Jennings, Coordinator, Rice Program  
 J.E. Douglas, Head, Seed Unit  
 J.M. Toledo, Coordinator, Tropical Pastures Program  
 J. Woolley, Cropping Systems (On-Farm Research Course)  
 R. Hidalgo, Genetic Resources Unit

Met at CIAT

M. Holle, IBPGR Representative for Latin America  
 G. Granados, Head, CIMMYT Andean Region Maize Project  
 J. Barnett, CIMMYT Andean Region Maize Project  
 E. Pulver, Co-Leader Rice Project Peru (IBRD/INIPA)  
 A. Samper, CIAT Board Chairman Emeritus

Instituto Colombiano Agropecuario (ICA) - Bogota

J. Navas, Director of Research  
 H. Gutierrez, Chief, Division of Animal Sciences  
 A. Mendoza, Chief, Seed Division  
 P.L. Gómez, Chief, Root and Tuber Crops Program  
 P. Mendoza, Chief, Pastures and Forages Program  
 M. Torregroza, Chief, Agronomy Division  
 C.T. Arraque

Met at ICA

O. Malamud, CIP Andean Regional Representative  
 P.L. Gómez C., Coordinator, Programa Papa, ICA  
 M. Pina Jr. - CIP Lima

Meeting at CIAT/CIMMYT Office

F. Arboleda, Head of Maize Program, ICA  
 M. Zapata, Coordinator of Wheat Program, ICA  
Ministry of Agriculture - Bogota

M. Ochoa, Desarrollo Rural Integrado

Acosemillas - Bogota

J. Durán, General Manager, Acosemillas  
 E. Villota, President, Acosemillas  
 J. Bernal, President, Semillas la Pradera  
 A. Mendoza, Chief, ICA Seed Services

FEDEARROZ - Bogota

C.C. Cano, General Manager, Rice Producers Association  
 R. Hernandez, Technical Manager  
 Ember Farah, Research Officer  
 Patricio Valdéz, Head of Research Department  
 Dr. Vargas, Head of Seed Department  
 Desiderio Diaz, Head Supervisor in Seed Programme

Graduate Faculty-Agronomy of Palmira, Branch of Universidad Nacional de Colombia

F.A. Vallejo, Dean (Graduate Program)  
 Adel Gonzalez, Soils Spec., Director, Graduate Program  
 Diosdado Baena, Director of Research, Graduate Program

National University of Colombia - Bogota

O. Briceno, Dean PEG (Programa de Graduados)  
 A. Ramirez, Vice-Rector Academico  
 Dr. Arbelaez, Dean, Agronomy Department  
 V. Alvez, Head, Planning Department  
 J. Clavijo

FEDERACAFE - Bogota

H. Valdes Sanchez, General Manager, Coffee Producers Association

PERU, 11 - 19 May 1984

Centro Internacional de la Papa (CIP) - Lima, La Molina

R.L. Sawyer, Director-General  
 J. Valle-Riestra, Deputy Director-General  
 O. Page, Director of Research  
 K. Brown, Director of Regional Research  
 M. Pina Jr., Head, Training and Communications

Thrust Leaders

C. Martin, III. Research on Bacterial and Fungal Diseases  
 L. Salazar, IV. Potato Virus Research  
 S. Raymundo, V. Integrated Pest Management  
 P. Jatala, Department of Entomology and Nematology  
 D. Midmore, VI. Warm Climate Potato Production  
 J. Landeo, VII. Cool Climate Potato Production  
 R. Booth, VIII. Postharvest Technology  
 P. Malagamba, IX. Seed Technology

Training and Communications Department

R. Robertson, Senior Training Specialist  
 H. Rincon, Communications Unit  
 R. Zachmann, Training Materials Specialist  
 C. Siri, Training Materials Specialist

Social Science Department

D. E. Horton, Head

Met at CIPUniversidad Nacional Agraria "La Molina" (UNA)

A. Cerrate C., Vice Rector  
 J. Estrada A., Dean of Graduate School  
 E.N. Fernandez-Northcote, Pathology Dept., Potato Program  
 R. Egusguiza, Potato Program  
 R. Mont Koo, Pathology Department, Cereals Program  
 M. Romero L., Cereals Program  
 R. Sevilla P., Corn (Maize) Program  
 A. Manrique, Bean Program  
 Alfredo Garcia, Director Designate of misc. courses in genetic resources  
 U. Moreno, Director, International Potato Course  
 C. Alvarez, Coordinator, International Potato Course

CIAT (Colombia)

S. Harris, Head, Communications and Information

Meeting at Instituto Nacional de Investigacion y Promocion Agropecuaria (INIPA) - Lima

V. Palma, Director-General  
 M. Arca, Director of Research  
 T. Alvarez, Director of O.C.T.  
 C. Rodriguez, for Director of Extension  
 J. Benavados, Secretary-General  
 A. Mandivel  
 Dale Bandy, North Carolina State University Mission to INIPA  
 C. Bohl, IBRD Loan Officer at INIPA

Santa Ana Experiment Station of CIP - Huancayo

M. Soto, Experiment Station Manager  
 M. Quevedo, Deputy to Station Manager  
 C. Vitorelli, Swiss Special Project on potato seed production  
 D. Untiveros O., Leader, Prog. Nacional de la Papa (INIPA)  
 F. Ezeta, Co-Leader, Prog. Nacional de la Papa (INIPA)

Experiment Station of CIP - San Ramon

M. Quevedo, Deputy to Station Manager

Instituto Interamericano de Cooperacion para la Agricultura (IICA) - Lima

A. Pinchinat, Director  
 M. Tapia N. IICA/IDRC Andean Crops Project

U.S. Agency for International Development - Lima Office

A.T. Turado, Agricultural Development Officer

N.G.O.

I.D. Bauman, Austrian Volunteer working with support of Peruvian Voluntary Agency

SYRIA, 11 - 15 July 1984

International Center for Agricultural Research in Dry Areas (ICARDA) - Damascus

Mohamed El Habib Ibrahim, Senior Food Legumes Training Officer  
 Samir El Sebae Ahmed, National Research Coordinator/International Cooperation Program  
 Abdul Karim Al-Ali, Director of Damascus Office  
 Husam El-Khaldy, Assistant Director of Damascus Office

Ministry of Agriculture and Agrarian Reform - Damascus

Hassan Saoud, Deputy Minister  
 Irfan Alloush, Director of Statistics and Planning  
 Hajera Al Samman, Director of Steppe and Range  
 Sultan El Amery, Director of Extension

Agricultural Research Council (ARC) - Duma (Damascus)

Rebhy Hamdan, Deputy Director of Research  
 Ali Shehada, Head of Cereal Improvement Program

Arab Organization for Agricultural Development (AOAD) - Damascus

Yehya Bakour, Regional Director  
 Gumaa Abdul Karim, Director of Soils Bureau  
 George Soumy, Deputy Director of Soils Bureau

The Arab Center for Studies of Arid Zones and Dry Lands (ACSAD)

Mustapha Shourbagi, Head of Natural Pastures Department  
 Habil Hassan, Animal Specialist  
 Mohamed Eleway, Soils Specialist  
 Refaat Rajab, Water Specialist  
 Ahmed El Genedi, Public Relations

ICARDA - Aleppo and Tel Hadya

L.R. Przekop, Head of Training  
 Habib Ketata, Cereals Training Officer  
 Ali Mohamed Abdul Moniem, Pasture and Forage Training Officer  
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 J.P. Srivastava, Leader, Cereals Improvement Program  
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 G. Hawtin, Deputy Director-General, International Cooperation  
 Mr. Saxena, Leader, Grain Legume Program  
 P. Goldsworthy, Deputy Director-General, Research  
 P. Cox, Leader, Pasture and Forage Crops Improvement Program  
 Ahmed Osman, Agronomist, Pasture and Forage Crops Improvement Program  
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 Walid Aswad, Vice-Dean for Administrative Affairs

National Seed Bureau

Nassan Mohamed, Director-General

INDIA, 16 - 21 May 1984

Indian Council of Agricultural Research (ICAR) - New Delhi

O.P. Gautam, Director General of ICAR and Secretary to the Department of Agricultural Research and Education, GOI  
 M.V. Rao, Deputy Director-General (Crops)  
 M. Singh, Deputy Director-General (Education)  
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Indian Agricultural Research Institute (IARI) - New Delhi

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 N.S. Jodha, Economist  
 R.K. Agrawal, Wheat Breeder  
 R.L. Paliwal (CIMMYT)  
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Met at IARI

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 A.S. Khehra, Maize Breeder and Head Plant Breeding Department

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 D. Ramakrishnaich, Economist  
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BANGLADESH, 22 - 25 July 1984

Bangladesh Agricultural Research Council (BARC) - Dhaka

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 Dorsey Davy, Staff Development, IADS  
 Donald E. Spears, Training Consultant (USAID)

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 P. Peterson, Agr. Dev. Officer, USAID/ADO  
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University of Mymensingh

Monwar Ahmed, Dean

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 N.I. Khan, Director of Training  
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 Mohammad H. Mondul, Associate Director, Research  
 Sufi Mohriddin, Project Director (Wheat)

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Bangladesh Agricultural Development Corporation - Dhaka

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 S.A. Munim, Joint Director, Training Wing  
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Lyle C. Sikka, CIP Bangladesh Representative

NEPAL, 25 - 28 July 1984

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G. Axinn, FAO Representative in Nepal

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R.B. Singh, Joint Secretary

K.B. Rajbhandary, Director-General, Dept. of Livestock Development and Animal Health

Department of Agriculture - Kathmandu

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Narayan Regmi, Deputy Director General

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Department of Agriculture - Khumaltar

A.N. Bhattarai, Chief, Agronomy Division

K.C. Sharma, Chief, Entomology Division

H.B. Shresta, Chief, Botany Division

M.N. Pokhrel, Chief, Potato Division

Farmers (contract seed potato growers)

Krishan Gopal Bake

Krishan Prasad Suwal

Narain Prasad Suwal

Chukva Khan Tuladhar

Top Bahadur Khadha

National Development Projects (Kathmandu)

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 P.S. Rana, Wheat Coordinator - Bhairahawa  
 B.B. Mathema, Rice Coordinator - Parwanipur  
 S.S. Bal, Supervisor SPIS - Teku (IADS Staff)

Agricultural Inputs Corp. - Kathmandu

Badri Kayastha (former DOA Staff)

U.S. Agency for International Development - Kathmandu

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 G. Alex, Program Officer

Tribhuvan University - Kathmandu

N. Besayat Basnet, Registrar

Met in KathmanduCIP Staff

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INDIA, 29 July - 1 August 1984

Agricultural University of Andra Pradesh - Hyderabad

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All-India Coordinated Rice Improvement Project - Rajendranagar

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 M.B. Kalode, Senior Entomologist  
 T.E. Srinivasan, Senior Rice Breeder  
 H.V.B. Reddy, Accounts Officer  
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All-India Coordinated Sorghum Improvement Project - Rajendranagar

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ETHIOPIA, 17 - 22 September 1984

International Livestock Center for Africa (ILCA) - Addis Ababa

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Abiy Kifle, Academic Vice President  
 Dejene Mekonnen, Associate Professor, College of Agriculture in Alemaya

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KENYA, 22 - 28 September 1984

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 E. Torres, Wheat  
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S. Nganga

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ZIMBABWE, 28 September - 3 October 1984

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Agritex

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CIMMYT

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THE NETHERLANDS, 5 October 1984

ISNAR - The Hague

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 H. Hobbs, Senior Research Officer  
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E. Trigo, Senior Research Officer  
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G. Gansey, Research Fellow

Proposed\* Table of Contents of Reports of Individual Country Studies  
on Training\*\* in Agricultural Research and Related Areas

I. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. Introduction

Who conducted the case study, when it was conducted, principal institutions providing information, number of people interviewed, etc.? This section is to give credibility and validity to the study.

B. Principal findings

A reminder: Country case studies cover the agricultural science profession in the country and the training systems for agricultural research and development with reference to past and to possible future contributions of the International Agricultural Research Centers (IARCs) i.e. the size of the profession and the impact the IARCs have had on it.

This section is to list succinctly the principal findings related to the objective of the case study.

C. Conclusions and recommendations

This section is to list succinctly all major conclusions reached from the case study work and all major recommendations to be made. Recommendations should be to modify or improve what the IARCs are individually or collectively currently doing and advance ideas for future action.

II. THE PLACE OF AGRICULTURE IN THE COUNTRY

A. Agro-ecological setting

B. Agriculture in the national economy

A descriptive account.

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\* Prepared at a meeting in July 1984 at the TAC Secretariat, Rome, by the six national collaborators, the two coordinating consultants, a member of the TAC appointed Study Team on Training in the CGIAR System, and the TAC Secretariat. Based on prior inputs provided by the TAC Secretariat, an ISNAR Working Group, and Manuel Pina.

\*\* With reference to past and possible future contributions of IARCs.

- C. Public sector funds allocated to agriculture
- D. Contribution to GNP or GDP of:
  - 1. Food crops - livestock
  - 2. Non-food crops
- E. The significance of IARC mandated crops
  - If possible give contribution to GNP or GDP
- F. Status of general and agricultural development of country and future projections

III. THE COUNTRIES' AGRICULTURAL AND RURAL DEVELOPMENT STRUCTURES AND PROGRAMS (WITH MANPOWER)

Each country will outline its own structures. Samples of agencies and institutions have been distributed.

IV. HISTORY AND PROJECTIONS OF PUBLIC SECTOR EXPENDITURE ON AGRICULTURE (OVERALL BIOLOGICAL PRODUCTION IN COUNTRY) FOR:

- A. Agricultural research
- B. Agricultural extension
- C. Agricultural education
- D. Others

Each of A, B, C, and D should be divided, if possible, into training and non-training components.

V. TRAINING POLICIES

- A. National perceptions of country's manpower needs for agricultural sector as seen by the nation
- B. National plans and policies to meet needs

VI. THE ATTITUDE OF IARCS AND OTHER DONORS IN REGARD TO:

- A. Assessing training needs
- B. Planning training programs
- C. Selecting participants
- D. Executing training
- (E. Follow-up can be mentioned here, if appropriate.)

## VII. TRAINING ACTIVITIES RELATED TO AGRICULTURE IN THE COUNTRY

Not confined to national institution. Give numbers trained per year, if possible. Refer to IARCs, but give details in IX.

## VIII. TRAINING ACTIVITIES OUTSIDE THE COUNTRY

Could include regional institutions, or national institutions who send people outside.

## IX. TRAINING ACTIVITIES OF THE IARCS

## A. Evolution of IARC cooperation with the country in training

For example what was the mode of operation when the IARCs began to work in the country, what is it now and what is it expected to be in the future? How is the IARC policy articulated by the IARC(s)? How does the national leadership interpret this policy?

B. Past History - Tables - Numbers trained and kind of training  
(See examples of tables)

Educational level of trainees who received training  
(Descriptive account)

C. Numbers of trainees currently working in Country  
Agricultural System

1. Ministries

2. Research

3. Extension

4. Education

5. Major development projects in the country

6. Bilateral and multilateral assistance projects

7. Private Sector (national and non-national agribusiness)

8. Whereabouts unknown

9. Others

10. Percentage or numbers not working on topics for which they were trained

## D. Unemployed

## E. Emigrated/immigrated

F. Relations between the IARCs and trainees after the Training Course (follow-up or after-care)

1. Comparison of IARC and other agencies offering training in terms of supporting the subsequent work of the trainees
2. Comparison of IARC support for trainees who participated in in-country - in contrast to those who attended headquarters training programs
3. Assessment by the nation of the value of the support and follow-up

X. EFFECTS OF TRAINING BY IARCs ON:

- A. Agricultural research
- B. Agricultural extension
- C. Agricultural education
- D. Farmers

If possible some assessment of increase in production would be useful.

- E. Agribusiness
- F. Institution Building

Do national commodity training programs now exist due to IARC influence?

- G. The trainees, including their contacts with other trainees in-country and internationally

The section would include training others and adaptation or adoption of training materials. Some IARC-generated technologies may also be seen.

XI. FUTURE NEEDS FOR TRAINING AND POTENTIAL FOR CONTRIBUTION OF IARCs

- A. Needs that could be addressed better by national Agencies (without IARC support).
- B. Needs that could be addressed better by IARCs
- C. Needs that could be addressed better by IARCs in collaboration with national programs

Are the IARCs offering what is needed?

Are the national programs asking for what the country needs, or for what they know the IARCs will offer?

Are national agencies asking for what they need or for what is in vogue?

Who decides in the country what is needed?

Who decides at the IARCs? How do they decide?

Are there differences between IARCs in their approach?

XII. OTHER TRAINING MATTERS OF INTERST

XIII. NATIONAL COLLABORATOR'S ASSESSMENT OF IARCs TRAINING IN THE COUNTRY

XIV. REFERENCES

XV. APPENDICES

List of contacts, etc.

Some of the Documents Consulted by Study TeamTAC and CGIAR Documents

First Review of the CGIAR, 1976. (= Report of the Review Committee, January 1977)

Second Review of the CGIAR, 1981.

Records of Meetings on Training, September 1977, Washington, D.C.:

-- Draft informal summary of CGIAR "Forum" discussion on training.

-- Papers presented at the "Forum":

"Objectives and Content of Training at the International Centers of Agricultural Research" by F. Fernandez (CIAT); and

"Training Requirements for Research and Its Application" by P. Oram (IFPRI).

-- A summary of Discussion at Joint Meeting of Heads of Training and Directors of International Agricultural Research Centers and Associated Institutions.

-- 1979 Integrative Report, CGIAR Secretariat (p. 23).

Reports and meeting documents of TAC

-- TAC 5 meeting document (FAO, 1973) "Socio-Economic Aspects of International Agricultural Research".

-- TAC 17 Report, 1977 (pp. 17-19).

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- TAC 33 Report, 1984 (p. 33).
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- Long Range Plans
- Training brochures/leaflets/documents for 12/83 Meeting on Training
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Study Team Summary Report on Findings: THE CENTERS

A. CIAT - CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL

3-9 May 1984, Araujo, Bunting, Herz. Further information gathered in 13 out of 18 countries visited (Mexico, Guatemala, Costa Rica, Indonesia, Thailand, Philippines, Colombia, Peru, Nepal, Nigeria, Ethiopia, Kenya, Zimbabwe).

History and current patterns in research

1. CIAT, including its work in training, descends from the period of collaboration between the Rockefeller Foundation and Colombia, commencing in 1950. CIAT was established in 1967, and originally inherited many of the components of the earlier program, as well as a history of intimate involvement with Colombia and its agricultural institutions. It regards itself as dedicated in the first place to Latin American questions. This has significant consequences - first that CIAT's service cannot be complete because many food commodities which are important in Latin America are not included in its mandate; and second that unaccustomed difficulties arise as CIAT develops its work in the very different conditions of nations in Africa and Asia. Evidently the increasingly close collaboration which CIAT is developing with sister institutions in the CGIAR System is helpful on these two counts. A third consequence arises from the extreme diversity in environmental, social, historical, developmental, educational, scientific, and political conditions of the nations of Latin America. The region cannot, consequently, be addressed as a homogeneous whole. A frequent consequence for training is marked diversity in the groups of participants.
2. CIAT's principal programs at the present time deal with cassava, Phaseolus beans, rice, tropical pastures and the technology and industry of seeds. The work on tropical pastures is directed to the improvement of marginal lands (acid, seasonally arid, or waterlogged) in the Llanos Orientales of Colombia, but may be expected to have much wider application.
3. Within the CGIAR System, IITA, in agreement with CIAT, carries the main responsibility for cassava in Africa. CIAT holds a good deal of germplasm of cassava from Latin America, where the crop was domesticated and the related wild species occur. Exchanges between the two Centers are by way of stem tip culture and true seed, to avoid disease risks. CIAT assists national cassava programs in Thailand and other nations of Southeast Asia through a regional officer based in Bangkok. CIAT's work on beans in Central America, Mexico and the Caribbean is supported through a liaison officer posted in Costa Rica, and for several countries of East and Central Africa CIAT is now locating staff at Thika near Nairobi to articulate the work and provide a logistic base. CIAT works closely with IRRI on rice for Latin America. At one time CIAT worked on maize; responsibility for this crop in South America is now carried by CIMMYT through a regional team. CIAT liaises with ILCA in work on tropical pastures. This work

replaced an earlier swine program at CIAT. Erstwhile interest in farm systems was revived recently in on-farm studies of bean production and the related training.

4. For its work on cassava and on tropical pastures (and earlier on tropical soils), CIAT has had to undertake some long-range studies, since relatively little had been done previously on these topics. For cassava, too, some research on post-harvest processing proved to be essential. In beans, new work was necessary, particularly in eco-physiology and pathology. Otherwise CIAT has been largely concerned with the adaptation of knowledge developed elsewhere to the conditions of the nations with which it cooperates.

#### The training programs (general)

5. From 1969 to 1983, 2,459 persons received training in various categories at CIAT (see Table 1 of report). Of these 46 were post-doctoral participants and 179 were degree-related. 941 are described (in 1983 Annual Report, section on Training and Conferences), as visiting researchers, and in many years this appears to have been the largest single group of participants. About 2,000 of the participants came from Latin America and the Caribbean, and 111 came from the United States and from Europe (CIAT Training Reference Sheet, 1 May 1983). Over this period the earlier training policies were substantially adapted in response to changes in research programs and national needs. The training offered since 1976 is said to be directed more to meeting the needs of the nations than to program interests alone, but the changes make it difficult to generalise, over the whole period, about categories of training at CIAT.

6. Before 1976, training at CIAT was organized and partly provided centrally, with the cooperation of the research programs. Since then, training has been given in the individual programs. Each program has its own needs and style, as well as its own cooperators in different nations, and so the training activities differ considerably in detail between programs, but the staff seem to us to be fully committed to training as an important activity.

#### Types of training provided

7. Short intensive courses. Short courses (3-8 weeks) are offered in seed technology, basic seed production and genetic resources. The "multidisciplinary" introductory portion of a commodity training course (see paragraph 10 below) is also offered as a short intensive course.

8. The seed technology course was the first of its kind to be offered in the system and is still the only broad specialised offering in this field at any of the Centers. There is a strong demand for it from both public and private organizations in Latin America. 31% of all participants were in seed courses in 1982 and 16% of total training time was devoted to these courses (Report of External Program Review Panel, 1984). The proportions seem to have been similar in 1983.

9. The "multidisciplinary" components of the commodity courses are attended by recent graduates and by some specialists. It seems difficult, in such short courses, to meet the needs of two such different sorts of participants.

10. Commodity training programs. Many of the "production" courses, before 1976, lasted as long as 12 months: the average length of a non-degree related course is now about 4 months. Though in the earlier stages of development of national programs, commodity courses lasting through the complete cycle of the commodity are no doubt fully justified, the change made it possible to accept substantially more participants, in 1977/80, than in earlier years (164 in 1979, largest total before 1977 was 28 in 1975). The numbers declined in 1981/83 (30-39) mainly for lack of funds, but were compensated by an increase in separately-funded training in individual countries (from 152 in 1980 to 569 in 1983).

11. Since 1978, the pattern of the commodity courses has been changed. All the participants are qualified professionals by the standards of their countries (which vary, however, from country to country). They are said to be younger than formerly, mostly from Latin American countries, and to have had an average of 3.5 years experience in-service before CIAT training in 1983. The demand is twice as large as the capacity and selection has to be rigorous. The courses open with a "multidisciplinary" phase of 4-10 weeks, presenting concisely the present state of knowledge about the commodity. Half of this period is occupied by lectures and the rest by work in laboratory and field. Reading and audio-tutorial work are increasingly important.

12. Many of the participants then move on to a period of more specialized individual work alongside experienced research workers in single disciplines related to the commodity. This phase lasts several months in cassava and tropical pastures, giving total lengths of 10 and 9 months respectively. The cassava courses now include post-harvest topics, particularly processing, marketing and utilization, which is in some respects an innovation in the CG System. In rice and beans the total lengths are about 5 months. In effect, all of these courses enable the specializing participants to observe and work through a crop cycle. So far as possible, the work in this phase is related to known needs in their home countries. Some participants in this phase feel that they are being used as technicians, but most seem to benefit substantially nevertheless.

13. In-country training. CIAT has developed in-country training in part to lessen the training load at headquarters, and in part to provide research-related training for extension and other development workers in the nations. We heard of seed courses taught by former trainees in Colombia, Panama, Guatemala, Paraguay and Honduras, of rice courses in Peru, Honduras and Haiti, of courses on cassava in Mexico and on beans in Cuba. Courses organized by CIAT in the nations are timed so as to support the introduction of new varieties and production methods. CIAT provides about one-fifth of the instruction, ideally for the first course only in each country, and also provides written and audio-tutorial materials. Well over 2,000 participants are said to have benefitted from "in-country" training assisted in some way by CIAT.

14. Visiting and associate researchers. These participants are graduates at Ingeniero, B.Sc. or M.Sc. level who come to CIAT to pursue individual investigations, often involving new procedures and techniques, and usually, but not necessarily, related to one of CIAT's commodities or programs. The numbers for 1982 given in the 1983 annual report (more than 84) differ from those in the report of the External Program Review Panel (56), apparently because the latter includes some of these persons in the total for commodity training programs. The numbers appear to have decreased in 1983 and 1984 (47 and 25 respectively, according to the EPR).

15. Post-doctoral fellows. The training reference sheet (1983) records a total of 38 post-doctoral fellows at CIAT from 1969 to 1982, a period in which suitable candidates were hard to find. In 1982 CIAT decided to increase participation at this level. For 1983 the EPR records 17 of whom 13 were funded from the core budget.

16. Degree-related participants. Notwithstanding the interest of CIAT in training for research, degree-related training remains limited, though the numbers have increased from 2 in 1970 to 37 in attendance during 1982 with 21 theses completed (1983 Annual Report). Of 85 M.Sc. and 89 Ph.D. participants up to 1984, 79 of the M.Sc. but only 29 of the doctoral participants came from developing countries (EPR). Most of the degree-related participants appear to have been registered in Universities or graduate programs in 21 institutions in 12 countries in North America, Europe, Africa and Latin America. Very few appear to have been registered in Colombia. One of the research programs is explicitly opposed to Ph.D. (advanced research) training, on the ground that holders of that degree, in general, do not work. The seed courses are largely concerned with technical training, but two students are working for M.Sc. degrees at present, even though the work of the seeds unit is not regarded as a research program.

#### Training staff

17. A coordinator of training and conferences is located in the International Cooperation directorate to support and articulate the training endeavours of the programs in support of research and development in the nations. Eight training associates appear in the list of training staff, but all of them are attached to and work in the programs (two each for beans, cassava and rice, and one each for tropical pastures and seeds).

18. The staff of programs and units contribute substantially to training. It is estimated that the proportion of research staff time spent on training (a difficult quantity to measure) is 10-12% in the rice and bean programs, 15% in the cassava program, 17% in the tropical pastures program and the greater part of the time in the seeds unit. The average for the research staff as a whole may be about 15%.

19. According to the External Program Review, the eight trainers in the commodity programs will handle 156 man-months of training in the multidisciplinary intensive courses in 1984. This could suggest that some of them (in programs other than the seeds unit, which seems to us

to be understaffed) are less than fully employed in these courses. No doubt they do other important things, and we regret that we did not learn about them.

#### Material resources for training

20. CIAT is very well equipped for training and communications work: it has an admirable conference and training Center, built with funds provided by the Kellogg Foundation, which includes a large conference room (100 persons), two meeting rooms (40 persons) and two classrooms (20 persons); an audiotutorial laboratory; and supporting facilities, including a travel office. The laboratories and field and other facilities of the programs and units are used for practical work, and there is an admirable library.

21. Well equipped living quarters have been constructed at CIAT for 64 conference participants (2 persons per room) and there are seven apartments for post-doctoral fellows. The dormitory capacity for training participants can accommodate 80 persons. The refectory and dining facilities are admirable and the pool and other recreational facilities seem fully satisfactory.

22. CIAT's principal language is Spanish. Staff members who do not originally speak Spanish learn the language (apparently without specific inducement) and seemed to us to be proficient enough. There are simultaneous translation facilities in the conference center but they do not appear to be needed for formal teaching, presumably because all the training officers are native Spanish speakers. Language does not seem to be a source of difficulty at present except for participants from Africa, parts of the Caribbean, and Asia; and as CIAT's work advances in those continents and regions the difficulty will increase. The Brazilian participants seem to handle Spanish well enough. We would draw attention here to our remarks in the main body of the report about English teaching.

#### Costs and funding

23. In 1983 CIAT core funds expenditure on "Training and Conferences" amounted to US\$ 1.035 M (out of a total core expenditure of US\$ 20.771 M). It is proposed to rise by 50% during 1984-85 and to remain at a level slightly above US\$ 1.6 M (in 1984 dollars) thereafter. Included in the core budget is the fulltime position of a coordinator of training and conferences. Special project funding of training activities, both group and individual types, has increased from just below US\$ 0.25 M in 1980 to nearly US\$ 0.42 M in 1983.

#### Evaluations (other than those of the study team)

24. We did not encounter any formal evaluations of individual courses or trainees, but we were provided with an unreleased draft, based on the Ph.D. thesis of Dr. Jairo A. Cano Gallego, of an evaluation of CIAT's training of agricultural researchers from Latin

American countries. The sample consisted of all of the 783 persons (out of a total of 1,259 Latin Americans) who had participated in research-related training at CIAT on rice, beans, tropical pastures or cassava during the study period of 1969-79. 332 of these persons came from Brazil (185) and Colombia (147); of the other 24 countries represented none contributed more than 52.

25. Many of the findings which concern the effects of training on individuals, and on their employers' perceptions of them, correspond to those summarised in our main report, and are not repeated here. Dr. Cano's findings on the subsequent careers of participants, and on the emergence of networks among them, are summarized in part in paragraph 33 below.

26. In our visits to Mexico, Guatemala and Costa Rica we interviewed a number of participants in CIAT training activities. Particularly commendatory remarks were made for training by the bean and the cassava programs, at CIAT as well as assisted by CIAT staff in the region.

27. Participants indicated that the training they received in writing reports did not correspond with the importance of reporting in their subsequent work.

#### Associations in training

28. Institutions in Colombia. CIAT has not developed close relations with the national university system of Colombia, in general, but has begun to work closely in training with, and to be well regarded by, the Palmira Campus of the National University of Colombia. CIAT staff members teach at the Palmira Campus and supervise the dissertations of final year students for the Ingeniero degree; cooperation in graduate work in soils is starting. CIAT also works with the Instituto Colombiana Agropecuaria (ICA), which regards the Center as a part of the national resource in agricultural research training as well as in research itself. CIAT also collaborates with the national associations of coffee growers, of seed producers, and of rice growers, but how far these organizations cooperate in training in addition to benefiting from its products we do not know.

29. Institutions in other nations. CIAT has provided training for staff members of the national research agencies, and of some Universities, in all Latin American countries and in several countries of the Caribbean basin including Cuba. It cooperates with IICA, perhaps somewhat formally, and at the working level with CATIE, and with the cooperative agency for crops research in Central America and the Caribbean. It has a formal agreement with SEARCA in Southeast Asia. It has provided facilities for thesis research in 20 universities in countries other than Colombia, including several in the United States and at least three in Europe. It is associated with the Cooperative Research Support Programme on beans and cowpeas established by USAID under Title XII of the Foreign Assistance Act, which includes a substantial training component. This link has been particularly useful in the Dominican Republic.

30. Other International Agricultural Research Centers. CIAT has a remarkable record of collaboration in training with other IARCs. Its training in research on farm systems began in collaboration with CIMMYT, where seeds training started in collaboration with CIAT. It provided facilities for a joint course offered in collaboration by CATIE and IICA. It provides support for regional training by the IBPGR. Its cooperation with IITA and IRRI on cassava and rice respectively has been mentioned above. We encountered at IITA a most interesting arrangement, funded by UNDP, for collaboration in training on root and tuber crops between CIAT, CIP and IITA. So far, this seems to have been used to support additional training activities by the three Centers separately, but we note that the proposals for the second period of the project (1982-87) include a number of joint activities on breeding and germplasm selection, propagation and tissue culture techniques, production/processing/utilization, integrated pest management, and germplasm exchange and quarantine. We have no information about the success or otherwise of these joint activities so far, but we hope they have been and will be successful.

Subsequent contacts, follow-up, networking

31. Like the other IARCs, CIAT endeavours to keep in touch with its alumni, mainly because they are the main instrument through which CIAT's work can become effective in the nations. We were told at CIAT that, because 46% of the alumni are no longer working on CIAT's commodities, the Center is no longer in touch with them and feels that their movement to other work has restricted the development of crop networks which can support CIAT's mission. But Dr. Cano's report tells us that about four-fifths of them are still active agricultural research workers, and that 54% are still working on the commodities for which they were trained at CIAT. Of the 19% who are no longer research workers, some at least are engaged in developmental activities, including some in the private sector.

32. As we see it, this is a most successful record, of which CIAT can be proud. Moreover, as the focal points of the action of the CG System move from the Centers to the nations, the 46% who have moved out of work on the particular commodities will surely have their parts to play. It seems to us most important that they should somehow be helped to feel that they are valued and supported by the CG System. This will cost money, but it will be money well spent. One may well ask, incidentally, how many staff members at the Centers themselves still work on the commodities or disciplines on which they were originally trained, and how long is the average stay of a staff member in a Center.

33. Moreover, Dr. Cano's report describes the continuing, spontaneous networks of international professional associations which link together about 1,810 CIAT alumni in 27 Latin American countries and 15 countries in other parts of the world, including Europe, North America and Australia. This remarkable finding, which must be the result of substantial and persistent enquiry, is carefully analyzed in the report. It illustrates one of the most important effects of training by the Centers, to which we have drawn attention in the main body of the report, namely a lessening of isolation and the

building of a feeling of belonging to the world community of agricultural science.

34. CIAT did not build these networks; and their basis is personal and not institutional or governmental. Indeed, many of the network participants are no longer working on CIAT commodities. But the value and significance of these networks is unquestionable, and CIAT can take credit for them, even though it did not create them.

#### Effects of training on research and on development in the nations

35. During CIAT's lifetime, output of food per head has increased by about 15% in Latin America. It is not possible to prove any direct link between this statistic and training by the Centers. But our informants in the nations, and the many participants we met (and those who responded to Dr. Cano's enquiries), all testify to the value of CIAT's training in improving research capabilities in the nations. The nations want more of it, particularly at the more advanced levels. CIAT's training in seeds has helped to develop the seed industry in many nations of Latin America and the Caribbean, and some have achieved important increases in rice, cassava and beans with CIAT assistance. It seems reasonable to conclude, therefore, that CIAT's training has been important for agricultural development.

36. It may well be that training by CIAT has also helped development in other crops. One of us spoke, in another context, to the coordinator of the national bean program in a Central American country, a strong supporter of CIAT. His view was that as new varieties and methods increased the yield per hectare of beans in his country, the area devoted to beans would decrease and that the land and other productive resources so released would be devoted to other purposes. The off-farm opportunities for beans in his country were not sufficiently attractive to small-scale producers to encourage the production of surplus beans for sale. There is much food for thought in this remark, not least for CIAT, some of whose staff members feel that if a participant moves to work on a non-CIAT commodity he is lost. He may be lost to beans, but he is not necessarily lost to development, which after all is what CIAT's work is ultimately about.

37. It is however also possible to point to some specific instances of progress - rice in Colombia and Peru, and the seed industry in Colombia - in which we feel sure that CIAT training has equipped people without whom the developments would not have occurred.

#### Future needs and plans for training

38. Many nations look to CIAT for research-related training for extension workers and University teachers. Much of this can of course be done "in-country", but some at least of these non-research participants will be made the more effective by spending some time at CIAT headquarters, as we have implied above. There is also a large demand for training related to seeds, which could, we feel, be broadened even further, particularly in respect of economic, legal and management considerations, and in research. CIAT needs no

encouragement from us to continue with its present offerings in Latin America and to extend them in Africa and Asia. We include cassava training in this, even if the need in Latin America is weak. In cooperation with IITA, there is much to be done in Africa to lessen labour inputs and in Asia to reduce land requirements per unit of product. Finally, for Latin America we may hope that, in cooperation with other Centers working in the region, the studies of farm systems will equip participants to guide producers in the most productive use of all resources for all products, and not merely for those which are written into CIAT's mandate.

39. CIAT plans to increase training of virtually every category of participant in the coming years, the main exception being visiting researchers at the "ingeniero agronomo" level. CIAT projections of group training activities over the period 1984-88 inclusive foresee 49 courses in the five programs at headquarters with a total of 950 participants. The same number are proposed to be trained in 39 projected courses to be held in the various regions where CIAT's commodities are important, several jointly with other Centers (viz. IITA, ICARDA, CIP) and organizations.

40. The present large-scale World Bank-IICA financial assistance to universities in Colombia (and in other Latin American nations) includes fellowships for higher degree studies. This is an opportunity for CIAT and the concerned educational institutions to see where and how training by the Center could be increased to yield the best fit to national needs.

#### In-country training in the future

41. In paragraph 13 we have mentioned the impressive strides made by CIAT through assistance to national organizations to conduct in-country training. Based on its estimate of readiness and interest in further in-country training activities, CIAT projects that perhaps over 130 courses may be assisted during 1984-88, and that close to 4,000 persons may participate in them.

42. It is of course essential to help the nations to develop their own capability to train local staff of all kinds, but two needs should not be forgotten. The national institutions must be strong enough to do the job, and the virtually unique special effects of training at and by the Center must be retained as far as possible. With respect to the first, it will be necessary to strengthen national institutions, usually starting with the Universities, a topic we have addressed in detail in our report. This can never be a task for one Center alone, whatever may be written into its mandate. CIAT and the other Centers active in each country could help the country to make more effective use of funds provided for University development, which appear to be substantial, e.g. in Colombia. With respect to the second, it seems sensible deliberately to link the development of in-country training with preceding participation of more senior national scientists and development workers as visiting and associate scientists at CIAT. These persons could be prepared for, and then reinforce the in-country training, with fuller understanding of CIAT's contribution. We also believe that more specific attention should be given to the professional training as trainers of at least some of these participants.

Study Team Summary Reports on Findings: THE CENTERS

B. CIMMYT - CENTRO INTERNACIONAL DE MEJORAMIENTO DE MAIZ Y TRIGO

15-22 January 1984, Araujo, Bunting, Herz. Further information gathered in 17 out of 18 countries visited (Mexico, Guatemala, Costa Rica, Colombia, Peru, Nigeria, Burkina Faso (Upper Volta), Ethiopia, Kenya, Zimbabwe, Syria, India, Bangladesh, Nepal, Indonesia, Thailand and Philippines)

History and Current Patterns in Research

1. CIMMYT has established in 1966. It descends from the early period of collaboration between the Rockefeller Foundation and the Government of Mexico, from 1942-3 onwards. CIMMYT works in two main crop areas, wheat (with interest also in barley and triticale) and maize.
2. These two programs are largely separate. They cooperate separately with the nations, through separately managed and staffed regional organizations which are only broadly congruent with each other. The reasons for the separation appear to be that in general the crops are grown in different environments, countries, or seasons; and that the breeding strategies differ because the crops differ in reproductive biology. The economics program has its own tasks, which also tend to be different for the two crops, but its work on farm systems, and methods for studying and developing production options for them, provides a common element in both research and training. Work on grain quality also has common elements, but in general, it has different emphases for the two crops. For wheat, the interest is in industrial quality, while for maize it is in protein quality. The service sections (experiment stations, data processing, and information) assist all the other programs.
3. Though CIMMYT has the global mandate for maize improvement, in Africa it shares this responsibility with IITA. Research staff are located at IITA, where they will further develop the long-standing program of research and training on tropical maize. Further evolution of this program may be expected in East, Central and Southern Africa, aided by CIMMYT's existing links in that region.
4. CIMMYT also has the overall principal responsibility for research on bread and durum wheat and triticale in the North African and Middle East region, in cooperation with ICARDA, which now has the primary responsibility for a separate program on durum wheat.
5. Longer range, more analytical and "basic" work on both maize and wheat is well established in developed countries, in Europe, North America, Australia and Japan. CIMMYT has therefore no general need to undertake work of this kind, because it has a strong collaborative

research program with maize and wheat research institutes in both developed and developing countries; one example is its work on wide crosses. Training at CIMMYT is consequently largely related directly to topics of practical importance, and is little concerned with "theory". This was criticized by some national leaders and former participants and approved by others; we feel that one of its main consequences may be reflected in CIMMYT's practice in respect of degree-related training.

