Consultative Group on International Agricultural Research
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From: The Secretariat

December 20, 1985

Consultative Group Meeting
October 28 - November 1, 1985
Washington, D.C.

MAIN CONCLUSIONS REACHED AND DECISIONS TAKEN

1. The Consultative Group on International Agricultural Research (CGIAR) held its regular yearly meeting, International Centers Week, from October 28 - November 1, 1985, in Washington, D.C. A two-day seminar on the impact study preceded the business meeting, which took place from October 30 to November 1. A note on the impact study discussions and a summary of the main conclusions reached and decisions taken at the Group meeting are attached, together with a list of the participants (see Annex I).

2. Members of the Group can obtain a transcript of the proceedings of the meeting on microfiche from the CG secretariat.

Attachments

Distribution
CG Members
TAC Chairman, Members and Secretariat
Center Board Chairpersons
Center Directors
Other Participants
Observers
Impact Study Seminar

1. The highlights of the impact study were presented and discussed by the Group in a two-day seminar on October 28 and 29, 1985. The seminar was open to observers and essentially consisted of presentations of highlights of the study by the Study Team. Following each presentation the discussion was initiated by an invited speaker (see Annex II).

2. Because the purpose of the seminar was to provide information to the Group, and because the full impact study consists of a printed summary, a main report and over 20 study papers, it is impossible to summarize either the main findings or all the comments that were made during the two days. In general, however, the impact study was well received by the Group.

3. The most frequent suggestions and comments included the following:

- the implications of the study's findings for the future work of the CGIAR should be drawn out more directly,

- TAC should study the documents produced by the study and take them into account in its deliberations on the future of the CG system,

- the system must consider whether it is currently meeting the research needs of Africa in the optimal way; the same holds equally well for other regions, but it is more evident in the case of Africa where there has been less impact,

- the CG centers should tailor their programs to the needs of individual countries,

- there is a question as to whether the CGIAR should expand its area of concern beyond strictly food crops and become more concerned with income rather than production, and

- the study did not completely satisfactorily explain why there was a convergence of political, scientific and bureaucratic will in the 1960s which was effective in leading to the "Green Revolution" in some places but not in others.

Several commentators noted that the quality of the report varies from chapter to chapter, and hoped it could be brought up to a uniform quality.
4. The Chairman indicated his belief that the study would form the basis for discussions within countries and among institutions, with governments, and would provide material for research in the future. In order to meet those needs the report should be amplified, clarified and edited as needed by Jock Anderson and his colleagues, after which the CG would proceed with its publication.

Group Business Meeting

5. The Consultative Group Meeting was held in the International Monetary Fund's Auditorium in Washington, D.C. from October 30 to November 1, 1985. The Chairman of the Group, Mr. S. Shahid Husain, presided over the meeting.

6. Mr. Husain's opening remarks to the Group are attached as Annex III.

Report by TAC Chairman on 37th and 38th Meetings - Agenda Item 3

7. The major focus of TAC over the last two and a half years has been strategy considerations, which was a separate agenda item. The External Program and Management Reviews of ISNAR have been received by TAC and will be reported on at Ottawa.

8. TAC reviewed the center-prepared paper on "Nutritional Concerns in International Agricultural Research" and found the paper timely and highly valuable in consideration of priorities and commends the centers for having addressed the topic. TAC recognized that in addition to the centers' efforts aimed at increasing the production of basic food commodities, other opportunities are available for centers to contribute to improved nutrition of poor people. TAC encouraged the centers to monitor the work of other international organizations, such as WHO and FAO in these areas, so that nutritional considerations can be appropriately embodied in resource strategies. TAC had also reviewed the budget study and endorsed those recommendations which call for the adoption of common accounting policies and common reporting formats for all financial statements, including those related to restricted and extra funds. Implementation of these recommendations as soon as possible would contribute to the improvements of financial and management practices in the system. TAC has engaged a consultant to prepare a short version of the training study for publication in book form and expects the manuscript to be ready for publication by the end of the year; the cost of the publication and its distribution is being borne by generous support from the governments of the Federal Republic of Germany and Sweden.

9. Two external reviews are scheduled for 1986; ILRAD which will actually begin in December 1985 and ILCA which is scheduled for March and April, 1986. The review of ILCA will see the end of the second cycle of external reviews, approved in November 1983. There have been at least 24 reviews of one kind or another since January 1983, with 18 of them external
program and management reviews. TAC is of the opinion that the review system itself should be studied. The objective of the analysis is to come up with better tools to meet the donors' legitimate needs in managing the system, also to increase the utility of the reviews, particularly with respect to the long-term guidance of the system and to reduce the burden on the centers and others in terms of time, manpower and financial resources. Dr. Vernon Ruttan has been retained to do a paper for the study. A time frame for this study will be reported in Ottawa.

10. TAC will shortly send out invitations requesting submissions for the 1986 King Baudouin Award. The selection will be made in June 1986 and the center chosen will be honored in Washington next November.

11. Professor Camus thanked Alexander von der Osten, who has been named Director General of ISNAR, for his work as executive secretary of TAC and introduced Dr. John Monyo as his successor.

12. In response to a question about donors sitting in on TAC meetings, Dr. Camus emphasized that TAC welcomed inputs from anyone who wished to attend the meetings and that TAC's ultimate decisions and advice were independent and their own responsibility. Dr. Camus responded to the questions concerning TAC's view of the impact study by stating that TAC was quite impressed by the outcome of the study which was conducted quite independently and without formal contact with TAC. TAC, however, did benefit during the course of the priority and strategy considerations discussions from inputs from Dr. Herdt of the CGIAR secretariat, who was associated with the impact study. TAC intends to give an in-depth consideration of the impact study document and to recommend how continuous monitoring of the evaluation of the impact could be done through the centers. The discussion on the external reviews of the centers led to an agreement by the Group that the third review of the system should only take place when a consensus had been reached on priorities. There was agreement, however, that the third review would analyze the decision-making process or governance of the system.

Report by Chairman of the Board Chairpersons - Agenda Item 4

13. Professor Dillon, chairman of the board chairpersons, reported to the Group on the two meetings held in 1985. The chairs attributed great importance to the impact and priorities studies. Comments on the latter had been given during the discussion on the previous day; the chairs would wish to continue to make inputs to the study as it progressed through its different stages. On the impact study the chairs believed that the implications of the study should be drawn out both systemwide and center by center. After editing, the study should be published and an executive summary, at least, should be translated into French and Spanish. Dr. Cunningham had prepared a paper for the board chairs on their potential contribution to the system, partly stimulated by the need for a follow-through on the impact and priorities studies, but also by the sense that the Group lacked a component specifically responsible for "visionary thinking". The chairs had identified the need for a small group,
unencumbered by considerations of the operational, organizational and financial problems of the system, to meet annually or biennially to do some deep and free-wheeling thinking about the system.

14. Following a request from the Group in Tokyo, the chairs had a preliminary discussion on comparative cost analysis between centers and agreed there should be a standardized coding system for center accounting, as recommended by the financial reporting and budgeting study currently under preparation; a further paper would be considered at the chairs 1986 meeting. The chairs recorded their support for the major recommendations of that study, but implementation would hinge on ironing out the problems of practical implementation. Pursuing the Group's comments at Tokyo, the chairs considered their role relative to center mandates and concluded that it was a continuing one of monitoring and of ensuring inter-center cooperation in the integration of mandates. The chairs discussed the functioning and the membership of their boards. A survey of the characteristics of the members, which had been done by Dr. Hertford, would be incorporated into the ongoing exercise undertaken by the CG secretariat. That exercise already showed the impact of some of the recommendations of the Hardin paper (The Roles, Relationships and Responsibilities of the Boards of Trustees, prepared by Dr. Lowell Hardin and discussed and approved by the Group at ICW 1984.)

Professor Dillon referred to Mr. Husain's opening statement to the Group in which he said that one of the fundamental bases of the CG system lay in the strength, accountability and autonomy of the Boards of Trustees, and urged donors and host countries to recognize the independence of the boards. In the context of board responsibilities, the chairs were preparing a coda of experience on the selection of a director general. In conclusion, the chairs recommended that the third review of the system should only take place after consideration and digestion of the impact and priorities studies.

15. In response to a donor's request, Mr. Husain said he would bring up at a future meeting a discussion, not just on the role of the boards, but on their functioning. One donor agreed that donors should be very careful not to put pressures on boards but, at the same time, they needed to be able to inform the boards of their concerns as donors; another speaker considered that the issue of board autonomy was a very serious one indeed and that donors should monitor their own relations with boards very carefully. A speaker registered his support for the idea of the board chairs being the Group to do some "visionary thinking"; he also went beyond the chairs' suggestion that the impact study be published, and suggested that the chairs should identify ways in which the findings of the impact study could be disseminated, before its publication, internationally and within member countries. Questions were raised about the number of boards with program committees (all of them) and the number of women on boards (nine). In this context reference was made to the computerized data base that has been prepared in the CG secretariat, which provides information on the characteristics of board members and on the structure of the boards. The data were being refined and would be circulated to the Group early in 1986.
Report by Chairman of Center Directors - Agenda Item 5

16. Dr. Bommer, who chaired this session, invited Dr. Williams to present his report on behalf of the group of center directors. Dr. Williams reported only on those aspects of the directors' activities which would be of greatest interest to the Group. He noted, first, that, as a follow-up of the directors' meeting with Mr. Husain on Sub-Saharan Africa held in January 1985, the directors began studying the training needs in Africa and the centers' comparative advantages in meeting these needs. One meeting was held at ISNAR in September and the training officers from CGIAR and non-CGIAR centers will be meeting again in 1986 to formulate a strategy and specific proposals for action.

17. The directors' group has decided to devote at least 50 percent of its meeting time to substantive issues facing the system. In this connection next year the directors will be addressing seed policy issues; a paper on the subject will be discussed at the directors' meeting in June and subsequently forwarded to the TAC and the Group. Inter-center seminars scheduled for the immediate future include seminars on variability in crop yields (organized by IFPRI, December 1985), farming systems research (organized by ICRISAT, February 1986) and agro-ecological characterization and classification (organized by ICARDA, April 1986). He also noted that the directors agreed to update every two years the paper prepared by Dr. Gamble on inter-center cooperation.

18. The directors were pleased with the first CGIAR Annual Report and offered full assistance to the secretariat in the preparation of future annual reports. Dr. Williams noted that the information officers from the centers were also supportive of the CGIAR Newsletter and recommend its continuation with a different format and editorial policy. He concluded his presentation by informing the Group that Dr. Peter Brumby will serve as the chairman of the center directors next year.

19. In the discussion of Dr. Williams' report, several speakers expressed satisfaction with the degree of cooperation that exists between the centers. A few speakers suggested specific policy issues for consideration by the directors, such as the role of the centers in facilitating the transfer of emerging technologies to developing countries (e.g., molecular biology, genetic engineering, agroforestry, biotechnology) and linkages between the centers at the national level.

Strategic Considerations Study - Agenda Item 7

20. A day was devoted to a discussion of the TAC paper on strategies and priorities. After a brief introduction by the TAC Chairman, the members of the TAC Standing Committee on future strategies briefed the CGIAR members on TAC's conclusions. This briefing included: (1) a discussion of the evolution of the CG system and its long-term strategies by E.T. York; (2) a brief outline of the analytical procedure used by TAC to reach its conclusions by Alexander von der Osten; (3) a presentation of the long-term
evolution of the system's program priorities by Alexander McCalla; and (4) a presentation of commodity priorities by Michael Arnold. The subsequent discussion was wide-ranging, with a variety of opinions expressed. On many issues opposite views were expressed and because of the nature of the discussion, which was one of exploring issues, there was no effort to reconcile divergent views or reach a consensus on the issue of the long-range strategy for the CGIAR. Instead, the Group focused most of its attention on the ideas in the document produced by TAC. In what follows, an attempt is made to reflect the flavor and diversity of that discussion.

21. Many members of the Group expressed their gratitude to TAC for the hard work and dedication reflected in the document, especially the clarification of system goals and program activities. There was broad consensus on the need to reflect adequately the future requirements for research contributions to food production given the population growth that is already assured by the birth of the mothers of the next generation. There were many comments on the issue of whether the CG's scope of concerns ought to remain exclusively on food crops. TAC's statement of the system's goal is restricted to food crops; many agreed, many others voiced a cautious opinion that because the food problem is an income problem and because the ecologies in many food-short areas require perennial crops for stable productivity, the CG ought to expand its scope to appropriate non-food crops. TAC was applauded for its vision in identifying and articulating a concern for resource management and sustainability of production, but most speakers were concerned that there was not adequate indication of how this concern should be manifested in the programs supported by the CG. Many asked how the centers should address soil and water management and agroforestry concerns.

22. A number of speakers expressed the opinion that the assumption of constant or at most a 25 percent increase in funding set too restrictive a tone for the analysis, particularly over a long period. It was TAC's job to establish priorities on technical grounds; resource constraints should be considered separately and, particularly, for the longer run. On the other hand many speakers agreed that TAC's approach met the funding realities.

23. Most speakers supported the general recommendation that the centers concentrate more of their resources on "upstream" research, in those regions where national research capacities could do the downstream work. Some advocated the transfer of responsibilities for downstream work to national programs, but others questioned the use of the term "transfer," arguing for greater partnership with each doing what it could best accomplish. The generation of fundamental knowledge may best be accomplished by specialized institutions, with the role of the centers that of applying that knowledge to problems; the use of terms like upstream and downstream was considered to be confusing, rather, the problems on which the centers would need to work ought to be defined.