#### The training programs (general)

6. From 1966, CIMMYT continued the previously established training in wheat. Maize training was reestablished along similar lines in 1971. The Center maintains a considerable training program at El Batan and elsewhere in Mexico, and a great deal of work is also done in the regional and national programs. The total number of persons trained at or with the support of CIMMYT (other than in regional and national programs) from 1966 through 1983, was 2,913. 198 were prepared for higher degrees, 88 were postdoctoral workers, and 1,175 visiting scientists came to CIMMYT over this period.

7. In its work related to existing systems of production (on-farm research) in countries and regions, CIMMYT has made considerable use of the so-called "call" system (though the method can, at least in principle, be equally useful for many sorts of field-based training). Both local and CIMMYT staff design the courses, and meet together on the ground with the participants to teach the course at critical times of the year.

#### Types of training provided

8. In-service training. This term covers the main types of training provided in Mexico (based at El Batan, but utilizing the many different environments in which CIMMYT works in the country) which are designed to advance the skills of middle-level research workers. These people come from national services and are consequently known as "in-service" participants. All are formally nominated by their employers (generally governments) and selected by CIMMYT. The courses they follow may be production courses (including methods for research on farms) for both wheat (either irrigated or rainfed) and maize; improvement courses for maize and wheat (including pathology); courses on experiment station management, or individually designed programs on protein quality for maize and on cereal technology for wheat. There was also a course for economists, but this was given up as emphasis on in-country training increased. At headquarters, economics participates in production oriented training. Most courses include elements of others, and all are based on work associated with the research programs in laboratory and field. So far as time and resources allow, components of these courses may be combined to provide appropriate experiences for individual participants.

9. In general, about one-fifth of the time of in-service participants is spent in the classroom, and about one-fifth on demonstrations. The rest is spent in the field. In the production and

breeding/improvement courses, the participants raise a crop from seedbed to harvest, often for the first time in their lives. They also work, usually for the first time, on real farms and with real producers. Many of them explained to us that this experience had changed them: what had previously been "theoretical" became "practical" at CIMMYT.

10. Essentially, the production participants are prepared for studies of existing farming systems and relevant survey, experimental and testing procedures at many locations. The improvement/breeding and other groups take part in the full range of activities necessary to operate the germplasm development and testing programs. CIMMYT expects that their experiences in Mexico will also enable them to advance the national programs in their own nations. Our visits to the nations confirm that this has been achieved in many cases.

11. About 120 people per year participate in these courses. The average age of a participant is below 30, and he or she will have been employed by his or her national government, in research or extension, for at least five years. All are therefore qualified for professional employment by the standards of their nations. 60% hold a Bachelor's Degree or the equivalent, and 20% hold higher degrees.

12. Though much detail has changed over the years, about 1,450 persons from 86 countries had participated in in-service courses in the wheat and maize programs at CIMMYT up to the end of 1983. Countries which had provided 50 or more were Algeria, Bangladesh, Mexico, Pakistan, Peru, Tanzania and Turkey. (The professional strengths of India and Mexico were already largely established before CIMMYT was founded.) Production training for maize, for which around 20 people were accepted in each of 1971 and 1972, could only be increased by 1979 to 45 out of a total of 60 (45 production, 15 improvement) because of limitations due to facilities. Somewhat similar but less marked trends appear in the numbers of participants in in-service training for wheat. The limit is said to be linked to shortage of funds, but it must also reflect priority decisions by CIMMYT or by bilateral donors on the balance between support for research and for training. It may also reflect the achievements of the past, which have enabled at least some countries that have cooperated for a considerable time with CIMMYT to provide their own courses, as well as courses for their regions, at this level. We were informed by CIMMYT that action needed to counter the consequences for training of a projected shortfall of funds for 1985 and 1986 is under consideration by the management.

13. In-service training in the economics program. In-service economics training seems to be relatively recent: the papers provided for us recorded 26 participants only, in 1979-81. We imagine that the reason for this lies in the later evolution of a separate economics program and perhaps in the acknowledgement that the methods of study of existing farm systems are extremely locale-specific and are often better handled in regional and national programs. Indeed, since 1982 separate economics courses have been part of regional and national programs, primarily using the "call system".

14. Production and breeding training outside Mexico. CIMMYT gives substantial aid to training away from its own working locations in Mexico. Many nations now provide for themselves, or in international courses, types of training which were formerly provided by CIMMYT. It is not easy to distinguish between "in-country" training provided by CIMMYT staff, national or regional courses in which CIMMYT staff play important roles in the design and delivery, and national or regional courses in which CIMMYT's role is now relatively small. The participants in in-country training associated with CIMMYT cannot therefore be rigorously defined, nor their number reliably estimated. But as an example, between 1975 and 1983, 1,084 persons attended seminars and short courses in breeding and production in eight nations of Central America and the Caribbean, organized and/or taught by CIMMYT staff, at least in part, whereas the total number of nationals of these countries who attended in-service courses in Mexico during the much longer period from 1966 to 1983 was around 200 only.

15. Economics training outside Mexico. The very considerable activity of the CIMMYT economics program in the regions depends on the training, in-country, of scientists in national programs. In the largest of the programs, in East and Central Africa, important parts of the work are undertaken by the University of Zimbabwe. We were impressed by the scope, organization and value of economics training away from CIMMYT headquarters and hope that support for it will be at least maintained.

16. Visiting and associate scientists. CIMMYT brings senior scientists from developing nations to Mexico for varying periods, many from 3 weeks to 4 months but some for as little as a week or less. These are the visiting scientists, and there were about 1,175 of these from developed and developing countries over the period 1966 through 1983, some 50 to 80 each year in recent times. The 30-40 who come annually from developing countries are supported by CIMMYT travel fellowships. About 15 to 20 come with their own funds. Associate scientists are persons of similar standing who work in one of CIMMYT's programs, usually supported by CIMMYT, for from 6 months to 2 years. In any given year, 6 to 8 associate scientists are working at CIMMYT.

17. Postdoctoral fellows. Up to the end of 1983, 88 persons had worked as postdoctoral fellows at CIMMYT. They were employed mostly in the existing programs; few had independent projects, as they might have expected had they undertaken postdoctoral work in a university. Though this has been criticized, we note that more than half (55%) of these postdoctoral fellows are, or were at one time, members of the senior international staff of CIMMYT, and that about one-fifth are working in international organizations, including other IARCs. Of the remainder, about 12 are in national agencies and about 5 are in private sector plant breeding firms. The investment seems to have paid off.

18. Degree-related participants. During 1966-83, about 198 candidates undertook thesis research with CIMMYT's help. About 80 of them came from and returned to the national programs of collaborating developing countries. Of the 92 for whom details were made available to us, at least 60 out of the 75 who came from 20 developing countries submitted their theses to universities in the United States. Of 20

from developed countries, 12 submitted their theses in the US, and most of these were US citizens. A significant part of the research for these degrees appears to have been conducted away from CIMMYT, often in a US university. Until fairly recently, CIMMYT did not encourage thesis research in Mexico. Even where the thesis research was done at CIMMYT, it was conducted so as to limit as much as possible the burden on CIMMYT staff. A substantial number (99) of candidates from Latin America have pursued postgraduate studies at the Colegio de Postgraduados in Chapingo, Mexico, under supervision of CIMMYT and CP-Chapingo staff.

19. During the seventies, with the cooperation of Cornell University and the support of the Rockefeller Foundation, five Ph.D. candidates undertook a joint interdisciplinary research project with CIMMYT's collaboration, out of which they obtained five separate and successful theses. We met some of these people; their reports are mixed, though all seem to have pursued satisfactory professional careers. The experiment has not been repeated.

#### Training staff

20. Several of the programs and units of CIMMYT include trainers on their headquarters staff -- three each in wheat and maize, one in economics, and two in the experiment stations group. There is also an economics training officer for East/South Africa. The research scientists participate significantly in training, which they see as providing a bridge to strengthened national programs. They are, however, increasingly heavily involved in their scientific and organizational work, as the number of countries they serve increases. It already seems likely at CIMMYT, as at some others of the older Centers, that senior staff do less research with their own hands, and as a result work less with training participants, than was the case ten years ago. It may be that this is a consequence of restrictions in the core budget, partly offset by increases in the numbers of special projects. The latter may maintain or increase support for training, but may also consume so much of the senior scientist's time in management tasks that he cannot contribute as much as he would like to training and perhaps even to research. We invite the attention of our colleagues to the phenomenon, whatever they may think of our interpretation of it.

21. CIMMYT does not have a training department as such. Until very recently, the Centers' overall training interests appear to have been looked after by the Deputy Director General. So long as the main crop programs are as sharply distinct from each other as they are now, and the pattern of training continues as it is, a training officer or department could do little more than allocate space and other resources -- tasks which appear to be handled satisfactorily by the present procedures. We feel, however, that as CIMMYT's work in training becomes more closely associated, in support of development in the nations, with that of other Centers and agencies, and as material resources at El Batan increase, some additional strength will become necessary, perhaps in the form of a training support unit. CIMMYT has recently appointed a training coordinator who will support the international relations component of training policy as well as the execution of training activities.

### Material resources for training

22. Teaching, residential and laboratory facilities. Though the number of participants at any one time is not large, the teaching space and residential accommodation (places for 60 persons in the trainee dormitory plus 15 places in the visiting scientists dormitory) are very fully occupied in maintaining the present levels of training. They are more limited than the corresponding facilities at several other Centers. Laboratory space seems to us to be adequate for the present level of activities. The library appears also to be adequate for training needs.

23. The main difficulty in training at CIMMYT is in respect of language. Most CIMMYT scientists in Mexico are anglophone; and though many have learned a creditable amount of Spanish, and simultaneous interpretation appears to be effective, more attention to language is needed. We see needs in two directions. Anglophones would, we believe, like to speak better Spanish: some will need to learn more French, and some will need Portuguese. But even more important is the wish of many participants to learn English, which is increasingly the most widely used language in international agricultural science. We have discussed these topics more fully in our main report.

### Costs and funding

24. In 1983, CIMMYT's expenditure of core funds on training amounted to US\$ 2.478 M (out of a total core expenditure of US\$ 17.887 M and included US\$ 0.222 M in training components of special projects transferred to core in that year. Included in the core budget are 8 full-time positions for training. CIMMYT estimates that costs in 1984 have been of the order of US\$ 3.550 M core (US\$ 20.975 M total) plus about double the 1983 funds from special projects, i.e., about US\$ 0.450 M. It is proposed that the allocation be increased slightly for 1985 and more substantially (to US\$ 4.135 M) for 1986, during which year a new training, conference and information building should become operational at CIMMYT headquarters.

The cost of fellowships within the training component of the budget is stated to have been US\$ 1.499 M in 1983 and is projected to rise to over US\$ 2.250 M in 1984 and 1985 and to US\$ 2.750 M in 1986.

### Internal evaluation

26. We did not encounter any records of formal internal evaluations of the immediate effects on participants of training experiences, though we are informed that each course is reviewed by the trainers after it has ended and that the Center has made a rigorous review of its training programs during the last two years. Though the testimony of the participants is varied, and many criticisms are balanced by equal and opposite praise, our talks with them do suggest that (as at other Centers) there are real difficulties arising from the mixture of levels of previous training and experience among them, although of

course some benefit comes from the increased diversity they bring to the groups.

#### Associations in training

27. With the host nation. Even before its formal establishment, CIMMYT was cooperating in training with Mexican institutions. Perhaps the chief among these today is the Colegio de Postgraduados at Chapin-go, with which CIMMYT has reciprocal relations in teaching for higher degrees, and in research (see paragraph 18 above).

28. With national research agencies. CIMMYT collaborates in research with a very large number of nations and of course very closely with INIA in Mexico. All these associations include training or support for training to strengthen national research systems. We believe, however, that the task is broader than this, as we indicate in the section on national agricultural knowledge systems in our main report. CIMMYT has involved national policy leaders in discussions of policy for wheat and maize, but may well have more to do at lower levels, in cooperation with other Centers, to strengthen national agricultural knowledge systems.

29. With other IARCs. So far as we are informed, CIMMYT does not offer any training jointly with other international Centers. We feel that in research related to existing systems of production, it is important that joint training should evolve -- for example, wherever wheat or maize are grown by producers who also grow rice, sorghum, beans, peanuts, potatoes or any other crops within the responsibilities of other Centers. We also suggest in our main report that the Centers working in any one nation should come together with national officials to determine the most appropriate levels and mixes of their contributions to national manpower needs.

30. CIMMYT provides facilities for ICRISAT training in Mexico and uses CIAT land for training in Colombia and ICRISAT facilities for training in India. ILRAD provides a logistic base for CIMMYT maize, wheat and economics training in East and Southern Africa.

31. With institutions in other nations. CIMMYT has worked with universities in many countries in providing facilities for thesis work.

#### Subsequent contacts, follow-up, networking

32. Continuing contacts between a Center and its training alumni are essential to ensure that both the Center and the alumni make the most of their association and that the sense of isolation from the worldwide community of agricultural science, which is so common in many developing countries, is offset. We discuss this important topic more fully in our main report. CIMMYT is doing a good deal in this direction, with the help of computerized address lists and outposted and travelling staff members, but it may not be doing enough. It seems to us fully justifiable to spend money to maintain networks, alumni groups and the like, and to bring representative and influential former participants to the Center from time to time. A training support unit could provide a useful service here.

### Effects of training on research and national development

33. Important as the postdoctoral and degree-related work has been over the past 18 years at CIMMYT, it has not contributed as much as the nations say they need to provide qualified research leaders in developing countries. On the other hand, the comments of our colleagues in the nations we visited make it clear that production training at, and scientific visits to CIMMYT have contributed effectively to professional development. It seems likely that in this way they have helped to advance wheat and maize research in many countries. We are not, however, able to prove that as a further effect they have contributed to increases in output or decreases in cost of the commodities. It seems likely that they have in Pakistan, Turkey and Bangladesh, but since knowledge alone is seldom a sufficient condition for development, other conditions must also have been favourable in those countries. The foundations in training for the great advances in wheat output in India were laid before CIMMYT was established. Since then, India has largely been able to meet her own training needs. CIMMYT's workshops for policymakers were praised by those who knew of them. These are now conducted by ISNAR.

### Future needs and plans for training

34. CIMMYT participants could usefully learn more about the scientific bases of differences between environments and of adaptation to different environments. We think it possible that CIMMYT could do more to develop thinking about the logical structure, design and analysis of complex experiments and multilocational trials.

35. We feel that taking into account the extreme importance, for the future, of wheat and maize in developing countries, the need and demand for trained people in most developing countries must be expected to increase. Even if, as we believe is appropriate, the main burden of training moves to the nations and the regions, training at CIMMYT will have to continue to support the continuing advance of national programs. Indeed, this has been the trend of the past, and we must expect it to continue, though the types of training which particular nations can provide for themselves, and the types for which they need external cooperation, will change as development proceeds, according to their stages of development. The cooperating nations look to CIMMYT for in-service training, specialist visits of various lengths, sabbatical opportunities for university staff, and training experiences for professionals other than research workers.

36. We think it likely that rather more teaching space and residential accommodation than is available now will be needed at CIMMYT in the future. We do not feel able to prescribe quantitatively what should be provided, but we suggest that CIMMYT be encouraged to submit proposals and understand that it has recently done so. We do not see a need for specially dedicated teaching laboratories. The main need in this direction is probably for the work of visiting and associate scientists, and this will, we understand, become available in the new training and conference facility to be completed in 1986.

37. Normal growth of the library should provide for future training needs. More may have to be done in producing teaching and other written materials, as other Centers have found. We may expect that the preparation of training materials of many kinds will have to increase to support in-country training. We are particularly impressed by the publications, in both Spanish and English, of the Economics program and hope that they will continue to be supported. We also welcome CIMMYT's initiatives in cooperation with the Commonwealth Agricultural Bureaux, in providing two serial publications (in English) of wheat, barley and triticale and maize abstracts to national scientists in cooperating countries.

#### In-country training in the future

38. We have discussed this topic in general in our main report and have little new to say that is specific to CIMMYT. There are three consequences. First, the trainers who will conduct the "in-country" training must be trained to be trainers. "Training the trainer" has been a recurrent phrase at CIMMYT since at least 1975. But beyond arranging some experiences in training local producers, participants are not in fact trained as trainers -- a task different from training in production, research on farms or crop improvement.

39. Second, the special advantages of an international center for training are bound to be diluted in training in most nations or regions. Training at a Center does far more for participants than add to their stock of knowledge. To support in-country training, some of the designated trainers should come to CIMMYT as visiting scientists to acquire whatever special things an international Center can give them and to be trained as trainers as well. Here, too, is a task for a training support unit.

40. Third, workers in parts of the national agricultural knowledge systems other than the research component (universities, agricultural colleges, extension and farmer training services, public and private sector agencies handling outputs and inputs including seed) will also require training so that they can participate in, and understand and use the output of effective research, and so support national development more effectively.

Study Team Summary Reports on Findings: THE CENTERS

C. CIP - CENTRO INTERNACIONAL DE LA PAPA

11-19 May 1984; Araujo, Bunting, Herz. Further information gathered in 12 out of 18 countries visited (Mexico, Guatemala, Costa Rica, Colombia, Peru, Philippines, Indonesia, India, Bangladesh, Nepal, Ethiopia and Kenya).

History and current patterns in research

1. CIP works solely on Solanum potatoes for the developing countries. Its goal is to develop technology to make potatoes available as a low cost, nutritive food in some climates of most developing countries. It evolved from an earlier program executed by North Carolina State University, and was legally established in 1967. CIP began to function in 1971, and became part of the CGIAR System in 1972. The original program, and CIP, were established in Peru because the Andean region is the center of variation of the crop and of its wild relatives. CIP holds 6,000 clones of "traditional" cultivated and wild forms of potatoes in the collection at Huancayo, and much of its work is directed to the utilization of this unique resource.

2. CIP's research program is concentrated on a single commodity, on which basic research has been carried on for many years in institutions in developed countries. Close cooperation with these institutions, in both program planning and research (including contract research funded by CIP) limits CIP's need to undertake long-range research itself except on topics which are important in the environments of developing countries but less so in temperate environments.

3. CIP is therefore able to concentrate on investigations of practical difficulties affecting producers. (This led to an interesting comment in Kenya, where it was suggested that CIP's training did not contain enough science, and that CIP seemed to be more interested in expanding output than in building national research capability). To support this practical objective CIP has developed socio-economic research, by mixed teams of biological and social scientists, to help to identify opportunities, resources and constraints at the outset of new collaborations and projects.

4. The research program has been organized in ten main sections or "thrusts": maintenance and utilization of unexploited genetic resources (tuber-bearing Solanums); production and distribution of advanced breeding material; bacterial and fungal diseases; potato virus research; integrated pest management; warm climate potato production; cool climate potato production; postharvest technology; seed technology; potatoes in developing country food systems.

Research at CIP is organized in six departments which group scientists according to field of research: taxonomy; breeding and genetics; physiology; pathology; entomology and nematology; and social science. The Training and Communications Department provides essential support services to these departments and to the technology applications program of the Regional Research and Training Directorate.

5. CIP has gone further than the other Centers in devolving its program to regions (it recognizes seven of these) and to cooperating nations themselves. Correspondingly the work in Peru at Lima, Huancayo, San Ramon and Yurimaguas is limited to what can only be done, or can best be done, in a well-run international Center. What can only be done, or can best be done, in national programs is done in them, so far as possible, and the regional organization manages the grey areas in between. This applies to training as well as to research.

#### The training programs (general)

6. We have little information about training at CIP before 1978. The object of CIP's training now, briefly described, is to develop regional capabilities for fitting improved potato technology into farming systems through national programs. It is significant that the word research does not appear in this statement. In more detail, however, the objectives are described as follows: to enable national potato workers to identify existing technology relevant to the country's needs; to identify research needs for improving potato production; to conduct research in the most important problem areas and evaluate results of research in their countries; to communicate results of research conducted in their countries, participate in the transfer of appropriate technology within their countries and to surrounding countries; and to train others to do these things.

7. CIP training seems to be aimed in practice at disseminating knowledge, and the capacity to generate and use it, to anyone who needs them - research workers, extensionists, university teachers, commercial growers of the crop or of seed, agribusiness, farmers large and small. Moreover, three quarters of the training, and the part which is most important to CIP, is organized or at least supported as part of the seven regional programs of CIP and of the five networks of cooperating nations through which CIP serves the developing countries, and is conducted in national institutions and programs. In some instances, CIP has delegated responsibility for the use of CIP funds to national programs, which call on CIP specialists as teachers only for topics on which they lack strength.

8. Many of the courses, including some of those offered at Lima, are of one to two weeks' duration only, which the participants, as well as the team, feel is often unduly short.

9. Training is supported from CIP headquarters by a Training and Communications department established in 1979 which is also responsible for the library. This department is a component of the Regional Research and Training Program of CIP. Research and training in Peru are conducted at four sites: coast (Lima, 238 m), highland (Huancayo, 3,280 m), high tropical (San Ramon, 800 m) and low tropical

(Yurimaguas, 180 m). Training in Peru and in the regions is based on a rolling five-year plan revised each year after consultation with national programs. An internal standing training committee of senior scientists and directors reviews activities every three months. The Department intends to produce training course materials in future.

#### Types of training provided

10. We have no information about patterns of training before 1977 except for Latin America. We think it useful to outline this experience because it exhibits so clearly the developing and responsive relations between CIP and the nations, and between research and other parts of the agricultural knowledge system. In the Latin American region, CIP developed links with national programs during 1972-74, in order to learn about needs, capabilities and achievements in the nations. During this time courses in the countries and at Lima were based on world-wide general knowledge of the crop, and Peruvian scientists, who had gained experience in the earlier bilateral programs executed by North Carolina State University, contributed much of the teaching.

11. As CIP's research and organization developed during 1975-77, training was offered in or for all countries of South and Central America and Mexico. Courses on potato production and seed production were given at Lima and in five countries, the first graduate scholarships were awarded to persons from Bolivia, Peru and Colombia for studies in Peru, USA and Europe, and specialized individual in-service training was started at CIP, Lima. Universities, starting with the Universidad Nacional Agraria of Peru at La Molina, were increasingly involved as partners in both research and training. Candidates were also sent to the annual 3-month potato production course at Wageningen, Netherlands.

12. By 1977 all the general courses had been transferred to regional management, and CIP developed specific discipline-oriented courses, related to the progress of the research program, at Lima (germplasm adaptation, storage of seed and ware, true potato seed, on-farm research and identification of viruses). In 1980, CIP began to provide mid-career training to bring national scientists abreast of CIP's advancing program and achievements and to make CIP more aware of national needs. Many of these people participate in teaching at CIP and in the regions and nations, and they have made it possible for many national and regional courses to be provided with little or no detailed technical involvement from CIP. Thus in 1982, the Universidad Nacional Agraria of Peru, La Molina, took full responsibility for organization and instruction of an international potato production course with emphasis on seed potato production. Participants in this course told us that they found it very concentrated.

13. The cooperative regional networks for research and training, managed by governments, supported by external donors, and assisted by CIP only where necessary, began to be established in 1978. There are three of these in Latin America. PRECODEPA (Switzerland, 1978) includes Mexico, five nations of Central America, the Dominican

Republic and Cuba. PRACIPA (IDRC, 1983) includes five Andean countries (Venezuela, Colombia, Ecuador, Peru, and Bolivia). PROCIPA (CIP pro tem., 1983) includes Brazil, Uruguay, Argentina and Chile. In other regions of the earth, two more networks of the same type have been established. SAPPRAD (Australia, 1982) includes the Philippines, Papua New Guinea, Indonesia, Thailand and Sri Lanka; and PRAPAC (USAID, 1982) includes Rwanda, Burundi and Zaire.

14. It is difficult to write a standardized global description of CIP's training program in this rapidly evolving scene. Formally, however, training is described as consisting of two types, production oriented and specialized.

15. The production oriented training is conducted entirely in the regions. It is intended to enable researchers and extensionists to respond to farm-level problems and situations. It includes both courses and individual activities. The courses are designed to meet particular needs in particular places at particular times. During 1978-83, 1,005 persons are said to have participated in CIP production courses, but it cannot be easy to define which courses are "CIP" courses, and which are national or regional. Regional courses, moreover, may be supported directly by CIP regional or headquarters staff, or indirectly through the regional networks. Some support may be mainly financial.

16. The specialized training may be given in regions or at headquarters. It is mostly research oriented, and concentrates on areas of potato research for which CIP is the main source of information. It is directed at scientists from developing countries for which particular topics are relevant and potentially useful research results are available. Most of the specialized training (1,136 out of 1,527 participants in 1978-83) was given in courses, which have tended to move from headquarters to the regions as their capability has developed. Thus during 1978-83, the numbers of countries for which specialised training was provided in the seven regions in courses of from 1 to 4 weeks were as follows: germplasm management, 31; true potato seed, 20; post-harvest (storage), 34; potatoes in warm climates, 10; rapid multiplication, seed production, tissue culture, 45; viruses, fungi, bacteria, 36; nematology, entomology, 15; on-farm research, social science, 32; production and seed courses, 63. These courses appear to cover relatively small discrete areas of immediately relevant knowledge, in a manner reminiscent of the training component of the Train and Visit System of agricultural extension.

17. Specialized training also includes several categories of individual training. They are listed as individualized (perhaps equivalent to the visiting scientists category of other IARCs, 105 in 1978-83), mid-career (perhaps equivalent to associate scientist, 11), assistants (5) and assistantships (112) (which appears to include postdoctoral workers (1-2 years, some of whom may be selected as members of headquarters or regional staffs) and younger graduates not working for higher degrees), scholarships (for M.Sc. and Ph.D., 91) and "practicants" (undergraduates conducting work for dissertations or otherwise, 67).

18. The degree-related participants may be attached to any appropriate university, but preference is accorded to universities to which CIP has given research contracts. Up to 1976, 31 Peruvians had been supported for M.Sc. courses at UNA, La Molina. Other universities which participated later include Cornell, Wisconsin, Minnesota, North Carolina State, Dundee, Birmingham, London and Chapingo. The thesis research is intended to be related to problems of potato production in the student's home country, and conducted in the home country. However the 1982 External Program Review records that it is not likely that any further scholarships will be awarded from core funds and suggests that CIP should look to special project funding to give additional support for degree-related work.

19. All training needs are assessed, the training to be offered is specified, and the participants are chosen, in consultation with national programs, through the regional organization.

#### Training staff

20. The headquarters training staff includes four professional workers, one of whom is a communications specialist. They coordinate the training program, instruct in their own professional fields, prepare training schedules and materials for training at Lima and in the regions and nations where necessary, and evaluate the training program.

21. The seven regional officers and the liaison officers in individual nations seem to us to be the mainstay of CIP's training. They work in a substantial degree of independence. The five we met were very impressive people.

22. Much of the training in the regions is done by people from the region. Of 138 instructors in production courses in the regions in 1983, 109 (79%) were local (including locally-engaged staff of CIP), and 29 (21%) were international; of 122 in specialized courses 67 (55%) were local and 55 (45%) were international.

#### Material Resources for training

23. At Lima, CIP has a dormitory for 18 persons, recreational facilities including a small well-equipped gymnasium, cafeteria services, three multipurpose conference rooms, library, research plots, laboratories and greenhouses. The station at Huancayo has a guest house for 19 persons, cafeteria services, a multipurpose conference room, research plots, laboratories and greenhouses. In the regions facilities vary. Where possible, national facilities are used for teaching, and lodging and meals are found locally. Demonstration plots are prepared, by CIP staff if necessary, on space allocated by national programs.

24. We had the pleasure of visiting the germplasm center of Region VII in the hills about 40 km from IRRI in the Philippines. Physically, the facilities were rudimentary, of the sort with which a pioneer research station might begin in an undeveloped area. Yet

both the quality of the work (which included the preparation of stem-tip cultures) and the morale of the staff and training participants (including two from Vietnam) were admirable.

25. The principal language of CIP is English, but the headquarters staff in Lima appeared to be proficient in Spanish, which is the language mainly used in the work in Latin America. Some staff members in Brazil have learned some Portuguese, and French or English is used in francophone Africa according to the abilities of the instructors.

26. At Lima, CIP has printing and word processing facilities adequate for the present level of training, but its capacity to produce slide sets appears to be limited.

#### Costs and funding

27. In 1983, CIP expenditure of core funds (including funds of projects transferred to core) on training amounted to US\$ 1.093 M (out of a total core expenditure of US\$ 9.295 M). It included substantial sums for fellowships (US\$ 0.331 M) and for travel related to training (US\$ 0.476 M). CIP estimates that its expenditure on training in 1984 will be of the order of US\$ 1.250 M (US\$ 10.511 M estimated total) and proposes a level somewhat lower (US\$ 1.076 M increasing to US\$ 1.142 M) for the years 1985-87. Within the proposed sums, however, the amount earmarked for fellowships would increase steadily. Included in the core budget is the full-time position of a head of the training and communications department. There is no substantial special project funding of training besides that for two projects (Kellogg Foundation and UNDP) transferred to core in 1983.

28. The 1983 Training Reference sheet provided by CIP records that core funds are used for all specialized training and for production oriented training where there is no local competence; where there is, special funding is sought to help national programs to organize and conduct training for themselves, and sometimes for nearby countries as well.

#### Internal evaluation

29. Training at Lima, and to some extent in the regions and nations also, is evaluated in respect of organization and content, including the reactions of participants. The progress of participants is followed during the course and they are evaluated when it ends. The criteria employed have to be adapted flexibly to the very wide range of backgrounds of different nations and participants. The participants themselves evaluate the course at the end. Methods of evaluating the effects of training in the nations are being studied.

#### Associations in training

30. With institutions in the host nation. It is evident from our account of the history that CIP is very closely associated in training

with institutions in Peru. In addition to the national program, CIP has particularly close relations with the Universidad Nacional Agraria, La Molina, its close neighbour. CIP provides facilities for undergraduate students of La Molina who are preparing dissertations for the Ingeniero agronomo degree. CIP also offers opportunities for training and research for staff members of La Molina. The presence of CIP is said to attract students to La Molina.

31. Undergraduates from the University of Central Peru visit the station at Huancayo, and 10 are at present working with CIP on theses, especially in nematology.

32. With institutions in other nations. It follows from what has been said above that training promoted by CIP is very closely associated with the national potato programs (both research and extension) of many nations. In some, there are also links with private sector agencies for storage and processing. CIP enjoys excellent relations with ICA in Colombia, where it works in research and training at Carimagua (alongside CIAT). We were told that CIP has trained most of the potato professionals in Colombia and also paid for degree-related training. Since 1970, CIP has supported international training courses at Simla, India, where two courses are now offered, on potato production and seed potato production.

33. CIP has many links with universities. These range from fully CIP funded scholarships in developed countries, to research assistantships provided as parts of contracts for research with key universities in both developed and developing countries. CIP may also provide assistantships for research supervised by CIP and conducted in collaboration with universities in developing countries.

34. However, since the primary relationship of CIP in a nation is with the official national potato program, it may be difficult for a university which is not associated with that program to have direct relations with CIP. On the other hand, one of our informants in Kenya felt that CIP had found it easier to relate to the university (where the Dean of Agriculture at the time of our visit was a potato research worker), and to the Agricultural Development Corporation, than to the official research service, and that in consequence CIP had not given sufficient credit to the long-established history of potato research in the country.

35. In Latin America, CIP has cooperated with IICA, which mediated CIP's cooperation with Brazil, and with CATIE, Turrialba, but our informants in Costa Rica felt that CIP could make better use of competence available in that country.

36. We have referred above (paragraph 13) to the inter-governmental networks for research and training which CIP has helped to develop in five regions of the earth.

37. With other IARCs. Joint training with two other IARCs, CIAT and IITA is being funded under the UNDP (training) project on root and tuber crops. A joint workshop on integrated pest management is planned to be held at CIAT in 1986; on tissue culture techniques and propagation by CIAT and CIP at CIAT in 1984, by CIAT, CIP and IITA in

Vietnam in 1984, and at IITA in 1985, by CIAT and CIP at CIP in 1986; on integrated production, processing and utilization by CIAT and CIP at CIP and CIAT in 1985; on germplasm exchange and quarantine by CIAT and CIP at CIP in 1987, by CIAT, CIP and IITA at ILRAD in 1987, and by CIAT, CIP and IITA in Indonesia in 1987. No doubt the International Board for Plant Genetic Resources will be invited to participate in the last-named courses.

#### Subsequent contacts, follow-up, networking

38. Measures to maintain contact with former participants have been discussed in relation to CIP since 1977, but apart from the preparation of computerized address lists the main action seems to be incidental to the progress of collaboration with national programs and institutions, in part through the governmental networks. CIP does not feel that this is enough, nor do we. This matter is considered in our main report.

#### Effects of training on research and on development in the nations

39. In the Latin American region, with the partial exception of Brazil, most of the present staff of all national potato programs have taken part in training promoted by CIP at one or other level. Many former participants are in posts outside the national programs, including the private sector, particularly in Ecuador, Peru and Bolivia. CIP appears bent on establishing a similar record in many of the countries with which it collaborates outside of Latin America.

#### Future needs for training

40. In general, CIP feels, and we agree, that over the next few years the present patterns of training are appropriate to the needs of the Center and of the nations with which it collaborates. Apart from feasible increases in the volume of training in the regions, no changes seem indicated.

Study Team Summary Reports on Findings: THE CENTERS

D. IBPGR - THE INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES

December 1984, Araujo, Bunting, Herz. Further information collected in 10 out of 18 countries visited (Mexico, Guatemala, Indonesia, Colombia, Peru, Syria, India, Kenya, Nigeria, and Ethiopia).

History and present patterns of activity

1. The International Board for Plant Genetic Resources was established in 1974. Its headquarters are in FAO in Rome, and it has neither laboratories nor fields of its own. Its purpose is to build a world network of activities, based on the other International Centers, on national institutions, and on regional organizations to collect, conserve, evaluate, document and make available for use in plant breeding and scholarly studies, the genetic resources of economic plants.

2. It has established global and regional priorities including about 80 species or groups of species, and in many cases, their wild relatives also. For each of these the Board has determined or will determine, in consultation with plant breeders and other cooperators, how and where material should be collected, how it is to be described and evaluated, how and where it is to be conserved, how and by whom and where the information will be assembled and recorded. The material concerned, together with information about it, is freely available to all who can use it. For a number of crops and groups of crops, Standing Committees have been established; for others ad-hoc working groups have proved sufficient for the Board's purposes. In some regions of the earth regional networks have been formed (particularly in Europe and South East Asia), and some individual countries have set up national organizations. Storage facilities (the so-called germplasm banks) existed, or have been established, in a number of countries, and regional centers have been set up in Addis Ababa and Turrialba. Several of the international Centers, notably IRRI, have advanced facilities.

3. From the outset the Board has seen itself as an agency of limited life. When national programs, regional cooperatives and crop networks are in place and functioning, the Board will have done the job it was set up to do. However, in 1985, that day still seems some way off. Meantime, the Board has been a catalyst: most of the money spent in the world on genetic resources is provided by the nations and by the Centers. The Board's own budget is small.

4. IBPGR is not a research institution; it is a promoting, facilitating and training agency. Interest in unimproved and traditional crop materials, and in the evolution of cultivated plants,

has existed for many years. It was promoted by plant breeders in the USA from about 1850, in the USSR from early in the twentieth century and in other developed countries later on. In the early 1960s it was taken up by FAO in respect of both crop and forest species. Those who worked with genetic resources were plant breeders or botanists, and not a few were amateurs.

5. The long-term future of the work is clearly linked to plant breeding and agronomy; but so far the necessary links are weak. There are two classes of reasons for this - first, plant breeders who already have commercially acceptable varieties to offer prefer to seek desirable new traits in already improved rather than in unimproved materials, and second, the genetic resources zealots have alienated themselves from many plant breeders by strident criticism - which may be justified but does not help their cause. Indeed some behave as if they do not wish the purity of unimproved material to be sullied by contact with commercially motivated exploiters.

#### The training program (general)

6. When the Board started work in 1974, only one training course in the subject existed - the M.Sc. course in plant genetic resources in the University of Birmingham, U.K. (established with FAO's encouragement), which received its first students in 1968. Training has consequently been of prime importance in the Board's work. Since 1974, 886 persons are listed as having attended courses or received training, but about 30% of these are likely to have attended more than one course.

7. The Board has no staff or premises in which to offer training. Instead, it promotes training in other institutions, largely in degree-related courses, workshops, seminars and short courses in which members of the Board's small secretariat may take part. In these efforts, it has been substantially helped by the International Centers.

8. The Board has sought to promote formal degree-related training courses elsewhere to share the burden with Birmingham. A course in Spanish may start in 1985 at the Universidad Nacional Agraria in Lima, Peru.

9. Interest in genetic resources work is now widespread, and many governments or agencies have supported training, not necessarily in relation with the Board. It may be that as many people have been trained by other agencies as by the Board. But genetic resources work as such seems unlikely to offer life careers to a very large number of persons, however enthusiastic they may be. The Board has, we understand, considered two mutually compatible options - to encourage the inclusion of training in the management and care of genetic resources in courses on plant breeding (in which it has a long and distinguished history); and to develop courses in plant genetic resources in such a way that the graduates can be considered for appointments in plant breeding if the "pure" genetic resources job market becomes saturated.

Types of training offered

10. IBPGR has supported, in whole or in part, degree-related training (Birmingham M.Sc.) and training in non-degree courses (at many institutions).

11. Degree related training. From 1975 to 1983, the Board supported 135 participants at Birmingham. (Before 1975, FAO had supported 47 more). It is possible that a few of the 11 who started the course in October 1974, were funded by the Board (which met for the first time in April of that year). Of these 135, 59 were from developed countries and 27 from South-East Asia. A comment on the content of the course will be found in paragraph 27.

12. The Board does not appear directly to have funded any courses leading to a Ph.D. degree.

13. Non-degree courses. IBPGR has supported participants to attend short courses mounted by other agencies, including short courses based on the M.Sc. courses at Birmingham, the seed technology course in the University of Edinburgh, and a course on collection, evaluation and conservation at the Universidad Nacional Agraria, La Molina, Lima, Peru. Other courses have been provided by International Centers (CIAT, IITA, ICARDA) jointly with IBPGR. Yet other courses would not have been possible without IBPGR-supported participants. Most of these courses have been shorter than 4 weeks, particularly in recent years.

14. The total number of such courses since 1977, irrespective of nominal sponsorship, has been 43 (including 6 at Birmingham), and they have been attended by 665 persons (67 at Birmingham). 82 of these persons came from developed countries.

15. Finally, the Board supported 39 study tours between 1974 and 1982, 9 by persons from countries in Southern Europe.

Training Staff

16. The Board has had no training officer hitherto. It may appoint one in 1985.

Material resources for training

17. The Board has no physical training resources of its own. It pays institutions to train people using their resources, and otherwise hires the resources it needs. It seems to take language problems in its stride. Its working language in practice is English, though some documents are translated into Spanish. The regionally-organized training is given in appropriate languages. Students at Birmingham have to learn English, but the founder of the course speaks Spanish.

Follow-up and contacts with participants

18. The Board's newsletter goes out several times a year to a considerable mailing list which includes all training participants. The enthusiasm of the genetic resources "profession" is such that the Board is probably in touch with the majority of its training participants, directly or indirectly. However, the Board has not yet sought to analyze the subsequent activities of its participants to find how useful their training has been to them and to the Board's work.

Costs and funding

19. In 1983, IBPGR expenditure of core funds on training amounted to US\$ 0.645 M (out of a total core expenditure of US\$ 4.510 M). It included US\$ 0.236 M for fellowships; there seem to be no contributions to training from special projects. IBPGR estimates that costs in 1984 have been on the order of US\$ 0.600 M from core (US\$ 4.819 M total). It is proposed that the allocation be increased for 1985 to US\$ 0.690 M and to US\$ 0.750 M for 1986, and that the fellowship component in this allocation be increased to double that for 1983 over the period 1984-1986.

Evaluation

20. We have seen no formal evaluation by the Board either of courses or of participants. It may well feel that its budget is too small for such luxuries, when the effects of training are so evident in the eagerness of participants.

Associations in training

21. The cooperating sponsors, in addition to International Centers, have included the University of Colorado at Boulder; the Indonesian National Biological Institute; the Aegean Research Center of the Turkish Ministry of Agriculture, at Menemen, Izmir; the Indian National Bureau of Plant Genetic Resources; the Philippine Council for Agriculture and Resources Research and Development; CATIE, Turrialba; the Instituto Nacional de Tecnologia Agricola, Argentina; the University of the Philippines, Los Banos; the Universidad Nacional Agraria, La Molina, Lima, Peru; the Italian Germplasm Institute, Bari; the University of Hawaii; the United States Department of Agriculture; Cornell University and the Office de Recherche Scientifique et Technique Outremer (ORSTOM), Paris.

22. The International Centers which have cooperated with the Board in training are IITA, CIAT and ICARDA. It is surprising that the papers provided for us do not refer to cooperation in training with IIRI, ICRISAT or CIP, all of which offer genetic resources training, or ILCA, which is interested and is in touch with the Ethiopian Gene Bank at Addis Ababa.

Subsequent contacts

23. The Board has only recently put together a record of its activities in regard to participants in training. It has maintained contact with a number of participants on an ad hoc basis, and may now be expected to review the purposes and mode of follow-up (see also paragraph 26).

Effects of training in the nations

24. IBPGR training has facilitated the establishment of national genetic resources programs in a number of nations, and stimulated activity in others. A good deal of the effect is indirect and catalytic.

25. It is not possible to point to direct effects of IBPGR training on development. One reason may be that many breeders are indifferent (see paragraph 5 above). As to research, IBPGR training has helped many people to do better work in genetic resources activities. In research as such, the main effects have been in seed physiology (which has direct economic application) and in studies of the evolution of cultivated plants.

Training needs for the future

26. It seems essential to assess the job market for genetic resources workers. The Board, and the world-wide professional interest in its work, have been able to ride on the wave of the green, alternative environmentalist enthusiasms which arose in the late sixties. If it comes to the crunch, and questions are asked about the cost of maintaining hundreds of thousands of accessions in cold stores, in vitro, or in living collections in the open, everything will depend on the attitudes of plant breeders. It is therefore essential that genetic resources workers, if they are not breeders, should be knowledgeable about plant breeding and able to join with breeders in evaluating and using the resources they collect, conserve and document. Their training should ensure this.

27. Several observers have suggested that the Birmingham course, which is taught in the Department of Botany of a University which has no Faculty of Agriculture, is deficient in this respect, even though it has had support from the breeders and the gene bank of the National Vegetable Research Station, about 25 miles away. The two most substantial elements of the course have been on the botany, taxonomy and evolution of cultivated plants, and on quantitative genetics. Though the course has unquestionably evoked dedication and scholarly qualities in its students, many of whom have gone on to complete Ph.D. degrees, the remaining elements did not add up to a basis for a career in plant breeding. We imagine that the Board is well aware of this question and will take due account of the comments of our informants.

Study Team Summary Reports on Findings: THE CENTERSE. ICARDA - INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH  
IN THE DRY AREASHistory and Current Patterns in Research

1. ICARDA works with 22 countries from Spain and Morocco to Pakistan and India. Its origins lie in the Arid Lands Agricultural Development Program of the Ford Foundation, which was directed by Dr. R. Havener, later Director-General of CIMMYT. As needs increased and the Foundation began to move out of agriculture, the need was felt to find some other way of supporting agricultural research in North Africa and the Middle East. The result, after due process of missions and consultations, was that a Center of a new type was brought into existence in 1977. Like ALAD, it was to be based in Lebanon, and was to work in the Beka'a Valley, but it was also to have other bases in Syria (near Aleppo), at high altitude (near Tabriz in Iran), and perhaps in North Africa.

2. The persistent continuation of politics by other means in the Middle East soon eliminated the prospects in Iran, but it took a long time, and a new Director-General, to convince ICARDA that times had changed and that Beirut and the Beka'a Valley were less healthy places than they had been for agricultural research. In 1981, the headquarters was moved to Aleppo and Tel Hadya, 30 km to the south of Aleppo, where a farm site had been developed; and building there was begun. Two small stations have continued in the Beka'a Valley, and ICARDA staff are working in Tunisia and Morocco. ICARDA is still looking for a highland base.

3. ICARDA, as its name implies, has agro-ecological terms of reference: its job is to help to improve systems of rainfed production in seasonally-arid winter rainfall areas. It may in future do some work on supplementary irrigation systems. In addition, it has responsibility, within the CGIAR System, for durum wheat, barley, faba beans and lentils, and it shares responsibility with ICRISAT for chickpeas. It has an uneasy truce with CIMMYT, which uses ICARDA as a base for its work on bread wheat in the Middle East and North Africa.

4. In fact, as in all arid regions, animals (often sheep, goats and camels) are very important in the ICARDA region, but they appear in its crop-centered charter only as parts of systems. One of us was once told that eyebrows were raised by the suggestion that a flock of sheep should be kept at Tel Hadya. However, the needs of the animals are recognized in the Pasture and Forage Improvement Program. Moreover, at least in Northern Syria, barley grain, as well as fodder and straw, is food for beasts rather than men. The topics ICARDA confronts are very similar to those which led in Africa to the establishment of ILCA, and will have to be handled in similar ways.

5. The other main programs are the Farming System Program, the Cereal Improvement Program, and the Food Legumes Improvement Program. Particularly since the move of the headquarters to Aleppo, they have

been making good progress individually, but how the parts of the Farming Systems Program fit together, and how FSP incorporates the outputs of the commodity programs, is still matter for debate. Training is also offered in genetic resources management, and in the computer unit.

The training programs (general)

6. Its Charter enjoins ICARDA to train scientists, technicians and other persons to improve the research and production capacities within the region. This is a very wide remit: it is not confined to ICARDA's research fields, and it instructs, or at least permits, ICARDA to train extension workers, administrators, managers, and persons engaged in the private sector, if by doing so it can improve research and production capacity.

7. The cooperating countries vary very widely in stage of agricultural, economic, educational and scientific development, and in language. Arabic is spoken in many, but not all countries; some use English or French as second languages. All this complicates ICARDA's training task. The region has been politically unstable throughout its history, and communications and travel are difficult.

8. Training was formerly organized for the whole Center by a Training and Communications Department. In 1982 training officers were placed in each research program, and a coordinating unit for logistics, coordination and services for training was set up under the Director of Administration. These tasks are now carried out by a Head of Training appointed in 1984. A training Committee including the unit and a senior member of each program, with the Deputy Director-General as Chairman, is intended to guide and coordinate the decentralization. We were not able to discern any general coordination, however, in the cooperation with the nations: programs seem to approach the nations separately. ICARDA has begun to develop networks including the national activities in particular commodities, disciplines and agro-ecological conditions. Just how these networks fit together in any one nation to advance national capability is not clear. This could lead to difficulties, particularly in nations which do not have manpower development projections. No doubt the consequences of all this are articulated by the Director-General and the Department of Government Liaison and Public Relations.

9. Participants in courses, and for some individual training, are selected by invitations to Ministers, associated with parallel communications to the Directors of appropriate research and development institutions in the nations. Local representatives of ICARDA may advise on nominations and selection. There are very few failures. The longer courses (see below) are intended for B.Sc. or equivalent graduates, but some participants have held Ph.D. degrees.

10. The total number of persons trained at ICARDA from 1978 to November, 1984, is at least 465. 93 more were trained in individual nations. Given the difficulties of working in the region, the changes in the Center itself, and the limited facilities, this number, though small (average 83 per year), is creditable. The detail is, however, not easy to disentangle, perhaps because the changes in management

organization have led to a loss of institutional memory. The records, including those provided for the QQR in 1983, are not systematic and they may be incomplete.

#### Types of Training Offered

11. The training offered at ICARDA headquarters varies in detail among the programs. The Cereals Program offered us lists going back to 1966; others gave no numbers at all. The general categories are group training, divided between long-term and short courses, and individual training, divided between two types of degree related training, i.e. research training scholars (for M.Sc.) and fellows (for Ph.D.); and non-degree related training (post-doctoral fellows, less senior research training associates, and senior research fellows). Some courses have been mounted by ICARDA staff in individual nations.

12. Long Term Courses. (Up to 6 months, in future probably 3-1/2 months only for cereals.) These courses extend through most of a cropping season, January to June. 60-70% of the time is spent in the field, and each participant has one or two research experiments, which give him experience in planning and conducting applied research, collecting, analyzing and interpreting data, and writing reports on the results. From 1978 to 1983 the total number of participants appears to have been 209 (+ 13 in 1984), of whom 81 (+ 8 in 1984) were in cereals courses, 83 (+ 5) in food legume courses, 41 in forage courses and 4 only in farming systems courses. About 60 were from Syria.

13. Short Term Courses. (2-4 weeks). From 1979 to 1984, 191 persons followed short courses, which were provided on Wheat and Barley Germplasm, (16); Seeds (2 courses) (36); Cereal Pathology (a workshop), (21); Legume Germplasm (19); Hay Making (12); Research Machinery (12); Genetic Resources (with ACSAD and IBPGR, and listed also by the Cereals Program) (14); Farm Operations (17); and Farming Systems (19) (all from Tunisia). Of the total, 46 came from Syria, and 25 from Tunisia. None of the other countries sent more than 15. Staff members feel that these courses are useful in keeping professionals abreast of recent advances.

14. Degree Related Courses. 4 persons did research for M.Sc. courses and 7 for Ph.D. courses between 1978 and 1983 (1 each in the Cereals Program). The program leaders expect to increase these numbers and seem to overestimate what they have done hitherto.

15. Non-degree Related Courses. The 1983 EPR mentions 36 participants, but the Cereals list alone contains 47 names to May 1984, though some came for as little as a week and many have been regarded as visitors rather than training participants. The number of postdoctoral participants is not recorded in the papers provided for us, perhaps because they are regarded as employees, not training participants. In addition five trainees were reported in 1984 by the Genetic Resources Unit.

16. In-country Training. 5 in-country courses are recorded, with a total of 93 participants. In 1981 the Faba Bean Project in the Nile

Valley trained 4 Egyptians and 10 Sudanese, and a second course in 1983 was followed by 11 Egyptians and 6 Sudanese. In 1984 the Food Legume Program gave a course on screening for resistance to Ascochyta in chickpea in Pakistan for 18 participants. The Cereals Program mounted two courses in Morocco, one in 1982 on the Improvement of Cereals for 24 participants, and a second in 1984 on Field Experimentation in the Improvement of Cereals for 20 participants. The Cereals Programme feels that in-country training is not a substitute for training at ICARDA and that both are needed. The Farming Systems Program mounted regional workshops on Economics in On-Farm Trials in Cairo and Farming Systems in Aleppo.

17. Relatively little other training seems to have been done by the Farming Systems Program. Perhaps it is modest about what it has to offer, which is considerable; and conversely its arduous field studies could benefit from the help of participants, who would gain valuable experience of real producers and production systems. The FS economists to whom we spoke felt that they could do more for degree-related and postdoctoral participants (though they seem to have had few of these). They feel that a 6-month course is not appropriate, and that training should be within the research program, which restricts the number who can participate. They have given service training courses (Food Legume Economics, On-Farm Trials with Livestock) for commodity courses, and workshops on crop rotations and farming systems. But if Farm Systems work is to have effects on research and development, ordinary professionals must know what it has to offer. We hope we are right in feeling that attitudes to training are developing along these lines.

18. The 6-month courses in the Pasture and Forage Improvement Program start with a six-week introduction, taught by staff of the program, to the five units of the program (annual forages, annual pastures, breeding methods, improvement of marginal land, and integration with animals) followed by a specific project for each participant. An M.Sc. student is evaluating a large collection of annual legumes for agronomic characteristics. The participants do not all share the attitudes of the program; they are interested in the improvement of marginal lands, irrigation and perennials, while the program is more interested in introducing annual legumes into rotations.

19. Other programs use a similar structure, particularly in providing projects for participants. The Food Legume Improvement Program has received participants from Peru, Chile and Argentina for training on lentils and faba bean.

#### Training Staff

20. The recently appointed Administrative Head of Training is chief of a new service unit intended to coordinate the work, prepare training materials, including audiovisuals, and manage the logistic support. The planning, and most of the teaching, of the courses is done by staff of the research programs. All scientists in the Food Legume Program were said to be keen on training, and we saw no sign that their colleagues in the Forage and Pasture Program were not

equally keen. Staff of the Farming Systems Program contribute to the 6-month courses of other programs, especially on the analysis of economic data. Perhaps teaching should become a contractual requirement of professional staff.

21. A consultant provides training in Farm Engineering, and specialists from the university and other national agencies also contribute.

#### Material resources for training

22. Teaching and Laboratory Space. At the time of our visit, class training was conducted in an ancient, inadequate and inconvenient barn-like structure, but new buildings were rising. Laboratory and farm facilities for training are those of the programs.

23. Residential. ICARDA has no dormitories for training participants: they live in furnished apartments rented by ICARDA in Aleppo, in a district where many staff members live also. This makes it necessary to transport them to and fro, and restricts working and library time; but these may be smaller problems than would arise in a small and isolated community at Tel Hadya.

24. Library. The Library is said to be small (2000 books, 100 journals); and it is located inconveniently far from the laboratories. The new buildings will, we understand, provide suitable space for the library. Maybe some kind donors will help to pay for books to fill it - no small matter in these days.

25. Linguistic Support. Teaching at ICARDA is in English with Arabic translation. In Western North Africa (Tunisia to Morocco) French speakers are required. ICARDA will no doubt consider the statements on language competence in our main report.

#### Cost and funding

26. In 1983, ICARDA expenditure of core funds on training amounted to US\$ 0.319 M (out of a total core expenditure of US\$ 13.690 M). ICARDA estimates that costs in 1984 have been of the order of US\$ 9.435 M from core (US\$ 16.043 M total), and will include for the first time a position (0.8 man-year) for training, to be made full time in succeeding years. It is proposed that the allocation to training be increased substantially for 1985 to US\$ 0.574 M, and to remain unchanged thereafter.

#### Evaluation

27. Participants on courses appear to be tested when they arrive, as they go along (including performance in seminars) and at the end of their courses, when their project reports are taken into account. They seem fully to earn the splendid certificate they receive at the end; but after that reports go to their employers and/or sponsors, who are also asked to evaluate the effects of the training on their work. All

this is a great deal of work, and we have no idea who did it before a Head of Training was appointed.

28. The Government and other employers to whom we spoke, and our informants in the University of Aleppo, praised ICARDA's training in terms to which we had become accustomed - knowledge, practical ability, initiative, confidence, ability to formulate programs and use statistical methods, communicate information and train others. All this is welcome news, but it carries an implied, perhaps unrealized criticism of the earlier training, both before and in-service, of the participants. The national institutions, which provide far more training than ICARDA ever should or could do, will have to advance to meet the demonstration that they are failing to develop the potential of their human raw material. This may suggest some long-range tasks for the Training Department.

#### Associations in Training

29. Host Nation. ICARDA works in higher degree training with Aleppo University and other universities in Syria, of which four (including Aleppo) have faculties of agriculture. Staff of ICARDA teach in the University, and staff of the University teach at ICARDA. ICARDA has trained staff for the National Seed Bureau, which cooperated in a regional course in seed technology and management.

30. Other Nations. ICARDA works with Universities and research institutions in the region, in Europe and in the US in higher degree work. (See paragraph 25 regarding languages.)

31. Other IARCS. ICARDA and CIMMYT have a joint training project, which has assisted wheat courses in North Africa and Sudan. We suggest that ICARDA and ILCA, and perhaps ILRAD also (in view of its work on trypanosomiasis (T. evansi) in the Middle East and North Africa) should explore common interests.

#### Subsequent contacts and follow-up

32. ICARDA keeps in touch with many of its former participants through their work in cooperative national programs, particularly in variety testing. It also sends them written material from time to time, a task which will be less burdensome now that ICARDA's computers can handle the mailing list. We feel that these and other ways of maintaining continuing contact are an extremely important part of the positive effects of Center training on participants, and, through them, on development. We hope that financial shortages will never be allowed to weaken these links.

#### Effects of training on research and development

33. Factors other than knowledge hold back both research and development in the ICARDA region, and ICARDA is young. We can point only to the fact that some former participants are now program leaders in their countries, and that ICARDA training has increased the number of legume researchers in the region.

34. Two Kenyan participants spoke of the effect on them of seeking how much more can be done with limited rainfall in Syria than is achieved in arid regions of Kenya. Of course the seasonal cycles of water balance are very different, but their comment illustrates a very significant effect which Center Training can have on participants from other places.

Future needs for training

35. ICARDA has done a good deal in a short time, but compared with the needs of the region it has far to go. The annual volume of both course and individual training has been restricted by lack of space, but as that is put right, and ICARDA develops its assessment of the needs of the nations, it will have to do much more. It must not then be held back unduly for lack of funds. We suggest in our main report that donors may wish to support training by establishing a second section of core funding, drawn not from their funds for research (which support the CG at present), but from their funds for training. We imagine they will continue to fund some training in bilateral projects; what we suggest is something new, which will help to ensure that the products from the Centers are not only relevant and appropriate but are also expeditiously transmitted to national agencies.

36. In-country Training. We do not think we need to urge ICARDA to advance in-country training and to help national institutions increasingly to provide it for themselves. In so vast and diverse a region, ICARDA cannot hope to achieve significant impact solely from Aleppo and Tunis. The nations, with appropriate support from ICARDA and the other Centers cooperating with them, must increasingly take up the load.

Study Team Summary Reports on Findings: THE CENTERS

F. ICRISAT - INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS

29 July - 1 August, 1984. Araujo, Bunting, Herz. Further information gathered in 12 out of 18 countries visited (Mexico, Guatemala, Burkina Faso (Upper Volta), Indonesia, Colombia, Peru, India, Bangladesh, Nepal, Ethiopia, Kenya and Zimbabwe).

1. ICRISAT was established in 1972, the first Center set up by CGIAR. Its original Constitution was interpreted by the ICRISAT Board during 1979-81 so as to give it four objectives. The first is to serve as a world Center for the improvement of the quality and yield of the grain of sorghum, millet (in practice, mainly pearl millet, Pennisetum), chickpea, pigeonpea, and groundnut, and to act as a world repository for the genetic resources of these crops. The second is to develop improved farming systems that will help to increase and stabilize agricultural production through more effective use of natural and human resources in the seasonally dry semi-arid tropics. The third is to identify constraints to agricultural development in the semi-arid tropics and evaluate means of alleviating them through technological and institutional changes. The fourth is to assist in the development and transfer of technology to the farmer through cooperation with national and regional research programs, and by sponsoring workshops and conferences, operating training programs, and assisting extension activities.
2. The work is specifically directed to improving the condition of poor people in rural communities which do not have the benefit of regular irrigation. Though ICRISAT concentrates on the semi-arid tropics, the results of work on its named crops may benefit those who grow them anywhere. ICRISAT's immediate clients are scientists in the national programs in countries in the semi-arid tropics.
3. To carry out these duties, ICRISAT's headquarters at Hyderabad, India, has six main research programs: Sorghum Improvement; Pearl Millet Improvement; Pulses Improvement; Groundnut Improvement; Farming Systems Research; and Economics. It has supporting units for genetic resources, biochemistry (mainly grain quality), plant quarantine, farm development and operation, computer services, statistical services, library and documentation, information, and electron microscopy and other specialized equipment.
4. Much of the semi-arid tropics lies in Africa. Both sorghum and pearl millet were domesticated, and are in genetic contact with their wild relatives, in parts of that continent. ICRISAT began to work in Africa in 1975, and each of its programs is active there. It has established a Sahelian Center in Niger (at Niamey and Sadore). It works also from national centers in Burkina Faso, Mali, Kenya, Senegal, Nigeria and Malawi. Nationally placed staff will likely be withdrawn as regional activities increase, such as the Eastern Africa

groundnut program (in Malawi) and the Southern Africa sorghum and millet program (in Zimbabwe for the SADCC countries). A grain legume project is intended for Southeast Asia. The work outside India is administered by the director of International Programs.

5. Although research has been done on ICRISAT's crops, in both developed and developing countries, for many years, most of it has been directed to production methods and relatively uncomplicated plant breeding. In 1972 little more penetrating or "basic" work had been done on ICRISAT's crops other than sorghum and groundnuts. ICRISAT has consequently found it necessary to develop several such investigations itself; for example, in groundnuts, on wild species and crosses with them and the related aspects of cytogenetics, and on crop morphology and physiology, and on the nature of infections, disease and resistance, in several crops. In farming systems research, it has studied the ecological physiology of competition in mixed cropping, and has developed critical original work in micrometeorology and agro-climatology. Its economics program has broken much new ground in village-level studies of resource use in production systems in different environments, and has used the results to advise research workers in the natural-science based programs. It has gone at least as far as any other Center in studying the rationale of existing systems in order to derive guidance for natural science based research.

6. As a result the research of ICRISAT includes significant innovative elements; and this affects the sort of experience ICRISAT can provide for training participants.

7. ICRISAT participates actively in two of the Cooperative Research Support Programs founded by USAID under title XII of the U.S. Foreign Assistance Act - the Peanut CRSP and INTSORMIL (the Sorghum and millet CRSP). This resource supplements ICRISAT's work in both research and training for these crops.

#### The training programs (general)

8. Training began at ICRISAT in 1974. ICRISAT sees the main purpose of much of its training as adding to the strength of national programs rather than buttressing ICRISAT's program. From 1974 to 1983 ICRISAT received 825 training participants. 212 came from West, 122 from East, and 52 from Southern Africa (total Africa 386); 352 from Asia, of whom 209 were from India; 28 from Latin America and the Caribbean, and 59 from 9 developed countries. Of the total, 567 were in-service trainees (see paragraph 9 below) who resemble the longer group course participants of other Centers. The participants have come from 66 countries in all. Many have been supported by a remarkably wide range of sponsors, whose contributions have continually increased.

9. The range of educational and research standards, and also of economic conditions, in the developing countries which ICRISAT serves is very wide. India has large and experienced services in the national institutions and in the States, including the State Agricultural Universities, and many of them are as advanced as any in the developing nations. At the other extreme are some of the African countries, in which both higher education and research services are

young, small and inexperienced. The gap between the salaries of qualified people in India and those usual in other developing countries is very wide. This leads (for example) to large differences between the pay and allowance of Indian and other training participants at some levels, and tends to make ICRISAT relatively unattractive for some qualified people from Africa. These diversities present special problems for ICRISAT trainers (of whom there are four full-time) and training managers.

10. The ICRISAT Sahelian Center at Niamey does not yet have a training officer. We hope that one will soon be appointed, particularly to support francophone participants and local training in francophone nations. It may well be that both the purposes and methods of training, and the categories of participants, will need to be different in francophone West Africa from current practice at ICRISAT Hyderabad.

11. Though ICRISAT scientists contribute substantially (about half of total time) to training, we formed the impression that the proportion of them who assign a high priority to it may be less than at other Centers. A good deal of the training is done by the full-time trainers. The Economics Group does not contribute a great deal to in-service courses: instead it has developed a separate course of its own. The full-time trainers seem to be fully qualified for the formal teaching and they keep themselves well-informed about what the research programs are doing.

12. Training at ICRISAT falls under the auspices of the director of international cooperation. A Training Advisory Committee, including the Director, the Program Leaders, the Principal Training Officer and a Senior Training Officer establishes policies, considers applications and recommends acceptance or otherwise, in consultation with the scientists who will train the successful candidates. All participants who need it attend a 2-month course in English, before they start their training courses proper.

#### Types of training provided

13. The categories of training participants at ICRISAT reflect some of the complexities outlined above. There are six main categories.

14. International Interns are postdoctoral participants, almost all from developed countries. From 1974 to 1983, there were 21 of them, of whom only one is listed as coming from a developing country (Uganda). Their initial appointments are for 12 months and may be extended to 24 months. They are paid at international rates and are allocated cars which they can use for personal travel, providing only the cost of fuel and lubricants.

15. Many of those we interviewed exhibited the not uncommon postdoctoral malaise - they are fully qualified, but they are not staff members. Some appeared to have suffered some sort of culture shock - a condition virtually unknown in colonial times, but seemingly a facet of the 'crisis of identity' which is fashionable nowadays. Some complained querulously that they had been misinformed, were not

treated as equals, were not consulted about the plans of the programs to which they were attached. Their future plans suggested that useful as they must be to ICRISAT, not all will serve development in the future.

16. Research fellows hold Ph.D. or M.Sc. Degrees, and they come from developing countries in the semi-arid tropics. From 1974 to 1983 there were 50, half from India. 8 were Africans, 9 came from Brazil, and most of the rest were from Asia. They are paid at the starting rate for a new Indian Ph.D. and they do not get cars. Their living conditions, however, are similar to those of international interns, and they do the same sorts of work. Some are extremely competent, perhaps more so than some of their international colleagues. We (and the international interns) were surprised to find that little or no friction had been generated by the difference in their rewards and conditions, which they seem to accept with remarkable equanimity. One can imagine that their future prospects in their own nations are better than those of the international interns; who will not all find it easy, in these hard times, to find satisfactory appointments when they leave ICRISAT.

17. In-service fellows are mid-level scientists with Ph.D., M.Sc. or occasionally B.Sc. Degrees, from developing countries in the semi-arid tropics, who have worked for one or more years in their own countries. These fellowships were instituted in 1982, and so far 19 have been awarded (5 to 8 Indians, 9 to 10 persons from other Asian countries, 3 to persons from Africa and 2 to persons from Latin America). The data provided do not allow us to compare their allowances strictly with those of research fellows, but we believe that they are appropriately larger than those of the less senior research fellows. The in-service fellows come to ICRISAT to learn techniques and take part in research, like visiting scientists at some other Centers.

18. A Research Scholar is a higher degree student registered at a university in India or elsewhere, who conducts his thesis research at ICRISAT. There have been 116 of them. 46 have come from India, 14 from Sri Lanka, 11 from other Asian nations, 20 from Africa, 4 from Brazil and 21 from developed countries. 46 universities have been involved, 13 in India, 6 elsewhere in Asia, 6 in Africa, 7 in Europe and 12 in the United States. The university supervisors are invited to ICRISAT at least once during the course to review progress. The living and other conditions, and stipends, of the research scholars, are broadly similar to those of research fellows. Like higher degree students everywhere, they cheerfully trade a degree of present adversity against the expectation of a more prestigious and better-rewarded future. The research scholars we met at ICRISAT were at least reasonably contented with the deal; their constructive suggestions for improvement were mostly related to minor matters. Personal association with staff seemed to be relaxed and productive.

19. However, it became clear that not all the ICRISAT supervisors were equally dedicated to their task. Some were formerly university teachers, who are accustomed to educating research students and guiding their struggles with their theses, but others preferred their research and found supervision burdensome. This is a difficulty in other Centers also and we consider it further in our main report.

20. In-Service Training at several other Centers is provided for groups. ICRISAT has modified this. The training in the first few weeks (up to 8) is in groups, taught, according to very condensed and comprehensive curricula, by the full-time training officers. After that the participants go to work individually in the programs, on particular techniques or problems. The total length of the courses is six months. The main fields of the courses are Crop Improvement, Crop Production and Farming Systems; and other general topics may be included, according to the needs of participants and their employers.

21. Invitations are sent each year to all cooperating countries, and up to four of the resulting applications are normally accepted from each country. The total number of in-service participants since 1974 is 567, from 60 nations. 193 have come from Asian nations (India 94, Thailand, 38); 354 from Africa (Nigeria 40; Sudan, 37; Kenya, 33; Niger and Mali, 32 each; Senegal and Upper Volta, 25 each), 13 from Latin America, and 7 from Europe (3 from Czechoslovakia). The most common highest qualification of an in-service participant is B.Sc. or Diploma, but some have had Ph.D.s and others have had no more than secondary school education.

22. In addition to the main subjects, the topics studied include economics, extension, training methods, research techniques and management. In the specialized part of the course a participant may conduct, or take part in, an investigation.

23. Apprentices are undergraduates or other students studying subjects related to ICRISAT's work. Application is by a university or individual. The apprentices may work at ICRISAT for 1 to 2 months. The participants must be fully supported from their own resources or by a sponsor. They can live in ICRISAT accommodation, if any is available, but they have to pay for it; alternatively they make their own arrangements and travel to and fro on the ICRISAT buses (of which a large fleet operates between Hyderabad and the Center). This seems a hard deal, but 52 people have accepted it, 39 from India and 12 from developed countries. 26 of them paid their own way, and ICRISAT helped the rest in one way or another. This category was of some importance in 1975-79, but declined as the physical development of the Center approached completion.

24. Special Groups receive training of from a couple of days of orientation to four weeks. These participants have mostly been in middle level management in national research and extension programs, or have worked for development agencies and banks and come to ICRISAT to learn about special topics, e.g. the management of deep vertisols. They receive accommodation and training from ICRISAT. The total number of persons in 31 courses since 1975 has been 495. Apart from 14 postgraduates from Sri Lanka, the rest seem to have belonged to Indian organizations. This type of training may increase in future in fields in which useful experience and skills can be acquired in a short time.

25. In-Country Training. ICRISAT has so far promoted little in-country training. In India the experienced and competent national institutions can provide for themselves all the training required and whatever they need from ICRISAT can be provided through scientific visits. Up to four Latin American scientists are trained each year by

ICRISAT staff working at CIMMYT. ICRISAT intends to develop short courses and on-the-job training in regions and countries.

26. In-country training will particularly be needed in West Africa, in both French and English; and will no doubt represent a substantial task for the training officer whom ICRISAT intends to locate at ISC Niamey. The task will meet special difficulties because professional levels in West Africa are very different from those to which ICRISAT is accustomed in India.

27. Since it is the view of the nations which have been involved in this study, as well as our own view, that in-country training should become, in part, the responsibility of the nations as in-country business, and should be designed to help national scientists to give better service to the needs of their nations, we feel that ICRISAT may have to develop from a training mode which seeks to disseminate the products of ICRISAT's research to one which is based on the real and felt needs of each country.

28. But there are further questions. Producers of sorghum and millet in West Africa grow many other Center crops, some of them in mixture with the cereals. Many of them keep livestock. ICRISAT cannot do the job alone. Several of the nations cooperate with CIMMYT, IITA, ILCA, CIP, CIAT, WARDA, ILRAD and IBPGR, as well as ICRISAT. But they confront already a peculiar difficulty. In many nations, particularly those with smaller populations at early stages of development, the professional cadre is not large enough or sufficiently advanced to bear the separate in-country training efforts of so many Centers. It seems inevitable that the Centers must come together to share the tasks. The nations want this, and they believe also that in-country training works both ways; that it can help to inform the Centers more fully about national needs, resources, constraints and priorities.

29. However, the resources of the different Centers for training in the region are dispersed, and moreover dispersed differently for each Center. It is not easy for us to see how, from so many different bases, the Centers can provide collective services. To an outsider, their separate activities look like an unplanned, anarchic array of unarticulated activities. This array does not seem to be able to meet the needs of eighteen different nations, many of which, though large in area, are now thinly populated, little developed, and economically poor. One possibility is that the Centers might develop common staging points at or near appropriate centers of air communications (such as Nairobi represents in East Africa), perhaps Dakar, Abidjan and Lagos. We believe that TAC and CGIAR should study this difficult matter and determine, in consultation with the nations, what might best be done.

#### Training staff

30. The training staff is headed by the Principal Training Officer. He is supported by four scientists with Ph.D. degrees, a senior administrative officer, six office workers and three driver/assistants. There is no designated training officer at Niamey.

31. About half of the training time is provided by the research programs and services. The economics program has developed separate training of 2 months for its own in-service groups. Not all of the scientists are interested in training and may also have too little experience to teach effectively.

#### Material resources for training

32. Teaching and laboratory facilities. On the ground floor of one spur of the buildings at ICRISAT Center, the training program has staff offices, one class room, and one room for the preparation of audiotutorial materials. The use of video equipment is being developed as a training aid. In another spur it has two additional classrooms. Training has 12 ha for field experimentation. Laboratory facilities are those used by the research programs. The program has only one micro-computer at present, but expects to obtain more which will be available for use by individual participants.

33. Residential accommodation. The training program has first call on the 120 rooms in the dormitories at ICRISAT Center, which also has a fully adequate refectory.

34. Library. The ICRISAT library is well-stocked (18,000 books, 1000 annual reports, 800 serials) and well-managed. It appears able to meet all, or almost all, of the needs of the training participants, though some said that there were some (unspecified) gaps. The library already has access to external computer-readable literature resources; this service is to be further developed.

#### Language

35. ICRISAT's working language is English. With the help of Osmania University, Hyderabad, ICRISAT offers a preparatory English course of two months, mainly for participants from Latin America and Francophone Africa. Though some of them found this course difficult, most valued it. We discuss this question further in our main report.

#### Costs and funding

36. In 1983, ICRISAT expenditure of core funds on training and fellowships amounted to US\$ 0.290 M (out of a total core expenditure of US\$ 17.657 M). Included in the core budget is 1 full-time position for training out of the 5 positions filled; the other 4 fall to the budgets of the research programs. ICRISAT estimates that costs in 1984 have been of the order US\$ 0.300 M from core (US\$ 20,503 M total). It is proposed that the allocation be increased for 1985 to US\$ 0.483 M and to US\$ 0.486 M for 1986.

Evaluation, subsequent contacts and follow-up

37. The progress of participants is evaluated, and participants evaluate their experiences, but ICRISAT has not yet evaluated the effects of the training on the subsequent work of the participants. No doubt it meets many of them in national programs - and these contacts should be systematically recorded in the computer files. ICRISAT has also endeavoured to keep in touch with them by correspondence, and obtained replies from 328 out of 515 who left before 1 January 1982. We were told, however, that the main burden of keeping in touch was left to participants, although some contacts are originated and continued by training through announcements of newly available information and germplasm. Other Centers' experience suggests that follow-up is more likely to be effective where contacts lead not only to expression of interest but also to material benefits, such as newsletters, and individualized selective dissemination of information (with reply cards now and again which have to be returned if the service is to continue) and above all interesting and useful plant material.

Our colleagues at ICRISAT know that they should do more about these matters and we encourage them to do so. It will establish or conserve ICRISAT's most precious resource - the world-wide community of those who have benefitted from visits and training.

Associations in training

38. Host Nations. In its work in India, ICRISAT is continuously in touch with units of the Indian Council of Agricultural Research/ Department of Agricultural Research and Education. It has close relations with several Indian Universities, perhaps particularly with Osmania University and Andhra Pradesh Agricultural University in Hyderabad. Notwithstanding some earlier difficulties, ICRISAT is part of the scene in training in India.

39. Other Nations. ICRISAT cooperates with many nations in research, and participants have come to ICRISAT from many of them, sponsored by various organizations. But otherwise cooperation in training with other nations seems to be largely restricted to universities. Research scholars have been registered in universities in 5 countries in Africa, 4 countries in Asia, 3 countries in Europe, and in the United States (12 universities). ICRISAT has links, assisted by IDRC, and which include training, with the Centre Ivoirien de Recherche Economique et Sociale of the University of Ivory Coast (where several Centers may be involved in curriculum development). ICRISAT has contacts through INTSORMIL (sorghum and millet CRSP) with Mexico and Peru.

40. Other IARCs. In training, ICRISAT assists or cooperates with ILCA, CIMMYT, and ICARDA, but little joint formal training seems to have taken place in these associations.

Effects of training on research and development in the nations

41. Fifteen of ICRISAT's international interns have taken up appointments in developing countries; research fellows work in universities or research institutions in ten developing nations; and

the in-service fellows and other participants, particularly those in training for improvement, are no doubt doing useful jobs in their countries, and others, in the semi-arid tropics. On the whole, however, we did not find that ICRISAT has yet produced many national leaders in research in its field, and we cannot point to important production or development gains which have flowed from ICRISAT training.

#### Future needs and plans for training

42. Training at ICRISAT headquarters seems to be comprehensive and well-organized, along established and stable lines. Some additional training topics might be offered from time to time and may have been addressed in thesis work or in ad hoc seminars. Examples are weed science, including parasitic weeds; the collection, maintenance, evaluation and documentation of germplasm; growth and stress physiology of crops; agricultural climatology and meteorology leading to modelling; nutritional, culinary and aesthetic quality of food products; and the developmental analysis of rural life situations. Such topics would help to increase the scientific depth of the program.

43. We believe also that ICRISAT is now well placed to increase higher degree training, provided funds become available.

44. The main need, however, reflects what we feel is a weakness in the present program - the development of in-country and regional training outside India. Particular attention is needed to francophone West Africa. We have reviewed above (paragraphs 25-29) the problems in that region. We believe our colleagues at ICRISAT are well aware of many of them, and we urge them to press on.

Study Team Summary Reports on Findings: THE CENTERS

## G. IFPRI - THE INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

January 12, 1984. Araujo, Bunting, Herz. Further information gathered in Syria (few of the persons the team met elsewhere were concerned with food policy).

History and present patterns of activity

1. IFPRI was established in 1975, and became part of the CGIAR System in 1979. It works on the economic and social effects of more advanced technical methods (principally in production) on food supplies and nutrition, and on the consequences for global and national policy and action. Some current areas of work include "growth linkages" (direct and indirect effects in other areas of the successful use of improved varieties and practices), policies in the production and pricing of rice, the relationship in West Africa between prospective movement in the prices of coarse grains and the production and importation of wheat and rice, policies for food prices and subsidies, relations between food and cash crops as food itself becomes a cash crop, and food-for-work programs.

2. The Institute does this work by collecting data (surveys, assembling and collating data collected by others) and examining the effects of past policy decisions, or of policy options for the future, on the economic and social circumstances of nations, producers and consumers. The term "food policy research" embraces all these activities. IFPRI's main concern is with these kinds of research and with the generation of research results useful to those who form policy nationally, regionally and globally.