24. A number of recommendations were made about increasing research on specific commodities; many mentioned annual oilseeds, others mentioned non-CG centers' activities. One or more speakers supported increased research
emphasis on unfavorable areas, on rainfed crops, on extension, on pesticide use, on socioeconomic aspects of technology development and introduction, on strategies that will avoid or reduce undesirable consequences of new technologies, and on animal research in Asia and Latin America. Many speakers indicated they would have liked to have seen stronger justification of the recommended shift away from wheat and rice. The Group was reminded that no speaker had identified research that should be cut out; to the contrary, it was recognized that continuity of support was important and for research to be productive it needed long-term support.

25. A number of speakers noted TAC's support for the "center model" but argued that the Group should explore new mechanisms like networks, posting staff to national programs, more regionalization of networks, germplasm exchange and training, more partnerships assessing constraints and results, more targeting of beneficiaries and the possibility for network coordination with some funding and occasional technical research support.

26. There was considerable concern as to how the implications of the impact study could be brought together with the ideas in the priorities paper of TAC. Some speakers suggested that TAC consider the impact study and bring a new consolidated strategy document to the Group. Others suggested that the chairman appoint a small group of the best intellects associated with the system to give the two reports, and any other relevant material, in-depth consideration on behalf of the Group, with many supporting a role for TAC in this exercise.

27. The chairman of the Group and the chairman of TAC conferred about the issue and decided to proceed with an intensive examination of future strategies. A task force on strategic planning for the CG was appointed by the CGIAR chairman consisting of Drs. App, Lampe, Moscardi, McWilliam and members of the Standing Committee of TAC (Drs. York, Arnold, Javier, McCalla and von Urff) to consider these issues on behalf of the Group. A number of speakers urged that the task force complete its work before the Ottawa meeting of the Group, but others noted that because the Group is planning for a 25-year time horizon, adequate inputs ought to be mobilized to deal fully with the issues. It was recognized that this would require time, but the Group anticipated receiving evidence of progress at its Ottawa meeting.

IBPGR - Committee Report - Agenda Item 8

28. The chairman, Mr. Husain, introduced the subject by summarizing the background of the issue, including the report of the external review panel, the two reports of the TAC, the discussion by the Group at Tokyo and the two reports of the CGIAR committee on this topic which he appointed at the Tokyo meeting. The issues included the need for extensive research on methodology of genetic conservation, the means of implementing such research, and other matters. Much attention had been focused on the management and structure of the IBPGR. The panel had found that being subject to the procedures of the FAO, the uncertainty concerning the responsibilities of the board had not
been conducive to the efficiency and future development of the IBPGR. The physical location and available space were also found to be unsatisfactory.

29. The committee had generally endorsed the recommendations of the TAC at this first meeting. The conservation of genetic resources was crucial to the future of the world, and hence the work of the IBPGR was of the utmost importance. The dual responsibility of the IBPGR could not continue: it should have greater authority in setting and managing the implementation of policy, it should choose a director and staff, and set appropriate salaries. The committee suggested explorations with the director general of FAO and the Italian government.

30. At its second meeting, the committee heard reports of discussions with the cosponsors, with the Director General of FAO, and with the Italian Foreign Ministry. The committee's recommendation was to continue efforts to convince the FAO to change the arrangements to make it possible for the IBPGR to remain within the FAO, and to make this clear in the formal letter which the Director General had requested be written to him outlining the CGIAR's position. In the meantime, the committee suggested taking preliminary steps to establish the IBPGR as an independent organization. The IDRC had been requested to act as an implementing agency on behalf of the Group and to make such an exploration, including, for example, looking into the implications and costs of a different arrangement. But no irrevocable steps would be taken in that direction until the response from the FAO was received, probably in early spring of 1986.

31. The members of the committee said in turn that they agreed with the summary, but some reserved their rights to participate further in the discussion.

32. Dr. Bommer speaking for the FAO reiterated positions taken earlier in presentations and in writing. It was constitutionally impossible for a body which was entirely responsible to an outside group to be a part of the FAO. It would also not be possible for an element within the FAO to have a separate salary structure. The FAO did not agree with setting up an independent body, but if it was the decision of the CGIAR that this should be done, appropriate means of cooperation would have to be established.

33. In the discussion that followed, most speakers indicated a desire to have the IBPGR remain within the FAO, provided that arrangements could be made to allow the IBPGR to pursue the goals set for it by the CGIAR effectively. If it was necessary to move to an independent organization, that organization would be expected to cooperate closely with the FAO. There was agreement that the work of the IBPGR was vital and should be continued under any circumstances. A number of speakers spoke in support of the recommendations of the CGIAR committee as presented by the chairman.

34. Speakers stressed that the improvements involved required a more independent management structure for the IBPGR, and a stronger scientific base for its staff. There was particular virtue in combining within the
CGIAR concern for genetic resource conservation and plant breeding. Others mentioned the need for a speedy resolution of the matter because of problems for staff and for the effective implementation of programs in a period of uncertainty.

35. One speaker called upon the FAO to be flexible in its approach, and to come up with proposals that might be acceptable to the Group. He suggested that there might be a means of having the board effective without necessarily making it independent in a formal sense. He pointed out that the Commission on Plant Genetic Resources had called for a reexamination of the relationships between the IBPGR and the FAO and hoped that in the context of this reexamination some compromise might be achieved. He asserted that there were no differences in priorities between the FAO and the CGIAR in this matter. Several speakers called for the examination of alternative approaches, including having the heavy research responsibility handled by the existing centers rather than by the IBPGR. One suggested that the IDRC should be charged with looking into alternatives.

36. Dr. Bommer replied on this point that there was no possibility of flexibility from the FAO point of view on the two points of having a part of the FAO controlled by a board that was independent, or having a different salary structure from that specified for the FAO by the UN system. If the CGIAR was inflexible on these points, it amounted to a decision to take the IBPGR out of the FAO, and the discussion would have to focus on what activities the IBPGR could then conduct effectively, vis-a-vis other bodies.

37. A speaker said that his government needed to know more about the implications of the establishment of an autonomous genes board before it could take a final position. He hoped that at Ottawa there would be more information on these implications. Would there be a joint working group between the commission and the autonomous board? If not, could TAC spell out the relative functions of the two bodies, with some ideas of how overlap could be avoided?

38. A number of alternative organizational approaches were suggested, including the FAO/IAEA unit located in Vienna (which may not be fully applicable because it is a collaboration of two UN system agencies). Dr. Bommer pointed out that there were several such collaborative endeavors in existence. Another possibility was the Collaborative Program between the World Bank and the FAO. It was agreed that these models should be looked at.

39. Speakers noted that in a time when funds were short, it would be well to work out a compromise with the FAO to avoid any duplication of effort.

40. The representative of Italy, responding to a request by the chair, said that if and when the Group decided to establish an independent genes board, the Italian government would be asked to give favorable consideration with respect to the international status of the IBPGR and would do its best to solve the problems concerning privileges and immunities in order that the center can operate effectively and with success.
41. In summarizing the discussion, the chairman said that the message from the Group - 'do your best to achieve a continuing arrangement with the FAO' - was clear. It was also clear that the Group wished to have an effective organization in the field of genetic resource conservation. There would be a formal communication to the FAO, which would outline the problems with existing arrangements, and also state that the Group was still open to alternatives.

42. The IDRC, with the help of the secretariat, would meanwhile investigate various aspects of setting up an independent organization and report back on costs, implications and related matters to the Group at Ottawa. The CGIAR committee would remain in existence to undertake continuous follow-up on these issues.

43. At the conclusion of the discussion, the chairman of the IBPGR Board commented on the need to continue with the task of the board during and after the interim period. He agreed with the chairman's point that hiring should be suspended by the IBPGR pending a decision on its future.

WARDA - Status Report - Agenda Item 9

44. Mr. Husain introduced this agenda item by asking Professor Camus and Mr. Farrar to summarize program- and management-related developments at WARDA, respectively.

45. Professor Camus noted that in June TAC was strongly encouraged by the progress made by the Association. One disquieting note was the level of contributions by member states to WARDA's administrative fund which stood at $280,000 in June, against the budgeted level of $1.4 million. TAC decided to hold the planned mid-term review in April-May 1986 through a panel made up of four TAC members (Drs. York, Javier, Sawadogo, von Urff), Dr. Blumenschein (chairman of the 1983 EPR panel) and one or two management specialists to be identified by the CGIAR secretariat.

46. TAC was disappointed to find out at its October meeting that the level of member state contributions for 1985 had increased to only $600,000. This meant that the member states had not met one of the important conditions for continued CGIAR support of WARDA agreed by them last year in Lome, namely, timely payment of their financial commitments to WARDA. Therefore, TAC decided to withhold its recommendation for budgetary support to WARDA, pending the member states' meeting their 1985 commitments to WARDA in full by the time of the Governing Council meeting in Dakar (December 19-20, 1985).

47. Professor Camus noted that in the event these member state obligations are not met, WARDA can no longer function as a viable organization in its present form. An alternative solution will then have to be worked out to preserve the capacity for rice research in West Africa. Donors should encourage the Governing Council to consider restructuring WARDA to make it more viable in the long run and to meet the donors' concerns.
Whatever the alternative solution, the donors should be prepared to make the commitments required to finance a transition period. TAC's mid-term review panel is prepared to act as a task force on rice research in Africa and advise the Group promptly as the situation unfolds.

Mr. Farrar reported on the WARDA donors' meeting held the previous evening and noted that there was no real consensus among the external donors supporting WARDA about the action that should be taken. Most donors agreed that the continuing uncertainty of member state payments to WARDA is more important than the actual level of these contributions. The shortfall in member state contributions, though not large in absolute terms, is critical because WARDA has no reserves. It appeared that the donors were not prepared to support WARDA in 1986 unless there is a significant change in the situation.

Mr. Husain suggested that in the discussion the members should no longer focus on incremental issues, e.g., how to find the next $500,000 to keep the Association alive, but instead begin questioning if the assumptions that underlie the relationship between CGIAR and WARDA are still valid. One key assumption is that WARDA is and will remain a cooperative institution of the West African states which will take responsibility for constituting its governing bodies and providing guidance on its policies, for appointing the key officers, and for providing a minimum financial base. The donors, in turn, will accept that this is a cooperative association of its member states and provide the bulk of the funds for operations and the required technical back-up.

The validity of some of these assumptions has eroded over time. Two years ago the member states failed to provide suitable top management to the Association and the organization still has no permanent executive secretary. In the financial area the member states have met only a fraction of their commitments to the Association. These actions or inactions by the member states have introduced discontinuities which are not healthy for carrying out meaningful scientific work.

Mr. Husain invited the members to comment on the situation and suggest courses of action the CGIAR could pursue. The first speaker agreed with Mr. Husain that "the band-aid approach" to WARDA is no longer appropriate and that some major changes will have to be made. But these changes would have to come from within WARDA, as WARDA is an association of its member states and not a creation of the CGIAR. One possibility is to have WARDA governed by a non-political, independent body. Another is to have one of the other centers, like IRRI or IITA, assume responsibility for WARDA's research component, along the lines of ICRA's involvement in West Africa. Dr. Brady noted that USAID's Africa Bureau would terminate its support for the special project carried out by WARDA as of April 1986, if there is no change in the present arrangements. This decision would be reconsidered if circumstances changed. Another speaker also agreed with Mr. Husain that the problem faced is not just financial, it is also structural and institutional. He argued that not enough thought had been given to the
institutional options. Of the two options mentioned, one based on depoliticizing and the other on internationalizing WARDA, the former is a priori preferable to the latter. However, there are other options, such as separation of WARDA's research from its development activities, which have not been studied carefully. The speaker noted that he had come to the meeting prepared to provide WARDA the same financial support in 1986 as in previous years, but was concerned that a number of donors were not willing to continue their support to WARDA. Whatever option is finally adopted, WARDA's survival will depend on the measure of support it receives collectively from the donor community. Dr. Bommer also expressed concern over the sudden deterioration of attitudes of the donor community towards WARDA since the meeting of the Group in Tokyo. Regarding communication with the member states, he suggested that the FAO could attempt to organize an informal meeting of the ministers of WARDA states who would be in Rome for the FAO Conference in about two weeks.

52. Mr. Husain invited Mr. Jagne next to comment on behalf of WARDA. Mr. Jagne first reported on the interest expressed by WARDA members in the World Bank's offer to use the proceeds from Bank loans or IDA credits towards payment of arrears and 1985 contributions. He informed the Group that Mali, Guinea and Guinea-Bissau had expressed strong interest, Senegal and Benin had indicated that they wanted to continue meeting their obligations to WARDA through their own means, and the remaining member countries were considering the offer. On the future of WARDA, Mr. Jagne remarked that a sizable number of donors favored a regional organization independent of political control. Such a structure can be established by giving full authority for decision-making and management oversight to the Scientific and Technical Council (STC). Mr. Jagne urged the Group to communicate directly with the member states to express concern about the current situation, and emphasized the need for change and for action by the Governing Council to solve the problem once and for all. He supported Dr. Bommer's proposal to inform the member states at the time of the FAO Conference.