Training at IFPRI

3. IFPRI does not have a formal training program. Individuals become more knowledgeable and competent by taking part in IFPRI's research, whether in Washington or overseas. Since all this research is necessarily done by qualified professional persons, none of it is analogous to the technical or production training provided at other Centers. Some of it is degree-related, in that a less senior research worker may use his work towards a higher degree, but most of it is of shorter term, more like the participation of so-called interns in other centers. The senior staff numbers 20 to 25. Although it is in principle and largely in practice, a permanent body, some members work at IFPRI in the intervals between other assignments or on secondment from their home institutions. Others come to work at IFPRI for a limited number of months or years, interspersed with periods elsewhere, after which they return to IFPRI and so remain associated with IFPRI throughout.

4. The resulting turnover of some senior staff, and of cooperators in individual nations, is the main expression of IFPRI's training function. Essentially, IFPRI is a largely invisible college of professional peers, and not of teachers and taught. The total number of persons who have worked with IFPRI in these ways since 1979, when IFPRI joined the CGIAR System, is 80.

5. Thus senior officials of overseas governments may participate by collaborating with IFPRI staff members. Less senior officials, and students registered for higher degree courses, may join field surveys, analyze their data at IFPRI, and write up their results in consultation with more experienced colleagues. They learn by collaborative doing; and a number of M.S. and Ph.D. degrees have been gained in this way. Moreover, IFPRI publications are known to be widely used for teaching and as parts of the raw materials for research in universities and food policy research institutes.

6. Seminars and conferences organized by IFPRI on specific topics for senior officials of governments and regional and international agencies also provide training.

7. In line with its mandate, the work of IFPRI therefore includes a significant training activity, even though it is informal and cannot be separated from the research of the Institute.

#### Associations with other institutions

8. Several other Centers, notably CIMMYT and IRRI, have found it necessary to take macro-economic questions into account in defining the direction and scale of their research programs. Consequently they already cooperate with IFPRI. As other Centers similarly find it necessary to take account of regional and global questions of food and nutrition policy in order to improve their service to development, they may be expected to cooperate with IFPRI in order to increase the capabilities of their economics programs to deal with "macro" questions. This too can be seen as a form of reciprocal training.

Study Team Summary Reports on Findings: THE CENTERS

H. IITA - INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE

5 - 11 March, 1984. Araujo, Bunting, Herz. Further information gathered in 13 out of 18 countries visited (Mexico, Costa Rica, Nigeria, Burkina Faso, Liberia, Indonesia, Philippines, Colombia, Peru, India, Ethiopia Kenya, Zimbabwe).

History and current patterns in research

1. IITA was established, a few miles north of Ibadan, Nigeria, by the Ford and Rockefeller Foundations in 1967. Its main purpose is ecologically defined: it is to develop permanent systems of farming and land use to replace shifting cultivation in the lowland humid tropics (altitude below 600 metres above sea level, precipitation exceeding evaporation for five or more months of the year).
2. IITA's scientific work is organized in four programs: cereals, grain legumes, roots and tubers, and farming systems. Within the CGIAR System, IITA has sole responsibility for cowpeas and sweet potatoes (*Ipomoea*). Since these crops are also grown in seasonally arid parts of the tropics, IITA in pursuing its responsibilities for them was bound to work outside the humid tropics. IITA also has sole responsibilities for yams and aroids, which are crops of the wetter tropics. It has responsibility for work in Africa on cassava, maize and rice, in agreement with CIAT, CIMMYT and IRRI respectively, and also works on soya bean. It was originally intended also to work on plantains/bananas, but has not had the resources of land and funds for a significant program on these crops. It cooperates with WARDA in swamp rice work in Sierra Leone. IITA's cooperation with SAFGRAD leads it into many drier environments, including that of Ouagadougou, Burkina Faso, where it works at the Kamboinse station.
3. IITA was the first International Agricultural Research Center to be established in Africa. It has felt itself from the outset to have a particular responsibility to the sub-Saharan parts of the African continent, across all environments. It is this, rather than the work on cowpeas and sweet potatoes alone, which has led it to be interested in many ecological regions of Africa in addition to the lowland humid tropics, and to develop cooperative programs accordingly with several African nations outside the lowland humid tropics.
4. IITA was among the first to study the rationale and constraints of existing systems of farming. It has done important work on soil physics, agroclimatology and water balance. It advanced the scientific (as distinct from agronomic) work on cowpeas, through promoting a good deal of work in developed countries on the physiology, biochemistry and

nitrogen nutrition of the crop, and complementary studies at Ibadan and elsewhere in West Africa. IITA also did necessary "more basic" work on aroids and yams, on the physiology of tropical maize and on diseases of rice. It has also worked on the nature and inheritance of resistance to diseases, insects and nematodes, particularly in cowpeas, maize, rice and cassava. IITA has laid the groundwork for a boldly innovative program, on a continental scale, on biological control of insect pests of cassava. It has worked on characterization of viruses using electron microscopy and other advanced techniques, and has employed "tissue" (including stem-tip) culture and rapid multiplication techniques for cassava and sweet potato. Thus IITA's program has always included "more basic" studies alongside more applied and practical research on breeding, production and protection. This wide spread of interests is reflected in the training program.

#### The training program (general)

5. In agricultural science and practice, Africa is the least developed of the continents. Few of its institutions of higher education or research are more than 40 years old. The agricultural knowledge systems in most countries are both poorly developed and conspicuously fragmented. Moreover, they differ profoundly because they are derived from at least five different foreign traditions in education and research - French, Portuguese, English, Scottish and American - and they use three different languages. The structures for management of agriculture are unstable, partly because the supply of well-trained manpower is still short of demand in many sub-Saharan countries. Africa is also environmentally, as well as culturally and historically, diverse. All this places peculiarly heavy and difficult responsibilities on IITA in respect of training. Nonetheless, the comparative advantages of training at an IARC are at least as pronounced at IITA as at most of the other Centers.

6. From late 1970, when training activities were begun, to the end of 1983, the 2,878 participants who came to IITA were from 84 countries, and 2,527 (88%) of them came from 40 countries of sub-Saharan Africa. 1,025 of the latter came from Nigeria (which contains about one-quarter of all the people who live between the Sahara and the Limpopo River), and six other nations of the region sent between 104 and 178 participants each.

7. At the outset, in 1970, IITA trained future cooperators in field agronomic or breeding programmes. This objective proved inseparable from that of helping to strengthen national capabilities for research in agriculture, particularly for food crops, to enable nations to solve their food production problems themselves. The participants also help in the testing of new methods suggested by research at IITA or elsewhere, and they sensitize IITA to the resources, needs and difficulties of their nations.

8. Almost all participants in training at IITA nowadays are professionally qualified by the standards of their own countries, or else have substantial experience of research or extension. They are employees of, and are usually nominated by, governments or other responsible public or private agencies in their home countries. For

different courses, the number of nominations is from 2 to 4 times the number of places available. The low use of core funding at IITA for training has had the effect that many participants are associated with special projects and are consequently selected to meet the needs of specific development actions.

#### Types of training provided

9. IITA divides the types of training it offers into two classes: individual programs and group courses. Some of the latter are offered away from IITA, "in-country".

10. Individual Programs. More than 100 persons follow individual programs at IITA at any one time. Though definitions have varied, there are in practice five main types of individual programs: post-doctoral, post-graduate but pre-doctoral (higher degree-related), professional non-degree related (called "in-service" at some Centers), undergraduate degree-related, and undergraduate vacation students. Of these, the first two could be viewed as further divided into two types each, depending on length, standard or both.

11. a) Post-Doctoral Workers. Since 1973, 85 post-doctoral fellows have worked at IITA. Of these 33 (39%) came from developed countries, and of the 52 from developing countries 33 (39%) were from nations of sub-Saharan Africa. The work at IITA of persons who have recently graduated with the degree of Doctor is formally divided into two types. There are junior scientist posts of 1 to 2 years' duration, and senior research fellowships of up to 6 months. The former appear to be intended, for the most part, to enable their holders to start their careers in independent research, whereas the latter have more of the character of in-service training for doctoral workers who are already in post but need additional knowledge or skills.

12. There were at one time misunderstandings about junior scientist (post-doctoral) posts at IITA. At the outset, African candidates were few mainly because they were in great demand for career posts in their nations. Hence, most post-doctoral workers at IITA at that time were from countries outside Africa, and some of them were subsequently taken on to the international staff. When African post-doctoral workers did present themselves, they naturally expected similar preferment, but few received it: vacancies by that time were few and competition was keen.

13. There were also difficulties about status and management. Some senior staff at IITA were said to use their post-doctoral assistants as technicians rather than as qualified colleagues, perhaps because they had not previously worked with post-doctorals. Post-doctorals also felt that they were not "trainees" and therefore should not have to report to the training officer or his staff. These difficulties, which were sometimes magnified by ethnic differences, appear to have become less acute with time.

14. b) Higher Degree-Related Training. Persons working for degrees of Master are called "research scholars", and those working for degrees of Doctor are "research fellows" (cf. the short-term "in-service" post-doctorals who are called "senior research fellows"). By the end

of 1983 IITA had trained or was training 169 M.Sc. students and 93 ✓ Ph.D. students. These students carried out prescribed course work at their universities and most of them conducted their thesis research at IITA under supervision of workers in the research programs. 61 of the research scholars (36%) and 20 research fellows (21.5%), came from developed countries. 45 universities in many countries cooperated, and teachers from many of them were invited to IITA to review the work of their students. The University of Ibadan has been foremost in this cooperation, and at least two other Nigerian universities have been involved.

15. Many, though perhaps not all, of the research staff of IITA are both eager and able to supervise the research of graduate students. We believe that their commitment is at least as great as that of their peers in any of the other Centers. But wherever we went we were told that IITA is not training enough higher graduates, particularly at the Ph.D. level. Part of the reason for this is the shortage of funds: a higher degree graduate is an expensive product. But evidently another part of the problem lies in the universities, of which there are many, in Nigeria and other cooperating developing countries. (See also paragraphs 43 - 44).

16. c) Training Related to a First Degree. In 1983 IITA and the University of Ibadan cooperated to enable 38 final-year students for the "Ingenieur agronome" diploma of the National University of Benin to prepare the theses which are required for that qualification. These successful candidates now constitute the foundation staff of the Faculty of Agriculture in Benin. IITA has assisted the University of Ouagadougou in a similar way.

17. d) Research Training Associates (not degree related). 20 to 30 professionally-qualified employees of departments or ministries of agriculture, international organizations and private agencies come to IITA each year to advance their knowledge, to gain experience of research ideas and methods, and to become acquainted with the Institute. They stay for from 2 weeks to 9 months and follow individual programs of work and study. 252 persons from 45 countries (29 in Africa) had been trained in this mode by the end of 1983.

18. e) Vacation Student Research Scholars. IITA receives each year for long vacation work about 20 entering senior-year students from an increasing number of African universities. 252 undergraduates participated in this way between 1971 and the end of 1983. There is a heavy demand for places, and the experience is valued by the students, the universities (who nominate their best students) and the governments. Many of these students have returned later to conduct research for higher degrees at IITA.

19. Group Courses. Altogether 2,070 persons from 84 countries have attended group courses at IITA. One quarter of them have come from francophone nations. These courses are intended for research, extension, management and technical development workers, all of whom are professionally qualified by the standards of their own countries. Each research program offers one main course each year, and proposes others. The courses proposed are offered to the cooperating nations, and their choices determine which shall actually be provided in any one

year. Participants come from universities, ministries, development projects (often externally funded), voluntary agencies and private-sector companies. Against this diversity of need and of national and professional background, it is often difficult to match the content of a course to the expectations of all the participants.

20. The courses vary in length. The average is about 16 weeks, and up to 20 are held each year. Production or production and extension courses on maize, grain legumes, rice, root and tuber crops and plantains have to be long enough to give participants experience of the main elements of the cropping cycle and so may last from 3 to 8 months, shortened where possible by pre-planting or staggered planting of the field plots. Improvement by plant breeding appears to be treated as part of production science in these courses. Courses have also been provided on research in soil and water conservation and management, fertilizer use in the tropics, nitrogen fixation and legume production, mixed production of maize and cowpea, post harvest engineering, soil and plant analysis, genetic resources conservation, genebank management, reduced tillage systems, weed control, soil management, on-farm research and communications. The more specialized courses may be as short as two weeks. A course on research planning, organization and management (including the management of research projects) was provided in 1982 in association with FAO and ISNAR.

21. The penultimate week of some production courses is devoted to a training course for farmers, extension workers and staff of development agencies. This course within a course is designed, managed and taught by the participants, who also write the training manual for it.

22. IITA staff have frequently prepared and taught courses away from IITA, in-country. In 1982, 4 courses were held, one each in Burkina Faso (Upper Volta) and Cameroon, and two in Nigeria; in 1983 five were held in Cameroon.

23. The group courses, at IITA and elsewhere, are supported by training manuals (where needed often in French as well as in English) which appear to be well prepared and useful.

#### Training staff

24. Formerly, training at IITA was organized and supported by a separate training program headed by a Training Officer with the rank of Assistant Director, reporting to the Deputy Director General. Following the External Program Review in 1983 training was attached to the Director of International Programs whose title was expanded to include training.

25. In 1983, the Assistant Director for training was assisted by two training officers, one of whom was responsible for group training, and by two francophone translators/interpreters. This staff is slated to decrease to a total of two core funded senior man-years in 1985 and 1986. The 1983 External Program Review report notes with concern the heavy workload on the current limited staff and recommends that up to three additional posts be funded from core as soon as possible.

26. All the group courses are designed and taught largely by the program scientists, cooperating with and effectively supported by the training staff. The scientists as well as the participants value the contact with each other and the exchange of knowledge on problems in the different countries. Outside lecturers are freely used, not so much to supplement deficiencies as to broaden the knowledge resource. In many courses additional teaching help is given by one or two former participants (francophone and/or anglophone), appointed as temporary assistant training officers.

#### Resources for training

27. Physical Facilities. IITA has a training block with two classrooms (equipped for simultaneous translation), a general purpose workspace used for engineering training and for handling material from the field, and administrative and tutorial offices. The Institute has also a large training and conference center, dormitories for 100 persons (which also house longer-stay participants), a number of flatlets available for post-doctoral workers and other long-stay participants, and substantial refectory and recreational facilities. Laboratory and field space for training is provided by the programs and units: there are no laboratories exclusively used for training. The excellent library of IITA meets all needs of participants at the present time.

28. Language. As has been indicated above, IITA maintains capability in both French and English, though it seems likely that French comes off second-best in spite of the devoted work of the francophone staff members. IITA has sought a grant to enable it to develop capability in Portuguese to sustain its cooperation with Angola, Mozambique, Brazil and other Portuguese-using territories.

#### Costs and funding

29. In 1982 and 1983 IITA expenditure of core funds on training amounted to US\$ 0.596 M and US\$ 0.482 M, respectively (out of a total core expenditure of US\$ 18.798 M and US\$ 20.320 M). IITA estimates that its expenditure on training in 1984 will be on the order of US\$ 0.450 M, and proposes to maintain this level for the years 1985-88. In spite of this rather low proportion of core applied to training, the volume of training has been maintained, and the facilities have continued to be used fully. This has been possible because of special project funds, which in 1982 totalled US\$ 0.458 M and in 1983 US\$ 0.405 M. Further, for up to one-quarter of the participants, fees are said to be paid to IITA by their employers. The 1983 External Program Review Report expressed concern about the low level of core support for training and recommended that it be raised.

#### Internal evaluation procedures

30. We believe that the training records include evaluation notes on participants, but the only systematic comparative evaluation we heard about was reported by Dr. E. Bortel-Doku in 1977. It was based on

responses from 63 participants, all research and extension workers who had attended production courses. His findings were largely positive.

#### Subsequent contacts and follow-Up

31. IITA appears to be in touch with many former participants, largely through the distribution of newsletters and other publications. In Nigeria and other African countries this is not a fully reliable means of communication. Moreover, younger professional workers in many African countries are rather mobile, so that address lists soon become out of date. These are probably the main reasons why a number of the former participants we met felt that they had been neglected. Most of the subsequent contact appears to arise from cooperation with former participants in national programs and from the visits of staff members. A few former participants are brought back to IITA to help in courses, and many return for workshops and conferences. We feel that in Africa the risks of professional isolation are so real that an unusual effort is needed to keep in touch with former participants and that special funds should be sought to do this, preferably from multinational sources with pan-tropical or pan-African interests.

32. Assistance to participants shortly after their attendance at training activities is particularly important. This need be no more than special letters to employers, but often small grants for equipment or to support early stages of independent work can have a powerful effect. IITA encourages some degree-related participants to seek help from the International Foundation for Science, and this has led us to suggest that the Center Directors might cooperate collectively with IFS for this purpose.

#### Associations in training

33. Institutions in Nigeria. IITA cooperates with the appropriate federal agencies and with many in individual states of the Federation. It works with several Nigerian universities. Many Nigerians have, not unnaturally, come to view and value IITA as an addition to the national training resource; and of course Nigeria's needs are at least quantitatively greater than those of any other African nation. But there are risks here of which the management is well aware.

34. Institutions in other nations. IITA has cooperated with 42 African nations by training participants, but few of them have developed bases for in-country training in cooperation with IITA. Yet there are competent training institutions in many African nations. We believe that one difficulty here may be that so many of the Centers are seeking such cooperation in some nations that their capacity to respond becomes strained. It may be that a regional base for training by the Centers will develop in East Africa, but we suggest that IITA, as the largest CGIAR Center in Africa, should take the lead in developing concerted action by all Centers working in Africa to investigate and meet the needs of individual nations, for example in topics like the study of existing systems of production.

35. IITA's extensive cooperation with nations in many regions (42 in Africa, 11 in Asia, 17 in the Americas, and 6 in South-East Asia and the Pacific) has not yet led to the emergence of formal networks linking the nations for research and training, such as those developed by CIP in several regions. We have already referred to the Center's collaboration with 45 universities worldwide.

36. Regional Organizations. The most important of these hitherto has been SAFGRAD, the cooperative organization of 28 nations of the drier parts of Africa for research and training on rainfed crops. IITA has also worked with the cooperative organizations in the Sahel region. It will no doubt play an important part in what we hope will be an orchestrated cooperation of the CGIAR Centers with the SADCC group for training.

37. Other IARCs. Cooperation with CIP and CIAT for training on root and tuber crops, funded by UNDP, has been ongoing since 1982. IITA cooperates also with CIMMYT, ILCA, IRRI and WARDA in training, though it has tended to offer training on specialized aspects of rice development independently of WARDA. We may perhaps be forgiven for expressing the feeling that IITA's relations with ICRISAT in West Africa are more concerned with demarcation than with interaction, even at Ouagadougou, where the two Centers work side by side. Some might feel that the emergence of a separate West African base for ICRISAT at Niamey may have done little to advance the effect of the CGIAR System as a whole on development in Africa, and perhaps particularly in those parts of the continent where cowpeas, sorghum and millet are grown together.

Effects of training on research and on development in the nations

38. IITA's training appears to have had substantial effects on research and extension in many African countries. In Nigeria and the several other African countries we visited, we were told that almost all supervisors who are responsible for in-service training have been at IITA. In many countries, the IITA training manuals have proved valuable. IITA training has provided most of the specialized professional manpower for national programs on cassava in Zaire, rice in Sierra Leone, and cowpeas in Burkina Faso. IITA participants are to be found doing useful research, or in management posts, in many public and private agencies in African nations.

39. Effects on development are more difficult to isolate. In many African countries since 1970, agricultural development has been slow (some would say regressive, in some instances), for reasons which have little to do directly with knowledge or research. Perhaps the most prominent identifiable effect has been on the output of cassava, particularly as means of protecting the crop against the most important insect pests (as well as against some of its most serious diseases) are becoming available. Streak-resistant maize, another of IITA's more significant achievements, and the methods of converting, improving and maintaining streak resistant populations, have been disseminated in the continent through training.

Future needs for training

40. IITA has achieved and must somehow maintain a unique place in the agricultural knowledge systems of Africa. The needs of these systems are at all levels, but there are now many chiefs but few well and appropriately trained supporting staff. Against this background we find it necessary to consider with care the advice of the 1983 External Program Review that IITA should offer less "production training". We feel that the group courses should continue at least at their present level. It goes without saying that training "in-country" should be encouraged, but many countries in Africa are not far enough advanced to do this, and the opportunity costs of sending out IITA staff members to conduct courses can be large. The first task is to use training at IITA to help to build institutions, where they are lacking, which can offer in-country training. To offer in-country courses in countries with which IITA does not have cooperative projects will have lasting effects only where satisfactory local institutions already exist; and even there it is not clear how such courses can be funded. Donors are not yet in the habit of using their budgets for "technical cooperation training" to support training by the Centers, which they regard as the business of the research department.

41. It seems to be generally agreed at IITA that more resources are needed for training. The 1983 External Program Review advised that extra provision should include one Administrative Assistant, one Media Specialist-Editor, and one Assistant Training Officer to train trainers. We fully agree that training at IITA needs more support. The scope of the endeavour is large and its quality appears to be admirable, but the needs of the nations which cooperate with IITA now and would like to cooperate in the future, particularly in Africa, are very great.

42. We feel also that there should be even more opportunities than there are now for fully qualified scientists from African developing countries to work at IITA for sabbatical periods of a few weeks to a year or more to maintain and advance their knowledge and skills.

43. In respect of higher degree training, we are bound to accept that many African nations need larger numbers of competent, dedicated, original, independent research leaders with Masters' or Doctors' degrees. But African nations, or at least the Anglophone ones, have a considerable number of universities, and very large numbers of Africans have been trained, and are currently intended to be trained, in them or in universities in developed countries. Yet wherever we went national leaders asked for more higher degree training in which the thesis work was done at IITA. Whether there were in all cases job opportunities for more Ph.D.'s we doubt, but it was not easy to investigate that topic. We were told, when we did, that the "private sector" could absorb the surplus; and this put further enquiry beyond our reach in most cases. Our informants may have asked for more higher degree training because it is customary to do so, but they could in fact be thought to be implying that their own universities, and those overseas, are not doing a sufficiently good job.

44. We believe that this may well be true in a number of cases, and if it is, the answer does not lie solely with IITA. University

standards must be advanced. IITA has recognized its responsibilities in this direction, but without extra funding it cannot do more than it is doing now. The Center certainly cannot, and should not, hope to do it all. Nor should IITA attempt to do it alone. This is a problem for all the Centers which collaborate in an individual country, and we hope they will approach it together.

45. As to the future content of training at IITA, this is necessarily related to the evolution of the research program. As new fields have to be investigated to strengthen IITA's endeavour for development, so training will inevitably follow, since training at IITA is led, intellectually, by the research workers. The content will, we believe, be influenced also by the complementary contributions of other Centers, particularly on such topics as the planning of research programs and the organization and management of research, in studies based on existing systems of production, in agro-climatology, in the design and analysis of experiments and surveys, and many more.

46. We expect also that IITA will wish to give more attention to languages, not solely to French, Portuguese and other languages of the cooperating countries, but also to the speaking and writing of English as a professional language.

Study Team Summary Reports on Findings: THE CENTERS

I. ILCA - INTERNATIONAL LIVESTOCK CENTER FOR AFRICA

16-22 September 1984, Araujo, Bunting, Herz. Additional information gathered in 4 out of 18 countries visited (Ethiopia, Kenya, Nigeria, Zimbabwe).

History and current patterns in research

1. Livestock are important, even dominant, components of the life systems of traditional subsistence producers in many regions of Africa, including most of the drier regions toward the desert margins. They are managed with considerable skill in ways which are closely adapted to the nature and uncertainties of the environments. In some regions they are important sources of cash income, but the traditional systems have not, in most cases, been meeting the increasing market demand for animal products.

2. Since the idea of an international center for research on livestock was first advanced in the late 'sixties, concepts of what it should do and how it should do it have changed from time to time. Some early thoughts were directed to transhumant and other customary producers, many of whom had not entered the developing economic life of their nations.

3. The proposal to establish ILCA was accepted by TAC and CGIAR in 1973. The first Director-General was designated in 1974; ILCA became a legal entity under a decree of the Ethiopian Government in 1975; and the lease for land for its headquarters, on the outskirts of Addis Ababa, was signed in 1976. During the period from 1974 to the first quinquennial review in 1981 a second Director-General took over (in 1978) and his successor, the present Director-General, was appointed in December 1981. The main buildings were constructed during this period. During these years the objectives and methods of work of ILCA were evolved slowly and painfully.

4. From the outset it was recognized as essential to base the work of ILCA on an understanding, both technical and socio-economic, of the existing systems, leading to the identification of the reasons why they are not more productive, and so to research on those constraints which seemed most likely to be lessened by the results of successful research. The work has always been confined to Sub-Saharan Africa and concerned exclusively with ruminants; it has always involved a range of disciplines in both human and natural sciences; and it has always been conducted in a range of environments.

5. The difficulties were about the conduct of truly interdisciplinary work by multidisciplinary groups, about how far ILCA was intended to promote development by proposing and undertaking interventions, some of which had no tested research foundations, about the roles of science and research as opposed to experience and preconception, and about the identification of researchable options and the

design of effective research programs to pursue them. Much of this self-examination was inevitable and had to be endured while it lasted, but it might not have led to the present pattern of work without the very vigorous contribution of the QQR in 1981 and of its Chairman, the late Sir John Crawford.

6. ILCA's field work is conducted in seven locations in four agro-ecological zones of Africa, the highlands (in Central Ethiopia), the humid zone (small ruminants at Ibadan, Nigeria), the subhumid zone (Kaduna, Nigeria) and the arid and semi-arid zones (Mali, Southern Ethiopia, Kenya Masailand, and Botswana). The trypanotolerance studies are associated with ILRAD and a network of 9 countries in West and 4 in East Africa, in several of which private sector agencies in animal production cooperate. The field programs study the whole of the production systems of the people in their regions, including crops and trees, water and power (including animal traction) and the processing of produce. Though they no longer seek to carry out development tasks, they are intended to have early effects on development, and not on science and technology alone.

7. The field programs are supported by central research units at Addis Ababa on livestock policy; the productivity of livestock with particular reference to tolerance of trypanosomes, the agronomy of legumes, native and introduced, in pasture land, animal nutrition, small ruminants and camels, aerial survey and cartography, and by a computer unit. The headquarters also includes the library and documentation, training and liaison, and publication units.

8. A structure of this sort, built to perform tasks for which there was no precedent, is inherently difficult to manage and to hold together, over thousands of miles of communications and several frontiers, some of which are more difficult to pass than others. But ILCA has a unique prospect of conducting comparative studies in a range of contrasting environments. Consequently it has developed a strong program on agroclimatology. Moreover it is the only Center which has from the outset recognized that it is essential to understand a system, and the people in and around it, before one sets out to try to make it more productive, and so to help the people to improve the quality of their lives.

9. All this is new, intellectually exciting, and important for rural animal producers, for consumers, and for governments. Substantial numbers of people will have to learn new ways of thinking and acting if ILCA's work is to be relevant and its results both acceptable and accepted. It implies directly a very considerable task for training.

#### The training program (general)

10. Training at ILCA is associated with international liaison. In the cooperating nations ILCA seeks, through training, to reach a very broad range of audiences. At one extreme, it includes national

administrators and formers of policy for agriculture and for development in both town and country: at the other it includes technicians and undergraduate students and producers. In between are the African scientists, in universities and official services. To many of its hearers it seeks to convey messages very different from those delivered by customary university courses and textbooks on agriculture and animal production - and, moreover, a message whose operational consequences are not yet fully specified and may never be final, since what can and should be done will change as development proceeds. Further, though ILCA already has a working typology of environments, the systems in them, and the conditions for change, vary in detail from place to place. What is needed and possible in mineral-rich Botswana, with a large market for animal products close at hand, or in oil-rich Nigeria, is likely to be very different from what is needed and possible in Somalia or Tanzanian Masailand.

11. Parts of ILCA's training message, then, will clearly be best delivered in the regions and nations where ILCA's field programmes and the cooperating national institutions are strong enough to deliver them. Other parts, concerned with the supporting sciences and techniques, will be best delivered at headquarters, at least until ILCA is able to cooperate in training with national centers of excellence. The Ministers, Permanent Secretaries and Deans will probably always prefer to come to ILCA's base. The content of training will also be influenced, through consultations, by the nations with whom ILCA cooperates, of whom there are six now and may be many more in future.

12. Some people feel that research at ILCA has not yet advanced far enough to have enough to teach. We think this view is unduly modest, but it is also clear that not all the researchers at ILCA are eager to train, that some regard training as a burden, and that so far few courses have been mounted at their request. The range of topics on which ILCA seems to us to have comparative advantage in training is already so large that we hope they will rapidly overcome their bashfulness.

13. The data provided for us about numbers of participants are not fully clear. It seems that since 1975 ILCA has trained almost 1,600 people - 1,500 (from 33 African nations) in group courses and 94 individually. The individual participants come from 22 African nations and 8 developed countries. Most of the training has been given at ILCA headquarters. There is no lack of African candidates. ILCA staff may promote requests, but the requests themselves come from the nations.

14. Training is substantially supported and extended at ILCA by the very dynamic information program, helped in its turn by the publications unit. All courses are said to include an introduction to information management. With the help of IDRC, ILCA has assembled on microfiches a good deal of recorded but unpublished or only partly published information about animal production and related matters from many African nations: and it maintains a very significant data base in computer-accessible form with cooperation from AGRIS and CAB. These resources enable ILCA to provide cooperators, including former training participants, with copies of microfiches and with selective

information services according to their individual interests and needs.

Types of training provided

15. Courses. In all years since 1975 (except 1976) from 110 to 230 people have attended courses each year. From 10 to 25 people have attended each course, and the courses last from 2 to 12 weeks. Subjects in which courses are regularly offered (not necessarily each year) include trypanotolerance, animal nutrition and methods of forage evaluation, epidemiology and economics of disease control, design and analysis of livestock development projects, livestock systems research, research management and administration, forage production (all of which lead readily to networks of former participants) and data management and statistics. All of this training is essentially practical in the field and/or in the laboratory. Each year 10-15 librarians spend 2-4 weeks working in the library.

16. Individual Training. About 100 people have participated as individuals since 1975, of whom about 75 have come from African nations. The names of different sorts of individual training have changed over time, but as of the end of 1983 they included the following categories:

post-doctoral (recent Ph.D. graduates working under guidance for 1 or 2 years) (12)

visiting scientists (senior scientists, mostly Africans, working independently, or nearly so, up to 1 year, usually on sabbatical leave) (7)

post-graduates, also called junior scientists, registered in a University and conducting thesis work under supervision of an ILCA staff scientist, years (about 30)

research fellows (scientists at any level who come to learn ILCA's research methods, up to 6 months) (about 30)

technicians (similar to research fellows except for formal professional standing, and treated in the same way) (about 12)

ILCA Staff "in-service" (ILCA employees approved by their departments) (16)

17. In-country Training. This is also called mission training when the trainer(s) come from headquarters. Courses have been held in Nigeria at Kaduna and Nsukka. The field programs have probably trained people, but since the headquarters training group would not have been responsible it has perhaps not been fully informed.

18. As we have said above, in-country training will be even more necessary for ILCA than for most other Centers. No doubt it will be promoted as soon as ILCA is ready for it and also finds that local staff in particular nations are ready to cooperate.

19. Training the Trainers. At ILCA, as everywhere else, people spoke of "training the trainers", but so far, at ILCA, this has not been specifically attempted.

#### Training staff

20. The first full-time training officer of ILCA was appointed (in the International Liaison and Training Unit) in 1984. He is supported by an animal scientist and one other staff member, and there are two secretaries. From half to three quarters of the teaching is done by ILCA staff, and the rest is done by visiting trainers from other institutions including Addis Ababa University and its College of Agriculture at Alemaya.

#### Material resources for training

21. Teaching and Laboratory Space. Training is conducted in the laboratories, conference and seminar rooms of ILCA and there are no special training facilities.

22. Residential. ILCA has 42 rooms for visitors. 11 are permanently occupied, so that the maximum size of a course (unless hotel accommodation is used) is about 30 persons. The refectory and kitchen arrangements could handle more, though mealtimes might have to be staggered. The Director-General told us that ILCA could use space for 50 more participants. We do not doubt that he will need it before long.

23. Library. The library is adequate for the present needs of training. It has 15,000 volumes, 24,300 microfiches, and 940 serial publications, and it provides large numbers of photocopies.

24. Language. ILCA uses French in West Africa and offers training at headquarters in both English and French. It should consider offering facilities for self-instruction language teaching on the lines suggested in our main report.

#### Costs and funding

25. In 1983, ILCA's expenditure of core funds on training amounted to US\$ 0.338 M (out of a total core expenditure of US\$ 10.098 M). Included in the core budget are no full-time positions for training. ILCA estimates that costs in 1984 have been of the order of US\$ 0.656 M from core (US\$ 12.240 M total), including 0.5 man-year for training staff. It is proposed that the allocation be increased for 1985 to US\$ 0.714 M and to US\$ 0.814 M for 1986. These are small numbers compared with what we think will be needed to develop and service "in country" training in the future.

### Evaluation

26. No internal or external evaluation of ILCA's training was mentioned to us; and the 1981 QQR did not have time to review the training program. Former participants felt that the nutrition and forage evaluation course was too short and that a partly peripatetic livestock system course held some time ago was too long. Our informants in Ethiopia and Kenya spoke well of the courses; but in general we did not meet people concerned with animal production in our travels (which were organized by the other Centers, most of which do not have an interest in animals).

### Associations in training

27. Host Country. ILCA works closely and productively with Addis Ababa University (AAU) and its College of Agriculture at Alemaya, Harar Province. University people help in training and supervision and ILCA people teach, advise and examine students in the University. ILCA has supported some students from AAU to take higher degree courses at Ibadan and Lomé.

28. Other Nations. ILCA has provided training for many Nigerians but does not seem to have regular links in training with any national institutions in Nigeria or elsewhere in Africa. It has cooperated in courses with the University of Hohenheim, the Economic Development Institute of the World Bank, the University of Reading, FAO, UNESCO, the Commonwealth Secretariat, the Association for the Advancement of Agricultural Sciences in Africa (AAASA), IDRC, the International Foundation for Science, the International Center for Aerial Survey and Earth Sciences (Enschede, Netherlands) and Government Departments and Universities in Nigeria and Kenya.

29. Other IARCs. ILCA has an agreement with IITA, where its humid zone program is based, and where there are common interests in mixed production systems including mixtures which contain shrubs and trees. With CIAT it has an agreement on tropical pastures, and postdoctoral workers will come to Africa under it to collect Brachiarias; and CIAT will help with seeds training. A CIAT liaison officer will be posted at ILCA. CIP has conducted training on potatoes at ILCA.

30. The principal link, however, is with ILRAD, with which ILCA has been intertwined from the start. Joint training with ILRAD on trypanosomiasis and trypanotolerance also includes ICIPE.

31. ILCA has two cooperative programs with ICRISAT, one at the Sahelian Center in Niamey and the other on vertisols in East Africa. It is noteworthy that ILCA does not seem to work with ICARDA, though the two Centers have much in common conceptually and technically.

### Subsequent contacts and follow-up

32. Amid the alarms, excursions and staff changes of the past, it is not surprising that there has been little follow-up of

participants. ILCA is in touch with those who collaborate with its field programs, in the networks, and no doubt some are included among the 300 or so who use the selective information service - a potentially powerful means of inducing participants to keep in touch. Many others must be on the mailing list for the newsletters, of which about 3,000 go out to addresses in Africa.

#### Effects of training on research and on development in the nations

33. ILCA training cannot yet, we feel, claim much effect on research in the nations other than through its own field programs. The Center itself recognizes 1983 as its "Year 1" of training. Much applied animal science in tropical Africa is still bound to its veterinary ancestry; and it may take time for ILCA's new ways of thinking and doing things to affect the practice of research. Nor do we feel that training of itself can have done much for development except perhaps through the work of the field programs. We have referred to the ILCA newsletters in paragraph 32.

#### Future needs for training

34. Training will no doubt evolve, both at ILCA and in the field programs, as research advances. Our informants in the nations would like more people to be trained by ILCA, particularly for higher degrees. ILCA shares this national reaction with all the other Centers. Several Asian nations would like to benefit from ILCA training.

35. We feel that it is urgent to get ILCA's results, methods and concepts, which are important for all training in the biological uses of natural resources, into the undergraduate and post-graduate curricula of appropriate courses in agriculture, animal production, animal health and animal science in the African universities. Perhaps the first step might be to bring a few appropriately experienced senior university teachers to ILCA for a week or two to draft appropriate additions and modifications to their own courses, guided perhaps by what ILCA already does for Addis Ababa University. The results might then be circulated more widely to African Faculties of Agriculture, Animal Production, Animal Health and so on, in preparation for a workshop. We know that there is no antigen so powerful as a new idea, but a start should be made as soon as ILCA feels ready for it - and for its consequences.

36. In-country Training. These Universities could then perhaps become bases for in-country training at appropriate levels. In analogous ways, the teaching of other institutions, at less prestigious levels (like AHITI and Egerton in Kenya) might be advanced, so that they too could provide in-country courses at their levels.

Study Team Summary Reports on Findings: THE CENTERS

J. ILRAD - INTERNATIONAL LABORATORY FOR RESEARCH ON ANIMAL DISEASES

22-29 September, 1984. Araujo, Bunting, Herz. Further information gathered in 10 out of 18 countries visited (Burkina Faso/U.V., Colombia, Ethiopia, India, Kenya, Mexico, Nigeria, Philippines, Syria, Zimbabwe).

History and current patterns in research

1. ILRAD has its origin in the interest of the Rockefeller Foundation, in the late 'sixties, in developing research to support animal production in Africa. The proposal to establish a laboratory in Nairobi to work in animal disease, with particular reference to trypanosomiasis and East Coast fever (one of the theilerioses) was endorsed by CGIAR in November 1972 as part of an integrated African Livestock Research Organization, which was also to be concerned with production. In the event ILCA and ILRAD were developed separately in adjacent countries, and though they cooperate closely and productively their constitutional links are solely through the CGIAR system.
2. The Memorandum of Understanding with the Government of Kenya, which established ILRAD legally, does not restrict its tasks to any geographical area or to particular animal diseases. It does however give first priority to extensive basic and applied research and experimentation on the immunological and related aspects of controlling trypanosomiasis and East Coast fever and the field testing of the results. The QQR in 1981 discouraged it from undertaking work on other diseases, but ILRAD has been able to conduct some work on T. evansi which affects horses, camels, cattle and water buffalo in Africa, in the Middle East, Asia and South America. Since human trypanosomiasis is caused by two subspecies of T. brucei, a third subspecies of which is one of the organisms causing trypanosomiasis in livestock, and the human pathogens have also been isolated from domestic livestock, ILRAD's work is also of interest for human medicine. Advances in the immunology of protozoans and in immunology in general, could have even broader value in human medicine.
3. ILRAD is also concerned, on the one hand, with the biology of the pathogens in general and their relations with their vectors (tsetse flies and ticks), in which it cooperates closely with ICIPE; and on the other, with the epidemiology of the diseases and their effects on the mammalian hosts, on methods and costs of controlling the diseases, and on the effects on the health and production of livestock, and particularly of ruminants, in which it cooperates closely with ILCA.
4. Though ILRAD has had four Directors in ten years, its work has forged ahead. It is now the most advanced institution of its kind in Africa, and among the most advanced in the world. Its work on the biology and immunology of trypanosomiasis and Theileria has required the most advanced concepts and methods in parasitology, cell biology,

pathology at all levels from cell organelles to whole organisms, immunology and immunobiology, molecular genetics and biochemistry; and it uses a corresponding array of advanced techniques including cell and tissue culture, electron microscopy, recombinant DNA procedures, and monoclonal antibody and immunofluorescence methods for typing antigens. It also maintains one of the largest facilities in the world for work with large animals and very substantial facilities for rearing tsetse flies and ticks. ILRAD recently began to introduce West African trypanotolerant N'dama cattle to Kenya as eggs, fertilized in vitro, to be implanted into Kenyan mothers. The first of the calves was born shortly before our visit.