53. A variety of viewpoints were expressed in the ensuing discussion. One speaker noted that his government has supported WARDA because it is a regional organization involving West African governments and because these governments contribute to the organization financially. Under the present circumstances that support could not be continued. He also suggested that the CGIAR should await the outcome of the Governing Council meeting before discussing new initiatives such as the establishment of a new center. Another speaker argued that rice research in West Africa is important and should continue if WARDA is there or not; the Group should inform the member states that it can no longer support WARDA and begin developing a strategy for rice research in Africa. Another speaker pointed out that the fundamental flaw in WARDA's governance is that the Governing Council is a political body, which is not suitable for a research and development organization; the current WARDA model would not work even if one were able to solve the financial problems of the organization. Professor Camus pointed out that, whatever the eventual solution, many aspects of the research done by WARDA should be preserved. On upland rice, for example, there is probably more knowledge in WARDA than anywhere else in the world.
54. The financial controller at WARDA alerted the Group that WARDA could not survive beyond December, 1985, without additional funds, either from the member states or the donors. Mr. Jagne suggested that the Group approve the WARDA budget and that members of the CGIAR release part of these funds to enable WARDA to continue its operations until the Group meets in Ottawa, at which time the CGIAR, with more information and analysis at its disposal, could decide either to continue funding for the rest of the year or to suspend funding.

55. Mr. Husain summarized the conclusions that emerged from the discussion and outlined the actions to take as follows:

(i) The members of the CGIAR are disillusioned with the failure of the member states to pay their contributions and arrears and to appoint a suitable executive secretary. These and similar difficulties faced by WARDA show that the problem is structural and, as such, its solution requires major structural change. Thus, the CGIAR should no longer treat the WARDA issue as an incremental problem. It should begin reexamining the fundamentals of its relationship with the member states of WARDA.

(ii) As WARDA is an association of its member states, it is not appropriate for the CGIAR to suggest solutions to WARDA's problems. However, the CGIAR should be ready to reassess its relationship with WARDA once the member states decide on a future course of action for the organization. The CGIAR should consider this issue at its mid-year meeting in May 1986.

(iii) There is overwhelming sentiment in the Group that rice research in West Africa cannot and should not be abandoned; on the contrary, it should be strengthened. If the member states of WARDA do not wish to pursue alternative arrangements, the CGIAR should quickly begin to study alternative ways of carrying out rice research and development in West Africa.

(iv) The CGIAR should accept the offer from the FAO to organize a meeting with the representatives of WARDA member countries at the time of the FAO Conference in Rome. The main purpose of this meeting would be to inform the representatives of WARDA member countries of the views of CGIAR members as expressed in this meeting and at the meeting of the WARDA donors on October 31. This would enable WARDA member states to come to the Governing Council meeting in December better prepared to discuss alternative arrangements for rice research in West Africa. Representatives of the cosponsors and the chairman of TAC should be present at the meeting to be organized by the FAO.
(v) The Group approved the WARDA program and budget for 1986, only for the purpose of disbursing funds in the first half of 1986 on a pro rata basis, and with the understanding that at the Ottawa meeting the Group could decide to suspend disbursements beyond mid-year 1986, or it could continue support until the end of the year. The pro rata disbursement arrangement should be implemented flexibly, taking into account constraints faced by some donors in making their disbursements in the first half of the year. The executive secretary of the CGIAR should follow this up with individual donors and develop a payment schedule which does not impose an unfair burden on any one donor.

(vi) The executive secretary, in consultation with the chairman of TAC, should inform the members of the CGIAR of the outcomes of the meeting with the member country representatives in Rome and of the Governing Council meeting in Dakar. After these meetings and TAC's deliberations on their outcomes, the chairman of TAC should inform the Group as soon as possible about the alternatives for CGIAR action regarding WARDA beyond the mid-year meeting in May.

(vii) The decisions reached at this meeting should be communicated to the WARDA member states by Mr. Husain as soon as practical.

Approval of Proposed Center Budgets for 1986 and Related Financial Matters — Agenda Item 10

56. Mr. Farrar reported on the following items:

(i) **FY 1985 outcome.** Expected funding for 1985 is $171 million, some $12 million below the contribution received in 1984. Most centers will be funded at 96 percent of the approved bottom of the bracket with three centers being funded somewhat lower.

(ii) **FY 1986 budget proposals.** TAC is recommending $190 million for approval by the Group. This figure includes $5 million for the stabilization mechanism. The Group approved the budgets proposed by TAC for all centers except WARDA.

(iii) **Stabilization mechanism.** Payments out of the fund because of exchange losses will be approximately $1 million, and for cost increases higher than anticipated, approximately $2.0 million.

(iv) **Special activities account.** Requirements for this account are smaller in 1986 than in either of the previous two years of its existence. However, contributions from donors other than the World Bank are needed for a number of activities — such as the financing of the participation of fixed-term representatives from developing countries to CGIAR meetings, the publication of the annual report and of other materials principally related to fund raising — and to insure World Bank contributions, which are given on the condition that they are matched.
Financial reporting and budgeting study. Group members were asked to take copies of this study and to provide comments to the secretariat by the end of the year so that they can be taken into account in preparing the final draft of the study. That document will be on the agenda at Ottawa for a full discussion.

Fund raising. A paper on the fund-raising unit was distributed. The unit exists primarily to support centers in their fund-raising activities and to make the fund raising done by the secretariat more effective. It is also venturing into the area of public support and private sector contribution, which will be the topic of a strategy paper to be put before the Group for discussion in May 1986.

Pledging Session by Donors - Agenda Item 11

Mr. Farrar reported that 1986 funding is likely to be in the range of a $182-185 million. This total represents an increase of about 6 percent over estimated 1985 funding of $171 million, but as average inflation for the system is 7 percent it does not represent an increase in real terms. The estimated 1986 funding level compares with $190 million net requirements which the Group approved the previous day. The funding level translates into a system funding ratio of 96 percent.

Centers' Research Highlights - Agenda Item 12

Individual center presentations were not made because of time pressures brought about by a very full agenda. Instead, Dr. Donald Plucknett, Scientific Adviser, CG secretariat, presented an overview based on materials supplied by each of the 13 international centers. Due to time constraints this overview was brief and a more detailed paper (Annex IV) was provided following the presentation.

Numerous comments were made concerning cooperation among the centers and coordination of their endeavors particularly in Africa. Dr. Trevor Williams responded to the question of collaboration by assuring the donors that there is significant cooperation among the centers as documented in a paper by the directors general presented to TAC last March. This cooperation ranges from formal memoranda of understanding on commodity research to the locating of liaison officers of one center at another. Specifically, in recent months the center information officers discussed how better to get information from the centers to national programs in Africa; training officers are about to discuss collaboratively how to enhance training and inter-center cooperation in Africa.

A question was raised as to how much the technology developed by the centers is applied. One speaker asked the CG to develop a mechanism to distill the information on things ready to go, perhaps in a short 15 to 20 page report for use by Prime Ministers to extension workers. The Technology Transfer Subcommittee at ICRISAT was cited as an attempt at this at the
institute level. A director general responded to the stated need for a "finished product" by pointing out that the greatest success is attained when national programs are involved in the development of the finished product.

Future Meetings - Agenda Item 13

61. The Canadian delegation reissued its invitation to the Group to hold the next mid-term meeting in Ottawa from May 19-23, 1986. Since the week of the meeting coincides with the Tulip Festival, members were urged to make their hotel reservations as soon as possible after they received the hotel registration forms from the CG secretariat in early January. The national agricultural research program in Canada marks its centennial in 1986; the Government would be providing a program on the first day or so of the CG meeting that would be fully integrated with the CG's business meeting. The Group agreed that since the priorities study would be discussed at the mid-term meeting, the center directors should be invited also.

62. The Group also agreed that there should be no radical change in the location and format of ICW in 1986, but that it should continue to be held in the IMF auditorium in Washington; if the Group favored such changes they should only be introduced in 1987. The Group considered the secretariat's proposal that the 1987 mid-term meeting be cancelled and decided to come to a decision at Ottawa. The German delegation invited the Group to hold the mid-term meeting in 1988 in either Berlin or Bonn and would advise the Group at Ottawa of the exact venue.

63. During a discussion about the possibility of holding a meeting at one of the centers in a developing country, the chairman pointed out that it would impose a tremendous burden on a center, would detract from its fundamental work and the Group would only see the center in a superficial way. The mid-term meeting, as the 1985 Tokyo meeting had shown, provided a means for the Group to become acquainted with the research programs and institutions of one of its members. The Canadian Government was encouraging members to visit its research institutions throughout Canada either before or after the mid-term meeting and would be providing the Group with an interesting presentation about Canada's research activities and achievements, which would give the Group a unique and in-depth insight into ways in which there could be even closer interaction between Canada and the Group. Mr. Husain expected that the German Government would provide the Group with a similar opportunity in 1988.

64. The Group discussed ways in which to handle the multiple meetings of non-CGIAR centers at the time of ICW. The Group decided that the secretariat should allocate specific days, divided into non-overlapping 2-3 hour periods for these meetings, prior to or immediately following ICW, and that non-CGIAR centers would be allocated these times on a first come, first served basis. The Group also discussed the format of the presentations by the centers at ICW. At the current meeting Dr. Plucknett of the CG secretariat had presented an overview of the centers' research highlights.
This summary presentation had replaced the traditional direct presentations by the individual centers to the Group, because of the time constraints created by the presentation of the impact and priorities studies at this meeting. The summary presentation received considerable praise but many speakers felt that there was a need for direct contact at ICW between the centers and the Group. The secretariat was asked to make a proposal to the Group at Ottawa for a format for ICW 1986.

65. The dates and location of future meetings approved at ICW 1985, are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>mid-year</td>
<td>ICW</td>
<td>May 19-23, Ottawa, Canada.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>November 3-7, Washington, D.C.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>October 26-30, Washington, D.C.</td>
</tr>
<tr>
<td>1988</td>
<td>mid-year</td>
<td>ICW</td>
<td>May 25-27, Germany (Berlin or Bonn).</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>October 24-28.</td>
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</tbody>
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Attachments

DEC/MH:ndm
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CGIAR Impact Study Presentation and Discussion
International Centers Week
October 28 and 29, 1985
IMF Auditorium
700 19th St., Washington, D.C.

Monday, October 28

9:00 Opening Remarks .................................................. S. Shahid Husain
Chairman CGIAR

Statement ................................................................. Frank Press
Chairman, Study Advisory Committee

Overview of Study and Presentation ................................. Jock Anderson
Study Director

Discussant .................................................................

Overview of Findings for Africa ................................. Hans Jahnke

Discussant .................................................................

Overview of Findings for Latin America .................... Grant Scobie

Discussant .................................................................

Overview of Findings for Asia ............................ Carl Pray

Discussant .................................................................

Tuesday, October 29

9:00 Introduction .......................................................... Jock Anderson

The Naming and Spread of Varieties ......................... Robert Herdt

Discussant .................................................................

Impact of Center's Training ................................ Carl Pray

Modern Varieties and the Poor ............................... Michael Lipton

Discussant .................................................................

The Future: Pipeline and Broader Issues ........ Grant Scobie and
Jock Anderson

Discussant .................................................................

Note: The discussants will be announced at a later date.

1/ The presentation on October 29 on Impact of Center's Training was not presented because an in-depth discussion had occurred in Tokyo.
ANNEX III

SPEECH BY MR. S. SHAHID HUSAIN TO THE MEMBERS OF THE CGIAR

WEDNESDAY, OCTOBER 30, 1985 9:00 A.M.

WASHINGTON, D.C.

Ladies and Gentlemen:

Good morning.

We have just completed two days of introspection, analyzing the impact of our system on agricultural research institutions and agricultural production in the third world. I hope you will agree that the study has been successful in achieving the desired result of providing us with a platform from which to take our bearings. We shall return to the subject on Thursday during our deliberations on the TAC Study of Priorities, since the question of our impact will necessarily be part of the fabric of that discussion. Our expectations are that the Priorities Study will signpost the routes that we should follow for the rest of this century and the beginning of the 21st.

I have heard many of you express some concern about the frequency of studies and, particularly, of reviews of the system. Before that concern erupts into exasperation with the news that Dr. Vern Ruttan has been asked to study the external review process, i.e. a review of the reviews, that we undertake, let me reassure you. Dr. Ruttan's review is focussed on the
question of the usefulness of existing review processes to the system. His terms of reference quite explicitly recommend an examination of the feasibility of reducing the number of external reviews and/or absorbing external processes as a part of internal control measures. At the same time, however, we must remember that our CG system is accountable to a plurality of audiences. I noted the comments in Tokyo by more than one donor, that their reviews of the centers are kept to a minimum because of the external review process that take place in the CG system. Furthermore, I rather believe that scientists in the system could welcome the occasion of a peer review - as a way of having a constructive dialogue about a particular line of research with a captive listener, who is eminently qualified as is the center scientist. The sole caveat here is that review teams must be composed of the highest caliber scientists with backgrounds that are clearly relevant to their task on a review team. We are all aware, too, that if our discussions of external reviews are frequently subtle rather than hard-hitting, the reason is that center managements tend to listen to the messages of the peer reviews and move quickly to implement those of their recommendations that clearly pinpoint weaknesses - often before the discussion with the Group takes place. Dr. Ruttan's study is one, then, that I believe we should welcome as a means of improving the efficiency of the review process as well as its quality. I understand the results could be before us at ICW next year.
We have begun the week and will end it on a high note. At the conclusion of the CG meeting, we shall hold the first Sir John Crawford Memorial Lecture. The occasion is one that necessarily creates mixed emotions. We remember a former colleague, a founding father of the system whose contributions in this forum are indelible. The first speaker in this lecture series will be Robert McNamara, another founding father of the system to whom we owe a great deal and I know many of you here will be delighted to welcome him back amongst us. Let me now express again my own and the system's gratitude to the Australian Government for creating an opportunity to remember Sir John for his intellectual contributions to the development of the Third World.

Robert McNamara has decided to focus the memorial lecture on African issues. Currently we in the CGIAR are facing the question of how best we can direct our resources to the intractable problems of African agriculture. The CGIAR with its mandate of increasing food production in the Third World must necessarily at this time of prolonged famine in Africa be concerned about the contributions that we as a system can offer. An easy answer would be to reallocate resources to that end. However, there are no easy answers, and, in fact, Africa's problems are more daunting than those of any other
area of the world. We have to take into account the combined problems of rapidly increasing populations, as was pointed out yesterday, a tremendous diversity of agroeconomic areas - the varieties of soils, climates and commodities - the scarcity of human and financial resources, weak national institutions and weak supporting institutional frameworks. The fragility of the physical resources is paralleled by an inadequate policy framework in many of the countries. At best we are looking at the beginning of progress in pricing policies, in improvement of input supply and in the creation of bridges that will transfer technology to the national systems and then from them to the farmers. Aid institutions have learned the hard way, the need to provide technical packages and concern themselves in greater depth than usual about the policy environment and the institutional framework, when financing projects. Whatever comparisons we make, however, and however much we may attempt to transfer experience from elsewhere, we are forced to admit the lesson of experience: that Africa is special, different and supremely difficult.

The history of the CG's involvement in Africa is a relatively short one. We have directed our activities so far at a relatively limited number of the several sources of nutrition, that are critical to the survival of specific groups of people throughout the African continent. We have had some
successes with indigenous crops, such as streak resistant maize and some sorghum varieties lately cowpeas. However, we must face the reality that the challenge of raising food production in Africa, will lead us into research on a variety of commodities and on a variety of factor services. As a corollary, we have learned that research on crops consumed by peoples outside Africa, requires considerable additional in situ research for its successful transfer to Africa.

In proposing that agricultural research embrace a wide spectrum of African commodities, I am not necessarily suggesting that the research be carried out within CGIAR only. Several Impact Study speakers indicated not only the relatively brief relationship between the CG system and the African continent, but also the wealth and length of experience outside our system. Particular mention was made of the contributions of institutions supported by France in Africa. And I would hope that we could dovetail our efforts with those of experienced people in bilateral programs. We can also expect some improvement in the supporting development framework from the efforts of the various aid agencies engaged in Africa.
However I do believe that we as a system should spend some time reflecting on the adequacy of our present institutional mechanisms in Africa. Is the concept of centers of scientific excellence, patterned on those that have worked elsewhere in the world, appropriate for the multiple agro ecological environments that characterize Africa? Should we be emphasizing single commodity research in isolation from other crops and, thereby, ignoring the fragmented nature of African agriculture? May not Africa be a more appropriate testing ground for CGIAR initiated integrated crop systems research than other parts of the world? We as the major international agricultural research system in the world, should, I believe, be providing creative guidelines for institutional organization of research - not only for national agricultural research institutes but also for international agricultural research efforts, including our own.

I want to commend this difficult problem to the centers who will be holding a farming systems research workshop in Hyderabad next February. It is a problem that I hope we shall tackle in the course of our debate on the Priorities study.

However painful the decision may be, I believe that we cannot afford to keep on allocating more than the approximately 40 percent of our resources that are already going into our programs in Africa. Our worldwide mandate
demands that we continue to serve that vast population that survive precariously - just above the starvation level, in Asia. I must appeal to you the donor community to recognize that we in the CG system cannot solve African problems simply by reallocating our own limited funds, but that doing so would endanger the results our system has achieved elsewhere in the world. Funds for the intractable African problems, and they are many, will have to be additional. I can do no more than appeal for that additionality. I must recommend against any further reallocations of the CG's present resource - apart from the decisions already taken.

We must also, I think, realize that, in Africa, we in the CG will pursue many avenues that will turn out to be cul de sacs. Our rate of failure is likely to be higher than it has been elsewhere because of those multiple sets of negative factors that I have mentioned. Yet we should not be deterred by failure, because our wisdom increases with the lessons of the past. We are working in developing countries precisely because they have not attained and we have not attained perfect solutions.

In this context, though, we must ask two of our institutions to devote special attention to Africa. We must ask IFPRI to continue to explore policy formulae that will help to prevent the rural terms of trade from
deteriorating to a point where agricultural development is harmed permanently in many African countries. We must ask ISNAR to devote particular attention to strengthening national research institutions in Africa and to help them coordinate their responsibilities through networking systems. We should continue to urge the centers, after our discussions in Tokyo, to ensure that some of their resources are devoted to training. We must, however, draw a firm line between the work of CGIAR center and the work of the development institutions. We have been a system that by any standard should be considered successful - because we have concentrated on scientific research. Let us tread the path of science in Africa and let us not allow ourselves to be diverted too much into development work.

In the World Bank we are making a special effort where Africa is concerned. Furthermore, at the Tokyo meeting, a discussion was held between the main donors in Africa of the possibility of an initiative that would involve coordination of aid efforts in the national agricultural research sector in Africa. I am particularly pleased to note the emphasis given to coordination of the efforts of the CG centers by TAC, by the Board Chairmen and the Center Directors.
With these considerations in mind we shall be reviewing the situation at WARDA again, during the course of this meeting. I have implied earlier that we should be more tolerant, in fact, should expect failure more frequently in Africa than elsewhere. However, let me be clear about what I mean by failure. I mean the failure of scientific research precisely because we follow many avenues, but I did not mean the failure of institutions. I exclude from the definition of tolerance, failures that result from poor management, lack of commitment in funding and proliferation of activities to the detriment of the mandate of an institution. In that context, we shall have to decide when we consider the situation at WARDA, what sort of failures are attributable to WARDA and which of these are tolerable and which are not, and how and what we can do to bring about a greater sense of commitment among the constituents of WARDA.

In touching on issues of efficiency of resource use, good management, clarity of purpose and mandate, I want to return to the question of accountability. Last year in this very forum we discussed the roles, responsibilities and relationships of the Boards of Trustees of the international centers, and returned to the subject again in Tokyo. In the year since it was first circulated to the Group, many of us have had cause to refer to Dr. Hardin's very sound paper on this subject, which we have a commitment to review periodically. The Hardin paper is based on a
fundamental principle of the CG system. The Boards of Trustees of the centers are autonomous. The principles of autonomy and the principles of accountability go hand in hand. The Boards are the policymaking body for their center and it is they who are accountable to the Group for the centers' achievements. We in the system rely on those Boards for the good management of the center, the performance of the director general and the successful implementation of the mandate of the center.

The directors general, therefore, have a particular responsibility towards their Boards to keep them informed and to have a frank and open dialogue with them about policy matters. Since it is the Boards that are accountable to the Group and not the DGs as Dr. Hardin points out in his paper, the success of the centers depend very much on the quality of the relationship between the Boards and the directors general. In the long run, the ultimate sanction on a center's performance by the donors is the withholding of funding for a center. However, I hope that in any situation where there is a temporary breakdown in relations between the director general and the Board of a center, we shall all stand back and allow the two parties to work things out between themselves within a reasonable period of time. The Group's influence over the Boards should be exercised exclusively
by ensuring that the best qualified people are appointed to the Boards of Trustees. I, therefore, urge the members of the Group to treat the circulars issued by the Secretariat about vacancies on the Boards of Trustees with the utmost interest and importance. The response I understand to these circulars is not as fulsome as it might be.

The Secretariat has prepared for review by the Board Chairmen and the cosponsors a paper on the nomination process for CGIAR designated members of the Boards. We shall be bringing a paper on this subject to the Group at Ottawa. As I have found, the system of which we are a part requires time to understand it. It is certainly one of the most carefully crafted systems in the world, but if you place it under a microscope, the salient feature, the most critical part of the structure is the strength, the autonomy and the accountability of the Boards of Trustees. We should all of us work to help strengthen the quality of these Boards, but we should at all times respect their autonomy.

We have all been impressed and heartened by the emergence of the group of Board Chairs as a strong force within the system. We heard the Chair of Chairs say in Tokyo that the group as a group was looking for a role in the system. I believe that one of its first tasks as a group, should be to work with the Secretariat in developing ways to identify those highly qualified
scientists and professionals from all over the world that we need to staff our Boards with integrity, and with the managerial and scientific competence that is essential to the success of this system.

I shall be reporting to you later about the very constructive discussions in the IBPGR sub-committee which has now met twice as well as my discussions with both the FAO and the Italian government.

Among the documents outside this auditorium you will find the first annual report of the CGIAR. I particularly wish to draw your attention to it. I hope that any of you who have not yet seen it will help yourselves to a copy. We shall be asking you to let us know whether you want bulk shipments made to your home countries. But more importantly, I am very anxious to have your reactions on this report. Because of pressures of time, we have no separate agenda item for this, but I look forward to receiving your comments verbally during the course of these meetings in our corridor discussions and would also appreciate your sending your comments to the CGIAR Secretariat so that we can take them into account in our future reports.
This time last year I allowed myself to let you glimpse some of my sense of dissatisfaction with an agenda which seemed to be overly concerned with housekeeping matters and insufficiently concerned with the great issues that our system should be considering. I believe that this year there can be no question that we have major issues before us and that our agenda is a most substantial and thought-provoking one.

In that context, I look forward this afternoon to the presentation of the centers' research highlights and the discussion that will follow. The previous plenary session, in which half the centers made presentations to the Group about their individual research work, had to be abandoned this year because of the crowded agenda on the Impact and the Priorities studies. Today's format of a presentation by Don Plucknett covering the system as a whole, was suggested by the directors general. We are still searching for effective ways to present the centers' work to you, the donors, and we shall look forward to your suggestions for centers presentations in succeeding years.

Let me conclude by welcoming those of you who are here for the first time. I am particularly pleased to note the presence of representatives from Austria and Hungary. On behalf of all of us I want to congratulate and welcome, Dr. Don Winklemann, representing CIMMYT for the first time as Director General, and Dr. Larry Stifel, representing IITA for the first time as Director General.
I now turn to the agenda. May I ask for your approval of the provisional agenda in document no. ICW/85/03. If there are no objections we shall take the agenda to be adopted. We shall try as much as possible to keep to the timed provisional agenda which is also before you. I will ask Professor Guy Camus, the Chairman of TAC, to make a report on the 37th and 38th meetings of his committee.

Professor Camus.

October 30, 1985

DEC: ndm
CENTERS' RESEARCH HIGHLIGHTS FOR 1985

1. INTRODUCTION

As you know, the individual center presentations will not be made this year, because of time pressures brought about by a very full agenda. For that reason, the Directors General asked me to present an overview of some of the research highlights of the past year. This overview will necessarily be brief and can only give a sample of the work in progress. Copies of the presentation will be available afterwards for those of you who might want them. These copies will include some highlights which could not be covered because of time pressures.

The overview will stress research in progress rather than impact. It will highlight the significant genetic resource and crop breeding activities of the CG centers, the importance of which cannot be overestimated. It is important to point out that 11 of the 13 centers are directly involved in genetic resources work. Only ISNAR and IFPRI do not have direct efforts in genetic resources; however, of course, both of them are involved in policy and institutional aspects of genetic resources. I will also spotlight recent work of the international centers on biological control of crop pests and diseases, livestock disease research, farming systems research, and relationships with national programs. Finally, I will briefly profile the careers of two outstanding scientists in the CGIAR system who are about to retire.

Stocktaking

The past year has been a year of stocktaking in the CGIAR system, stocktaking that has affected every center. However, it is important to point out that the centers have been and are operating on the basis of past and continuing stocktaking. I am speaking, of course, about the development and refinement of Long-Term Plans for each center, the results of which are used as a basis for program planning and development. The centers devote considerable effort to deciding what their research agendas should be as well as strategies for dealing with national programs. We are seeing clearly the results of this planning in ongoing research programs. Some of the considerations involved are:

-- for centers like IRRI and CIMMYT, helping to sustain yield gains already made (sometimes referred to as maintenance research),

1Presented by Donald L. Plucknett at the 1985 International Centers Week in behalf of the 13 IARCs who provided the information for the presentation.
-- plant breeding strategies that emphasize increased resistance to pests and diseases, tolerance to environmental stresses, and yield stability across differing ecologies,

-- use of Farming Systems Research to determine farmer circumstances, and to sharpen research priorities,

-- ways of working with national programs with differing capacities,

-- ways to work effectively in Africa.

Concerns for Africa

The food crisis in Ethiopia this year caught the attention of people throughout the world and underscored the urgency of boosting food production in Africa. The centers located in Africa as well as the other centers with regional offices or cooperative programs on the continent are all working to meet increased food demands through improved technology generated through research. All of the centers have programs in Africa. A few of these research efforts in Africa will be summarized here, more will be presented in later sections of this report.

Plant breeding programs in Africa have produced favorable results in a number of crops. IITA's improved cassava varieties outyield traditional varieties from 2 to 18 times, the highest under severe disease pressure. The improved varieties, requiring neither fertilizers nor pesticides, are now grown on about 1.5 million hectares in various African countries and are being multiplied in 24 African countries.

A significant change in yam production is in the making as a result of the development, in collaboration with the Nigerian National Root Crops Research Institute, of miniset and microsett techniques of seed-yam production. Yam acreage has been limited by the scarcity and cost of planting materials. The new technology will remove those constraints and increase yields substantially.