5. In this work ILRAD cooperates with universities and research institutes in many countries besides Kenya, including Belgium, the United Kingdom, Switzerland, Togo and Zaire.

6. ILRAD's terms of reference (as well as the nature of the work) require it to help cooperating countries to use and apply its results. Perhaps the main direct benefit to practice has been in providing new, operationally simple but technically and scientifically very sophisticated methods of diagnosis and typing in the field, which are now very widely used in Africa. But ILRAD's main contribution to the nations has been in training people at all levels, not only to help the nations to cooperate in its work, but also to raise the scientific and technical standards of practice and research in animal health generally. This is valuable in itself, and it is also essential if the levels and standards of work established at ILRAD are to take root and flourish in developing countries.

#### The training programs (general)

7. ILRAD's responsibilities in training are laid down in some detail in the Memorandum of Understanding as:

- "4. Organization of discussion groups, seminars, workshops and conferences on topics related to the work of the Laboratory;
5. In cooperation with universities and other research institutes, provision of opportunities for advanced professional training and experience in animal disease research within the scope of the Laboratory;
6. Training of scientists who will be involved in research, education and action programs in cooperating countries in which the Laboratory's program will be applicable;
7. Assistance to cooperating countries in using and applying the research results of the Laboratory;"

ILRAD intends its training to develop scientific and field personnel who can extend research on trypanosomiasis, theileriosis and other pressing veterinary problems, primarily in Africa, but in other regions also. Training now seems to have a firm place in ILRAD's program.

8. Many members of ILRAD's staff, including technicians, are interested in training, and in the production of training manuals and instructional video tapes. ILRAD staff see training as a means of strengthening the national programs with which they cooperate, and conversely of keeping themselves continuously informed about the animal health situation in the cooperating nations.

9. ILRAD's training is clearly doing what the MOU intended. It seems to us that at the same time it is doing more. ILRAD has become a source, which is probably unique in Africa, of persons trained to an advanced level in several rapidly advancing areas and techniques of modern biology - parasitology, cell biology, pathology, immunology and immunobiology, biochemistry (particularly of antigens), molecular genetics, electron microscopy, recombinant DNA, monoclonal antibodies for diagnostic work, and enzymology. This must in due course influence the state of biology and applied biology in African academic and research institutions. However, many of those trained are specialists who are bound to their professions. They are less potentially mobile or interchangeable than (say) crops specialists, though some could presumably move to medical laboratories. It therefore seems particularly important to ensure that the number of persons trained is not out of balance with the future prospects for employment in institutions which can provide the sorts of facilities and resources that their work would require.

10. The points we have made in our main report about gaps in standards between Centers and national knowledge systems would appear to apply with particular force to ILRAD. It will therefore, no doubt, seek to cooperate with Universities and research institutions in as many nations as possible, particularly in Africa. It is relevant that participants have come to ILRAD from many developing nations, including countries of francophone Africa. In 1983, participants came from many African countries, as well as from India, Sri Lanka, Indonesia and Australia. In other years participants have come also from Thailand, Indonesia and some nations of Latin America. Others have come from developed countries including Belgium, Germany, Japan, the U.K. and the U.S.A.

#### Types of training provided

11. ILRAD's training at various stages is conveniently considered under seven headings: training of staff for ILRAD itself, vacation experience for undergraduates, post-doctoral training, degree-related training, visiting scientists' and technicians' courses at ILRAD, and courses provided elsewhere.

12. Training of Staff for ILRAD. ILRAD's first task was to train technicians for its own research programs in the laboratory, for the production and veterinary care of laboratory animals, for the insect rearing facilities and for the cattle rearing facility at Kapiti. It cooperated for these purposes with, and helped to strengthen, the Kenya Polytechnic, where ILRAD technicians attended the pre-technicians course of 3 months or the course for the Ordinary Diploma in Laboratory Technology (3 years, day release). It also cooperated with ICIPE, the Kenya Veterinary Research Institute, the Kenya Trypanosomiasis Research

Institute, and the Veterinary Faculty of the University of Nairobi. It also undertook and still undertakes a good deal of training of its staff within its own programs.

13. Vacation Experience for Undergraduates. Research institutions in many countries receive undergraduates during their long vacations. These people help with tasks of many kinds at peak periods. In return they learn something of the nature of professional work and life early in their careers. Opportunities for this sort of educative work experience are rare in most developing countries, and Universities as well as students welcome them. Several Centers consequently provide them, as ILRAD did in its earlier years. The 1981 QQR advised against this and ILRAD does not now accept undergraduates. Unless ILRAD's experience was particularly adverse, this matter could perhaps be reconsidered.

14. Postdoctoral Fellows. ILRAD has accepted postdoctoral participants from the outset, and has now received a total of a hundred. The quality of postdoctorals accepted at ILRAD has been outstanding. They normally work at ILRAD for two years, during which they are regarded by the staff as colleagues. They contribute to the research program, and they help to train M.Sc. and Ph.D. candidates. In all laboratories, postdoctorals find themselves in an insecure and equivocal position; they are fully qualified professionally but not fully independent as research workers; and at other Centers some resent being administered as 'trainees'. Though we heard some minor adverse comments, most of the postdoctorals we met seemed fully contented with their situation, and with the resources available for their work. The advice of the 1981 QQR that they should be included as members of the scientific staff has not in practice been followed: the training officer is still responsible for administrative matters concerning them. In 1983 there were 11; 4 were African and the rest were from the US, Germany, Japan, Belgium and the U.K. We met 7, of whom 2 were Africans.

15. Degree-Related Training. ILRAD enables higher degree candidates from universities to spend from 1 to 3 years carrying out their thesis research in close association with ILRAD scientists. 33 have been received since 1975. In 1983 there were 15 ( 5 M.Sc., 10 Ph.D.). 13 were Africans, and the remaining 2 were from Belgium. Seven were enrolled in the University of Nairobi. We met 9 degree-related students, of whom one felt neglected, but the others all felt that they were contributing and were accepted as contributors. These students work on topics within the research program but not on general scientific topics such as molecular biology for which there are few appointments in developing countries at present. Some students have been sponsored for training elsewhere than at ILRAD.

16. Our general impression was that the relations between staff, postdoctorals and degree related students were warm and close. The feeling of community was at least as strong as in a good University department.

17. Visiting Scientists and Technicians. These participants generally spend up to 10 months learning specific techniques. No social

distinction seems to be made in the laboratory between scientists and technicians. Of the 23 who came in 198 , 17 were from 11 African countries (5 from Kenya), 3 from India and 1 each from Sri Lanka and Australia. The topics ranged from rearing tsetse flies to monoclonal antibody techniques, and some participants have studied the diagnosis of trypanosomiasis.

18. Courses. Up to 5 training courses, usually for up to 12 participants and lasting for up to 6 weeks, are held each year. ILRAD contributes 7-8 week courses to the training of field staff in the ILCA - ILRAD Trypanotolerance Network. The participants include both veterinarians (mostly technicians) and agronomists. In 1983, two such courses were held, one in French and the other in English, on diagnosis, epidemiology and control of trypanosomiasis, helminthiases and tick-borne diseases, tsetse trapping and the collection and analysis of related data on animal productivity, draft power and biological productivity. Other topics of courses have been the diagnosis of haemoprotozoan cattle diseases, with emphasis on trypanosomiasis or on East Coast fever, and isotope labelling techniques in the study of the immunology and pathogenesis of infections by protozoa and helminths.

19. In 1983 an ILRAD scientist gave a course of lectures on trypanosomiasis to final year veterinary students in Maputo, Mozambique, and another spent two months in Zambia teaching the biology, ecology and control of tsetse in a UNDP/FAO course for technical staff from several African countries.

#### Training Staff

20. In the training and information services, one person is listed as Training and Outreach Officer. He is responsible for a training laboratory (below), but most of the teaching and training is done by staff of the research programs. His responsibilities also include the library, and publications, travel and management of visitors. The officer is overloaded with management tasks, but we were told that he is to have administrative help.

#### Material resources for training

21. Teaching and Laboratory Space. Most of the training uses the research facilities of the Center in laboratory and field. Teaching is done in conference and seminar rooms. There is a small teaching laboratory in which participants can learn general applied methods without occupying research space.

22. Residential. ILRAD has enough accommodation to provide for most visitors from other countries, most of the time, but Kenyan participants have to fend for themselves. Dormitory and refectory facilities are in fact limiting the growth of training already. The difficulty is accentuated by ILRAD's hospitality to other Centers which seek bases in Nairobi. It seemed to us that whether or not it has intended to do so, the CGIAR System has in fact developed an East African base of which Nairobi is the hub. The logistic resources which are necessary as a result need to be planned, provided and managed in a rational manner, looking to the future as well as to the present.

23. Library. Our brief inspection suggested that the library is well-run but small. It has over 2,500 books, receives 196 journals covering the fields of ILRAD's work, and obtains other materials on interlibrary loan or from international data bases including those accessible through CAB.

#### Language

24. ILRAD uses English and French separately in some courses, but otherwise appears to work solely in English. Participants from Latin America, and one from Thailand, appear to have had more difficulty than francophone Africans.

#### Evaluation

25. ILRAD does not appear to have evaluated its training. It feels that its contribution in training is undervalued in Kenya and elsewhere in Africa, particularly in individual training which seems to be less visible. We do not seek to explain this, but it suggests some gap in communication between ILRAD and the Directors and Ministers of African governments. If this is correct, the cost of an occasional "high level" conference might be well spent.

#### Associations in Training

26. Host Nations. Relationships with the Kenya veterinary and trypanosomiasis laboratories in training seem to be satisfactory. There is a certain sense of malaise in the the Ministry of Agriculture about the Centers' roles in Kenya. Many, perhaps all, of them use Nairobi and several work in Kenya, but the Ministry seems to feel that it is not getting enough of something in return. It may be that it feels it is not master in its own house; and if this is so, collective action by the Centers in Kenya, to consult with and accept some measure of guidance from the Ministry, might help. This is a facet of a broader topic considered in our main report.

27. Other Nations. Training participants come from many nations, and ILRAD staff visit many nations. Perhaps it is early days to expect ILRAD to promote "in-country" training, but the time cannot be far off, at least in respect of diagnostic methods and support for the work on trypanotolerance.

28. Other IARCs. The close links between ILRAD and ILCA, which also involve ICIPE, have been mentioned. Otherwise ILRAD does not seem to work in training with any of the other Centers, most of which are not interested in animals. ILRAD's interest in T. evansi suggests that it would be well to explore possible associations with ICARDA.

#### Costs and funding

29. In 1983, ILRAD's expenditure of core funds on training and conferences amounted to US\$ 0.695 M (out of a total core expenditure of

US\$ 8.357 M). Included in the core budget is one full-time position for training. ILRAD estimates that costs in 1984 have been of the order US\$ 0.974 M from core (US\$ 9.335 M total). It is proposed that the allocation be increased for 1985 to US\$ 1.050 M and to US\$ 1.095 M for 1986.

30. Subsequent contacts and follow-up, networking. ILRAD is in touch with many participants most of whom continue to need support through literature and with technical materials. The Trypanotolerance Network offers an opportunity to keep in touch with many of them, The very well-produced publication "ILRAD Reports" goes out to more than 1,200 individuals and institutions, which we believe includes those participants whose addresses are known. Unfortunately, we met few ILRAD participants on our travels.

#### Effects of training on research and development in the nations

31. We have no evidence about effects on research, but we feel assured that in some countries ILRAD training is helping veterinary services to do a better job. Whether this affects development must depend largely on the extent to which the animal industry is commercial, and so has the resources and support to take measures in accordance with advice. We feel, however, that promising as the outlook is, the days of ILRAD's main impact on development are yet to come. In the meantime, no doubt ILRAD is preparing to develop roots for the future in Botswana, Zimbabwe and Zambia, as well as in Kenya.

#### Future needs for training

32. Our comments here are related to the preceding paragraph. It could be well to ensure, through training, that ILRAD is well-connected and supported in those African nations where animal industry is strong. ILRAD's Board includes an outstanding veterinarian from Zimbabwe.

33. In-Country Training. ILRAD has made a beginning, and through former participants will no doubt go further in those countries which wish it and where there are institutions capable of mounting, or helping to mount, "in-country" courses. It is important, we feel, to consider this soon, and have some structures in place ready for the day, perhaps not far off, when the nations beat a path to ILRAD's door for the new means of control of trypanosomiasis and theileriosis.

Study Team Summary Reports on Findings: THE CENTERS

K. IRRI - INTERNATIONAL RICE RESEARCH INSTITUTE

10-16 April, 1984. Araujo, Bunting, von der Osten. Additional information gathered in 14 out of 18 countries visited (Mexico, Guatemala, Nigeria, Liberia, Indonesia, Thailand, Philippines, Colombia, Peru, India, Bangladesh, Nepal, Kenya, Zimbabwe).

History and current patterns in research

1. IRRI was established in 1960. It was the first of four International Centers established by the Ford and Rockefeller Foundations. It was intended to conduct basic research on the rice plant, and on the production, distribution and utilization of rice, in order to improve the food supply and economic condition of the people of Asia and other rice-growing areas. Virtually all its effort is devoted or related to one crop. Within this otherwise quite unrestricted remit, IRRI has in practice concentrated on indica rice and the countries in which it is grown most of which are within the tropics; and the bulk of its effort has been in tropical Asia. It has been particularly associated with irrigated rice varieties of intermediate and short stature, the so-called dwarf rices, which can accept additional water and nitrogen with less risk of lodging; and also with forms whose morphology and physiology enable them to produce large yields, even without extra water and nitrogen. Large potential yield is not a direct consequence of short stature, as some observers believe, but it is easier and cheaper to realize in short-statured cereals.

2. Large-yielding short-statured rices were not invented by IRRI: they were known and also used in China, Sri Lanka and Taiwan before IRRI was established. But IRRI vastly increased the range and usefulness of such materials, largely through assembling a very large collection of land race materials, evaluating them for resistance to pests and diseases, and for adaptation to the wide range of environments in which rice is grown in Asia and elsewhere, and by breeding systematically for multiple objectives including large yield potential, combined heritable resistances to an ever-increasing number of pests and diseases, and the nutritional, culinary and aesthetic qualities required by different consumers. This has been promoted by the Genetic Evaluation and Utilization program conducted by a multidisciplinary team, and this example has been followed in other areas of IRRI's program.

3. The breeding has therefore had to be supported not only by a very substantial effort on genetic resources, but also by ecological, biological, physiological, economic and agronomic studies of morphology and ecophysiology of growth, and of pests, diseases, environments

and systems of production. The studies of nitrogen nutrition have also included critical work on sources of nitrogen, including biological nitrogen fixation (especially that associated with the symbiosis of the water fern Azolla and Anabaena).

4. As a result IRRI maintains outstanding basic and analytical work in a wide range of disciplines. The work is not only multi-disciplinary: it is increasingly interdisciplinary. This tradition appears to have arisen largely because scientists of all disciplines were obliged to work together on the evaluation of genetic resource and breeders' materials. An example of more basic work is the mapping of the 12 chromosomes using trisomics, which helped in the breeding of IR36 and in elucidating the relationships between indica and japonica rices.

5. At the start IRRI seems to have hoped to produce a small number of widely-adapted types, but in the event the diversities of environments, needs and constraints have frustrated this ambition. IR5 and IR8 which became available in the early sixties showed that much larger yields were possible than had previously been thought, but in most countries the markets were not enthusiastic about them. They have however provided the large-yielding, short statured chassis of a long series of numbered materials, extending already as far as IR64. One of them, IR36, has proved valuable in irrigated culture in many countries.

6. Though irrigated rice, with substantial or complete control of water, is the largest-yielding and most secure type of rice culture, there is in Asia an even larger area of rainfed rice grown without control of water, the so-called upland rice. It is also dominant in Africa, where land is seldom the limiting factor, and where labour-intensive irrigated rice has so far been little developed. IRRI has consequently started research on upland, on rainfed lowland and on deep-water (floating) rice.

7. From the start IRRI began to cooperate with national rice programs - first in Asia but later in Africa and Latin America. In some Asian countries which had worked on rice long before 1960, IRRI encountered difficulties from time to time, but these seem largely to have been overcome as reciprocal collegial relations have developed. In recent years cooperation with the People's Republic of China has grown significantly. In West Africa, IRRI works through IITA and WARDA, and in Latin America through CIAT. It seems clear that IRRI has cooperated in a number of highly successful national developments. For example, the International Rice Testing Program reaches about 70 countries. Other networks include from 7 to 17 nations. IRRI staff members are located at IITA and CIAT, and in Bangladesh, Burma, China, Egypt, India, Indonesia, Japan, and Thailand, and two staff members at IRRI have special responsibility for cooperation with the Philippines.

8. The program is reviewed each year by the International Rice Research Conference which discusses progress and joint planning for future collaboration. Joint research may be developed with national scientists on problems of common interest.

The training programs (general)

9. IRRI's terms of reference include

"4. to develop and educate promising young scientists, primarily from South and Southeast Asia, along lines connected with or relating to rice production, distribution and utilization, through a resident training programme under the guidance of well-trained and distinguished scientists".

10. This instruction does not include the word "research": it enjoins IRRI to train scientists, but not exclusively as research workers. In carrying out this instruction, from 1962 onwards, IRRI has provided training for 3,451 persons through 1983. These came from 58 developing and 12 developed countries (168 participants from the latter). IRRI appears to have provided proportionately more opportunities than most other Centers for degree-related (637 through 1983) and postdoctoral (217 through 1983) studies; and it has been helped substantially in the former by the University of the Philippines at Los Banos, on whose land IRRI was established.

11. Senior scientists at IRRI nowadays probably spend less of their time training the less senior participants than they once did. They probably also spend less of their time doing research. As the Center has grown and its organization has become more demanding, and as more staff time had to be devoted to coordination, management of work in other places, developing and reporting on special projects, and handling the stream of reviews (like ours) which breed like rabbits in the CGIAR System, the seniors seem bound to have less time for training.

12. A risk that could flow from this is that training comes more and more to be directed by persons who have not become distinguished as scientists, however well trained and distinguished some of them may be as educationists or communicators. It is possible to interpret some of the signals from IRRI in this way, particularly the separate management of graduate and postdoctoral training (on the one hand) from the Training and Technology Transfer Department, TTTD, on the other, and the division of training in the list of activities between research-related and instruction-related. If our perception is not unduly wide of the mark, we hope our colleagues at IRRI will think carefully about what this implies.

13. TTTD has many tasks which will help training at IRRI. But it also has a significant set of tasks relating to the development of in-country training. In this important domain TTTD has much useful work to do. It could study technical and economic needs (alongside the research programs) and existing training (level, quantity, quality) in cooperating countries, and it could then ensure that remedial or harmonizing elements were included in the training of participants from different countries at IRRI so that they could be more effectively trained in mixed international groups. A good deal of this seems to have happened without special intervention in the past, but no doubt it could be improved, at a price.

14. This sort of task is not reflected in the papers provided for us, which present TTTD as a top-down agency, which will develop in-country dissemination, teach nationals of cooperating countries what to teach and how to teach it, and how to deliver the message from on high to the end-users. The constraints to be overcome are described in terms of the effects of social and cultural differences in the learning process. As represented, the driving force is not national need but IRRI's strengths. Trainees will come from the nations to learn how to train, and to tell IRRI about their countries' needs. Technical course content would be validated at on-farm sites in the Philippines leading to adaptive research in the cooperating country. We do not think that this is really what is intended, but this is how it reads to a visitor, even one who is an old friend.

15. But nations differ in many more respects than social and cultural factors. They differ in national environment, in stage of economic and educational development, in place of rice in rural production systems, in need for additional rice and many other factors. They are not simply a homogeneous mass "out there", differing only in social and cultural factors affecting the learning process. Many of them developed in-country training for themselves, with or without IRRI's help, many years ago - for example India, Sri Lanka, Bangladesh, and Indonesia, all of which have used it to support substantial production achievements. In all IRRI's collaborating countries other Centers work also for national progress, and the relations among their separate in-country training activities must be considered.

16. We offer these comments not as criticism but as a suggestion that IRRI's training should develop in a bottom-up rather than in a top-down mode. We note that, in the organogram provided, the national systems (a diverse lot of entities, incidentally) are at the top of the page, and that all the arrows are double-headed, but the text is not. It contains many valuable thoughts, particularly about teaching methods, equipment and materials ("course-ware"), but it seems to us to be too closely modelled on the "sock it to them" tradition of so much of conventional education. IRRI training is not a village school. It sets out to disseminate knowledge to responsible adults in sovereign independent nations. It must start from their perceptions and needs, and it must be built from strong interactive elements, more like an effective school of business administration.

17. IRRI has established an academic council to oversee and advise on the improvement of its training programs, its policies regarding training materials, the movement of courses to national programs, and cooperation with universities. We were privileged to meet some of its members. This led us to wider thoughts about the implication of this admirable development, which we have set out in our main report.

#### Types of training provided

18. IRRI's training is divided into three classes: research-oriented programs, short-term courses, and special training courses. The research related programs (program class 1001) appear in

the organization chart as the responsibility of the Director, Research and Training. The participants include postdoctoral fellows, participants working in M.Sc. and Ph.D. degrees, and non-degree research fellows.

19. Postdoctoral fellows. All of these participants hold recent doctors' degrees. The total number to the end of 1983 was 217. 41 came from developed countries, and 176 from developing countries, mostly from Asia (169, 84 from India and 24 from the Philippines). 11 were women (8 from the Philippines). They work as independent research workers, usually under no more than nominal guidance from IRRI staff. IRRI sees them as probationers who will go on to lead in their national programs and improve standards in national universities.

20. Degree-related participants. All of these participants are graduates. Most of them come to IRRI to conduct research for their theses, and they fulfill the other requirements at the University of the Philippines, Los Banos, or elsewhere. Some are said to have conducted all of their thesis research in their own countries, presumably supervised in part by IRRI regional staff. The total number of degree-related participants, to the end of 1983, was 637 (435 M.Sc., 202 Ph.D.). 26 came from developed countries, and 611 from developing countries, again mostly from Asia (559, 161 from the Philippines, 91 from Bangladesh, 68 from Thailand and 42 from Indonesia. 56 were women, mostly from the Philippines (34) and Thailand (11). This is indeed a very substantial contribution and must require a large and continuing effort by supervisors at IRRI. In each of the years 1981 - 1983 there were more than 150 of these participants at IRRI. We imagine that the postdoctoral fellows, who increased over the period from 38 to 51, bear a share of the work.

21. Non-degree fellows. These participants (498 to the end of 1983) come to IRRI to work on special topics, usually for 6 months to 1 year. They are all B.Sc. or M.Sc. graduates, and 71 were women. Although the description of them provided for us suggests that they are supervised "apprentices", they seem to be, at least in part, the equivalent of the visiting scientists who figure in the programs of other Centers. We understand that these courses have changed with time and are to change further. Perhaps IRRI might consider whether it could increase the number of opportunities for intellectual refreshment in mid-career. We can see that it might not be easy to fund or accommodate a larger number, but we believe the need is real and substantial. This seems a suitable field for special project funding.

22. The IRRI staff list for 1983 includes the names of 19 visiting scientists mostly from developed countries. IRRI supports travel and maintains them, but does not pay them a salary.

23. The short-term and special training courses (program class 1002, instruction-related) appear in the organization chart as the responsibility of the Training and Technology Transfer Department (TTTD), located not under the Director, Research and Training, but in a separate line of command under the heading of global research services for which no Director is listed. We met the TTTD and the

Director, Research and Training together and the two streams of training activities clearly seem to be related but the philosophy of the structural difference was not explained and we grasped the difference too late to probe it.

24. The short-term courses (excluding a 2-week course in rice production) had trained 2,099 persons up to the end of 1983. Most were B.Sc. graduates or the equivalent. 166 were women. From 1964 to 1968 the only course offered was on rice production, but others were added as the years went by. The dates are given in the following paragraphs. The list of courses is sent in advance to cooperating nations and agencies, who say what they want.

25. The rice production training program (RPTP) (6 months, 1964-1983, 584 participants) includes applied research techniques and methods of disseminating new methods for producing rice; management of soil, water and pests; socio-economic topics; statistical methods; and communication. Like many similar courses at other Centers, this is not a course for beginners on how to grow rice. It is an up-grading course for professionals who already know something about the crop and need to become acquainted with IRRI's methods and results. Participants raise a crop, from seed to harvest, conduct experiments and make systematic observations on it, and analyze the results. The course is offered every year.

26. The cropping systems training program (CSTP). (6 months, 1969-1983, 442 participants) is said to teach participants to design and conduct applied and adaptive research for rice-based cropping systems in their own regions, to identify and solve production constraints in various crops (not rice alone) and cropping systems, and to use concepts in crop science to improve the ways in which farmers use their resources. It evidently studies farming systems, not rice systems, or even cropping systems, only. It has a sufficient economics component, and (knowing the scientists involved) we imagine that it includes studies of real life systems and methods of experimenting in them. It is of interest that this work began 15 years ago, long before OFR and the like became as fashionable as they are today. This course is offered every year.

27. The genetic evaluation and utilization (GEU) training program (4 months, 1975-83, 328 participants) includes studies of different types of rice culture, and of locations where pests or environments offer particular difficulties. Participants are taught methods of screening for tolerance or resistance, of crossing, and of evaluation and selection of progenies. They take home with them promising materials derived from varieties from their own countries, and so become links between breeding at IRRI, and in their own nations. This course was formerly offered twice a year, but is now offered only once, in order to release resources for the new upland rice course.

28. The course on soil fertility and fertilizer evaluation for rice (INSFFER) (4 months, 1979-83, 107 participants) deals with both biologically fixed (including Azolla) and fertilizer sources of nitrogen; and it is based on field and laboratory experimentation.

29. The course on integrated pest management (3 1/2 months, 1981-83, 74 participants) includes training in rice production, the biology, ecology and control of insects by various means, and the economic aspects. It emphasizes work in the field.
30. Shorter courses are provided in agricultural engineering (2 weeks - now three - 1975-83, 243 participants), largely concerned with farm machines developed at IRRI; agroeconomic methods (1 month, 1975, 1981-83, 42 participants); and irrigation water management (6 weeks, 1978-83, 139 participants). Former participants felt that the agro-economics course should include post-harvest topics, and be lengthened to do so.
31. A course on upland rice (4 months) was introduced in 1983, with 28 participants. It deals with production problems in upland rice, including climate, soils, weeds, water conservation, protection and the mechanization of harvesting. It will no doubt develop alongside the new research program on upland rice. The course invites lecturers from IITA, WARDA, CIAT and EMBRAPA.
32. A number of short courses are offered from time to time (various lengths, 1968 onwards, 112 participants in all).<sup>15</sup> Topics have included farm management (3 weeks); field studies with N<sup>15</sup>; varietal improvement in upland crops, particularly grain legumes; pest control and disease control in cropping systems; library and documentation work; research management; statistical methods (up to 3 months). A 2-week course on rice production (1967, 1970-83) has been provided since 1967 for a total of about 2000 participants who were not included in the statistics presented in paragraphs 10 or 24. This course is also used as the introduction to longer courses on other topics.
33. In-country training. IRRI appears to have trained many people on the job in collaborative programs with different nations, but formal in-country courses have been few. We have commented on future plans in paragraphs 13-16 above.

#### Training staff

34. In addition to the Director, Research and Training, there were 23 staff members (4 seniors, 19 assistants) in the Training and Technology Transfer Department at the end of 1983. Four were working in cooperating countries. The tasks of the department are conceived broadly. It coordinates the training activities; provides assistance in developing course schedules, choosing participants, logistics, methods, developing teaching resources, determining course standards, and evaluating courses; and studies the learning process in order to suggest improvements in methods. Goals and priorities in "technology transfer" are to be guided by a Technology Advisory Board, but since they must be country-specific, the task of the Board is likely to be complex. Perhaps the countries should have a say. We have commented more fully on TTTD in paragraphs 13-16.
35. In addition, one member of the IRRI team in Egypt has training responsibilities. None of the research programs includes a training officer of its own.

36. The research departments, working through a committee on non-degree training, offer the courses, develop curricula, provide expert guidance, devise research projects and generally supervise the courses as well as the degree-related and postdoctoral participants. The QQR in 1982 reported that 35 scientists taught in the rice production course and 68 in the genetic evaluation and utilization course.

37. It seems to us that training at IRRI is very well supported by the research staff and is indeed accepted as an integral part of their work.

#### Material resources for training

38. Teaching and laboratory facilities. We saw no dedicated training space; teaching is done in seminar and lecture rooms, in the laboratories of the programs, and in the fields of the Center.

39. Residential accommodation. IRRI can accommodate 200 participants in plain but apparently acceptable accommodation, and it has adequate refectory facilities. This accommodation is fully used, and it limits any expansion of the training program at IRRI.

40. Library. The large and admirably-managed IRRI library appears to be fully adequate to the needs of training participants; and it is well able to secure additional material from other libraries or from the world-wide data base systems.

#### Language

41. IRRI is anglophone, but about half its training participants are not proficient in English when they arrive. Even if they have learned English, they may have difficulty because the variants of English current in different parts of the world are not only in danger of becoming different languages - some have already done so.

42. In so diverse a set of regions as the rice-growing zones of the world, there is little to be gained by insisting that the instructors learn foreign languages. Moreover, English is increasingly the principal international language of agricultural science. Every participant who wishes to learn English (including professional conversational English) should be helped to do so, perhaps using self-instruction audio tapes with portable individual equipment and texts. Audio-visual aids and computer-based instruction might help if they are sufficiently cost-effective. This seems likely to be particularly important for China. It would not be sensible to exclude participants who need training at IRRI simply because their English could not pass the TOEFL tests; the correct answer is surely to help them to improve their English.

43. In their work on rice in francophone West Africa WARDA and IITA use French effectively, and CIAT teaches rice courses in Spanish in Latin America.

Subsequent contacts, follow-up, networking

44. IRRI's main links with many former alumni are continuous, through the national cooperative programs. But IRRI has also established an association of alumni and published a volume of the portraits of most of them. We see some difficulties in keeping the portraits up to date as the participants age. The IRRI newsletters and annual reports, which are valued by participants, are a powerful aid, and IRRI has, we believe, experimented with reply cards inserted into the former. Follow-up is an expensive business but we feel that within reason the cost is justified to maintain the "invisible college" of the IRRI family and benefit more fully from the large investment in human capital. The International Rice Testing Program and INSFFER (see paragraph 28) are among the outstandingly successful networking efforts in the CGIAR System, with a Center at the hub.

Costs and funding

45. In 1983, out of a total core expenditure of US\$ 20.732 M, IRRI's expenditure of core funds on "training" stated as such amounted to US\$ 1.250 M, but an additional US\$ 0.397 M was spent under "Training and Technology Transfer". Included in the budget item for the latter are two full-time positions, whereas "training" has no provision for staff. Additionally, special project funds of more than US\$ 0.200 M were largely devoted to training. The "Training and Technology Transfer" component was reclassified as a separate "research" program beginning in 1984. This program is estimated to have had expenditures in 1984 of US\$ 0.823 M, and "Training" per se of US\$ 1.371 M, making a total of US\$ 2.194 M out of a total estimated budget (before devaluation of the Philippine peso) of US\$ 22.053 M. It is proposed that the total of the two allocations to training be increased for 1985 to US\$ 2.419 M and to US\$ 2.431 M for 1986.

Evaluation

46. TTTD evaluates the progress of participants during training, and the courses themselves at the end. It is also interested in evaluating their subsequent performance. About 1981 IRRI sent a questionnaire to the 1700 alumni who had been at IRRI up to November 1980 to find out what each was doing, how relevant his training had been to his work, what effect it had had on his professional advancement, and how useful he felt his stay at IRRI had been. Alumni were also invited to comment on the adequacy and relevance of their training and to suggest improvements. By the end of a second round of requests, 50% had responded. This was increased (to 72% in the Philippines) by more intensive efforts but the patterns in general were not significantly altered.

47. 94% of respondents were in universities (17%) government agricultural agencies (72%) and private corporations (5%). 55%-57% were in research, irrespective of type of course. 21% of short course participants were in extension and 27% of degree-related participants were teaching. Of both lots, 14% were in administration.

48. 27 alumni were directors of rice institutes, and 8 had received national recognition awards. 40% of alumni were involved in collaborative research projects with IRRI, and 70% are in touch with IRRI scientists and receive IRRI literature. All have advanced professionally with time, but 20-30% of those short course participants who came to IRRI with B.Sc. have gone on to graduate training or taken diplomas. They might have done all these things anyway: none of them can be ascribed exclusively to IRRI training.

49. In a separate enquiry, 149 national supervisors (who were in charge of nearly half the participants from 11 countries) said that participants were more responsible, committed, competent and technically knowledgeable, and that 77% were training others, mainly their own staff. They felt that the programs were satisfactory, but they wanted more local training related to local needs, more training for people other than university staff (and presumably research staff), more training in physiology, marketing and statistics, and an assembly of alumni every 2 or 3 years. Some felt that IRRI training should concentrate on research and leave extension to the countries, but we know that most countries like to send extension people to IRRI to learn more about research.

50. Yet another survey found that IRRI scientists were keen on training and its effects, and were glad to have postdocs and graduate students. Some felt that lectures took too much time away from their research, but were ready to help to prepare audio-visual (slide/tape) materials to facilitate training. They pointed to language difficulties and they wanted IRRI to develop short courses in-country - which has of course happened in many cases without much effort from IRRI.

#### Associations in training

51. In the host country. There can be very few institutions concerned with rice in the Philippines with which IRRI is not in contact: IRRI is a national as well as an international resource. It played a notable part in training for the Masagana 99 program; and has trained many staff in the national institutions. The most important is the University of the Philippines at Los Banos. IRRI's association with UPLB has achieved what the founding fathers intended and more, and it has set an example to many other Centers. We were told at UPLB that IRRI staff are conscientious about their supervising responsibilities and observed the rules of the University; and that UPLB gains at least as much as IRRI from the relationship. 60 IRRI staff are faculty members of UPLB, and UPLB staff are honorary research staff of IRRI. UPLB has an M.Sc. course in seed technology. IRRI also works with Central Luzon State University in the Philippines and has trained one student for a degree at the Ateneo de Manila University.

52. Other nations. Similarly there can be few centers of rice research anywhere in the world with which IRRI is not in contact, and for which it has not trained people. But of specific cooperation in training we have few examples except for universities. The universities with which IRRI now has formal agreements include Cairo University, Egypt; Institut Pertanian, Bogor, Indonesia; Universiti

Pertanian, Malaysia; Post-Graduate Institute of Agriculture, Sri Lanka; Kasetsart University and the Asian Institute of Technology, Thailand; Bangladesh Agricultural University; and Cornell University. However, there are also ad hoc arrangements under which students graduated in 1983 at 4 universities in the US in addition to Cornell, two in Germany and one each in Britain and Japan. We were told that IRRI expects to cooperate in future with agencies in India to train research and extension workers together in the 6 eastern states of India - as was done in Bangladesh.

53. Other IARCs. IITA and WARDA provide rice training in association with IRRI in West Africa, and CIAT does the same in South America.

#### Effects of training on research and development in the nations

54. We have noted above that 27 IRRI alumni direct rice research institutes in 9 Asian nations, and that 98 have received national recognition and awards in 6 Asian and a number of other countries. No one we met doubts that the useful products of IRRI's research have been delivered to the nations largely through the training participants, or that this has been responsible in part for production gains or for lower costs in many of them. Officials in the Philippines, Thailand, Indonesia and Bangladesh expressed this view. In Nepal the gains are seen as coming from the Integrated Cereals Program, but that would have achieved less without the 51 people trained by IRRI. India values IRRI's contribution, but India's vast program has so many competent rice workers that the 303 who have been to IRRI may have had no more than a synergistic effect.

#### Future training needs and plans

55. We feel that IRRI has done what it could of what has been needed in the past. Its future tasks in training must be predominantly directed outwards - to strengthen capacity in rice research and teaching in universities, and in short courses, in rice-growing countries. An increase in the numbers of non-degree fellows might help here. IRRI should however not abandon rice production training, at least in the foreseeable future. When all rice-growing nations are able to offer these courses themselves, and for each other, as "in-country" business, IRRI will still need to support them through short courses in which national trainers can keep themselves informed about IRRI's research results and teaching methods.

56. We think IRRI has done and is doing a remarkable job in degree-related and postdoctoral training. The next stage is surely to support national universities in doing these things for themselves, as rice research advances in them and in their countries. Some IRRI staff members would like to receive participants from hitherto under-represented nations - Burma, the Mekong countries, and South America were mentioned.

57. The main new need is in training related to rainfed rice. We imagine that as the research on which it is based advances, training will advance also, particularly in those countries in which upland rice has, at least for a time, both comparative advantage and social significance.

Study Team Summary Reports on Findings: THE CENTERS

L. ISNAR - THE INTERNATIONAL SERVICE FOR NATIONAL AGRICULTURAL RESEARCH

5 October, 1984. Araujo, Bunting, Herz. Further information gathered in 5 out of 18 countries visited (Mexico, Burkina Faso [Upper Volta], Colombia, Kenya and Zimbabwe).

History and current pattern of activity

1. ISNAR began work at its base in The Hague, Netherlands, in 1980. Its purpose is to help governments of developing countries to strengthen the national agricultural research system through improved organization, planning, manpower development, infrastructure and financial and program management. It also endeavours to help nations work more effectively with donors, and to improve the planning of research itself, and the setting of research priorities. It also seeks to promote cooperation between the national systems and the IARCs.

2. Though many of ISNAR's staff were formerly employed in senior research or academic positions, it is not intended to be a research organization. It is primarily an analytical and service institution. However, as its country specific activities advance, it will no doubt begin to delineate general principles among them and so move towards broader comparative concepts and hypotheses which can be tested in a more general research mode.

3. ISNAR's advice to nations is of course based on a wide range of practical experiences which are applied in the analysis of specific situations. These experiences, and the analytical procedures they suggest, have to be explained to personnel of national and international agencies, and this is the basis of ISNAR's training function.

4. ISNAR has worked so far in Fiji, Thailand, Bangladesh, Ivory Coast, Kenya, Madagascar, Malawi, Burkina Faso, Zimbabwe, Burundi, Costa Rica and Guyana.

Training programs (general)

5. ISNAR's training is intended to make participants aware of how management works and what it can do, and to teach some management concepts and skills. It is carried on in seminars, workshops, conferences and short courses, which have been organized, mostly in places other than The Hague, since 1981. To the end of 1984, there have

been 21 of these, and 14 are planned for 1985. ISNAR has not funded degree-related work, but some staff members may have based theses on their work.

Types of training offered

6. Seminars. So far, there have been 6 seminars - on National Agricultural Research Systems in Africa, Nairobi, 1981 (2 days) and in Asia (Los Banos), 1981 (2 days); on Agricultural Research in Rwanda, Kigali, 1983 (8 days); on Agricultural Research Policy, Minneapolis, 1984 (12 days); Agricultural Research Management, Yaounde, 1984 (13 days); and on ISNAR's Experiences and Perceptions for the Future Concerning National Agricultural Research, The Hague, 1984 (4 days).

7. 9 seminars are projected for 1985. Topics are Strengthening Agricultural Research Systems, The Hague (5 days); Agricultural Research Management in the Sahel; Human Resource Development in Agricultural Research, Bangkok; Women and Agricultural Technology, Bellagio (5 days); Manpower Planning and Personnel Management, Dhaka; Agricultural Research Policy, Minneapolis (11 days); Agricultural Research Management under Resource-Scarce Conditions, Khartoum; Agricultural Research Management, Yaounde; and National Agricultural Research and ISNAR, The Hague.

8. Workshops. 11 workshops have been held; none is planned for 1985. Topics have been: Strategies to Meet the Demand for Rural Social Scientists in Africa, Bellagio, 1981 (5 days); Agricultural Research Management, IITA, 1982 (13 days); Agricultural Research Management, India, 1983 (12 days); Agricultural Research Policy and Management in the Caribbean, Port-of-Spain, 1983 (5 days); Organization and Management of Research with a Farming System Perspective, The Hague, 1983 (4 days); Agricultural Research Cooperation in the Near East and North Africa, Nicosia, 1983 (3 days); Agricultural Research Planning and Management, Washington, D.C., 1983 (5 days); and in Mananga, Swaziland, 1984 (25 days); Agricultural Research Policy and Organization in Small Countries, Wageningen, 1984 (5 days); Research Program Evaluation, Dhaka, 1984 (4 days); and Strengthening Management in National Agricultural Research, Amman, 1984 (4 days).

9. Conferences. 5 conferences have been held, and 4 are planned for 1985. Past conferences have been on International Associations to Strengthen National Agricultural Research, Bellagio, 1981 (4 days); Training Needs in Agricultural Research Planning and Management, The Hague, 1982 (4 days); Issues in Agricultural Research in Latin America, Madrid, 1982 (5 days); Potential and Challenges of Agricultural Research for Development in Asia, Jakarta, 1982 (6 days); and the First Congress of the African Chapter of the International Federation of Agricultural Research Systems for Development (IFARD), IITA, 1983 (5 days).

10. Topics intended in 1985 are Strengthening Management of National Agricultural Research, Singapore; Implementation of Agricultural Research in the Near East and North Africa, Aleppo; Strengthening National Agricultural Research Systems in Africa; and Agricultural Research in the 21st Century, Brasilia.

11. Courses. The workshop on Agricultural Research Planning and Management held at the Mananga Training Center of the Commonwealth Development Corporation in Swaziland in 1984 (with strong help from CDC staff) was very well spoken of by the participants. It is to be followed by a course on Agricultural Research Management at the same location in 1985.

#### Training staff

12. ISNAR has no full time training staff. Its training is done by research staff and consultants.

#### Resources for training

13. At its headquarters, ISNAR has a large conference room and some smaller seminar rooms. Most of its training is done on the premises of other institutions, using their accommodation. It has a limited library but has access to other, large resources in the Netherlands and internationally.

#### Costs and funding

14. In 1983, ISNAR's expenditure of core funds on training and conferences amounted to US\$ 0.354 M (out of a total core expenditure of US\$ 3.318 M). ISNAR estimates that costs in 1984 have been of the order of US\$ 0.439 M from core (US\$ 3.555 M total). It is proposed that the allocation be decreased somewhat for 1985 to US\$ 0.407 M and remain at this level thereafter.

#### Evaluation

15. We saw no systematic evaluation of ISNAR's Training, but (as has been noted) the Mananga Conference was praised. We also heard favourable comments on a meeting at IITA.

#### Subsequent contact with participants

16. This seems to be informal and personal.

#### Associations in training

17. Host Nation. ISNAR has cooperated with the Agricultural University at Wageningen.

18. Other Nations. Paragraphs 6 - 11 indicate the locations where training has been given. Local institutions have been co-sponsors in many cases. The Governments of The Netherlands and of Spain have also been co-sponsors.

19. Other IARCS. ISNAR has worked in training with IITA, CIMMYT, and ICARDA.

20. Other International Agencies. The list of sponsors includes IFARD, SEARCA, IDRC, Ford Foundation, Rockefeller Foundation, IADS, The Economic Development Institute of the World Bank, IICA, the German Development Aid Foundation (DSF), CDC, UNDP, CILSS, the Consortium for Development in Africa and FAO.

Effects of Training on Research and Development in the Nations

21. It is too soon to expect visible effects on either research organization or development of ISNAR's work, but the cooperation in manpower planning with Kenya should lead to useful consequences soon.

Training needs for the future

22. Our main perceptions are at opposite ends of ISNAR's spectrum of interests - the design and execution of individual research programs, the building blocks of the whole structure; and the national agricultural knowledge systems as a whole, of which research is but one part, but which have to work acceptably in all parts if any research organization is to be productive. We discuss the latter in more detail in our main report, and we believe that ISNAR training is bound to take account of it, and of the relations between knowledge and development.

23. As to the former, we know that many new entrants to the research profession, even those with M.Sc. and Ph.D. degrees, cannot design a logical, coherent, feasible and economical program of research. Unless these building blocks are sound and productive, the management edifice will be a useless hollow shell. Most new entrants can relatively quickly learn how to design programs. They can be helped by group discussions of cases coupled with individual tutorial sessions. Perhaps ISNAR could promote action in this area also.

24. Finally, ISNAR's operating programs themselves could surely provide outstanding training experiences for participants.

Study Team Summary Reports on Findings: THE CENTERS

M. WARDA - WEST AFRICA RICE DEVELOPMENT ASSOCIATION

14-18 March 1984, Araujo, Bunting, Herz. Further information gathered in 3 out of 18 countries visited (Nigeria, Burkina Faso (Upper Volta), Liberia)

History and Current Patterns in Research

1. WARDA was established in 1971. It is a regional, inter-governmental association of 16 West African member states (Benin, Burkina Faso, Chad, Gambia, Ghana, Guinea, Guinea Bissau, Ivory Coast, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo). WARDA's function in practice is to assist member states to increase rice production through research and development activities.
2. Its research program includes the screening and testing in the member countries of large numbers of rice varieties and populations from member countries, IITA, IRRI, IRAT and other sources, experiments and trials on fertilizer, water management, production practices and machinery, and it seeks to improve seed production and storage and post-harvest methods. It supports special research projects on mangrove rice at Rokupr in Sierra Leone, on deepwater rice at Mopti in Mali, on upland rice at Bouake in Ivory Coast, and on irrigated rice at Richard Toll, Senegal. It has not worked on rice in hydromorphic (seasonally wet valley) situations. In francophone countries WARDA benefits substantially from earlier or present work on rice by IRAT. Its development program advises governments on policy, economics and development projects. The research and development programs cooperate in a technology assessment and transfer sub-program which has identified some of the obstacles which hinder increases in output in West Africa. Its training program is discussed below.
3. The organizational structure of WARDA includes a headquarters office in Monrovia, Liberia (including library, documentation and information services) the training center at Fendall, also in Monrovia, and five sub-regional coordinators at Banjul (Gambia), Conakry (Guinea), Bobo-Dioulasso (Burkina Faso), Accra (Ghana) and Niamey (Niger).
4. Its operations (other than training) are largely decentralized to the member nations, most of which are too small, too poor, and too underdeveloped to mount full research and development programs by themselves. In structure, it consists therefore of a network which, provided it is effective, is very appropriate to the circumstances of the region; but it is hampered by difficulties of communications and travel in the region.

5. The research program is aimed very much at the interface with extension and production, and apart from some crossing and selection it does very little work of a more innovative or analytical character to address the specific scientific and technical difficulties of rice production in West Africa. In this sense it is a survivor of an earlier period in which researchers expected to find cultivars of wide adaptation.

6. WARDA employed 55 scientists in 1983, 30 of whom work in the special projects and the rest in national programs.

7. The CGIAR has supported the coordinated variety trials since 1974 as a means of transferring promising materials and methods from IRRI and IITA to the West African nations; and it also contributes to the support of the Training Department. The link with IRRI is partly direct and partly through IITA, which has a liaison officer at WARDA headquarters in Monrovia.

#### The training program (general)

8. Since WARDA began to offer training in 1973, about 1000 persons have followed courses lasting from 2 weeks to 6 months, mostly at Fendall but also in member states (Burkina Faso, Sierra Leone, Ivory Coast, Benin, Togo). Thirty-one persons (11 from the special research projects) have worked or are working for higher degrees; 25 of them have obtained degrees (19 M.Sc., 6 Ph.D.).

9. Most participants appear to have been qualified and experienced agricultural workers before they were trained and all had worked with rice, 75% for more than one year. They are nominated by and return to member governments, each of which is entitled to send two persons to each course. Not all entitlements are taken up, partly because not all the nations are equally interested in rice or equally eager to expand the size of their staffs working on rice. There do not appear to be any national or regional projections of manpower needs for rice research and development. Courses are announced about 6 months in advance, and there are severe administrative delays which also limit the number of participants. Up to October 1983, when 907 persons had attended courses, Senegal had sent 90; at the other extreme Niger had sent 30 only. On the average 38 weeks of training have been provided for 30 persons each year at Fendall, a creditable figure if one allows for the time needed to prepare the courses, and the administrative delays.

10. Fendall is located on the campus of the University of Liberia in Monrovia. It is not a research base and it is not in a rice-growing region. Apart from the library and communications services and the development program, the headquarters of WARDA in Monrovia is not a professional scientific or technical base either. The training at Fendall is not, therefore, provided in a research environment. In this it differs completely from training at the headquarters of the other CGIAR Centers.

11. The training at Fendall is, however, well managed and appears to be valued both by participants and by governments and research workers in member states. Some regard it as the most successful part of the

WARDA program. The 1984 External Program Review advised that more of the training should be done in the national programs and special projects, and that the facilities at Fendall should not be extended apart from increasing dining and common room space. We concur.

#### Types of training provided

12. Rice production specialist training (251 participants up to October 1983). This is a six months' course, May to October. It is said to be similar in content to the IRRI course, and to be updated as the IRRI course evolves, but the circumstances at Fendall and IRRI are so different that the two courses must differ substantially in character.

13. Shorter (specialized) courses (656 participants up to October 1983) are provided, not necessarily every year. There are two for field assistants (234) and for research assistants (46), of 6 and 8 weeks duration respectively. There are 6-week courses on water management (42), integrated pest management (28), seed multiplication and certification (74), post-harvest technology (particularly milling) (123), and the management of rice projects (95); a 3-week refresher course on rice milling (14), and a 2-week course for rice scientists and extension workers together (251).

14. The maximum number of participants per course is 32 - the capacity of the dormitories. The number of persons trained per year was 60 in 1973. No course was offered in 1974. From 1975 to 1983 the number increased from 22 to 136.

15. WARDA has in addition provided specially designed courses for individuals or groups on topics requested by member states (control of small vertebrates, Azolla, seed laboratory technicians), training in library sciences, cataloguing and dissemination; language training for WARDA staff in English or French, and occasional courses on mechanization, and on audio-visual communication and extension.

16. Degree-related training is mentioned above (paragraph 8). We have little further information on this training. Most of it was supported by donors. In 1982-83 awards were made to staff of special projects for study in the United States or France, and in 1983 France and Belgium offered awards. In earlier years some students are said to have studied in universities in Africa.

17. The training of trainers is mentioned but does not generally seem to have been implemented, the exception being a two-month sequence on communication, extension and teaching of science and methods for rice production specialists.

#### Training staff

18. The Headquarters staff of the Training Department consisted in 1984 of a Director and an Assistant. During our visit the latter post was held by a Swiss Technical Assistance Officer. Between them, they ran two Divisions of the Department - pedagogical support (both for the

Training Center at Fendall and for training in the member nations and sub-regions) and planning and follow-up. These Divisions (we were told) were to be combined, which follows a suggestion of the EPR. A proposal for a second assistant had been made but we do not think it has been implemented.

19. The staff at Fendall, at the time of our visit, consisted of a Chief, 3 training officers and two interpreters. Much of the teaching of courses is done by scientists from the nations or from WARDA projects, and by an engineer attached to the Development Department. Invited guest lecturers are brought in as required.

20. The EPR felt, and we agree, that the sub-regional coordinators could and should do more in selecting participants and organizing training regionally and in the member states: and we believe that the special projects could properly include more in-service training activity. The Center at Fendall is useful, but as we have suggested above (paragraph 10) its usefulness is limited. Training should move towards the scenes of action in research and development.

#### Material resources for training

21. Teaching, Laboratory and Residential Space. The Fendall Center was established in 1976. It has 1 classroom equipped for simultaneous translation, offices for the Chief and some of his staff, dormitories for 32 persons, a kitchen, refectory and lounge, and a limited area (a few hectares only) of undulating, and partly swampy, and very heterogeneous land. The Development Department has workshops, rice hulling plant, and seed technology facilities, and the Research Department has a seed storage facility which seemed no more than adequate. While we were there, we were shown how the kitchen, refectory and common room space were to be expanded when funds permitted. The expansion is certainly needed. We do not, however, feel enthusiastic about increasing the dormitory space at Fendall. Any funds available for that purpose could be better used in developing or improving the resources for training in the region and in special projects.

22. The library at Fendall is very limited and access by the students living there to the much better collection at headquarters (said to contain 12 000 volumes, 800 periodicals and 1550 monographs, quarterly collection lists, and photographic and microfilm facilities) is not easy.

23. Language. The interpreters at Fendall seemed to us to be very competent and knowledgeable, but more strength is needed. The Department would like to strengthen its capacity to translate written materials, and has therefore requested a third post for a translator. This seems to us to be a reasonable request, since more bilingual language competence is badly needed in West Africa, but we think it should be supplemented by equipment and materials for self-teaching in English and French, of professional as well as conversational language for WARDA staff as well as for training participants.

### Evaluation

24. WARDA does not evaluate its training; and until it reviews its use of funds, along the lines suggested by the 1984 EPR, we do not think it has the resources to do so. A Swiss expert studied the effects of training on about 100 participants in April-June 1982. He found that all participants valued their training and most wanted more and that their employers were also pleased with the effects. He also commented inter alia on the need to assess the future training needs of the nations (particularly as so many people have already been trained); to strengthen the contributions of the sub-regional coordinators, to prepare intending participants for their courses, to prepare more and better training manuals, to strengthen language capability, and to strengthen contacts with former participants. Our colleagues in WARDA appear to include all these points in their ambitions for a more prosperous future.

### Association in training

25. WARDA has links in research with IITA, IRRI and IRAT, and its Training Center is located on the campus of the University of Liberia, but in training it seems to stand very much on its own apart from using guest lecturers. Its main associations are with member countries. It has limited links in training with universities other than those to whom it sends higher degree students.

### Costs and funding

26. WARDA is supposed to be supported in part by member states, but in recent years many have failed to pay, so that the CGIAR and 18 bi- and multi-lateral foreign donors are almost the sole sources of funds. Of the total budget, in 1981-82, 10 to 13% respectively was used for training, and 6 and 8% for documentation and communication. USAID, Japan, Switzerland, Belgium and CGIAR were donors for training in those years. The CGIAR contribution to training in both 1983 and 1984 was US\$ 0.129 M, and WARDA proposes that it should increase to US\$ 0.167 M each year in 1985 and 1986.

### Effects of training on research and development in the nations

27. The 1000 people or so who have been trained by WARDA provide the nucleus of middle level technicians for production, research, management and training for rice (and to a small extent other crops also) in all member countries. We were told by the representative of FAO in Liberia that WARDA is almost the sole source of trained manpower at these levels in Liberia. The Head of the Training Bureau of the Liberian Ministry of Agriculture spoke warmly of WARDA training. He told us that of the 22 persons who had attended the rice production specialist courses, 18 or 19 are still working on rice, and that about 40 others had benefitted from the short course for extension workers.

28. WARDA training has helped to build up professional resources in the knowledge systems of the nations, but this is not yet associated

with significant effects on development. In West Africa, knowledge is not the principal factor restraining progress.

#### Future needs for training

29. Since no-one knows the size or shape of the needs of the member nations of WARDA for professional workers in rice research and development, training needs for the future cannot be estimated quantitatively. With 1000 rice workers already trained, it may be that one of the future needs will be to keep them up to date and perhaps to extend their knowledge and skills - for example, to equip them to train others in the nations or to cooperate more effectively with both more specialized workers on the one hand and with producers on the other. But the time may not be far off when WARDA's past modes of training for the 16 nations will begin to seem less important than they were 12 years ago.

30. We share with the EPR the feeling that the present provision for more analytical studies of many kinds (particularly on crop protection, on systems of production, and on breeding for multiple objectives including consumer requirements) is deficient in West Africa generally. We feel that as population grows and development proceeds, extra output is likely to be economically and socially desirable, at least in those environments in West Africa which have comparative advantages for rice growing. While the most urgent measures needed to evoke this output are probably in national economic management and physical infrastructure, means of increasing output at a lower unit cost of product will be needed sooner or later. (The example of rice in Colombia is bound to affect our thoughts here). For this, stronger and deeper scientific and agronomic bases will be essential. IRRI and IITA can or could provide some of them, but much of the work will have to be done in the actual environments which are favourable for rice growing. WARDA has an appropriate structure - at least in form - to support such a development.

31. So we feel that in order to advance training, WARDA may need to move in four ways:

- a) study the West African environments as resources in order to determine which have comparative advantages of different kinds for rice;
- b) study of the constraints on increasing output of rice in those environments, and the scientific and management actions necessary to overcome them and post-harvest and quality problems.
- c) make an outline assessment, with governments, of possible development paths for these environments, bearing in mind the costs and returns of different paths (including competition from other ways of using resources);
- d) develop a quantitative (or perhaps semi-quantitative) projection of professional manpower needs in different locations and different subject fields, including those needed by WARDA itself, to support the cooperative regional endeavour.

32. From all this, the demands on WARDA - and on universities and other training agencies - for the necessary manpower can be assessed and WARDA's long-term role determined. In all this, the sub-regional coordinators and the special projects will surely have important parts to play.

## Study Team Summary Report on Findings: THE COUNTRIES

## INTRODUCTION

The Study Team visited the host nations of the ten IARCs which are located in developing countries (Mexico, Nigeria, Liberia, Philippines, Colombia, Peru, Syria, India, Ethiopia, Kenya) and eight neighbouring countries (Guatemala, Costa Rica, Burkina Faso [Upper Volta], Indonesia, Thailand, Bangladesh, Nepal, Zimbabwe). Country Studies were commissioned in six countries, of which two (Bangladesh and Kenya) were also visited by the Study Team. The remaining four were Tunisia, Ecuador, Senegal and Sri Lanka. This annex reviews briefly some aspects of the 22 countries included in the two parts of the study as a whole. The visits were not long enough, and too little time was available subsequently, to permit accounts to be included here of the national agricultural knowledge systems of the 22 countries. Separate studies would be necessary to achieve this very desirable objective.

The numerical and other information used in this report is taken almost entirely from our conversations in the countries, from the Country Studies, and from official sources. Table 1 presents some relevant statistical data about the 22 countries. The sources are the FAO Production and Trade Yearbooks for 1983 (volumes 37), FAO Country Tables 1984, other data held by FAO, and the IBRD World Development Report 1984.

## MEXICO

Mexico is in the "upper middle income" group in the IBRD list. The GNP per head of her 76 M people in 1982 was US\$ 2,270. One third of the economically active population was in agriculture in 1983. Industry (including oil), communications and financial institutions are well developed. The agricultural environments range from lowland rain forest to desert and cold arid mountain plateaux; and the agricultural systems range from subsistence to irrigated farming of modern type. Of total exports valued at US\$ 21.2 billion in 1982, US\$ 1.37 billion were agricultural. Among these exports no IARC commodity was significant: they were made up mainly of coffee, fruit and vegetables, and fibres, which between them accounted for US\$ 1 billion.

The reported arable area of Mexico is 21.9 M ha. The recorded harvested area of IARC crops is about 14 M ha (equivalent to 65% of arable area). The more important products of agriculture in 1983 included about 14 M tons of maize, 6.4 M tons of sorghum, 3.7 M tons of wheat, 0.65 M tons of rice, 1.4 M tons of Phaseolus beans and about 8.4 M tons of milk and meat.

In 1983 the total quantity of cereals produced was 25.2 M tons; and a further 8.5 M tons net were imported, mainly maize and sorghum. Mexico appears to be self-sufficient in rice. She imports large quantities of soya and other oilseeds. The estimated (1979-1981) food intake provided 2,890 kcal of energy (406 from animal products) and 59 g protein (22 from animal products) per day - an adequate diet which accords with the average level of income. The average life expectancy at birth is 64 years.

The Study Team visited, or met senior staff members of, the following institutions in Mexico: Instituto Nacional de Investigaciones Agricolas (INA); Fondo de Garantia y Fomento para la Agricultura e Fideicomisos Agricolas (FIRA); and the Colegio de Postgraduados, Chapingo.

IARCs which have trained Mexican participants are CIAT (117), CIMMYT (146), CIP (37), IBPGR (8), ICRISAT (3), ILRAD (1) and IRRI (10); total 322.

Though there are said to have been differences in the past, our Mexican colleagues evidently regard CIMMYT as a primarily Mexican institution. The considerable development of irrigated wheat production in the northern states has been supported effectively by that Center and its predecessor, the Office of Special Studies, for over 40 years; and CIMMYT training is highly valued in the national institutions.

We did not see enough of these institutions to assess the national knowledge system in this large country; but we were told of impressive numbers of persons trained and to be trained in the national institutions. Using the term "professional" in the sense of "qualified through formal training", we understand that by the year 2000 Mexico expects to have about 450,000 professionals in the public and private services and practice of agriculture. This is a most ambitious program, in which many IARCs besides CIMMYT may well be able to assist.

#### GUATEMALA

In the World Bank listing, Guatemala, with GNP per head of US\$ 1,130, is in the lower middle income band and is the poorest country we visited in Latin America. Of the population of 7.9 M in 1983, 4.2 M were agricultural, and the proportion of agricultural to total economically employed persons was 53%. Of the total GDP of US\$ 8.7 billion in 1982, agriculture contributed 23%. Of total exports of US\$ 1.17 billion in 1982, US\$ 0.73 billion were agricultural, and of these US\$ 0.36 billion (about half of the total) were coffee. No other single agricultural commodity was significant among the exports.

The arable area of Guatemala is recorded as 1.3 M ha. The harvested area recorded for IARC crops is about 1.1 M ha (equivalent to 87% of arable area). The more important products of agriculture in 1983 included about 1 M tons of maize, and about 89,000 tons of Phaseolus beans. Other products included 340,000 tons of milk and 111,000 tons of meat of all kinds, 6.6 M tons of sugar cane from which about 0.27 M tons of sugar were exported, and 675,000 tons of bananas of which about 316,000 tons were exported.

Guatemala produced about 1.21 M tons of cereals in 1983 and imported a further 130,000 tons. Most of the production was maize (about 1 M tons) and the imports were mainly wheat and flour. Guatemala's output of food appears to have been increasingly well ahead of the rate of population growth during the past 15 years, and food imports seem relatively modest. But the estimated (1979-81) food intake provided only 2,138 kcal of energy per head per day (211 from animal products). Of 58 g protein per head per day, 15 only came from animal products. These figures suggest a national diet which is no more than marginally sufficient, and may be inadequate for many. Nevertheless, the average expectation of life at birth is 60 years.

The Study Team visited, or met senior staff members of, the following institutions in Guatemala: Institute of Agricultural Science and Technology (ICTA); Nutrition Institute of Central America and Panama (INCAP).

IARCs which have trained Guatemalan participants are CIAT (129), CIMMYT (40), CIP (15), and IBPGR (5); total 189.

Our visit to Guatemala was too brief to permit any useful assessment of the national agricultural knowledge system.

## COSTA RICA

Costa Rica is a "lower middle income" nation in the IBRD list. The nation is small (2.3 M people in 1983) and the GNP per head in 1982 is recorded as US\$ 1,430. One third of the economically active population is in agriculture. Though not, on average, wealthy, the country appears to be well developed with respect to infrastructure and communications. The agricultural environments range from humid lowlands to cool humid elevations. The gross domestic product in 1982 was US\$ 2.6 billion, of which 21% came from agriculture. Total exports in 1982 were valued at US\$ 872 M, of which US\$ 605 M were agricultural. Coffee contributed US\$ 246 M, and bananas and other fruits US\$ 253 M.

The arable area of Costa Rica is recorded as 0.28 M ha. The harvested area recorded for IARC crops is about 0.22 M ha (equivalent to 79% of arable area). No IARC crop is significant among Costa Rica's exports, but the more important products of agriculture in 1983 included 2.5 M tons of sugar cane (from which was derived an export total of about 55,000 tons); 69,000 tons of meat, 320,000 tons of milk, and 212,000 tons of rice.

The total quantity of cereals produced in 1983 was 376,000 tons, and an additional 160,000 tons was imported (wheat and flour 110,000, maize 50,000 [to add to a domestic total of 113,000]). The estimated (1979-81) food intake per head was 2,683 kcal of energy (650 from animal products) and 63.8 g protein (31 from animal products) per day - a better average diet than is recorded for any other country we visited in Latin America. The average life expectancy is 74 years, a remarkably large value for a nation with so small an average GNP per head.

The Study Team visited, or met senior staff members of, the following institutions in Costa Rica: National Council of Production; the University of Costa Rica at San Jose; the Ministry of Agriculture; the Inter-American Institute for Agricultural Cooperation (IICA); and CATIE (at IICA headquarters).

IARCs which have trained participants from Costa Rica are CIAT (69), CIMMYT (13), CIP (26), IBPRGR (6), IITA (1) and IRRI (1); total 116.

Our visit to Costa Rica was short and concentrated, and its main purpose was to learn from the national and regional personnel and institutions how they viewed the training provided by IARCs. However, we were impressed by the academic and research resources concentrated in this small country, and we felt that they are in fact working well together.

## NIGERIA

Although Nigeria is a substantial oil producer, the GNP per head of her population of 85 M people in 1982 was no more than US\$ 860, placing her in the middle of the range of lower "middle income" nations. The distribution of wealth is markedly skewed, and many of her people continue in the style of life which was normal before 1970. The result is marked structural change in rural society: of the economically active population, only 50% is now in agriculture. Many families have abandoned small scale production and a modern mechanized sector, financed by local investment, is emerging, helped by substantial improvements in roads and other infrastructure and the growth of the non-rural market.

The agricultural environments range from tropical lowland humid forest to Sahelian and desertic. Apart from the new developments, there are few large commercial plantations, and virtually none in the private sector. Of total exports valued at US\$ 16.42 billion in 1982, no more than US\$ 404 M were of agricultural products in 1982, and this figure has declined substantially since the mid-seventies. Of these exports US\$ 276 M were coffee and cocoa (US\$ 6-700 M in 1977-8).

The reported arable area of Nigeria is about 28 M ha. The harvested area recorded for IARC crops in 1983 is about 19.5 M ha (equivalent to 70% of arable area), though the basis for these numbers is not robust. With the collapse of groundnut production, no IARC crop is significant among Nigeria's exports. The more important products of agriculture in 1983 included about 1.0 M tons of rice (paddy), 1.6 M tons of maize, 5.0 M tons of sorghum and millet, 10 M tons of cassava, 6.6 M tons of yams, 1.6 M tons of taro, 0.84 M tons of pulses (much of which is cowpea), and 450,000 tons of groundnuts in shell (formerly more than 2 M). Other products reported included about 600,000 tons of meat of various kinds and 1.7 M tons of fruit and vegetables including a good deal of plantain.

The total domestic production of cereals in 1983 was 7.6 M tons, and an additional 2.3 M tons was imported, mostly wheat, wheat flour and rice. Substantial quantities of sugar and of vegetable oils were also imported. The estimated nutritional intake in 1979-81 provided 2,378 kcal of energy (107 from animal products) and 55 g protein (11 from animal products) per day - an adequate diet, but without much margin for disasters and seasonal difficulties for the poor. The average life expectancy at birth is 50 years only, related to large birth and child mortality rates.

The Study Team visited, or met senior staff members of, the following institutions in Nigeria: Federal Ministry of Agriculture and Water Resources; Federal Ministry of Education, Science and Technology; University of Ibadan; University of Ife; Ahmadu Bello University; United Nations Development Program and SAFGRAD.

IARCs which have trained Nigerian participants are CIAT (5), CIMMYT (32), CIP (8), IBPGR (19), ICRISAT (41), IITA (1010), ILCA (15), ILRAD (13), IRRI (30), and WARDA (69); total 1242. IITA tends to be regarded by many people in Nigeria as a national rather than an international institution, particularly as Nigeria is a significant donor and has been very helpful at critical times in the past. The new types of cassava and streak-resistant maize are valued by producers and government; but most of the obstacles to agricultural progress in Nigeria are outside the domain of knowledge.

The national agricultural knowledge system of Nigeria is dispersed. In particular, stronger articulation is needed across the Ministerial boundaries between the numerous agricultural faculties of Universities, which relate to the Federal Ministry of Education, Science and Technology, and the Ministries of Agriculture at Federal and State level.

## BURKINA FASO (UPPER VOLTA)

Burkina Faso is one of the poorest countries in the world. The GNP per head of her 7.5 M people in 1982 was US\$ 210 only. The agricultural population is recorded as 5.9 M, and it is estimated that of the economically active population nearly 80% are in agriculture. By West African standards, communications and financial institutions are adequate; industry is little developed. The agricultural environments are all seasonally arid, but they range from subhumid in the South, with up to 1000 mm of annual rainfall, to Sahelian and desertic in the North. Most agriculture is small scale for subsistence and cash crops; and in the North there are transhumant pastoral communities. The reference sources available to us do not offer an analysis of the external trade of the country. In 1982, agricultural exports were estimated at US\$ 48 M. Among the export products is the seed fat of karite, Butyrospermum parkii, a small tree widespread in traditional agro-forestry systems.

The reported arable area of Burkina Faso is about 2.6 M ha. The harvested area recorded for IARC crops is about 2.7 M ha (equivalent to more than 100% of arable area). No IARC crop is significant among the country's exports. The more important products of agriculture in 1983 included about 0.7 M tons of sorghum, 0.4 M tons of millet, 176,000 tons of pulses (mostly cowpea), 77,000 tons of groundnuts and about 20,000 tons of cotton lint.

The total quantity of cereals recorded in 1983 was about 1 M tons. Small amounts of wheat, wheat flour and rice were imported. The country is virtually self-sufficient in cereals, perhaps because it cannot afford to be anything else. The estimated (1979-81) food intake provided 2,009 kcal of energy (88 from animal products) and 64 g protein (7 from animal products) per day - a marginal average diet, but at least one which seems to contain a sufficient amount of protein. The average life expectancy at birth is no more than 44 years.

The Study Team visited, or met senior staff members of, the following institutions in Burkina Faso: Ministry of Agriculture; Kamboinse Experimental Station; Institut Voltaïque de Recherche Agronomique et Zootechnique (IVRAZ); Direction des Services Agricoles; USAID and IDRC.

IARCs which have trained participants from Burkina Faso are CIP (2), IBPGR (3), ICRISAT (27), IITA (51), ILCA (4), ILRAD (3), IRRI (2) and WARDA (72); total 164.

Agricultural knowledge institutions are at a very early stage of development in Burkina Faso. University courses leading to the Ingenieur Agronome qualification are beginning at Ouagadougou University, with help from IITA.

## LIBERIA

Liberia's population was 2.2 M in 1983. 1.5 M of this total were regarded as agricultural; and of the economically active population 68% were in agriculture. GNP per head in 1982 was US\$ 490, at the lower edge of the "lower middle" income band of the IBRD listing. The agricultural environments are mostly those of the humid lowland forest and riverain and coastal swamps. Much of the agriculture is small scale, basically for subsistence, but ready to produce surpluses for the market if resources are available and returns favourable. There is, however, a modern plantation rubber industry, which produced 80,000 tons in 1974-76 but only 65,000 in 1983. Of total exports valued at US\$ 477 M in 1982, US\$ 85 M were agricultural, and of these US\$ 52 M were rubber and about US\$ 30 M were coffee and cocoa.

The reported area of arable and permanent crops in Liberia is 370,000 ha of which 130,000 are arable. The harvested area recorded for IARC crops is about 300,000 ha (multiple and mixed cropping), equivalent to more than 100% of arable area. No IARC crop is significant among Liberia's exports. The more important products of agriculture in 1983 included about 0.25 M tons of rice (paddy), and 0.3 M tons of cassava.

To supplement the output of rice, the only significant cereal of Liberia, the country imported 16,000 tons of wheat and flour and 110,000 tons of rice. The estimated (1979-81) food intake provided 2,276 kcal of energy (114 from animal products) and 43 g protein (10 from animal products) per day - a limited diet which seems likely to place vulnerable groups at risk of protein shortage, at least seasonally. The average expectation of life at birth is 54 years.

The Study Team visited, or met senior staff members of, the following institutions in Liberia: Ministry of Agriculture; Central Agricultural Research Institute (including staff of an FAO/UNDP project); Agricultural and Cooperative Development Bank; Cuttington College (including the Rural Development Institute); and the representatives of FAO and USAID.

IARCs which have trained Liberian participants are CIP (3), IBPGR (2), IITA (52), ILCA (4), ILRAD (3), IRRI (7) and WARDA (99); total 170.

We were not able to meet members of the University of Liberia; but our impression is that the national agricultural knowledge arrangements in Liberia are both weak and dispersed.

## INDONESIA

Indonesia produces oil, which has helped her into the "middle income" group in the World Bank list. The GNP per head in 1982 was US\$ 580. The population in 1983 was 85 M people, 20.8 M of whom were regarded as agricultural. In the economically active population, 24% were in agriculture. Industry, communications and financial institutions appear to be well developed. Not surprisingly, there are many different environments in a country that has so many islands, scattered over such a wide arc of the earth's surface. Much of the western and northern regions are humid to very humid, but eastern Java and neighbouring islands are very much drier. In densely populated central Java farms are small and intensively worked; in the new settlement areas there is more land and technique has yet to develop. The agricultural economy also includes substantial plantation businesses.

The gross domestic product in 1982 was estimated as US\$ 90 billion, of which 26% was attributed to agriculture, 39% to industry, and 35% to services. Of total exports valued at US\$ 22.3 billion in 1982, US\$ 1.58 billion were agricultural, made up principally of coffee, tea and cocoa, rubber and palm and coconut oils and tobacco.

The reported arable area of Indonesia is about 14.3 M ha. The harvested area recorded for IARC crops is about 15.1 M ha (equivalent to more than 100% of arable area). No IARC crop is significant among Indonesia's exports, but the more important products of agriculture in 1983 included about 34.3 M tons of rice (paddy), 4.0 M tons of maize, 13.8 M tons of cassava, 2.0 M tons of sweet potatoes, 0.2 M tons of potatoes, 0.32 M tons of pulses, and 0.76 M tons of groundnuts. Other products included 11.4 M tons of coconuts and 24.5 M tons of sugar cane (which did not produce enough to meet Indonesia's needs, so that about 0.18 M tons of sugar were imported).

The total quantity of cereals produced was 28.3 M tons, and an additional 3 M tons was imported (wheat and flour 1.6 M and rice 1.2 M tons). The estimated (1979-81) food intake provided 2,373 kcal of energy (53 from animal products) and 49 g protein (6 from animal products) per day - an adequate but distinctly frugal diet. The average life expectancy at birth is 53 years.

The Study Team visited, or met senior staff members of, the following institutions in Indonesia: Ministry of Agriculture: Secretary-General; Directorate General for Food Crops; Agency for Agricultural Extension, Training and Education; Agency for Agricultural Research and Development; Central Research Institute for Food Crops. They also visited or met staff of the Institut Pertanian Bogor; the National Biological Institute of the Indonesian Institute of Sciences; the National Library for Agricultural Sciences; and the Agricultural Information Center.

IARCs which have trained Indonesian participants are CIAT (27), CIMMYT (5), CIP (37), IBPGR (66), ICRISAT (9), IITA (16), ILRAD (2) and IRRI (426); total 588.

Our views about the articulation of Centers' support for national development, and on the need for nations to articulate their own knowledge systems, with whatever help the Centers can give, developed notably in Indonesia, where all the relevant questions are exemplified.

#### THAILAND

Thailand is a "lower middle income" nation in the IBRD list. The GNP per head of her 50 M people was US\$ 790 in 1982. Industry, communications and financial institutions appear to be satisfactory for development purposes in large areas of the country. The agricultural environments (valley floodplains in the south to upland regions in the northeast) are varied. As seen from the air, both subsistence farming and large scale agriculture are represented. The gross domestic product in 1982 was estimated as US\$ 36.8 billion, of which 22% was attributed to agriculture, 28% to industry, and 50% to services. Of total exports valued at US\$ 6.94 billion in 1982, US\$ 3.95 billion were agricultural. Of these, US\$ 1.42 billion were cereals (mostly rice) and US\$ 1.12 billion were fruits and vegetables. Tobacco, sugar and rubber also contributed significantly.

The reported arable area of Thailand is about 17 M ha. The harvested area recorded for IARC crops is about 13 M ha (equivalent to 78% of arable area). Rice is the most significant and characteristic of Thailand's exports, and maize and pulses are also important. Other important products of agriculture in 1983 included about 17 M tons of cassava and 23 M tons of sugar cane.

The total cereal production of Thailand in 1983 was 22.4 M tons, of which 6.2 M were exported. Small amounts of wheat and unspecified cereals (presumably sorghum) were imported, but otherwise Thailand is evidently self sufficient in cereals. The estimated (1979-81) food intake provided 2,330 kcal of energy (152 from animal products) and 47 g protein (12 from animal products) per day - an adequate but somewhat austere diet. The average life expectancy at birth is 63 years.

The Study Team visited, or met senior staff members of, the following institutions in Thailand: Ministry of Agriculture; Department of Agriculture and Department of Agricultural Extension; the Graduate School, Kasetsart University.

IARCs which have trained Thai participants are CIAT (29), CIMMYT (48), CIP (20), IBPGR (50), ICRISAT (51), IITA (5), ILRAD (1) and IRRI (351); total 555.

University education in agriculture and the related sciences is well established in Thailand; and the official agencies and the University appear to cooperate in research. But our visit was not sufficiently long for us to offer any suggestions or criticisms.

## PHILIPPINES

The Republic of the Philippines is in the "lower middle" income group in the World Bank listing, with an average GNP per head per year of US\$ 820. The population in 1983 was 53.2 M, of whom 23.2 M were regarded as agricultural. Of the economically active population, 43.9% were in agriculture. Industry, communications and financial institutions are well developed. The agricultural environments are very diverse, including both more and less arid sections at a range of altitudes over a considerable range of latitude. The agricultural systems are mostly small scale, for subsistence and market, but modern enterprises also exist and land ownership is concentrated in relatively few hands.

The gross domestic product in 1982 was estimated as US\$ 39.8 billion, of which 22% was attributed to agriculture, 36% to industry, and 42% to services. Of total exports valued at US\$ 5.02 billion in 1982, US\$ 1.58 billion were agricultural, made up principally of bananas, coffee, sugar, palm oils and tobacco.

The reported arable area of the Philippines is about 7.8 M ha. The harvested area recorded for IARC crops is about 7.3 M ha (equivalent to 93% of arable area). No IARC crop is significant among the Philippines' exports. The more important products of agriculture in 1983 included about 8.2 M tons of rice (paddy), 3.4 M tons of maize, 1.0 M tons of sweet potato and 2.3 M tons of cassava. Other products included 9.2 M tons of coconuts, 0.46 M tons of pig meat, and 21 M tons of sugar cane from which about 1.0 M tons of export sugar were derived.