Sweet potato varieties developed at IITA or selected from IITA germplasm are being grown widely in eight African countries and in islands of the Caribbean and the South Pacific. The major advantage over local varieties is exceptionally high yields -- up to 40 t/ha in only 4 months.

IITA's new cowpea varieties have attributes that are critically important in various ecologies, including the Sahelian zone. Varieties with multiple disease resistance, insect resistance, and very early maturity have been released in 31 countries in Africa, Latin America, Asia and the Caribbean. One variety, TVx 3236, is being grown by an estimated 13,000 farmers in the Kano state of Nigeria. Other varieties that mature in only 60 days are being adopted widely, particularly in rice-based farming systems.

Soybean production in tropical Africa has been hampered by introducing varieties having poor seed vigor and viability and requiring
specific rhizobia that are not in tropical soils; IITA scientists have
developed high-yielding soybean lines with superior seed longevity that
nodulate freely with indigenous rhizobia.

ICRISAT had several successes in Africa last year. Hageen Durra 1,
a sorghum hybrid, was released in 1983 for commercial production in the
Sudan. It had dramatic success in the 1984 drought and the seed was
extensively multiplied for use this year. Also in Sudan, Ugandi, a
drought-resistant pearl millet variety, has performed well and is being
popularized over a larger area. Pearl millet variety ICMMV 1 (also known as
WC-C75), already in use in India, has performed well in Zambia and the Yemen
Arab Republic.

Framida, a sorghum variety developed from germplasm of southern
African origin and introduced by ICRISAT to West Africa, is doing well in
Burkina Faso. It is resistant to the parasitic weed Striga and to drought,
has brown seeds and good seedling establishment, is well suited to various
soil conditions, can be intercropped and has acceptable qualities for food
and local beer. Yields are stable in multilocation tests, and Framida is
expected to spread from Burkina Faso to Ghana and Togo. ICRISAT has another
sorghum in the pipeline, ICVS 1002, which is superior to Framida in yield and
Striga resistance.

Starting in 1983, CIAT expanded its research collaboration in beans
to Africa because of the food need there, the importance of beans, great
progress in genetic improvement of beans in Latin America, and indications
that production problems were similar in both continents.

CIMMYT increased its resources in Africa during 1985-86 by adding a
minimum of six staff in cooperation with IITA in a mid-altitude maize
breeding station at the University of Zimbabwe and in strengthening on-farm
research teams.

IITA is increasing staff in its cooperative maize program with
CIMMYT. Also, IITA continues its research in alley cropping, a stable and
productive alternative to shifting cultivation. In 1984, IITA opened a
station in Benin Republic for more effective work in Francophone African
countries and moved a cowpea breeder to Niger to work on problems posed by
the Sahelian ecology.

Policy Research. Much of IFPRI's research is directed at Africa.
IFPRI's research is directly related to maximizing the acceptance and
benefits, particularly among the poor, of the new agricultural technologies.
IFPRI's role is twofold: to identify policies to accelerate the rate of
adoption of new varieties and to increase the flow of benefits to the poor.
IFPRI here illustrates three research objectives that are currently high in
the policy dialogue. They are improved farm prices in Sub-Saharan Africa
(which for brevity is referred to here as Africa), better fertilizer policies
for the especially nutrient-deficient soils of Africa, and the favorable
nutritional consequences of the adoption of the new technologies. IFPRI has
exciting preliminary results in these three research areas. The analyses are
in the early stages, and are presented here stripped of complexities and
qualifications to give you a sense of the main thrusts of this work.
In Africa, marketing margins -- or the difference in prices paid by consumers and producers -- are on average twice as large as those in Asia. Research on food prices in Africa indicates that reducing marketing margins in Africa to the levels found in Asia and assuming normal elasticities would increase producer prices by 30-50 percent and decrease consumer prices by 10-20 percent. Transportation costs make up 40 percent of the difference in marketing margins between the two continents, emphasizing the tremendous costs of the lack of rural infrastructure in Africa to producer incentives and to the incomes of the poor.

Comparison of the road systems -- the major component of infrastructure -- of Asia and Africa indicates that intensity and quality of the African road networks are, in general, low. A key component of the widespread adoption of high-yielding varieties throughout Africa will be the development of infrastructure, particularly roads.

Fertilizer policy is especially important in Africa. We know that African soils tend to be fragile and low in nutrients; that in the short run, adoption of existing technology packages requires fertilizer use; that in the long run, agricultural productivity will be linked to sustained growth in fertilizer consumption; and that growth in fertilizer use requires processes that ensure increasing availability and profitability for small farmers.

By world standards, fertilizer use in Africa is extremely low. Although there is some variability among African countries, this is largely due to the relative importance of cash crops.

In many countries, India for instance, it appears that prices are not directly related to fertilizer use. Prices in India have fluctuated widely during the last 10 years, yet fertilizer use has grown steadily.

Comparing prices and use in a number of countries, there appears to be no clear relationship, and at best a weak relationship, between the price and use of fertilizer. Comparing Pakistan and Bangladesh, for instance, fertilizer use is similar, despite strikingly different fertilizer prices during most of the last decade. Elsewhere, countries with similar nominal and real fertilizer prices exhibit sharply divergent patterns of use. Clearly fertilizer use is largely governed by factors other than price. IFPRI research on Africa is working toward identifying the appropriate mix of price, import, stocking, distribution, and infrastructure policies to ensure increased fertilizer consumption by smallholder food producers. As special project funds to finance collaborative work with African institutions become available, this work will be pushed rapidly.

In the third area of research, IFPRI is trying to answer two basic questions: What has been the effect of the new technology on human nutrition? And what can be done to improve the record?

The preliminary answer to the first question is, yes, the effect of the new technology on human nutrition has been positive. Research in the Muda region of Malaysia shows that where the introduction of irrigation and
new rice varieties led to large increases in rice production and farm incomes, the extent to which calorie requirements were met among the poor increased from 87 to 99 percent.

In addition, the percent of rural poor with calorie deficiencies dropped from one-half of the population to one-third, or from 54 to 36 percent. And those with protein deficiencies dropped from 15 to 2 percent.

Similar findings have been obtained in an ongoing study of technological change in North Arcot, India, where calorie consumption in the sample households increased markedly after the introduction of the new rice varieties, from almost 1,700 to more than 2,400 calories for years with similar rainfall. It is striking that in a recent year of extreme drought, calorie consumption was higher than in an earlier normal year. The picture is clear -- not only are the new technologies improving production, but the poor are benefiting.

In answer to the second question, IFPRI is doing a number of things to improve the nutritional impact through the network established at the workshop on Nutritional Goals and Agricultural Research held last year at the International Livestock Centre for Africa. IFPRI and the other centers in the CG system are looking at how to incorporate nutritional goals into research on commodity priorities, characteristics of technology, farming systems, and government policies.

2. PLANT GENETIC RESOURCES

As has been stated, the importance of genetic resources work in the CGIAR can not be overestimated. Indeed, genetic resources work lies at the heart of the CG system. Leading the way is IBPGR, which because of its collaborative relationships and coverage, is probably the most international of all the international centers or of any technical and scientific organization for that matter.

When the IBPGR was established in 1974 there was little awareness by the public, scientists or most governments of the imperative need for an international program in genetic resources conservation.

By now, the general awareness has been raised markedly. Much of this change is attributed to the attempts made by IBPGR to act as an effective catalyst to establish and coordinate a global network of germplasm centers and to collect, conserve and make freely available for all users, significant parts of the genepools of various crops.

The IBPGR sponsors and coordinates numerous collecting missions. During 1984, germplasm sample number 100,000 was collected, a remarkable achievement.

The IBPGR has continued to stress the need for a firm scientific base for conservation procedures, and where gaps have been shown to exist, it has been active in promoting research and the development of appropriate technologies.
The need for qualified personnel to operate genebanks in national and regional programs, particularly in developing countries, has long been recognized by the IBPGR. Almost 150 students from 45 developing countries have been supported by the IBPGR at the post-graduate level.

Conservation in long-term storage facilities involves placing seeds in air-tight containers and storing in refrigerated rooms or cabinets. The IBPGR has now designated 36 such base collections in 29 countries.

Research supported by the IBPGR during the past few years has resulted in both conceptual and technical changes in standards for seed conservation. The IBPGR has also developed standards for an international register of genebanks which include minimal and adequate standards, as well as higher standards which should be aimed for. The IBPGR is initiating registration and monitoring of genebanks, and plans to formalize better the network of active genebanks where day-to-day characterization, multiplication, documentation and exchange of seeds are carried out.

The IBPGR is supporting research on in vitro culture for crops not reproduced by conventional seeds, and especially the development of long-term preservation techniques to ensure genetic stability. This research has led to the development of an in vitro field collecting technique for difficult materials. This work has already produced a technique for collection of cacao and a similar technique is now being developed by CIAT for cassava.

At IRRI in collaboration with national programs and IBPGR, 500 traditional rice varieties were collected from remote areas and special environments in Bangladesh, Bhutan, Indonesia, Sri Lanka, and the Malagasy Republic and about 20 wild rice species from Sri Lanka and northern Sumatra, in Indonesia.

The first priority of ICARDA's Genetic Resources Unit is multiplication, evaluation, documentation, and storage of available collections. Last year some 9600 accessions were multiplied and over 12,000 accessions were evaluated and described using internationally accepted descriptor lists. Next priority goes to the introduction of new germplasm to provide alternative sources of required traits and to fill gaps in the collections. Last year, 782 samples of different crops and their wild relatives were collected in Egypt, Jordan, Pakistan and Turkey in collaboration with national institutions. The new accessions include some from extremely stressful habitats and may contain new sources of resistance to drought, salinity, and diseases.

IITA's Genetic Resources Unit holds a collection of 23,000 accessions of 13 different crops; including the world cowpea collection of nearly 12,000 accessions. During the period 1978-1984, IITA sent, on request, almost 23,000 samples to plant breeders in over 50 countries.

In root crops, rapid propagation of disease-free germplasm for distribution to national programs has usually involved plantlets. Two problems associated with this practice are: (1) plantlets are highly susceptible to environmental changes during transportation and subsequent
planting, and (2) tuber formation from the plantlet is delayed. CIP is exploiting in vitro tuberlets in order to avoid plantlet-related problems. These tuberlets appear identical to their field grown counterparts. CIP researchers have discovered the optimal environmental conditions required for production and maintenance of the tuberlets. This research will dramatically streamline worldwide distribution of potato germplasm.

Another major issue in the international distribution of potatoes is prevention and eradication of Potato Spindle Tuber Viroid which causes deformed tubers as shown in this slide. Setting up procedures for screening of Potato Spindle Tuber Viroid involves high expenditure for sophisticated laboratory equipment and the hiring of highly trained scientists. Such expenditure by national seed programs has been obviated by the development at CIP, in collaboration with USDA-Beltsville, of a new, rapid, highly sensitive test involving nucleic acid spot hybridization. In practice, an envelope-size piece of nitrocellulose membrane is sent to a national program where up to 100 potato sap samples are applied to it. The membranes are returned to CIP for rapid diagnosis. Radioactive measurements rapidly determine Potato Spindle Tuber Viroid content of each sap sample. Thus, the low-cost part of the operation is carried out by the national programs and the advanced biotechnological aspects are performed at CIP.

Pasture Research

CIAT, ICARDA and ILCA are actively engaged in collecting and using germplasm of pasture and forage species.

In Africa, as in many parts of Asia and Latin America, low nitrogen levels in soils and forages limit plant and animal production. In these circumstances forage legumes provide a critical link between the enhancement of soil fertility and crop yields, and an increase in the quantity and quality of feed for livestock. Much of the work at ILCA is directed to exploring the critical role of legumes in improving the fertility cycle. ILCA scientists are working with many types of herbaceous, grain and browse legumes, seeking legumes adapted to particular ecological conditions and farming systems. A very large forage legume germplasm collection has been established, documented, and distributed throughout ILCA's African forage legume network. In many areas of Africa small amounts of added phosphorus dramatically improve growth and nitrogen fixation of these legumes, and often simple untreated rock phosphate in very small amounts is sufficient for this purpose.

ICARDA too is working on using self-regenerating, annual medic pastures to improve soil productivity and to reduce further depletion of soil fertility. Recent results show promise. In two consecutive years medic pastures have yielded more than 9 tons per ha, compared with less than 1 t/ha from native pasture. Medic pastures could potentially carry 9 to 10 sheep per ha, compared with about one sheep per ha on native pasture.

The self-generating capacity of a medic pasture depends on its ability to produce a reservoir of seed in the soil. ICARDA medic lines have produced about 1 t/ha of seed and regenerated readily following a wheat crop,
producing more than 6 t/ha of forage. During the 1984/85 growing season more than 400 kg/ha of seed still remained in the soil as seed reserves.

Similar farming practices in Australia since the 1950s have added an average of 70 kg N/ha/yr. Last year ICARDA's medics fixed 150 kg N/ha. At the village of Tah, about 60 miles south of Aleppo, one pioneer farmer claims to have fattened 250 lambs on his 5 hectares. If half the value of the lambs is assigned to the medic pastures, then the pasture yielded about $1000.00 per ha.

Milk production from ewes grazing medics was 70 percent higher than ewes grazing native pasture and 30 percent higher than from ewes fed with a concentrate ration. At Tel Hadya, lambs are gaining about 300 g per day grazing medics alone, as compared with penned lambs which gain at best only 350 g per day.

ICARDA focuses on indigenous medic cultivars which are much hardier than commercial varieties. For example, frost killed 96 percent of commercially available medic variety plants, but only 2 percent of the plants of indigenous cultivars selected by ICARDA.