The total harvest of cereals in 1983 was 11.5 M tons. It was made up virtually entirely of the rice and maize mentioned above. In addition, the Philippines imported about 1.4 M tons of cereals, made up of 0.8 M tons of wheat and flour and 0.5 M tons of maize. The estimated (1979-81) food intake provided 2,405 kcal of energy (228 from animal products) and 54 g protein (19 from animal products) per day - an adequate diet. The average life expectancy at birth is 64 years.

The Study Team visited, or met senior staff members of, the following institutions in the Philippines: Ministry of Agriculture, Bureau of Plant Industry; Philippine Council for Agriculture and Resources Research and Development (PCARRD); South East Asian Center for Graduate Study and Research in Agriculture (SEARCA); University of the Philippines at Los Banos.

IARCs which have trained participants from the Philippines are CIAT (11), CIMMYT (36), CIP (153), IBPGR (61), ICRISAT (3), IITA (12) and IRRI (572); total 848. IRRI is evidently fully adopted as a national institution in the Philippines, and it has grown up together with the Los Banos campus of the University.

Partly as a result of IRRI's relations with several University campuses in the Philippines, on the one hand, and the official agencies for agricultural development and research on the other, the agricultural knowledge system seems to be more closely articulated in the Philippines than in many other countries we have visited. PCARRD also illustrates a response to need in the same direction.

## COLOMBIA

Colombia is a "lower middle income" nation in the IBRD list. The GNP per head of her 27 M people (of whom only one quarter of the economically active were in agriculture in 1983) was US\$ 1,460 in 1982. Industry, communications and financial institutions are well developed. The agricultural environments (lowland rain forest to cold arid Andean mountain plateaux) are diverse, and the agricultural systems range from subsistence to modern coffee production on both large and small scales (about 1 M ha). The gross domestic product in 1982 was estimated as US\$ 35 billion, of which 26% was attributed to agriculture, 31% to industry, and 42% to services. Of total exports valued at US\$ 3.07 billion in 1982, US\$ 2.15 billion were agricultural, and of these US\$ 1.51 billion (about half of total exports) were coffee.

The reported arable area of Colombia is about 4 M ha. The harvested area recorded for IARC crops is about 1.8 M ha (equivalent to 44% of arable area). No IARC crop is significant among Colombia's exports, but the more important products of agriculture in 1983 included about 1.8 M tons of rice (paddy), 0.9 M tons of maize, 0.6 M tons of sorghum, 2.2 M tons of cassava, 2.0 M tons of potatoes, and about 88,000 tons of Phaseolus beans. Other products included 3 M tons of bovine milk, about 0.7 M tons of meat, 28 M tons of sugar cane from which about 0.3 M tons of sugar were exported, and 2.5 M tons of bananas of which 0.8 M tons were exported.

The total of cereals produced in 1983 was about 3 M tons, and nearly 1 M was imported, two-thirds of it wheat and wheat flour. Colombia is self-sufficient in rice. About 0.72 M tons of plant and animal fats were also imported in that year. The estimated (1979-81) food intake provided 2,494 kcal of energy (365 from animal products) and 55 g protein (24 from animal products) per day - an adequate but far from lavish diet which accords with the middle-income status of the country and the average life expectancy at birth of 64 years.

The Study Team visited, or met senior staff members of, the following institutions in Colombia: Ministry of Agriculture (Division of Integrated Rural Development); Instituto Colombiano Agropecuario (ICA); ACOSEMILLAS (the national federation of seed producers); FEDEARROZ (national federation of rice producers); FEDERACAFE (Coffee Producers Federation); and the National University of Colombia (at both Bogota and Palmira).

IARCs which have trained Colombian participants are CIAT (513), CIMMYT (43), CIP (65), IBPGR (23), IITA (3), ILRAD (1) and IRRI (16); total 665. CIAT is regarded by many people in Colombia as a national rather than an international institution. With IRRI's support, CIAT helped the notably successful development of irrigated rice in Colombia from 1970 onwards, which has increased consumption of rice from around 20 to 32 kg per head per year in the country.

Formally, the national agricultural knowledge system of Colombia appears to be dispersed. It seems to work through a series of ad hoc agreements and understandings which have not been notably stable in the past. Unless the relations between ICA and the

University can be developed, the strengthening of ICA, which seems to be the main purpose of donors at present, may well be less than fully effective. It is also essential to strengthen the university in research and postgraduate work. Unless the apex institutions of the national knowledge system are strong, the flow of recruits into the others, and the standards of the system as a whole, will not sufficiently meet the future needs of development.

#### PERU

In the World Bank listing, Peru is a "lower middle" income nation, with GNP per head US\$ 1,310 per year in 1982. The population in 1983 was 19.2 M, of whom 7.2 M were classed as agricultural. Of the economically active population, 35% were agricultural. The agricultural environments (including desert along the Pacific coast, with irrigation ancient and modern, a range of Andean plateaux and intermontane valleys, the higher and lower forest regions east of the Andes) are extremely diverse. The agricultural systems range from relatively large modern undertakings to the small holdings of shifting cultivators in the jungle. Of total exports valued at US\$ 2.81 billion in 1982, only US\$ 263 M were agricultural products; and of these about US\$ 116 M were coffee and cocoa products. About US\$ 80 M were fibres, mostly cotton. Of the gross domestic product of US\$ 31.6 billion in 1982, only 8% was ascribed to agriculture: industry (including mining) and services constitute 92% of the economy.

The reported arable area of Peru is about 3.2 M ha. The harvested area recorded for IARC crops is about 0.95 M ha (equivalent to 30% of arable area). No IARC crop is significant among Peru's exports. The more important products of agriculture in 1983 included about 0.7 M tons of rice (paddy), 0.6 M tons of maize, 1.2 M tons of potatoes, and about 92,000 tons of pulses, including 38,000 tons of Phaseolus beans and 22,000 of broad beans (Vicia). Other products included 0.8 M tons of bovine milk, 265,000 tons of meat, and about 5.5 M tons of sugar cane from which about 90,000 tons of export sugar were obtained.

The total production of cereals in 1983 was about 1.52 M tons - including 0.77 M tons of rice and 0.58 M tons of maize. 1.76 M tons of cereals were imported, including over 1 M tons of wheat and flour and 0.5 M tons of maize. The estimated (1979-81) food intake provided 2,195 kcal of energy (287 from animal products) and 59 g protein (22 from animal products) per day - an adequate but certainly not lavish average diet which must leave part of the population hungry for at least part of each year. The average life expectancy at birth is 64 years.

The Study Team visited, or met senior staff members of, the following institutions in Peru: Instituto Nacional de Investigacion y Promocion Agropecuaria (INIPA); Universidad Nacional Agraria "La Molina"; Instituto Inter-Americano de Cooperacion para la Agricultura (IICA); and the US Agency for International Development.

IARCs which have trained participants from Peru are CIAT (149), CIMMYT (58), CIP (306), IBPGR (38), IITA (5), ILRAD (1) and IRRI (2); total 559. CIP has substantially supported potato research in Peru; and CIAT is presently assisting the development of rice growing east of the Andes.

As in a number of other countries which we visited, the relationship between higher agricultural education and official research in Peru does not seem to be clearly defined. CIP seems effectively to bridge whatever gaps there may be, in respect of research on potatoes and in the disciplines used by CIP.

#### SYRIA

Syria is the least prosperous member of the "upper middle income" group in the IBRD listing. The GNP per head is estimated as US\$ 1,680. The population in 1983 was 10.1 M, of whom 4.7 M were regarded as being in agriculture. Of the economically active population, 47% were in agriculture. Industry, communications and financial institutions are well developed. The agricultural environments are all seasonally very arid, with rain or snow during a very cold winter season. The desert and steppe are never far away. With irrigation, the cropping systems are very productive, but the greater part of the land area supports transhumant flocks and herds. Tree crops of several kinds are seen everywhere. The gross domestic product in 1982 was estimated at US\$ 15.2 billion, of which 19% was attributed to agriculture, 31% to industry, and 50% to services. Of total exports valued at US\$ 2.03 billion in 1982, only US\$ 0.29 billion were agricultural. Of this, US\$ 129 M was provided by cotton, but some of this, as of other exports, seems to be re-exported, since Syria is a route to the Mediterranean for much of the interior of the Middle East.

The reported arable area of Syria is about 5.3 M ha. The harvested area recorded for IARC crops is about 3.06 M ha (equivalent to 58% of arable area). No IARC crop is significant among Syria's exports. The more important products of agriculture in 1983 included about 1.6 M tons of wheat and 1.0 M tons of barley, 300,000 tons of potatoes and 178,000 tons of pulses, 230,000 tons of olives and 422,000 tons of grapes, more than 1 M tons of watermelons, 1.1 M tons of milk and 157,000 tons of sheep and poultry meat.

The total production of cereals recorded in Syria in 1983 was about 2.75 M tons. Net imports of cereals were about 1.43 M tons, mostly wheat and flour. The estimated (1979-81) food intake provided 3,010 kcal of energy (404 from animal products) and 85 g protein (22 from animal products) per day - a diet approaching that of the West in its physiological superabundance. The life expectancy at birth is 66 years.

The Study Team visited, or met senior staff members of, the following institutions in Syria: Ministry of Agriculture and Agrarian Reform; the Agricultural Research Council; the University of Aleppo; the National Seed Bureau; the Arab Organization for Agricultural Development (AOAD) and the Arab Center for Studies of Arid Zones and Dry Lands (ACSAD).

IARCs which have trained Syrian participants are CIMMYT (11), CIP (7), IBPGR (13), ICARDA (83) and ILRAD (1), total 115. However, the links between ICARDA and Syria are much older than the Center itself: they go back to the days when the Arid Lands Agricultural Development program of the Ford Foundation brought CIMMYT into the region.

Many agencies are active in the agricultural knowledge sectors in Syria; and not all seem to know what the others are doing. Our time with the Agricultural Research Council in Damascus was too short to enable us to find out how it views this question.

#### INDIA

The average GNP per head in India is calculated at US\$ 260 for 1982 - eleven from the poorer end of the "low income" group in the World Bank list. The population of India in 1983 was estimated at 725.5 M, of whom 442.1 M were regarded as agricultural. Of the economically active population, 61% are agricultural. Because of her size, India is among the largest industrial nations in the world even though her population is predominantly agricultural. Communications and financial management appear remarkably effective for so large and poor a country.

The agricultural environments include virtually everything the world has to offer - arid Rajasthan; the seasonally dry and seasonally waterlogged Deccan plain; the flood plains of the northern rivers; the temperate to alpine environments of Jammu, Kashmir and Ladakh; the humid lowland tropics of Kerala; and scattered throughout India the cool and humid hilly tracts. Systems are correspondingly diverse, but the figure of the small-scale cultivator and his bullock, with his landless neighbour and the local land-controlling and money-lending magnate, is pervasive.

The gross domestic product in 1982 was estimated as US\$ 150.8 billion, of which 33% was attributed to agriculture, 26% to industry, and 41% to services. Of total exports valued at US\$ 9.37 billion in 1982 (against imports of US\$ 14.8 billion), US\$ 2.48 billion were agricultural. These exports were very diverse, but the largest single item in the FAO tables is coffee + tea + cocoa, valued at US\$ 813 M.

The reported arable area of India is about 165.5 M ha. The harvested area recorded for IARC crops is about 135 M ha (equivalent to 82% of arable area). 1982 exports included rice valued at US\$ 195 M and groundnut products valued at US\$ 38 M. Other important

products of agriculture included 42.5 M tons of wheat, 90 M tons of rice, 1.8 M tons of barley, 7.3 M tons of maize, 10.5 M tons of millet, 12 M tons of sorghum, 10 M tons of potatoes, 5 M tons of cassava and 1.5 M tons of sweet potatoes and about 12 M tons of pulses.

Other important products include 190 M tons of sugar cane (represented in the exports by 783,000 tons of sugar), 32 M tons of milk and 38 M tons of vegetables.

Somehow, in Delhi, one becomes accustomed to these vast figures, first because the crop-cutting sample surveys give some confidence that they represent reality, and second because one's Indian colleagues are so calmly accustomed to working in these orders of magnitude.

The total quantity of cereals produced in 1983 is recorded as 164 M tons. Net imports of cereals added another 4 M tons, mostly wheat and flour. The estimated (1979-81) food intake provided 2,056 kcal of energy (104 from animal products) and 50 g protein (5.5 from animal products) per day - no more than a marginally adequate diet, which assures us that many millions are at least seasonally very hungry indeed. Nonetheless, the average life expectancy at birth is now 55 years.

The Study Team visited, or met senior staff members of, the following institutions in India: Indian Council of Agricultural Research; Indian Agricultural Research Institute; Central Potato Research Institute; Punjab Agricultural University, Ludhiana; G.B. Pant University of Agriculture and Technology, Pantnagar; Andhra Pradesh Agricultural University, Hyderabad; All-India Coordinated Rice Improvement Project and the All-India Coordinated Sorghum Improvement Project, Rajendranagar.

IARCs which have trained Indian participants are CIAT (1), CIMMYT (32), CIP (95), IBPGR (47), ICARDA (5), ICRISAT (210), IITA (28), ILRAD (9) and IRRI (353); total 780. ICRISAT is regarded by many people in India as a national institution. CIMMYT's work was in effect done before CIMMYT was established and IRRI needed to do little more than support and encourage Indian colleagues.

The Indian Council of Agricultural Research and the Department of Agricultural Research and Education which covers it come close to unifying the national agricultural system. With the addition of the new regional stations in the states under the IBRD National Agricultural Research Program the main remaining gap, between many of the state Ministries of Agriculture and the State Agricultural Universities, may well be bridged.

## BANGLADESH

After Chad, Bangladesh shares with Ethiopia the rank of poorest nation. The average GNP per head in 1982 was US\$ 140, at the lower edge of the "low income" group. The population in 1983 was 96 M of whom 79 M are recorded as agricultural. Of the economically active population, 83% were in agriculture.

However, industry, communications and financial institutions are not undeveloped: Bangladesh is better provided in these respects than many other nations of similar GNP per head. The most prominent agricultural environment is that of the flood plains of the Ganges and Brahmaputra rivers, but Bangladesh also includes higher and cooler areas. With so abundant a supply of water and of mud, progress is proving to be feasible, in spite of the pessimism of donors some years ago. The main resource is in fact the courage, patience and fortitude of many millions of people who are set to build a nation from the debris of politics and wars during the past 40 years.

The gross domestic product in 1982 was estimated as US\$ 10.9 billion, of which 47% was attributed to agriculture, 14% to industry, and 39% to services. Imports in 1982 were US\$ 1.78 billion, against which exports were 0.62 billion only. Of these, only 0.16 billion were agricultural. The main components were tea and jute (US\$ 40 M and 101 M, respectively).

The reported arable area of Bangladesh is about 8.9 M ha. The harvested area recorded for IARC crops is about 11.6 M ha (equivalent to more than 100% of arable area). No IARC crop is significant among Bangladesh's exports. The more important products of agriculture in 1983 included about 1.1 M tons of wheat, 21.7 M tons of rice, 1.1 M tons of potatoes, 0.69 M tons of sweet potatoes and 211,000 tons of pulses, including Phaseolus, chick peas and lentils. Other products included 1.6 M tons of cow and goat milk, 0.68 M tons of bananas, 7.3 M tons of sugar cane (not represented by any exports), and 0.2 M tons of meat.

The total production of cereals in 1983 was about 22.85 M tons. Imports were about 1.5 M tons of wheat and flour and about 0.3 M tons of rice. The estimated (1979-81) food intake provided no more than 1,837 kcal per day (66 from animal products) and 40 g of protein (6 from animal products) - one of the poorest sets of values in the tables. The average life expectancy at birth is 48 years.

The Study Team visited, or met senior staff members of, the following institutions in Bangladesh: Ministry of Agriculture; Bangladesh Agricultural Research Council; Bangladesh Agricultural Research Institute; Bangladesh Rice Research Institute; Bangladesh Jute Research Institute; Sugar Cane Research and Training Institute; and the University of Mymensingh. We also met representatives of donors. We carried from these meetings the lasting impression of both ability and determination to ensure progress.

IARCs which have trained Bangladeshi participants are CIMMYT (60), CIP (104), IBPGR (20), ICARDA (6), ICRISAT (9), IITA (3) and IRRI (295); total 497. IRRI effectively supported the Bangladesh RRI and CIMMYT has played an appropriate part in the current developments of wheat output.

The national agricultural knowledge system of Bangladesh appears to be held strongly together by the Agricultural Research Council, except perhaps for Mymensingh University, which may have to increase in strength before it can hold its own with confidence.

#### NEPAL

Nepal is one of the poorest countries. In the IBRD list, it appears fourth from the lower end of the list of "low income" economies with GNP per head in 1982 of US\$ 170. The population in 1983 was 15.3 M people of whom 14.1 M were regarded as agricultural. Of the economically active population, 92% are said to be in agriculture. Industry and communications are little developed. The agricultural environments range from the northern margin of the Gangetic plain, which looks very much like adjacent parts of India, through the foothills of the Himalayas to the high mountain valleys. Much of the country is accessible only on the feet of humans and animals, or by helicopter. Most of the producers work on a small scale, and their first priority is for subsistence and survival.

The gross domestic product in 1982 was estimated as US\$ 2.35 billion, of which 63% was attributed to agriculture, and no details are given for other sectors. No general data about exports are available. Agricultural exports in 1982 are said to have been worth about US\$ 41 M. Because much of the border with India is open, goods tend to flow either way as prices move.

The reported arable area of Nepal is about 2.32 M ha. The harvested area recorded for IARC crops totals about 2.52 M ha (equivalent to more than 100% of arable area). The more important products of agriculture in 1983 included about 0.66 M tons of wheat, 2.74 M tons of rice (paddy), 0.77 M tons of maize, 0.11 M tons of millet (perhaps not Pennisetum), 67,000 tons of pulses (36,000 chickpea) and 0.37 M tons of potatoes. The record also speaks of 0.70 M tons of milk and 80,000 tons of Brassica seed.

The total quantity of cereals produced was about 4.30 M tons. Net imports were minute, presumably for lack of effective demand, since the diet is poor. The estimated (1979-81) food intake provided 2,011 kcal of energy (132 from animal products) and 46 g protein (7 from animal products) per day - a diet which most nutritionists would regard as inadequate, even for a small-bodied people. The average life expectancy at birth is 46 years.

The Study Team visited, or met senior staff members of, the following institutions in Nepal: Ministry of Agriculture and its Department of Agriculture; National Development Projects; Integrated Cereals Project; Agricultural Inputs Corporation; Tribhuvan University; and FAO.

IARCs which have trained Nepali participants are CIAT (2), CIMMYT (46), CIP (16), IBPGR (16), ICRISAT (4), ILRAD (1) and IRRI (59); total 144. IRRI and CIMMYT have combined to support the Integrated Cereals Project, established in recognition that where wheat and rice alternate in winter and in the rains, a joint approach to the system is necessary.

The services of agriculture seemed to us to be in a somewhat precarious state in Nepal. Further development of both personnel and organization seems clearly to be needed. However, the quality of the people we met was such that we do not doubt that this could be done. The main difficulties will continue to be with infrastructure and an inherently difficult environment.

#### ETHIOPIA

Ethiopia is one of the poorest countries in the world. After Chad and Bangladesh, she occupies the lowest position in the IBRD low income group. GNP per head of her 33 M people was US\$ 140 in 1982. Industry, communications and financial institutions are not yet well developed. The agricultural environments range from near desert in the northern rift valley through seasonally arid to wet forest environments on the high plateau, covered with a remarkable basalt-derived cracking clay. There are few plantations: most agriculture is for subsistence, but many of the subsistence crops are in demand in the internal and (in the case of oilseeds) external markets. Ethiopia is the home of coffee, much of which is gathered as a forest product. The gross domestic product in 1982 was estimated as US\$ 4 billion only, of which 49% was attributed to agriculture, 16% to industry, and 36% to services. Of total exports valued at US\$ 404 M in 1982, US\$ 370 M were agricultural, and of these US\$ 252 M (62%) were coffee. The balance was made up of hides and skins, oilseeds, cotton and other raw materials.

The reported arable area of Ethiopia is about 13 M ha. The harvested area recorded for IARC crops is about 4.5 M ha. (equivalent to 34% of arable area). No IARC crop is significant among Ethiopia's exports, but the more important common products of agriculture in 1983 included about 0.95 tons of wheat, 1.2 M tons of sorghum, 1.4 M tons of barley (as a human food at high altitude) and 1 M tons of pulses, including the typical species of both Africa and the Middle East, together with a small output of Phaseolus beans. The agriculture of the plateau is plainly an extension into a summer rainfall region of the agriculture of south-west Asia. Other products included 0.6 M tons of bovine milk, about 0.1 M tons of meat, and about 1 M tons of roots and tubers.

The total quantity of cereals produced in 1983 was 6.76 M tons. It included about 2.5 M tons of teff, a virtually exclusively Ethiopian cereal. The other components have been listed above. In addition the country imported 0.32 M tons of cereals, mostly wheat and flour. Otherwise Ethiopia is more or less self-sufficient at a rather low level. The estimated (1979-81) food intake provided 2,149 kcal of energy (154 from animal products) and 73 g protein (11 from animal products) per day. The average life expectancy at birth was 47 years in 1982.

The Study Team visited, or met senior staff members of, the following institutions in Ethiopia: Ministry of Agriculture; Institute of Agricultural Research; Agricultural and Industrial Development Bank; Addis Ababa University; and the Plant Genetic Resources Center, Addis Ababa.

IARCs which have trained Ethiopian participants are CIMMYT (34), CIP (13), IBPGR (11), ICARDA (6), ICRISAT (21), IITA (28), ILCA (26) and ILRAD (12); total 150.

In the national agricultural knowledge system, the heart seems to be in the right place: a sound tradition of cooperation among all elements, in the public, private and voluntary sectors, has existed for many years and seems to have been little affected by political change. But the individual components are not strong, and a substantial task lies ahead for the IARCs which are interested in the needs of this most attractive people and their country.

#### KENYA

The Kenya Country Study provides a far fuller account of the country and of the usefulness of IARC training in it than is possible in this note.

Kenya is a "low income" nation in the IBRD list. The GNP per head of her 19 M people was calculated as US\$ 390 in 1982. Industry, communications and financial institutions are well developed, in part as a legacy of the colonial period of foreign settlement. The greater part of the country is arid land used mainly as range pasture for transhumants, but the coast, the central highlands, and the western regions, at different altitudes, include valuable areas of larger average rainfall. There are some large farming enterprises, but the great majority of units are small. Nonetheless, all producers of crops are interested in the market. The gross domestic product in 1982 was estimated as US\$ 5.3 billion, of which 33% was attributed to agriculture, 22% to industry and 42% to services. Of total exports valued at US\$ 1.05 billion in 1982 (which includes much transit trade to other nations of Eastern Africa), US\$ 0.59 billion were agricultural and of these US\$ 0.42 billion were coffee and tea.

The reported arable area of Kenya is about 1.9 M ha. The harvested area recorded for IARC crops is about 2.6 M ha (equivalent to more than 100% of arable area). No IARC crop is a major contributor to Kenya's exports, but there is a small export of beans, some of it for seed, and occasional exports of maize (120,000 tons in 1982). The more important products of agriculture in 1983 included about 2 M tons of maize, 0.66 M tons of cassava, 0.26 M tons of potatoes and about 0.23 M tons of pulses. Other products included 1.3 M tons of bovine milk, about 0.2 M tons of meat, and 4 M tons of sugar cane from which about 4,000 tons of sugar were exported. The production of sugar has declined markedly in recent years.

The total quantity of cereals produced in 1983 was 2.67 M tons. Net imports were 35,000 tons only, the export of maize being offset by imports of wheat and flour and of rice. On balance, Kenya is self-sufficient in cereals at the present level of demand. The estimated (1979-81) food intake provided only 2,011 kcal of energy (225 from animal products) and 55 g protein (15 from animal products) per day - a barely adequate diet, but nevertheless able to sustain a population growth of 4.4% per year. The average life expectancy at birth is 57 years.

The Study Team visited, or met senior staff members of, the following institutions in Kenya: Ministry of Agriculture and Livestock Development; University of Nairobi; International Centre for Insect Physiology and Ecology, IDRC and Kenya Agricultural Research Institute (KARI).

IARCs which have trained Kenyan participants are CIAT (5), CIMMYT (23), CIP (50), IBPGR (15), ICRISAT (38), IITA (28), ILCA (26), ILRAD (115) and IRRI (5); total 320. There is a certain malaise in Kenya about the IARCs: what they do is valued, but perhaps there is something about the ways in which they do it that evokes sensitivity.

In the national agricultural knowledge system, articulation involving the Ministry (except with KARI) may be satisfactory, but the University does not yet appear to participate as fully as both it and the Ministry would like.

#### ZIMBABWE

Zimbabwe is a "lower middle income" nation in the IBRD list. The GNP per head of her 8.2 M people averaged US\$ 1,460 in 1982, but this value covers a large difference between white and black, urban and rural. Industry, communications and financial institutions are well developed, as a most important legacy of the colonial and UDI periods and of the historical and commercial links with neighbouring countries. The agricultural environments range widely from the drier western plains adjoining Botswana to the wetter Eastern uplands and mountains and the lowveld beyond. There are two main and distinct agricultural systems, the larger scale commercial agriculture (mostly operated by whites) for crops as well as for range and other types of

animal production; and the small scale farming, increasingly for the market, of the African producers in the crowded communal areas. The events of recent years have shown that both sectors have essential contributions to make.

The gross domestic product in 1982 was estimated as US\$ 5.9 billion, of which 15% was attributed to agriculture, 35% to industry (including mining as well as manufacturing and agro-industry), and 42% to services. Of total exports valued at US\$ 1.29 billion in 1982, US\$ 0.52 billion were agricultural and of these US\$ 0.26 billion were tobacco.

The arable area of Zimbabwe is about 2.70 M ha. The harvested area recorded for IARC crops is about 2.04 M ha (equivalent to 76% of arable area). Apart from animal products, no IARC commodity other than maize (0.6 M tons in 1983) is significant among Zimbabwe's exports. The more important products of agriculture in 1983 included about 1 M tons of maize, 140,000 tons of wheat and 76,000 tons of groundnuts. Other products included 0.2 M tons of milk and 84,000 tons of meat, and about 4 M tons of sugar cane, which gave rise to about 0.25 M tons of sugar exported.

Zimbabwe produced 1.3 M tons of cereals in 1982, mostly maize and wheat. Relatively small amounts of wheat and flour, and of rice, were imported. On balance, Zimbabwe is self-sufficient in cereals at the present levels of demand. The estimated average (1979-81) food intake provided 2,108 kcal of energy (152 from animal products) and 54 g protein (9 from animal products) per day. Since these data aggregate the intakes of two very different classes they are not easy to interpret, but the diet of the majority was evidently sufficient to sustain population growth at 3.4% during 1969-82. The average life expectancy at birth is 54 years.

The Study Team visited, or met senior staff members of, the following institutions in Zimbabwe: Ministry of Agriculture, including Agritex (technical services) and the Department of Research and Specialist Services and its Plant Protection and Agronomy Institutes; University of Zimbabwe (Faculty of Agriculture).

IARCs which have trained Zimbabwean participants are CIAT (4), CIMMYT (3), CIP (3), IBPGR (5), ICRISAT (3), IITA (19), ILCA (4) and ILRAD (4), total 47.

The national agricultural knowledge system of Zimbabwe is well established and substantially articulated. Relations between the University and the Ministry seem to be positive and effective. The main trends at the present time of great change are to increase the knowledge support for the progress of small-scale African producers; and to train African professionals to take their appropriate part in the work. At the same time the traditional support for the larger-scale sector (some of which is now provided by private-sector organizations) must continue, and remain articulated with the work for other producers. We were impressed not so much by the potential difficulties but by the encouraging prospects for success.

Study Team's Summary on Findings in Those Nations Which Were Covered  
Through Country Studies Only

ECUADOR

The GNP per head of Ecuador is US\$ 1,350 per year, which places it near the top of the "lower middle income" group of nations. The population in 1983 was 8.8 M, of whom 3.7 M were agricultural. 42.5% of the economically active population were in agriculture in that year. The gross domestic product in 1982 was US\$ 12.3 billion, of which 11% was attributable to agriculture and 40% to industry (including the oil industry).

As in the other nations of South America we visited, the agricultural environments (lowland rain forest to cold arid Andean mountain plateaux) are diverse, and the agricultural systems range from subsistence to modern production of coffee, sugar, cacao and bananas on both large and small scales. Of total exports valued at US\$ 2.14 billion in 1982, US\$ 522 M were agricultural, and of these US\$ 213 were derived from bananas, US\$ 139 M from coffee, and US\$ 63 million from cacao.

The reported area of arable and permanent crops in Ecuador was 2.62 M ha in 1983. About 850,000 ha were in permanent crops, leaving 1.30 M for arable. The harvested area recorded for IARC crops is around 450,000 ha equivalent to about 26% only of the arable area. No IARC crop is significant among Ecuador's exports, but the more important products of agriculture in 1983 included about 222,000 tons of rice, 258,000 tons of maize, 394,000 tons of potatoes, 240,000 tons cassava, and about 50,000 tons of pulses (Phaseolus beans 34,000 tons).

The total of cereals produced in 1983 was 539,000 tons. Net imports of cereals were 400,000 tons, principally wheat and flour (280,000 tons) with smaller quantities of rice, barley, maize and sorghum. The estimated (1979-81) food intake provided 2,114 kcal of energy (403 from animal products) and 50 g protein (26 from animal products) per day - a distinctly marginal diet which suggests that part of the population must be at least seasonally short of food. The average life expectancy at birth is 64 years.

The Study Team did not visit Ecuador: it was one of the nations of which a country study was commissioned (see part 2 of the Report).

IARCs which have trained Ecuadorian participants are CIAT (148), CIMMYT (44), CIP (82), IBPGR (3) and IRRI (2); total 279. About one-third of these persons are now working in the private sector.

Responsibility for agricultural education in Ecuador was transferred some years ago from the Ministry of Agriculture to the Ministry of Education and Culture. Agricultural research is managed

by the Instituto Nacional de Investigaciones Agropecuarias (INIAP). CIMMYT and CIAT are credited with the influence which stimulated the formation of this effective institution (in which 111 participants work). INIAP is included within the organization of the Ministry of Agriculture, but we are not informed about its links with the institutions for agricultural education or extension.

## SENEGAL

Senegal is at the lower edge of the "lower middle-income" group in the World Bank list. The average GNP per head in 1982 was US\$ 490 in 1982. The population in 1983 was 6.1 M. 4.5 M were agricultural, and the proportion of agricultural workers in the economically active population was 73%. Considering the size of the country, communications seem to be well developed and industry is making progress. It is perhaps of some advantage to Senegal that Dakar was once the capital of francophone West Africa. The agricultural environments range from desertic and Sahelian to sub-humid seasonally (in Casamance and other parts of the South). Important areas of irrigation exist and are being developed, particularly in the basin of the Senegal River.

The gross domestic product in 1982 was estimated at US\$ 2.5 billion, of which 22% was attributed to agriculture, 25% to industry, and a remarkable 53% to services. Of total exports valued at US\$ 0.55 billion in 1982, US\$ 0.17 billion were agricultural, and of these perhaps US\$ 0.13 billion represented groundnut oil and feeding stuffs.

The reported arable area of Senegal is about 5.22 M ha. The harvested area recorded for IARC crops is about 2.13 M ha (equivalent to 41% of arable area). Of the IARC crops, only groundnut is significant among Senegal's exports. The more important products of agriculture in 1983 included about 0.3 M tons of millet, 80,000 tons of milk and 51,000 tons of meat.

The total quantity of cereals produced in 1983 was 0.48 M tons, mostly millet, but also about 70,000 tons of rice and 62,000 tons of maize. Cereal imports were 0.59 M tons, mostly wheat and flour and rice. The estimated (1979-81) food intake provided 2,346 kcal of energy (179 from animal products) and 67 g protein (17 from animal products) per day - an adequate diet, but not lavish. The average life expectancy at birth is 44 years only.

The Study Team did not visit Senegal. An account of the institutions for the management of agricultural development and the knowledge services will be found in the Country Study included in Part II of the TAC Report on Training.

IARCs which have trained Senegalese participants are CIMMYT (5), CIP (11), IBPGR (2), ICRISAT (33), IITA (28), ILCA (4), ILRAD (2), IRRI (13), ISNAR (4) and WARDA (82); total 184.

The national agricultural knowledge system of Senegal is fully considered in the report of the Country Study. It is sufficient here to say that higher education in agriculture and related subjects is still young in Senegal, and that the agricultural knowledge services, though evidently effective within the areas they cover, have considerable development ahead of them with the coming of further advances in irrigation in the main river basins and in rainfed agriculture in the southern regions.

#### SRI LANKA

Sri Lanka is in the "low-income" group in the IBRD list. The GNP per head of her 16 M people was US\$ 320 in 1982. Nevertheless, some industries, and communications and financial institutions appear to be adequately developed. The agricultural environments (including lowland rain forest, arid plains, and cool highland areas) are diverse, and the agricultural systems range from subsistence to modern tea production on both large and small scales. The gross domestic product in 1982 was estimated as US\$ 4.4 billion, of which 27% was attributed to agriculture, 27% to industry, and 46% to services. Of total exports valued at US\$ 0.99 billion in 1982, US\$ 0.58 billion were agricultural, and of these US\$ 0.34 billion were tea and US\$ 0.11 billion were rubber.

The reported arable area of Sri Lanka is about 1 M ha. The harvested area recorded for IARC crops is about 1.14 M ha (equivalent to more than 100% of arable area). No IARC crop is significant among Sri Lanka's exports. The more important products of agriculture in 1983 included about 2.2 M tons of rice and smaller quantities of maize, millet, potatoes, sweet potatoes, cassava and pulses (principally chickpea). Other significant products included 1.24 M tons of bananas/plantains; 2.30 M tons of coconuts, and 175,000 tons of coarse fibres, probably coir.

In 1983 Sri Lanka produced 2.24 M tons of cereals: virtually all of this was rice. 0.77 M tons of cereals were imported, mainly wheat and wheat flour, but including about 0.18 M tons of rice. The estimated (1979-81) food intake provided 2,235 kcal of energy (95 from animal products) and 45 g protein (8.5 from animal products) per day - which would be regarded by most observers as a barely adequate diet, particularly in respect of protein. The average expectation of life at birth was nevertheless 69 years.

The Study Team did not visit Sri Lanka. An account of the arrangements for the management of agricultural development and of the agricultural knowledge system will be found in the Country Study in Part II of the TAC Study of training.

IARCS which have trained Sri Lankan participants are CIAT (6), CIP (253), IBPGR (13), ICRISAT (20), IITA (20), ILRAD (3) and IRRI (243); total 559.

We have no independent opinion to advance on the agricultural knowledge system in Sri Lanka: this is adequately discussed in the Country Study.

#### TUNISIA

Tunisia is classed in the upper part of the "lower middle income" group of nations in the World Bank list. The average GNP per head of population (6.8 M in 1983) was US\$ 1,390 in 1982. 2.6 M of the people were considered to be "agricultural" in 1983, and the ratio of agricultural workers to the total of economically active persons was 38%. Industry, including the mining of phosphate rock and the extraction and refining of petroleum, is well developed and communications and financial structures are effective.

Tunisia has a winter-rainfall climate; and the annual rainfall is generally small. In the Sahelian region of the south of the country (60% of area) rainfall is less than 200 mm and shades away into desert. In the middle zone (15% of area) it is between 200 and 350 mm, and in the north (25% of area) it exceeds 350 mm and annual crops, tree crops and livestock can all be produced.

The gross domestic product in 1982 was estimated as US\$ 7.1 billion, of which 15% was attributed to agriculture, 35% to industry, and 50% to services. Of total exports valued at US\$ 1.99 billion in 1982, only US\$ 0.17 billion were agricultural, and of this quantity olive oil provided nearly 0.1 billion.

The reported area of annual and permanent crops in Tunisia is 5.0 M ha. Of this 3.49 M ha is reported as arable, but since a good deal of the arable cropping occurs in traditional "agro-forestry" systems there must be some uncertainty about the estimate. The harvested area recorded for IARC crops is about 1.7 M ha (equivalent to 49% of arable area). No IARC crop is significant among Tunisia's exports, but the more important products of agriculture in 1983 included about 0.6 M tons of wheat, 0.3 M tons of barley, 0.14 M tons of potatoes, about 0.1 M tons of pulses, 260,000 tons of milk and 91,000 tons of meats. 0.5 M tons of tomatoes and peppers are produced, partly for export.

In 1983, Tunisia produced 0.96 M tons of cereals, mostly wheat and barley (see above). In addition, she imported 1.13 M tons of cereals, mostly wheat and flour, but including 0.2 M tons of maize. The estimated (1979-81) food intake provided 2,763 kcal of energy (246 from animal products) and 76 g protein (17 from animal products) per day - a fully adequate diet. The average life expectancy at birth is 61 years.

The Study Team did not visit Tunisia. The Country Study, in part 2 of the TAC Report on Training, contains an account of the management of agriculture and of the agricultural knowledge system of the nation.

IARCs which have trained Tunisian participants are CIMMYT (30); CIP (67 according to Country Study but 44 according to CIP), IBPGR (3), ICARDA (40 according to Country Study and 31 according to ICARDA), ILCA (2) and ISNAR (2). The discrepancies may arise from differences in definition of "training by a Center in-country". We may conservatively estimate the total as 110.

The Country Study should be consulted for information about the effects of training on the development of the nation, and on the characteristics of the agricultural knowledge system.