The ICARDA medic program has now established many of the most important principles for increasing production. The dramatic success of the work at the village of Tah is resulting in enthusiastic collaboration between farmers and scientists from ICARDA and from the Syrian Ministry of Agriculture.

At CIAT, two programs concentrating on tropical pastures are showing results. Andropogon gayanus is a tufted grass species introduced in 1973 to Colombia from Nigeria by CIAT. After extensive evaluation it was formally released in 1980 as a cultivar by national institutions in both Colombia and Brazil. It has also been released in Venezuela, Peru and Panama.

Recent surveys of adoption by graziers indicate that established Andropogon pastures now cover 15,000 ha in Colombia and 150,000 ha in Brazil. Differences in adoption between these countries reflect, in part, their relative size, infrastructure and the degree of utilization of acid soil savanna for beef production. Ranchers in Brazil are attracted to Andropogon because of its resistance to spittle bug, an important pest of grass pastures. Other attributes are its good adaptation to low fertility acid soils, excellent dry season performance, high palatability and high carrying capacity.

CIAT in collaboration with national programs has identified several promising legume species as potential associates with Andropogon. A cultivar of Stylosanthes capitata named Capica has been released by ICA in Colombia. Similarly, a cultivar of S. guianensis has been released by IVITA in Peru as the cultivar "Pucallpa". Other species of Stylosanthes and Centrosema have advanced to final stages of evaluation.
Advances have also been made towards identifying legume associates for more aggressive grasses such as *Brachiaria* spp. Included are *Desmodium ovalifolium* and especially *Arachis pintoi* which seems to satisfy practically all requirements of a nearly ideal legume companion of aggressive grasses.

To date Carimagua, a perennial forage groundnut, growing on low fertility soil in the Colombian Llanos, has persisted under grazing in combination with several species of *Brachiaria* for 3 years and has been well accepted by animals.

3. BREEDING STRATEGY

The Centers have adopted a number of breeding strategies to deal with specific problems for their mandated crops. Such strategies include: (1) choice of parental lines, (2) breeding for higher and more stable yields, (3) breeding for resistance to pests and diseases, (4) breeding for environmental stresses, and (5) breeding for specific farming systems.

Choice of Parental Lines

Choice of parents for crosses to be made is a crucial part of plant breeding. A few examples of approaches used by ICRISAT serve to illustrate the choices necessary as well as the benefits of those choices. Similar examples could be drawn from most crop breeding programs in the CGIAR system.

Hageen Durra 1, the sorghum hybrid mentioned earlier, was made from a parent that ICRISAT brought from Texas A&M University and mated with a line of Nigerian parentage. It was synthesized and evaluated from more than 300 new experimental hybrids grown by ICRISAT in Sudan during 1979-1982 and was released for commercial production there in 1983. After its dramatic success in the 1984 drought, its seed was extensively multiplied for use this year. Under irrigation, Hageen Durra yielded over 5000 kg/ha compared with 1100 kg/ha produced by the local variety. Under normal rainfed conditions it more than doubles the yield of the locals.

ICRISAT's pearl millet variety ICMV 1 — also known as WC-C75 — was derived from seven lines from the World Composite developed in Nigeria and brought into ICRISAT's early germplasm collection. After passing through 6 years of testing in the trials of the All India Coordinated Millets Improvement Project, it was released in 1982 and is being grown this year on some 900,000 hectares in all nine millet-growing states of India. This variety has shown stability for yield on a par with the best hybrids and, more importantly, resists downy mildew, which has been a plague to farmers. It also has performed well in Zambia and the Yemen Arab Republic, two countries in which it is likely to be released soon.

ICMS 7703, another pearl millet variety released in India this year, was developed at ICRISAT Center by random mating of seven partial inbreds from African and Indian pearl millet lines. It has similar stability for yield and disease resistance as ICMV 1 and also shows tolerance for drought and salinity conditions. It was grown by farmers on more than 40,000 ha in 1984.
Chickpea ILC 3279, developed in Syria from a landrace of Russian origin by cooperating scientists from ICARDA and ICRISAT, has been released in Cyprus, and is being considered for release in Syria and some other countries. It is cold-tolerant, resists ascochyta blight, gives reasonably high yields, and being tall, is suitable for mechanical harvesting. In all these traits, except yield, it is superior to ILC 482, another chickpea line from the ICARDA-ICRISAT cooperative program already released in Syria. Another ICRISAT chickpea, Kabuli or bold-seeded ICC 32, has been identified for release in central and northwestern India.

Two ICRISAT sorghum varieties released in India and Zambia, ICSV 1 and ICSV 2, respectively, earlier known as SPV 351 and SPV 386, have been developed from two different parents from Purdue University and a common parent line in the Indian national program. All three parent lines, in turn, are converted lines from zero-zero landraces in Ethiopia.

ICRISAT has also, at times, combined two parents from a national program with impressive results. For instance, pigeonpea ICPL 87, a line likely to be released soon in central India, is derived from two cultivars used in India, T21 and JA 277. One parent is early maturing, and has small seeds and wide adaptability, and the other is late maturing and has large seeds. The improved line is high yielding and combines the best agronomic traits of both parents: it is early maturing, has large seeds and is widely adapted. It also lends itself to two or three harvests from the same crop and, with good management, yields in excess of 4 tons/ha.

The broad genetic base that ICRISAT has established goes far beyond specific examples by way of released varieties. Many improved lines have already been supplied to national programs for adaptation and released by them. In sorghum, 45 ICRISAT-bred A and B lines with phenotypic diversity, good agronomic traits, and stable yields have been distributed to national programs across the SAT for evaluation and use in breeding hybrids. Three ICRISAT-bred pearl millet lines, which are male sterile, early maturing and downey mildew resistant, are being widely used in the Indian national program and an earlier released male sterile line, 81A, has produced at least 10 new hybrids now under trial in India.

In dry areas of West and South Asia as well as Ethiopia, lentils are an important food legume. However, yields are poor, partly because there has been little research on the crop in the past. Part of ICARDA's work focuses on selection in existing landraces and hybridization to produce new genotypes with large and stable yields. Several of the new genotypes have performed well in a variety of different environments, and have been taken by national programs. As an example, Ethiopia has very recently released ILL 358 to be distributed to farmers.

Breeding for High Yield Stability

CIMMYT's breeding strategy in maize and wheat has been to develop germplasm with broad adaptation that performs exceptionally well in several ecological zones and under both high and low input conditions. Broadly adapted germplasm is needed because of the wide range of environments which
can occur even in a very small geographic area and because of the high cost inherent in developing a variety. In some developing countries, there is often no alternative to a breeding strategy based on broad adaptation, if programs with limited resources are to breed for large geographic areas. A benefit, of course, is yield dependability.

In recent years, CIMMYT has conducted extensive evaluations of large amounts of international testing program data to determine how its high-yielding varieties (HYVs) have performed in comparison to locally developed varieties (LDVs) which were bred for more specific and often homogeneous areas. Four basic conclusions can be drawn from the analysis of wheat data:

1) HYVs are at least as stable in yields as LDVs under all environment conditions (but on a higher yield plateau);

2) HYVs are at least as input-efficient as LDVs (and generally more so) under difficult production conditions;

3) HYVs are significantly more yield responsive than LDVs to improved agronomic practices; and

4) "True" HYVs (the type produced following the CIMMYT breeding strategy) combined all three of the above characteristics.

Examples of the types of HYVs of wheat produced by CIMMYT are a pure spring variety, Nacozari and the spring x winter variety, Veery "S". These varieties have high genetic yield potential, excellent rust resistance, and exhibit superior yield performance across a broad range of environments. In poor environments the yield of Nacozari is not very different from the mean of all entries, but as production conditions improve, its yield becomes significantly greater than the average. By contrast, the yield of Veery "S", a more recent variety, is better than the mean of all entries in nearly all environments, an indication of broad adaptation and superior yield performance in all environments.

This slide shows the performance of Veery in different environments. Note that its highest yield advantage shows up in the lower-yielding environment, especially those in which high disease levels regularly hold yields down. The superior performance of Veery selections has led nine developing countries to release 12 new varieties based on this cross in the last several years.

A parallel study was conducted on CIMMYT's maize germplasm to examine the yield stability of experimental varieties (EVs) developed in international progeny testing trials (IPTTS) for two intermediate-maturing tropical maize populations and two late-maturing tropical populations. The EVs were formed over two or three consecutive cycles of population improvement and tested at multiple sites (17-41) during the period 1979-1984 in Latin America, Asia and Africa.

Several salient points seem evident from a statistical analysis of the data. First, although the average percent yield difference between EVs
and those of reference entries in a given trial did not change much from
cycle to cycle, a few superior EVs were present in most cycles. Second, all
the EVs exhibited an indication of high yield stability. Third, over the
cycles newer EVs were either more stable or just as stable as the EVs from
earlier cycles. Fourth, in any given cycle of improvement, some EVs were
both highly responsive to better growing conditions and yet showed excellent
yield dependability across a broad range of environments.

A second part of the maize study considered results of on-farm
trials in Mexico, Guatemala and Paraguay. In these trials, local varieties
were compared with improved experimental varieties (many of CIMMYT origin)
for yield, stability and economic risk. Varieties were tested both at
farmers' levels as well as recommended levels of inputs and management.
HYVs and LDVs yielded similarly in poor environments. However, under
improved conditions and management, HYVs showed considerable yield response
and high stability while the LDVs yielded poorly (often because of lodging)
and were less stable.

Similar trials conducted in Ghana compared farmers' varieties and
practices with an improved variety (La Posta) and two levels of agronomic
inputs (one only slightly higher and another considerably higher than the
farmers'), and included economic analysis. The improved variety plus
agronomic inputs gave higher yields than the farmers' practices in all
environments, with a high marginal rate of return and, if anything, a lower
risk of failure with the investment.

Resistance Breeding

All of the centers with plant breeding programs place heavy
emphasis on breeding for resistance to plant diseases, insects and other
pests and environmental stresses. Keeping ahead of pests and diseases is a
major task, and centers must employ all forces and strategies to meet the
constant challenge.

Disease resistance breeding is a major thrust at the crop based
international centers. At ICRISAT, for example, wild groundnut relatives,
mainly from South America, are being crossed with cultivated groundnuts of
varying origin to incorporate disease resistance. This work is difficult,
involving crossing of genotypes that are not compatible. ICRISAT scientists
have, through a complex process involving several years, bred some
interspecific hybrids that are almost as good as cultivated varieties. In
addition to disease resistance, the improved groundnuts will offer farmers
large hay yields, valuable as livestock feed.

Incorporating stable resistance to pests and diseases and other
stresses is a cornerstone of IRRI's work. IR64 and IR65 named by the
Philippine government can serve as examples. IR64 matures in 110 days, has
excellent grain quality, resistance to brown planthopper, green leafhopper,
bacterial blight, tungro and grassy stunt viruses, and tolerance to soil
salinity, alkalinity, phosphorus deficiency, boron toxicity, and peat soils.
IR65 is glutinous with substantial yield advantage over conventional
glutinous rice. Work on irrigated rice focused primarily on greater yield
stability against pest and soil constraints, grain quality and early maturity, but efforts were intensified on rainfed rice, including upland and deepwater conditions. Cell and tissue culture techniques have reached the stage where better breeding lines suited to various adverse conditions are available for testing.

IRRI has increased its efforts in producing rice lines suited to adverse conditions especially under rainfed conditions. Cell and tissue culture techniques have been useful in developing such hardy and robust plant materials.

A new research site for upland rice at Caliraya about one hour drive from Los Banos is helping identify varieties adapted to soils with low pH; low nitrogen, potassium and phosphorus; and high aluminum saturation. Work on adverse environments was further intensified by appointment of a new rice breeder for problem soil tolerance and creation of a research group to characterize typical adverse rainfed environments as well as to evaluate breeding lines. Two Philippine sites and one in Thailand have initially been selected as widely representative rainfed sites. These studies are supported by intensive evaluation of germplasm collections and breeding lines to suit the various biological and physical constraints.

Maize streak virus is perhaps the most devastating disease of maize in Africa. When streak virus epidemics in 1983 and 1984 devastated local maize in many parts of Africa, resistant varieties were remarkably productive and drew widespread farmer attention. CIMMYT and IITA have a cooperative program for developing streak resistance in maize. Using effective screening techniques devised at IITA, along with sources of resistance from the Tanzanian National Maize Program and from Reunion Island, researchers have made rapid progress in developing adapted, streak-resistant germplasm for African national programs. In addition to participating in IITA’s ongoing work on streak resistance, CIMMYT moved its center of improvement for La Posta from Mexico to West Africa. La Posta was chosen because it has performed well in the lowland tropics of Latin America, West Africa and parts of East Africa and because various selections from it had been released to farmers by national programs and were widely grown in several African countries.

At the same time that streak resistance was being developed in La Posta, CIMMYT breeders kept upgrading the population and developing experimental varieties from it. This approach has proved effective. Whereas in 1980 only 4.6 percent of the selected families had plants showing streak virus resistance, in 1984, after three cycles of selection, 100 percent of selected families were resistant. CIMMYT expects that La Posta will have a high level of streak resistance by 1986 and that all varieties derived in the future from it will be streak resistant.

A different approach in breeding for streak resistance has been to convert elite CIMMYT varieties through backcrossing. Breeders are using the most recent experimental variety from populations that have performed well as a recurrent parent in each backcross generation. This approach has given very encouraging results. In Nigeria converted varieties were decidedly
superior in yield under very heavy streak pressure. The first varieties from
the conversion program are now being multiplied and have been released to
farmers in Benin, Togo and Nigeria and are being tested in several other
countries.

Two additional steps will make resistant germplasm more widely
available to African farmers. The first has been to organize variety trials
beginning in 1984 that include the streak conversions and varieties derived
from the IITA populations and to distribute these trials to cooperating maize
researchers throughout Sub-Saharan Africa. The next step will be to
introgress streak resistance into each population from which the conversions
were derived and to build up this resistance through screening under
artificial streak infection in Nigeria or elsewhere in Africa. Introgression
of streak resistant conversions into the gene pools corresponding to the
populations has already been started at CIMMYT, and within a few years, all
the populations that are important for Africa should have strong resistance
to MSV.

At IRRI, crosses of O. officinalis and O. australiensis were
utilized in improving the insect and disease tolerance of cultivated rice.

Environmental Stress

Breeding for resistance to stressful soil and climatic conditions
is also a top priority at the centers. ICARDA, for example, is producing
barley varieties suitable for dry environments. One of the main objectives
of the breeding programs at ICARDA is to develop diverse germplasm from which
national programs can select materials best suited to their conditions. This
year ICARDA began to explore two new avenues for barley improvement: 1)
using landraces in breeding; and 2) making crosses between wild barley and
cultivated barley. From the white peg at left, moving to the right are the
three local varieties of landraces, and three families of a cross between a
cultivated barley ARAR x H. spontaneum. It shows the plant height of these
crosses compared with the cultivated barley parent (ARAR) as well as with the
locally grown land race A. black, adapted to dry areas.

Tadmor, a pure line isolated from a population collected at a very
dry site near Palmyra, in the Syrian steppe, is an example of how locally
adapted germplasm can be used to improve barley yields in harsh environ-
ments. Tadmor outyielded two local cultivars that are widely grown in Syria
(Arabi abiad and Arabi aswad) especially in dry locations. Similar results
have been obtained with durum wheat. ICARDA intends to make full use of
locally adapted germplasm to improve both barley and durum wheat for dry
environments.

At CIP, the development of a practical true potato seed technology
has been the highest research priority for the past several years. CIP's
long-term plan stated that this technology should be in farmers fields in a
number of developing countries by 1985. CIP is on schedule. There is an
increasing demand for CIP's superior hybrids, many of them being produced
through contracts with developing countries.
CIP's approach emphasizes development of the private sector for production and distribution of true seed. Recent research at CIP has focused on producing information on efficient methods of TPS production, disease control, transplanting techniques, seedling-tuber production and socioeconomics.

Because of the high degrees of location and growth stage specificity in producing upland rice, substantial portions of IRRI staff time are devoted to: 1) basic research on breeding methodology, 2) generation of basic stress-tolerant germplasm, and 3) generation of crosses specifically tailored for use by national, regional and international centers on three continents. The parents of such crosses are stipulated by these centers themselves.

Using an electron microscope provided to IRRI by the Government of the Netherlands, scientists established the proportions of bacilliform and spherical tungro virus particles which determine stability of tungro resistance in rice varieties. Both of these virus forms are present in tungro-affected plants.

Breeding for Specific Farming Systems

All of the crop oriented centers breed for specific conditions in the farming system. A few examples will be cited to show how that approach can be used in crop improvement. Beans are produced by thousands of small and medium sized farmers. The CIAT Bean Program squarely directs its research towards them. Although the small farmer is difficult to reach, his production problems can be solved through research. An obstacle to research progress has been that many small farmers live in the higher altitudes, especially in the densely populated Andean zone where often only one bean crop per year can be produced.

For the Colombian highlands the intensive collaborative research effort of the national research institute (ICA) and CIAT has resulted in the release of three varieties. The first variety, released in 1983, was "ICA-Llanogrande". It is a climbing bean which is planted in relay with maize. Its planting coincides with the physiological maturity of the maize, and no intercrop competition occurs. While ICA-Llanogrande is outstanding from an agronomic point of view, its seed type was not quite up to standards. Since the release of "ICA Llanogrande" this has been corrected, and now, in 1985, a further improved variety, "Frijolica LS-0-3.3", a variety combining the agronomic advantages of ICA Llanogrande and of outstanding seed quality, has been released.

The second release, that of "Frijolica 0-3.2", was in June, 1985. This is a climbing bean planted directly with maize, and using maize as its support. Extensive on-farm-testing preceded this release. The new variety is already in the hands of many farmers who are growing it enthusiastically.

The third newly released variety is "Frijolica 0-3.1", an early maturing bush bean which can be grown, in monoculture, between two wheat crops.
For the Peruvian highland, similar progress can be reported. In 1982, the variety "Gloriabamba" was named but official release and promotion only took place in mid-1985. In the meantime, farmers in the remote highlands of the provinces of Choto and Cajamarca have adopted the variety, where it is now grown extensively. Farmers like this climbing bean variety because it allows an early harvest (2 months earlier than their traditional variety) and permits them to arrive in time, after bean harvest, in the Peruvian Selva to help as migrant workers in the harvest of new CIAT-bred rice varieties.

At ICARDA, the Food Legume Program has shown advances in chickpeas and lentils. Yields of chickpea in the region are poor and variable because the cultivars and landraces available to the farmers are susceptible to ascochyta blight, caused by _Ascochyta rabiei_. To avoid complete loss of crop from this disease, farmers in the region delay sowing until the spring, when the weather does not favor development of the disease. But yields from the spring sown crop are only modest because, from the early stages of seed development onwards, water becomes progressively more limiting as the temperature rises. Joint research by ICARDA and ICRISAT has led to the development of new genotypes that are very resistant to ascochyta blight and to the cold winters of West Asia. They can therefore be sown in winter, when they will give almost double the yield of the normal spring sown crop. The new genotypes are well adapted in a range of different environments.

Hybrid maize, developed at IITA, has given on-farm yields in the forest zone of 4 to 8 tons/ha compared with 1.5 to 2.0 tons of the best local maize. In the savanna zone, hybrid yields are even higher, up to 11 tons/ha. Farmers' enthusiastic reception of hybrid maize led to the incorporation of two Nigerian commercial seed companies in 1984 and an additional one in 1985 that have begun producing and selling hybrid seeds.

4. BIOLOGICAL CONTROL

Reducing pest and disease damage to crops and livestock depends on research on plant breeding and integrated pest management, including biological control. Collaborative efforts between CIAT and IITA for the control of mites and mealybugs that attack cassava in Africa were initiated about 7 years ago during efforts to find the home in the Americas of the cassava mealybug _Phenacoccus manihoti_. An IITA exploration team concentrated its efforts in Mexico and Central America, while CIAT concentrated on South America. CIAT found a related mealybug, _Phenacoccus herreni_, in Colombia and Brazil in 1978 — and in 1980 discovered the species causing problems in Africa — _Phenacoccus manihoti_ — in Paraguay.

This advance was quickly followed by the identification of _Epidinocarsis lopesi_ as a major parasite of cassava mealybug (_P. manihoti_). Today, this parasite is the "star" of the IITA Africa-wide biological control program.

Because of the similarities between the two mealybug species _P. herreni_ and _P. manihoti_, CIAT has sent — in containers as shown here — several _P. herreni_ predators and parasites to IITA over the years (via the Commonwealth Institute of Biological Control). The search for other predators continues, with considerable success.
During the last 2 years, CIAT has dedicated considerable effort to exploration and study of predators of cassava mites and to the evaluation of a complex of mite predators. Here we see a mite predator feeding on cassava green mite. More than 25 predator species have been discovered, and the ones most important in regulating cassava mite populations have been identified and sent to IITA. One of these has been released on farms in Nigeria.

CIP is working on a biological control for the root-knot nematode, *Meloidogyne incognita*, a major potato pest. All effective chemical nematicides have recently been declared unsafe and removed from most markets. CIP researchers have discovered a fungus, which parasitizes nematode eggs under field conditions; this organism is as effective as the best chemical nematicides at a fraction of the cost. Tests in over 50 countries show that the fungus is active against a wide range of nematodes affecting a wide range of crop species. The fungal agent is being prepared for commercial marketing by several companies.

At IRRI, integrated pest control is the main theme of the pest management program. Pest threshold levels for economic injury and epidemiology and the supplemental role of biological control agents and resistant varieties have been established. Buprofezin, which inhibits brown planthopper moulting, and botanical pesticides such as products of the neem tree, offer great potentials for safe and relatively inexpensive control measures. On another front, *Azolla microphylla* and the vigorous early development of hybrid rice help to suppress weed growth.

**Animal Disease Research**

ILRAD's work to find ways to control East Coast Fever and Trypanosomiasis is important because these diseases kill some 3 million cattle each year and limit production in 7 million square kilometers of land.

The objectives of ILRAD's Theileriosis Program are:

1) To increase knowledge of theileriosis epidemiology in Africa and other affected areas in order to develop and apply improved vaccines for the control of the disease; and

2) To identify, isolate and characterize parasite antigens which can serve as the basis for new, safer and more effective vaccines against theileriosis.

Areas affected by theileriosis are shown on this map of Africa. Current status of the "Infection and Treatment" method of immunization is as follows: In the last 5 years over 700 cattle have been experimentally immunized against East Coast Fever in Malawi and Kenya in projects supported by FAO, DANIDA, UNDP and ODA and in ILRAD's collaborative program with the Government of Kenya Veterinary Department. On exposure to the disease at various locations in both countries only 1 percent of the immunized cattle developed East Coast Fever whereas control, non-vaccinated cattle suffered ECF mortalities ranging from 40 to 90 percent.
It has been estimated that improved -- hence potentially highly productive -- cattle that could be immunized include over 0.5 million improved dairy and beef cattle, as well as approximately 2 million local cattle of several breeds.

ILRAD's research contributes to better and more widespread use of the "Infection and Treatment" method as a means of vaccination against Theileriosis by:

1) Characterizing strains of Theileria using newly developing immunological and biochemical techniques;

2) Assessing the usefulness of such strains in developing better vaccines;

3) Providing expertise, in collaboration with FAO, to international, regional and national programs, to establish and evaluate vaccination programs; and

4) Training personnel of national veterinary services in the techniques required to implement an "Infection and Treatment" vaccination policy.

ILRAD is now working on new "dead" vaccines, i.e. isolated antigens, not live parasites. Progress toward new vaccines is based on isolated components of:

a) The sporozoite stage of the parasite; and

b) The schizont stage of the parasite.

Sporozoites are very small and therefore ILRAD must use biotechnology to isolate antigens. The slide shows an electronmicrograph of a sporozoite approaching a bovine lymphocyte. The small rectangle is the parasite surface where the protective antigens are located. The objective is to block invasion of the bovine lymphocyte with antibodies developed through biotechnology. Resistant cattle in the field have antibodies which block sporozoite invasion, and these have been used to identify relevant sporozoite antigens and their genes.

Antigens on the surface of the sporozoite stage of the parasite which induce protective antibody responses in the cow have been identified and characterized.

Also, the parasite genes coding for these protective antigens are being identified and isolated using advanced techniques of molecular biology, with the objective of producing sufficient amounts of these antigens in vitro to test their ability to immunize cattle.

As regarding the schizont stage of the parasite, the slide shows parasite infected lymphocytes (two large cells center left and right). The pink/purple rods at 12 o'clock in the cytoplasm of both cells are schizonts of the parasite. The smaller cells in apposition to the infected cells are
immune lymphocytes specifically recognizing the cells as infected and about to kill them. The ability to generate and clone such immune cells allows ILRAD to find ways to identify relevant antigens on the surface of schizont-infected cells. This is the equivalent to the use of anti-sporozoite antibodies to attack sporozoite antigens.

New technologies have been developed whereby bovine cells which specifically recognize antigens on the surface of schizont-infected bovine cells can now be cloned and maintained in vitro. Such immune cell lines can now be used to identify the antigens responsible for induction of protection by the "Infection and Treatment" method of vaccination. These antigens can then be tested for their ability to immunize cattle.

For its trypanotolerance studies, ILRAD has imported N'dama cattle from West Africa into Kenya using embryo transfer techniques. The calves were carried by Boran mothers and have done well.

The performance of N'dama and Zebu cattle following experimental infection with Trypanosoma Congolense was compared. Here the N'dama calves are shown on test. Results showed 75 percent of the Zebu cattle required treatment to prevent mortalities 3 to 7 weeks after infection, while no N'dama cattle required treatment to prevent mortalities.

5. FARMING SYSTEMS RESEARCH

Many of the centers are involved in farming systems research. These centers have worked together in 1985 to prepare for a Farming Systems Research Workshop at ICRISAT in early 1986. Farming systems programs include a range of activities from environmental characterization and mapping work to on-farm research. Most FSR work is aimed at understanding farmer circumstance and in sharpening research goals and strategies. FSR work is multidisciplinary and some of the examples cited will illustrate the wide variety of problems tackled by scientists involved in FSR.

At WARDA, the tidal (Mangrove Swamp) rice production has been seriously affected during the past few years by severe drought. The reduced rainfall has shortened the salt-free period in the riverine (mangrove) production areas causing severe losses where traditional later maturing varieties were grown. The WARDA Regional Mangrove Swamp Rice Research Station at Rokupr, Sierra Leone had shorter duration, higher yielding, salt tolerant varieties available which have been adopted readily by farmers in the Gambia, Guinea and Sierra Leone. This was promoted by the presence of WARDA Technology Assessment and Transfer Trials in those countries where the transfer trials survived when farmers' crops failed.