Table 1: Relevant statistical data on countries visited by Study Team or included in Country Studies. Part 1: LATIN AMERICA

	Colombia	Costa Rica	Ecuador	Guatemala	Mexico	Peru
<b>Population data, millions and %</b>						
total, 1983	27.5	2.3	8.8	7.9	76.1	19.2
% growth rate 1969-82	2.2	2.5	3.0	3.1	3.1	2.7
agricultural, 1983	6.8	0.8	3.7	4.2	25.5	7.2
% growth rate of agr. pop. 1969-82	1.1	0.6	1.6	2.0	0.8	0.9
agricultural % total econ. active 1983	24.8	33.0	42.5	53.0	33.5	35.2
<b>Land areas, m ha and %, 1983</b>						
arable and permanent crops	5.68	0.64	2.62	1.78	23.45	3.52
arable	4.05	0.28	1.76	1.30	21.90	3.20
harvested area of IARC crops	1.79	0.22	0.45	1.13	14.16	0.95
do. % arable area	44	79	26	87	65	30
<b>GNP per head, US \$, 1982</b>						
	1460	1430	1350	1130	2270	1310
<b>Gross domestic product 1982</b>						
total, billion US \$	35.0	2.6	12.3	8.7	171.3	21.6
% agriculture	26	21	11	23	7	8
% industry	31	32	40		38	39
% services	42	47	49		55	53
<b>Agricultural imports and exports, m US \$</b>						
1983 imports	577.46	112.13	224.42	130.04	2419.44	717.60
1983 exports	2109.66	607.42	383.54	751.06	1557.36	224.40
1982 exports	2154.96	605.30	521.84	730.43	1374.98	263.09
main non-IARC crops						
coffee, tea, cocoa	1584.53	246.12	271.76	359.54	395.05	123.01
fruit and vegetables	170.25	252.60	219.84	85.15	411.26	
textile fibres	26.83			82.90	197.38	81.76
tobacco	23.58				47.56	
<b>Annual rates of change, %, 1969-82</b>						
total food output	4.2	3.0	2.9	4.3	3.8	0.5
total food per head	2.0	0.5	-0.1	1.2	0.7	-2.2
<b>Manufactured fertilizer, pesticides, m US \$, kg/ha and 3-year trends, +, - or = (little change)</b>						
Fertilizer imports 1982	88.1	11.4	21.2	27.3	129.0	11.1
Fertilizer use, kg/ha and trends	50+/-	151+/-	26+/-	56+	67+	37+
Pesticide imports, 1982	28.9	38.0	27.2	18.0	19.0	12.3

Table 1: relevant statistical data on countries visited by Study Team or included in Country Studies,  
Part 2: AFRICA

	Burkina Faso	Ethiopia	Kenya	Liberia	Nigeria	Senegal	Tunisia	Zimbabwe
Population data, millions and %								
total, 1983	7.5	33.8	18.6	2.2	85.2	6.1	6.8	8.2
% growth rate of total popn. 1969-82	2.5	2.1	3.9	3.9	3.2	2.8	2.2	3.4
agricultural, 1983	5.9	26.1	14.1	1.5	43.0	4.5	2.6	4.7
% growth rate of agr. pop. 1969-82	1.8	1.5	3.3	3.3	1.6	2.1	0.1	2.5
agricultural % total econ. active 1983	79.4	77.4	76.0	67.7	50.5	72.6	37.9	57.0
Land areas, m ha and %, 1983								
arable and permanent crops	2.63	14.00	2.39	0.37	30.44	5.23	5.00	2.78
arable	2.62	13.25	1.90	0.13	27.90	5.22	3.49	2.70
harvested area of IARC crops	2.71	4.49	2.63	0.30	19.50	2.13	1.70	2.04
do. % arable area	>100	34	>100	>100	70	41	49	76
GNP per head, US \$, 1982	210	140	390	490	860	490	1390	850
Gross domestic product 1982								
total, billion US \$	1.0	4.0	5.3	0.95	71.7	2.5	7.1	5.9
% agriculture	41	49	33	36	22	22	15	15
% industry	16	16	22	28	39	25	36	35
% services	43	36	45	36	39	53	49	50
Agricultural imports and exports, m US \$								
1983 imports	74.31	108.92	142.89	110.17	1935.79	269.37	517.89	49.32
1983 exports	66.66	380.54	622.51	89.52	459.52	169.15	111.00	463.18
1982 exports	47.61	369.36	590.71	85.18	403.64	165.36	173.81	517.44
main non-IARC crops, 1982								
coffee, tea, cocoa		249.59	420.81	30.00	275.70			27.48
fruit and vegetables							38.82	
rubber				51.66	21.59			
sugar								69.39
olive oil							97.33	
tobacco								257.57
textiles						14.60		69.87
main IARC and related commodities, 1982								
animal products		41.20						
maize								55.72
pulses		17.72	11.58					
groundnut products		4.3				127.17		
Annual rates of change, %, 1969-82								
total food output	2.1	1.4	2.2	2.2	2.1	1.4	3.6	2.2
total food per head	-0.4	-0.7	-1.7	-1.7	-1.1	-1.4	1.3	-1.2
Manufactured fertilizer, pesticides, m US \$, kg/ha and 3-year trends, +, - or = (little change)								
Fertilizer imports 1982	8.3	6.3	28.7	0.5	58.6	0.6	14.0	22.6
Fertilizer use, kg/ha and trends	2 =	3 =	34 +	9 -/=	1.4 =	5 -/+	18 -	68 +/-
Pesticide imports, 1982	3.1	6.8	16.5	1.6	68	8.8	6.0	25.2

Table 1: Relevant statistical data on countries visited by Study Team or included in Country Studies.  
Part 3: ASIA

	Bangladesh	India	Indonesia	Nepal	Philippines	Sri Lanka	Syria	Thailand
Population data, millions and %								
total 1983	95.9	725.5	84.9	15.3	53.2	15.8	10.1	50.3
% growth rate 1969-82	2.6	2.2	1.9	2.3	2.7	1.7	3.7	2.6
agricultural 1983	79.4	442.1	20.8	14.1	23.2	8.3	4.7	37.1
% growth rate of agr. pop. 1969-82	2.3	1.2	0.7	2.2	1.3	1.4	2.9	2.0
agricultural % total econ. active 1983	82.8	60.9	24.0	92.1	43.9	52.4	46.8	73.9
Land areas, m ha and %, 1983								
arable and permanent crops	9.14	169.54	19.60	2.33	11.80	2.17	5.80	18.98
arable	8.92	165.60	14.28	2.32	7.80	1.05	5.29	17.10
harvested area of IARC crops	11.58	135.15	15.11	2.52	7.29	1.14	3.06	13.26
do. % arable area	>100	81.61	>100	>100	93.46	>100	57.84	77.54
GNP per head, US \$, 1982								
	140	260	580	170	820	320	1680	790
Gross domestic product 1982								
total, billion US \$	10.9	150.8	90.2	2.35	39.8	4.4	15.2	36.8
% agriculture	47	33	26	63	22	27	19	22
% industry	14	26	39		36	27	31	28
% services	39	41	35		42	46	50	50
Agricultural imports and exports, m US \$								
1983 imports	416.47	1876.20	1539.17	61.52	629.45	301.09	788.43	564.74
1983 exports	164.75	2349.58	1952.81	33.93	1403.93	627.86	235.00	3332.19
1982 exports	163.59	2478.74	1580.35	40.66	1575.85	575.50	292.75	3953.70
main non-IARC crops								
coffee, tea, cocoa	40.66	812.91	546.13		101.36	340.60		24.91
fruit and vegetables		233.25			373.52	49.65	37.73	1115.80
textile fibres	100.94	119.26			26.04		129.24	39.60
rubber			606.94			111.48		413.32
sugar		210.38			444.55			600.30
plant oils other than groundnut			101.60		402.08	57.74		
tobacco		228.59	42.25		48.70		18.07	111.28
main IARC and related commodities, 1982								
animal products								
barley							87.75	58.76
rice		195.00						978.67
maize								357.86
pulses							16.55	96.47
groundnut products		37.80						
Annual rates of change, %, 1969-82								
total food output	2.1	2.6	4.2	0.8	5.0	5.5	8.9	4.4
total food per head	-0.5	0.4	2.3	-1.5	2.3	3.7	5.0	1.8
Manufactured fertilizer, pesticides, m US \$, kg/ha and 3-year trends, +, - or = (little change)								
Fertilizer imports 1982	112.4	285.2	155.8	11.7	107.9	26.8	17.6	145.9
Fertilizer use, kg/ha and trends	8.3+	34+	74+	9+/-	32+/-	77+	23+	18+
Pesticide imports, 1982	9.8	45.0	45.2		15.2	5.6	12.8	59.7

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TAC STUDY OF TRAINING IN THE CGIAR SYSTEM - 1984

SIX COUNTRY STUDIES - A SUMMARY

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SUMMARY: SIX COUNTRY STUDIES

(Bangladesh, Ecuador, Kenya, Senegal, Sri Lanka, Tunisia)

In the following an attempt has been made to extract from the individual studies the most significant findings and recommendations made by the national collaborators. In this task, the "Executive Summary" prepared mainly by Dr. Manuel Pina, Jr. for use in an informal presentation to TAC 35, has been of inestimable value. Background information about the origin and implementation of the six country studies is given in the Report of the Study Team, paragraphs 22-32. A discussion of selected issues is also presented.

A. PRINCIPAL FINDINGS

1. Introduction

1.1 The training provided by the IARCs is highly regarded by those whose opinions were canvassed in the preparation of the country studies. Some specific deficiencies are apparent but it was thought they could be overcome by consultation and an exchange of views between the IARCs and the NARS (National Agricultural Research System or Systems).

1.2 Up to mid-1984, about 1,700 people from the six countries have attended IARC courses. This represents only a small proportion of the countries' trained manpower and a small proportion of those who would benefit from attending courses. Despite this, the training is regarded as having had a very great impact on the countries' agricultural services. A direct impact was occasionally referred to as in the setting up of research units working in the Bangladesh Rice Research Institute and the Bangladesh Agricultural Research Institute or in the setting up of INIAP in Ecuador.

2. Training Opportunities

2.1 For the purpose of the country studies training is considered as being of three types: (a) production training, which is concerned with growing a crop; (b) specialist training which is concerned with techniques or topics such as the control of a disease or the evaluation of genetic resources; and (c) degree related training which leads to the award of a higher degree (M.Sc. or Ph.D.).

2.2 Production courses have been extremely successful and have played a major role in increasing production. They have provided the means by which new technology has moved from the IARCs to the developing countries. The demand for the six countries, in terms of

research staff wishing to attend production courses, has diminished, however the NARS see a continuing demand and benefit for newly appointed staff, extension staff or personnel from related Government departments such as irrigation and water management.

2.3 As the number of a country's trained staff has increased, it has become feasible to mount production courses in-country with partial support provided by IARC personnel. In-country training is normally less costly and many more people are able to participate. There is less restriction in choosing participants as the national trainers can teach in the local language and translate when necessary. Being in the country, the courses are usually more relevant to the local situation than courses mounted at the Centers. The NARS would like the IARCs to do more in the way of identifying national trainers and provide them with a training in the methods of teaching (the training of trainers).

2.4 Despite these factors in favour of in-country production courses, a main finding is that NARS and participants wish the Center-based courses to continue for a proportion of their national staff, as time spent at the Center provided the participants with much more than what was learned in the course. The participants had contact with all aspects of the Center's work and became aware of new technology developed by the Center.

2.5 Specialist courses are highly regarded and considered to have great potential to improve the countries' research and extension services. The general opinion is that there have not been enough of these courses and that many of those held have been too short. This criticism was very commonly expressed.

2.6 Degree-related training is in great demand as the countries realize the benefit to be gained from their nationals undertaking the research component of higher degrees at an IARC instead of in a developed country. The research is more relevant in terms of the crop species, environment and level of farming technology. Higher degree training may involve a Center and a university in the Center's host country or a university in the candidate's home country. It is hoped that when the home country university is involved, the link will lead to collaboration and development of the agricultural faculty of the national university.

2.7 The NARS are pleased that links are being forged between their national universities and the IARCs. It is believed these links will encourage the universities to provide an education dealing more with the countries' special agricultural problems, it will ensure the academics are kept up to date about new technology and that the research undertaken in the university is concerned with appropriate applied problems. Linkages are developing as more higher degree candidates are enrolling in the national universities and undertaking the research component of their degree in the IARC under joint

supervision of an academic and IARC staff member. Other collaborative work is expected to follow.

2.8 There are large differences between the countries in the number of persons who have obtained a higher degree with IARC support. The numbers are Bangladesh 89, Ecuador 4, Kenya 24, Senegal 2, Sri Lanka 44 and Tunisia 1. These differences are attributable to the relatively strong emphasis placed on higher degree training by IRRI which has determined the high numbers for Bangladesh and Sri Lanka. The Kenyan figure has been influenced by ILRAD support. The low values for Senegal and Tunisia are also a consequence of the language difficulties francophone people experience at Centers and that, in Senegal, overseas qualifications other than from France and a few European countries are not recognized in the Government service; this situation is likely to change. All the countries are keen that more of their staff obtain higher degree training.

2.9 In relation to courses in general, some NARS are keen to see the development of a regular dialogue with the IARCs about course contents, believing this will ensure relevance. They also believe the IARCs have the expertise and capacity to mount courses not currently provided. The subjects most commonly requested are given in the Recommendations that follow.

2.10 There is widespread concern in the countries about the lack of information about forthcoming courses. The NARS, potential participants and donors consider the IARC training programs would be more efficiently used if a brochure were published annually giving the dates, cost, entry standards and contents of the forthcoming courses. If the brochure were produced by the IARCs collectively it could be used by NARS to select the courses most appropriate to their needs. It would also reduce the effect of the short notice sometimes given by an IARC when vacancies have arisen as a result of slots not being taken up by one or another country. The publication of the course contents would ensure that applications are made for appropriate courses. Occasionally in the past the subjects in the course have not conformed with what was expected from the title. Many donor representatives in the countries are not aware of the extent of IARC training and believe a brochure would be the most efficient way of overcoming the lack of information.

### 3. Participants

3.1 The qualifications held by participants attending courses have differed between countries. Nearly all the participants from Bangladesh had at least the B.Sc. degree and many had an M.Sc. or Ph.D., whereas from Senegal most participants had a lower level qualification. In view of the few comments made about qualifications, the IARCs clearly have been successful in modifying courses to arrive at appropriate levels of teaching to a group of participants. A few participants did comment on inefficiencies when a course was attended by mixed participants having different levels of qualification.

3.2 Virtually all the participants from some countries have been staff of the research services and none from the extension service, whereas for other countries the majority have been from the extension service. The proportion from the extension service varied from 1% for Bangladesh to 59% for Tunisia. These differences are due to the relative emphasis placed on research or extension in government policy and in donor-funded projects and on advice of IARC staff regarding selection. Although it is acknowledged that the local extension of research findings is a NARS responsibility and that the NARS should have a comparative advantage in extension, it is believed the IARCs should recognize the countries' many difficulties and the IARCs should help extension in every way they can.

3.3 A very low proportion of the participants have been members of staff of the universities, agricultural colleges or other educational institutes concerned with agriculture in the six countries. The NARS have indicated that it would be advantageous to the countries' research effort and future education if more academics and teachers had experience of the IARCs. It is thought they could then be involved in collaborative research and in in-country courses.

3.4 The NARS realize that the agricultural education provided by the IARCs serves many countries and that only a small proportion of their own country's staff can be trained. For development however it is essential that all the country's institutions providing an agricultural education be upgraded.

3.5 NARS staff who are working on crops other than the mandate crops of the Centers have been participants in courses and have benefitted from IARC training. The NARS believe such training should not be considered wasted effort by the IARCs, rather it should be thought of as contributing to agricultural development and institution building in the country.

3.6 The selection of persons to participate in courses is determined by national agencies, in consultation with donors and with Centers' staff who are in-country. Everyone, including participants, with the possible exception of some from Kenya, appears to be reasonably satisfied with the procedure, and instances of inappropriate persons being selected were thought to be few. It was recognized and accepted, that seniority is an important factor in selection in many countries. In Kenya it was thought the opportunities for selection were not equal and were biased towards counterparts in IARC or other donor projects.

3.7 The selection of participants is not based on projections of the need for trained manpower, as comprehensive and detailed studies have not been made. In several instances the NARS referred to the advantage that could be gained from having such projections made with some IARC input. They believe a more effective training program could then be operated.

3.8 At times very short notice is given about vacancies on courses, and as a result it has not always been possible to take advantage of the opportunities that have arisen.

3.9 A questionnaire for participants was developed jointly by the national collaborators and the TAC coordinating consultants. The one used in the Bangladesh study is reproduced in annex; the others were very similar.

#### 4. Follow-up and Employment

4.1 The NARS and participants place great value on the follow-up provided by IARCs after a course. It gives a participant the feeling of belonging to a community with similar objectives besides providing him with information and genetic material. They particularly value the regular receipt of information on recent research findings. Follow-up is so vital to the morale of participants that although the follow-up provided by IARCs is regarded as superior to that of other training agencies there were frequent requests that more be done.

4.2 For five of the countries, the exception being Ecuador, the participants have tended to stay in Government service and in the subject in which they received training at the IARC and only 1 to 4% have moved to the private sector. In these countries there are either few opportunities to change employment because the private sector is not well developed or else Government service has continued to be attractive. In Ecuador about 30% of participants have moved to positions in the well-developed private sector. Both in Ecuador and the other countries, this movement is not perceived as a waste of IARC training but is acceptable in terms of the countries' total development.

4.3 For all the countries the number of participants who have attended IARC courses and who are now unemployed is negligible in terms of trained manpower in general. Only in the studies of Tunisia and Senegal was there mention of the potential for supply meeting demand and for these two countries the circumstances differ. Tunisia had developed a very considerable capacity for agricultural education within the country and believes she is able to meet immediate needs. Senegal has had many privately sponsored students trained overseas but the training is considered to be inappropriate and there is unemployment among these graduates.

#### 5. National and Regional Representation

5.1 It is generally accepted there is a great advantage in having a Center's representative in the country. Besides the research he does he provides lines of communication and information on forthcoming training courses by his Center. The NARS also believe he can draw the attention of IARCs to local and regional problems, the need for a

whole-farm approach and not a single crop approach, and the socio-economic constraints that sometimes make his Center's technology of limited application. The NARS accept that it is not feasible to have a Center's representative in all countries and furthermore he cannot meet all the concerns expressed by the NARS.

5.2 Many consider that, in addition to Centers' representatives, there should be a person representing all the Centers operating in a region. He would be responsible for coordinating and rationalizing the activities of all Centers and liaising with the duplication of effort that has occurred at times and also to highlight gaps in training and research particularly in regard to a whole-farm approach. He could promote knowledge of the CG System so necessary in some regions such as francophone Africa. There is a risk, as noted in the Kenya Study, that a regional representative even for one Center has too much to do, but the rationalization of the Centers' collective efforts is seen as of such great value that it should be attempted.

## 6. Languages

6.1 The language issue is of concern particularly to the francophone countries of Africa but it is also a problem for young Sri Lankans. The need to understand English has restricted the number of persons who can be chosen for training. French speaking nationals learn English rapidly if given the opportunity, but this has not always been provided. Many participants indicated their keenness to learn English, realizing the advantages in terms of being able to cover the literature and improved possibilities for communication with other nations. Many production courses but few specialist courses have been given in French. There is also concern that the translation of scientific terms has frequently been incorrect.

## 7. Findings Relevant to a Few Countries

7.1 No one from the two Asian countries in the study has attended training courses in livestock at an IARC. Many senior staff of the animal research departments are unaware of the existence of the ILCA courses that are serving the African countries. A training in animal husbandry is particularly needed for the Asian region. There is less concern about a training in animal diseases because of the several good institutes in Asia devoted to specific diseases.

## B. RECOMMENDATIONS

### 1. Introduction

1.1 General recommendations that were common to all the countries are given first, followed by some specific recommendations put forward by one or two countries.

## 2. Training Opportunities

2.1 Increasingly the present production type of courses should be given in-country, as each country develops its pool of trained staff capable of giving the course. To hasten this process and improve the quality of teaching the Centers should give national trainers courses on teaching methods (the training of trainers). The Centers should continue to provide logistical support and some of the trainers in these courses.

2.2 In-country training should not replace all production training at the Centers as contact with the other activities of the Center and with Headquarters staff is of great benefit to participants and their countries.

2.3 The duration of many specialized courses should be extended to provide time for participants to understand more fully the subjects being taught. A greater period would also help overcome displacement and language problems and enable the participants to learn of other aspects of the Centers.

2.4 The IARCs with their own staff or in collaboration with specially commissioned personnel should give courses additional to those currently provided. The topics mentioned were extension methodology, research methodology, experiment station management, scientific documentation and data handling, library science, laboratory instrument maintenance and seed processing. For some courses the staff of two or more IARCs could profitably collaborate in the training.

2.5 The IARCs collectively should publish and widely distribute annually a brochure of training courses to be given in the following year. This should contain details of the dates and location of the courses, entry standards, closing dates for applications, costs and an outline of course contents. The brochure should also contain information on post-doctoral fellowships.

2.6 There should be regular opportunities for the NARS and representatives of other institutions in the countries to discuss the contents and duration of courses offered by IARCs.

2.7 In some countries it is evident the national universities cannot meet the need for higher degree training in agricultural science, and the IARCs should increase the opportunities they currently provide for persons to undertake higher degrees.

2.8 More links should be established between IARCs and national universities to provide for higher degree training. In time these links should be extended to include joint collaborative research.

### 3. Participants

3.1 Members of staff of universities and colleges should be participants in courses and the more senior academics should be encouraged to visit the Centers with a view to increasing collaboration. Suitable members of academic staffs should be used as trainers in in-country courses. Personnel in Government departments related to agriculture such as Irrigation and Water Management and Extension (where these are separated from research) should also be considered for participation in courses.

3.2 The IARCs should recognize that courses dealing with their mandate crops are of benefit to agricultural scientists working on other crops and be prepared to accept such scientists as participants.

### 4. Follow-up

4.1 The follow-up after training should be strengthened by the regular provision of newsletters and reports on research findings, longer visits by Centers' staff, cooperative research, the exchange of genetic material and the organization of meetings and seminars.

### 5. National and Regional Representatives

5.1 Each IARC should develop regional networks for training and research in in-country programs and use the best staff available in the region for the training.

5.2 IARCs collectively should appoint a regional representative who would develop regional networks for training and research in subjects such as farming systems that include the mandate crops of two or more Centers.

5.3 IARCs should assist in the planning of national research, extension and education institutions so that they provide an infrastructure for development. They should assist in the making of projections of the needs for trained manpower.

### 6. Languages

6.1 If a course is to be given in a language likely to cause difficulty to a participant, the opportunity should be provided for him/her to follow language training before the course commences. If a formal training cannot be arranged it could be based on a self-learning program using cassette tapes.

## 7. Specific Recommendations

7.1 The IARC System should recognize that for Asians a training in livestock is not available at ILCA because of its mandate for Africa. It is recommended that ILCA's mandate be enlarged or that some other Center be considered to meet the needs for training and research on livestock in Asia (Recommended by Bangladesh and Sri Lanka).

7.2 Each Center should select, in collaboration with the NARS, a senior individual in the government service who is an alumnus of the Center to act as a liaison officer and an additional channel of communication (Recommended by Bangladesh).

7.3 The Centers should encourage and help in the joint publication of research undertaken by nationals in collaboration with the Centers' (Recommended by Kenya).

## C. SELECTED ISSUES

1.1 The following expands on selected issues that have arisen in the Country Studies and seeks to analyze and interpret some of the data presented.

1.2 To a reader of the country studies it soon becomes evident that on some issues all six countries have had similar experiences in their relations with the IARCs and these experiences can be described briefly. On other issues the involvement has been diverse and the situation with each country needs separate treatment. The length of the discussion therefore is not an indication of the importance of an issue; it is a reflection of the diversity.

## 2. Links between National Universities and the IARCs for Higher Degree Work

2.1 The developing countries have for many years depended on universities in the developed countries to provide the higher degree education of many of the scientists serving in the countries' agricultural research services. This method of educating their research staff has come under increasing criticism in recent years for its high cost, the cultural shock experienced by the candidates, the long period the candidates are away from their homes and country, problems of language and families, the irrelevance of much of the training to developing country issues and the increased opportunity the training provides for the successful candidate to seek employment in the developed country. It is fair to say that overseas training is a major factor contributing to a brain drain.

2.2 As a means of overcoming these problems many developing countries have welcomed the proposal that their own national universities be linked to IARCs for higher degree training. The universities would provide the course work component of the higher degree and the IARCs the research component. It is believed with justification that the IARCs will provide an excellent training and one that often will be better than that offered by the national universities. Some IARCs have already shown what they can do in this regard, with their existing links to universities in the host country of the Center; the IRRI-UPLB link is an example. It is considered that the contacts developed by the candidates will enable them to integrate effectively with the Centers' research on their return to their national organizations.

2.3 This concept of linking national universities with an IARC is new to the six countries studied, and no one has graduated so far in this way. If the idea develops and becomes generally accepted it could form a significant component of IARC training.

2.4 The six countries differ in their recognition of the existence and value of such links. Whereas Bangladesh, Sri Lanka and Tunisia are enthusiastic about the prospect, in Senegal the matter has been barely considered.

2.5 In Bangladesh the national research organizations see the link as encouraging the agricultural university at Mymensingh to take a greater part in the country's research and helping to overcome isolation and other difficulties. Although the university was founded in 1961 and has 120 Ph.D.'s on its staff (i.e. half of the total Ph.D.'s in agriculture in the country), it has trained only four Ph.D.'s in agriculture in its 24 year history. This low output may be ascribed to various factors, many of them operating outside the university, but it does indicate that a valuable human resource in the form of a highly educated staff is not being utilised fully for post-graduate education.

2.6 In Sri Lanka the Post-Graduate Institute for Agriculture, founded in 1975, has awarded 10 Ph.D.'s. The Institute and the university from which most of the institute staff are drawn welcomes the links and sees particular merit in the relevance of the IARC training in research. The national research organization believes any university-IARC cooperation will ensure the university's involvement in the applied problems that face the national organization.

2.7 In Tunisia the Ministry of Agriculture has expressed enthusiasm for links with ICARDA and it was hoped some higher degree candidates would commence study this year. The system in Tunisia for awarding higher degrees resembles that operating in France and is not the same as that in Bangladesh, Sri Lanka or Kenya. Clearly, however, accommodations have been made to satisfy the Tunisian system. This augurs well for other francophone countries who wish to make use of IARC research opportunities. Language differences between candidates

of these countries and many IARC staff will continue to prevent efficient communication but in the long term it will be to the candidates' advantage to be able to converse and read the scientific literature in English and it will be to the supervisors' advantage to be able to communicate more effectively in French. Because there are strong similarities between French and English this language problem is far less serious than the one experienced by many Asian students (including increasingly staff from Sri Lanka who have not been educated in English) who go to an IARC for higher degree research.

2.8 Kenya has seen a very rapid increase in the number of its agricultural staff and has made projections of need for trained manpower with post graduates qualifications for the next few years. These needs cannot be met by the national university and, even with the present numbers, there have been problems in supervising candidates. The prospect of linkages with IARCs has not been adequately considered by the university largely because of a lack of awareness of such possibilities.

2.9 The prospect of Senegal utilizing links is still remote for many branches of agriculture, as a university level institute for agriculture (L'Institut National de Developpement Rurale) was only created in 1981/82 and no one had graduated by 1984. Under the Senegalese system, like that of Tunisia and France, the first degree - the Ingenieurs degree - requires 5 years of study. Higher degrees (troisieme cycle) are therefore even further away in time. Moreover, the degree can only be undertaken if a person of professorial status is available to act as supervisor. Currently there are no professors on the Institute's staff.

2.10 The situation is different for candidates interested in veterinary science or animal nutrition as these subjects have been available for sometime from the University of Dakar where there are professors who could co-supervise candidates. ILRAD in 1984 announced it would welcome francophone students for higher degrees and the conditions therefore seem propitious for the commencement of links in these subjects.

2.11 Senegal maintains strong cultural and financial ties with France where a high proportion of higher degree training has been obtained in the past. Many degrees obtained elsewhere (including the USA) are not recognized officially, and it is only recently that a Commission has investigated the recognition of PhDs from the USA. No French university has had links with an IARC for higher degree training. It seems therefore that for some time the number of francophone students from West Africa seeking to do the research component of a higher degree at an IARC will continue to be small.

2.12 Some of the donor and aid agencies prefer higher degree training to be undertaken in the donor country and are not enthusiastic about supporting training in a third country. It has been easy for detractors of aid programs to suggest questionable

motives for this preference but frequently there are genuine desires that the training in the developed country will also involve a cultural exchange and foster a deeper understanding between the two countries. It must also be recognized that the visibility of an aid program does make it simpler for the donor government to obtain public support for the program.

### 3. The Recognition of Degrees

3.1 The issue of the recognition of degrees arises because of the possible increasing collaboration of the IARCs with universities in the provision of higher degree training. The agricultural services of some countries will only recognise degrees awarded by a limited number of approved foreign universities. This limitation is imposed to maintain standards and is a praiseworthy objective in itself provided the approval is based on sound agricultural and educational principals.

3.2 The six countries differ in their official recognition of degrees obtained in foreign universities. At one extreme lies Senegal which until recently recognized degrees only from France and a very limited number of other countries (the USA was not among them), and at the other extreme lie Bangladesh and Sri Lanka which recognize all degrees no matter where they are obtained. The Senegal insistence on French or equivalent degrees has ensured a high standard of a certain type of degree, but it has been at a cost in terms of a limited outlook and diversity of experience among its staff. The view is expressed in the study for Senegal that French education gives a theoretical and intellectual training at a very high level, but practical aspects of the research are lacking. An education in some of the English-speaking countries is often believed to be preferable in that it provides the person with the capacity to tackle research problems he will experience at home. The official attitude to recognition is changing only slowly in Senegal as these views are not held by everyone. Understandably the need for an education in problem-oriented research is not present in all disciplines, and in many disciplines French degrees are highly appropriate. A second mitigating factor is that a large proportion of the available grants are from France for education at a French university and not elsewhere. The IARCs are not considered. These grants are part of France's continuing cultural and traditional ties with Senegal, a relationship respected by both sides.

3.3 The situation in Bangladesh and Sri Lanka is very different. Neither country has maintained close relations with an overseas country through a feeling of traditional or cultural ties, and grants for higher education have come from many different sources. Any award that has become available has been taken in the desire to have as many people trained as possible. When this is added to the view that higher degree education is cheaper and preferable in some respects from a university in a developing country, it is understandable that

both Bangladesh and Sri Lanka have felt the need to officially recognize all degrees. At an unofficial level, and on a basis of capability following training, it is realized within the Bangladesh and Sri Lankan agricultural research service that a Ph.D. from one university may not be of the same standard as that from another university. Some universities award a Ph.D. for a much lower standard of work than others. Unofficially, this is realized; but officially, all Ph.D.s are recognized as the same qualification.

3.4 The significance of all this to the IARCs is that some countries will take every opportunity to train their nationals through links to overseas universities as the official recognition of degrees is not in question, whereas other countries will be much slower in favouring higher degree education involving IARCs because of the non-acceptance of certain degrees.

#### 4. Information about Forthcoming Courses

4.1 An opinion common to the six countries was that they receive insufficient information about forthcoming courses. There was a widespread belief this deficiency would be overcome if the IARCs were to collaborate and produce annually a brochure of all training courses to be held the following year. The brochure could contain details of the dates and location of each course, expected standard for entry, its cost and the course outline. The NARS believe the brochure would enable them to formulate training plans more in accordance with needs. When two Centers were giving similar courses it might be possible to decide which was the most appropriate. The NARS understood very well that the announcement of a course in a brochure did not mean there would be vacancies available to their staff.

4.2 The participants said that a brochure with entry standards would ensure they attended courses that were at an appropriate level and on a subject in which they were interested. They were concerned that at times participants with mixed backgrounds were in the one course, and that for those with a higher level of initial training the course covered material with which they were already familiar. This issue of attending a course that is inappropriate can be very serious for participants from countries like Bangladesh where there are controls on the number of overseas visits a national may make in a given period. Attending a course one year will limit his prospects of attending another for some years to come.

4.3 The representatives of the donors in the countries were also concerned that they were not sufficiently aware of training opportunities available at the IARCs. For some, the absence of information has meant that IARC training has not entered into their consideration when dispensing funds. They believed a brochure produced in collaboration by all the IARCs would greatly assist a rational approach to their funding of training.

## 5. Short Courses and Specialist Courses

5.1 The short course of two to four weeks duration provided by the Centers to specialists or to those wishing to learn a technique were very commonly criticized for their short duration. The participants and NARS emphasized that the displacement shock, and cultural and language problems were often greater than Centers' staff realize, and that the benefit from the course was not in accord with the cost. This concern was so frequently expressed that it clearly represents a serious matter that needs to be addressed. The courses are not having the benefit that could be achieved with courses of longer duration.

5.2 At the same time, it should also be emphasized that the specialist courses were the ones considered to be the most valuable to research and sometimes extension staff. There was a widespread feeling that great benefit would result if more were available.

## 6. Participation in Courses

6.1 In each of the country studies the authors have presented tables of the numbers of their nationals who have attended the production and specialist courses or who have been involved in degree related research while at the Centers. Because the Centers were established at different times and to provide some comparability across Centers, the numbers for the years after 1972 are presented here, and within parentheses the number of participants before 1973. In the country studies themselves the numbers are given for each year, but that detail is not warranted here as the trends are simply described. There are uncertainties about the precision of the figures in these tables as Centers use different terms to describe courses and there are ambiguities about what constitutes a visit or a short course. In addition, records have not always been kept as well as they are now that computers are available. As there are doubts about precision there is little point in trying to extract the last bit of information from these tables and only the obvious trends are discussed for the three types of training.

6.2 Production courses. The numbers attending this type of course are given in Table 1 where it is evident that CIP has had both the greatest number and widest distribution across the range of countries. This is understandable given CIP's emphasis on increasing production by means of courses given in various regions. It is also evident that some Centers - IBPGR and ILRAD - do not give this type of course as they do not conform with the Center's mandate. On less sure ground it might also be suggested the figures indicate a lower participation from the two francophone countries, Senegal and Tunisia.

**Table 1** Participation in Production Courses for the years 1973-1984.  
(In parentheses the numbers prior to 1973)

	Bangladesh	Ecuador	Kenya	Senegal	Sri Lanka	Tunisia	Total
CIAT	0	52 (15)	4	0	0	0	56 (15)
CIMMYT	66 (2)	14 (2)	9	0	0	7 (9)	96 (13)
CIP	42	45	192	8	33	38	358
IBPGR	1	0	0	0	0	0	1
ICARDA	7	0	0	0	0	15	22
ICRISAT	1	0	35	10	10	0	56
IITA	0	0	50	17	26	0	93
ILCA	0	0	69	0	0	0	69
ILRAD	0	0	0	0	0	0	0
IRRI	69 (8)	0	0	3	114 (41)	0	186 (49)
WARDA	0	0	0	62	0	0	62
<b>TOTAL</b>	<b>186 (10)</b>	<b>111 (17)</b>	<b>359</b>	<b>100</b>	<b>183 (41)</b>	<b>60 (9)</b>	<b>999 (77)</b>

6.3. Specialist Courses. In Table 2 the numbers attending specialist courses are given. Perhaps an obvious point may be mentioned that was referred to in the Ecuadorean study, namely that participation is strongly biased towards the nearest Center. This would follow in view of regional similarities in environment, crops and livestock but it is surprising that no Ecuadorean has been to the more distant Centers where the crops grown in Ecuador are mandate crops.

6.4 The figures also reveal a matter of concern to the Asian countries, namely that they have been unable to participate in courses given in the animal Centers in Africa.

Table 2 Participation in specialist courses for the years 1973-1984  
(In parentheses the numbers prior to 1973)

	Bangladesh	Ecuador	Kenya	Senegal	Sri Lanka	Tunisia	Total
CIAT	0	75 (2)	0	0	0	0	75 (2)
CIMMYT	2	25 (5)	78	5	0	14	124 (5)
CIP	17	0	6	3	7	28	61
IBPGR	10	0	0	2	0	0	12
ICARDA	0	0	2	0	0	25	27
ICRISAT	3+	0	0	20	2	0	25
IITA	0	0	3	9	2	0	14
ILCA	0	0	14	1	0	0	15
ILRAD	0	0	26	1	0	0	27
IRRI	89 (12)	0	0	1	48	0	138 (12)
WARDA	0	0	0	20	0	0	20
TOTAL	121 (12)	100 (7)	129	62	59	67	538 (19)

6.5. Higher Degree Training. The number of persons who have received higher degree education with Centers' support is given in Table 3. The higher degree may have been obtained at a university in a developed country or it may have involved some time at a Center and a university in the Center's host country. It is clear from the table that IRRI has provided more support for this type of training than have the other Centers. One result is that the countries that grow irrigated rice - Bangladesh, Sri Lanka and Senegal - have had a greater number of people trained in this way. CIMMYT has been much less involved because it has approached training differently. It has been only in the last two years that the nine Bangladeshis indicated in the table have commenced their higher degrees with CIMMYT support as a complement to CIMMYT's highly successful wheat program in Bangladesh.

**Table 3** The number of persons who have received higher degree education with Centers' support

	Bangladesh	Ecuador	Kenya	Senegal	Sri Lanka	Tunisia	Total
CIAT	0	3	1	0	0	0	4
CIMMYT	9	0	0	0	0	0	9
CIP	3	2	1	0	2	1	9
IBPGR	2	0	0	0	0	0	2
ICARDA	0	0	0	0	0	0	0
ICRISAT	1	0	5	0	14	0	20
IITA	0	0	3	0	2	0	5
ILCA	0	0	4	0	0	0	4
ILRAD	0	0	10	0	0	0	10
IRRI	65	0	0	2	29	0	96
WARDA	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>80</b>	<b>5</b>	<b>24</b>	<b>2</b>	<b>47</b>	<b>1</b>	<b>159</b>

#### 7. Between Country Differences in the Participants

7.1 Differences between countries in the participants is evident mainly in the relative proportion of research or extension personnel.

7.2 Training in extension is not a mandate of any IARC as it is believed within the CG System that Centers do not have a comparative advantage in extension. Extension is strongly related to the locality, cultural factors and government policy. It is therefore the responsibility of government service. However, NARS in many countries realize that to increase food production the extension of research findings must be undertaken efficiently. These countries have made use of the IARC production and specialist courses or the in-country courses to further train their extension staff in the latest technologies of production. Large differences were encountered between the countries in ....

.... the percentage of participants concerned with extension

Bangladesh	Ecuador	Kenya	Senegal	Sri Lanka	Tunisia
1	NA*	33	24	30	59

\* A very small but undisclosed proportion.

7.3 These differences have been caused by the actions of the Governments, donor organizations, and the IARCs. For example Bangladesh has had Centers' staff in the country's research institutes for a long period of time and they have favoured the education of their counterpart staff. The result has been the strong research units in BRRI and BARI. In contrast there have been no large programs on extension in Bangladesh and serious deficiencies are now evident.

7.4 In many countries it is very difficult to organize an efficient extension service. The Ecuadorean study illustrates this point. Extension is not included in the responsibility of any department, section or technical service of the Ministry of Agriculture and none of the participants in IARC courses could be identified as extension personnel.

7.5 Sri Lanka had a large World Bank loan to upgrade its extension service and the training funds in the project were used to send staff to IRRI. On the other hand IARC staff have not been stationed in country in recent years and there has not been an emphasis on research.

7.6 The very high proportion of extension staff (59%) among Tunisian participants is partly a consequence of CIP in-country courses designed to increase productivity, but even for the other IARCs involved - CIMMYT and ICARDA - nearly 50% of participants have been extension personnel. This emphasis on extension is a result of the Tunisian government policy of developing the extension services.

## 8. Participants Working in the Private Sector

8.1 The proportion of participants that are now working in the private sector also varied a great deal....

... the percentage of former participants currently employed in the private sector

Bangladesh	Ecuador	Kenya	Senegal	Sri Lanka	Tunisia
2	32	4	1*	2	2

\*Present employment unknown - presumed to be private.

These differences were related to opportunities for employment in the private sector in the various countries. In Ecuador, where that sector is well developed and where cash crops are a valuable part of agricultural production, there are considerable opportunities for employment. Furthermore, a person who has been trained in an IARC has a qualification and experience that makes him attractive to employers in agribusiness.

8.2 In the other five countries studied the private sector presents fewer opportunities and the proportion of participants who have left government service is very low. The countries do not regard a change to the private sector as being a loss as the persons will continue to contribute to the country's agricultural development and well-being.



18. How do you rate this contact with IARC?  
(a) useless            (b) useful            (c) outstandingly useful
19. Are you working in the commodity in which you were trained?
20. Are you involved in any collaborative or cooperative research with IARC?
21. Are there any constraints to your work?  
(a) inadequate support staff  
(b) inadequate operational budget  
(c) inadequate facilities
22. How many times did you visit the IARC where you were trained, and for what purpose?  
(a) further training  
(b) visiting scientists' program  
(c) seminars/workshops  
(please indicate against each number of visits)