In addition, mangrove swamp farmers suffer severe losses from crab damage to transplanted seedlings. WARDA research has shown that use of fertilizer on nurseries results in much better developed seedlings for transplanting which, because of their thicker and tougher stems are much less subject to crab damage. Farmers are now using fertilizer on their nurseries to take advantage of this protection from a serious pest. The use of nitrogen fertilizer is also increasing in the tidal areas as a result of the introduction by WARDA of a simple fertilizer injection technique which
markedly reduces losses which result when urea is broadcast and washed out by the twice daily tidal inundation. Nitrogen response is nearly doubled by use of the procedure.

At ICARDA, the Farming Systems Program has studied the barley/livestock systems dominant in the drier areas (less than 350 mm - 14 in annual rainfall) and the wheat-based systems in the wetter areas (more than 350 mm - 14 in).

In these systems, barley and sheep are the main sources of livelihood. Heavy pressure on land resources is a problem so the research emphasizes alternative rotations and improved management of barley and livestock. Fertilizer, in particular phosphate, has been shown to improve barley yield and stability of yield through its effect on crop water use efficiency. Phosphate further affects the time to maturity, allowing it to escape moisture stress. Research on wheat-based systems focuses on the introduction of legumes into the rotation and on effective fertilizer management and weed control.

ICRISAT continues to work on improving farming systems to help farmers exploit available inputs to the maximum. Included in this work are cropping systems studies; physiological and microbiological studies to help plants endure stresses or exploit nutrients available in the soil and air; and evolving improved farm implements and practices for use by farmers.

Crop management problems are acute in the drought-prone Sahelian zone of West Africa. While ICRISAT scientists screen lines that can withstand long dry spells, poor soil texture, high soil temperatures, and sandstorms characteristic of that zone, agronomists aim to improve management of limited available resources. For example, scientists at the Sahelian Center in Niger have observed that the practice of ridging increased the plant stand of pearl millet by 50 percent, as a result of reduced sand blasting and conserved soil moisture. Mulching the field with millet stalks increased grain yields by 16 to 32 percent. Responses to phosphate were highly significant, and a locally produced acidulated rock phosphate was as effective as commercial superphosphate.

Intercropping millets with cowpeas is also being studied at the Sahelian Center, in collaboration with scientists from IITA. In cooperation with SAFGRAD (Semi-Arid Food Grain Research and Development Project), a maize/millet intercrop package was tested on 15 farmers' fields in the Sikasso region of Mali, with the package producing grain yields of 45 percent higher than the sole crops.

In India, an ICRISAT operational-scale evaluation on three major types of soils confirmed that pigeonpea-based intercrops gave the best and most stable returns.

Continued studies on nitrogen fixation in chickpea showed that the crop can derive almost 90 percent of its nitrogen requirement from the air; this equals about 40 kg/ha of applied nitrogen. In research on mycorrhizae -- beneficial fungal strains associated with the root zone of plants --
ICRISAT scientists found that the inoculation with one such fungus can at least double the growth of pigeonpea plants in sterilized soil.

Designing or adapting farm implements for use by farmers also received due attention. ICRISAT engineers improved their design of a planter and fertilizer applicator unit, modified low-volume and ultra-low-volume sprayers, shown here, for farmers using insecticides, and developed the Agribar, a simple toolbar that is being tested on farmers' fields in India, Mali, and Niger.

ICRISAT has also initiated agroforestry work to study the effects of trees on crops grown alongside them. While crop yields may decline in some instances, economic yields are expected to be higher because of increased fodder production. Trees will also help improve the soil profile, arrest erosion and lead to a more balanced ecosystem.

Analyses of long-term trends in rainfall and other agroclimatic factors also aid in crop planning and management decisions. For example, rainfall and water balance over three decades in groundnut-growing areas of the Sahel showed a definite falling trend, explaining why production has declined in the region, a traditional groundnut exporter. ICRISAT's analysis suggests that shorter-duration, drought-resistant groundnuts may stabilize production in that region, and work on such genotypes is in progress.

Studies on adoption of ICRISAT's improved deep Vertisol technology in India have revealed the crucial role of institutional credit, which has been quantified in relation to farm size and adoption rates. This is expected to facilitate institutional intervention. Other ICRISAT studies have quantified the role of common property or open access resources in the lives of the rural poor, indicating that the availability of such resources augments productivity.

To improve its knowledge and understanding about beans in Africa, CIAT established a social science component in its team there. This work has helped determine CIAT's research strategy in the Great Lakes region of the French-speaking Central African highlands by finding that:

(1) In Rwanda beans are produced by small farmers with, on the average, less than 1 ha of land.

(2) People consume beans three times per day. Beans are cooked and then kept for 2 or 3 days; therefore resistance to spoilage is important.

(3) While farmers plant varietal mixtures consisting of different colors, the color of the seed is less important than in Latin America.

(4) Farmers do not know the word "disease". It is referred to as "wet weather" and ranks among the top production constraints, just as in Latin America.

(5) Farmers plant mixtures of genotypes which differ in their responses to different production constraints. They rank yield stability above yield potential.
A large majority of bean farmers in Africa are willing to try new varieties. If they produce well and are of good eating quality, they add the varieties to their mixture. This finding now determines CIAT's breeding strategy; while it would be very difficult to improve a varietal mixture, CIAT strives to develop varieties in monoculture with competitive ability. Promising lines are tested by the on-farm research program in monoculture by the farmers. Depending on the results, farmers then incorporate them in their mixtures.

IITA strengthened its socio-economics unit and began a major research thrust on the role of women in agriculture. During the past year, IITA organized field days and briefing sessions for farmers, agribusinessmen and policymakers. Among activities designed to bring IITA's research results to the attention of more people was a highly successful conference on the mass media and food production which also sought to forge a partnership in Africa between agriculture and journalism. IITA is also taking its research closer to potential beneficiaries through intensified on-farm research decentralization.

Technology transfers in Africa include ILCA's construction of simple ponds using ox-drawn scoops. These ponds are principally for domestic and stock water but also have a valuable role in irrigating specialized crops and for fish culture. ILCA has also adapted single-ox plows to create broadbed and furrow systems of cultivation on heavy clay soils. By developing a reversible mouldboard on this local plow it has also been possible to construct terraces simply and cheaply on eroding hillsides.

The demand for most traditional staples decreases as society modernizes. In Latin America traditional cassava products, such as farinha and casabe, face decreasing demand. In the case of dry cassava an alternative market as animal feed exists in Latin America. CIAT, in cooperation with the National Integrated Rural Development Agency in Colombia, has developed this market. Technology from Asia has been adapted and used to develop a viable small-scale agro-industry in an area considered marginal for conventional agriculture.

Twenty small processing plants have been established and twenty more are being built by associations of small farmers. These plants are economically viable in their first year of operation and make substantial profits in succeeding years. The profits are distributed to the plant owners who include small farmers and landless laborers. The plants also provide significant employment opportunities for landless labor. Furthermore, small producers gain by having an outlet for their cassava.

The major response in increased production to satisfy the demand for cassava created by these plants has been by farmers who plant 3 hectares or less. Thus we have an industry biased to small farmers, and benefits are distributed to the poorest of the poor. It is very rare to find development projects which can so effectively meet social needs in this manner.

As contrasted to dry cassava, fresh cassava, has a strong demand. However, fresh cassava is highly perishable. CIAT has developed a simple
storage technique that allows roots to be stored for 2 weeks instead of 2 or 3 days. The process involves treating roots with thiabendazole, an innocuous chemical used for treating bananas for export, and then placing them in polyethylene bags. The roots shown here have been preserved 3 weeks using this new storage technique and are in flawless condition.

This process is now being tested in Peru, where cassava production is to be increased in the jungle where cassava grows very well and sent to Lima which is suffering appalling food deficits at present. The potential of this technique is, however, much wider than just Peru. Fresh cassava is consumed throughout tropical Latin America, tropical Africa and Indonesia.

IRRI has obtained outstanding results from using 45-day old Sesbania rostrata as a green manure in rice-based systems; rice yield increased 1.5 t/ha equivalent to 50 kg N as fertilizer. The stem nodulated Sesbanias originated from work by IRAT scientists in Senegal. IRRI has provided seed to collaborators and is studying effects on soil physical conditions and establishment of food crops following rice.

6. IMPORTANCE OF STRENGTHENING NATIONAL PROGRAMS

ISNAR was created to help countries increase their capacity to provide a flow of new technology needed for agricultural development. Although country needs are diverse, several of the same needs are often met, in both similar and contrasting forms. Examples from Indonesia, Kenya, Madagascar, and the Dominican Republic show how ISNAR worked with these countries in 1985 to improve their abilities to organize, program, monitor and evaluate their research. The list of issues needing attention in a national system may be long, but one or a few key elements must be chosen for first attention.

Indonesia has shown what research can do to transform traditional agriculture in a short time provided there are policy commitments to support and strengthen the research system. In the last 10 years Indonesia has more than doubled its rice production. During this same period it has also established one of Asia's largest national networks of experiment stations, with 25 central and regional institutes, and a staff of 1500 graduate scientists, many of whom have advanced degrees. Having made this massive investment in its large research infrastructure, the Indonesian Agency for Agricultural Development (AARD) has been concerned in recent years that its system be efficient and effective, and thus provide good economic return.

ISNAR's cooperation with Indonesia began in 1981. The main purpose is improving of Indonesian scientists' capabilities in evaluation and monitoring skills, and building within AARD an institutional capacity to help them make more effective use of their large research capability.

ISNAR's work with Madagascar has emphasized developing procedures to focus available resources on a few priority problems and opportunities. ISNAR did a comprehensive review in 1983, and then helped to design a new organizational structure, and to implement procedures to ensure that national priorities and development needs were reflected in the research program. ISNAR posted a staff member to Madagascar to help with the work, and provides additional short-term help in research management as needed. Procedures for systematic planning, programming, and evaluation of research are being phased
in over a 4-year period. Again, ISNAR seeks not only to help do the work, but to build an institutional capacity.

While reorganization of the structure of a national research system is seldom sufficient to make it effective, it is often essential. Many developing countries will have to bring about significant structural and organizational changes in their agricultural research services if they are to service a modern and productive agriculture.

In 1985, ISNAR's work in Kenya focused on a reorganization of the research system. The ISNAR team working with Kenyan scientists, has helped to define more clearly the national research priorities and programs. One example is the identifying soil and water management research as an overriding priority for the semi-arid and marginal lands. The ISNAR team further recommended that the number of experiment stations be reduced from the present 33 to 19. The mandates of each of the 19 have been clearly defined, consistent with their location in the different agro-ecological regions to be served, and the identified research priorities.

In the Dominican Republic, ISNAR's essential task has been to build political support for difficult decisions that had to be made on the organization of the research system so needed technology could flow to the system's clients. A 1983 review of the Dominican Republic system recommended the establishment of a new decentralized research organization, the Institute for Agricultural Research (IDIA). ISNAR worked closely with the Secretary of Agriculture in drafting the required legislation to create the new institute; in developing the organizational and management instruments needed to operate it; and in a search for donor assistance to support its activities during the early stages.

ISNAR is now concentrating on specific aspects, such as design of the new Institute's basic policies and operational procedures -- including the planning, programming, monitoring and evaluating mechanisms -- as well as the preparation of a new master plan for agricultural research for the medium term. These efforts will be complemented by a training program to improve aspects of research methodology, particularly for on-farm research. In these activities ISNAR will work in close cooperation with donors and technical assistance agencies, who are also supporting efforts to reorganize and strengthen the agricultural research capabilities of the Dominican Republic.

These brief examples illustrate some of ISNAR's activities as it cooperated with some 30 countries in working to strengthen their national agricultural research systems.

Other centers are also involved in extensive programs with national agricultural research systems. During 1983-84, CIMMYT conducted a study of comparative advantage and policy incentives for wheat production in Ecuador. The goal of this effort was to develop procedures which national staff can employ to provide analysis in support of research resource allocation decisions. Wheat production in Ecuador over the last 10 years decreased sharply while consumption increased markedly, with a result of a 10 percent annual growth in wheat imports. The study was conducted in the Cayambe
region, northeast of Quito and traditionally the most important wheat-growing region in Ecuador. The profitabilities of wheat and competing crop and livestock activities were compared at two levels of technology: 1) current farmer technology, and 2) an improved level of technology.

Producer prices of wheat in Ecuador in the past decade declined sharply in real and relative terms, largely due to a policy of linking producer prices to the import price of wheat. The import price, in turn, was measured at the significantly overvalued official rate of exchange, rather than at the free rate. For milk production, the most important alternative use of land, imports of dairy products were restricted, tending to raise their internal price. The producer price for the barley also rose relative to wheat, also due to the protection against imports. Overall, in the period 1970-83, the price of wheat declined 30 percent relative to barley and about 50 percent relative to milk.

The results showed that under current prices and technologies, farmers' returns to land in wheat production were slightly less than for other cereals and less than half of the returns in dairying and potatoes. Not surprisingly, there has been a substantial shift in land use toward both intensive and extensive dairy. High capital and labor requirements and price risks of potato production combined to limit expansion of that crop.

When national profitability of each crop and livestock enterprise was calculated, wheat provided the highest returns to land, after potatoes, while extensive dairying gave the lowest returns. The differences between farms' returns, which are low for wheat, and returns to the nation from wheat production, which are relatively high, are due to the effects of subsidies, taxes, and exchange rate anomalies. Taken alone and recognized that overvalued exchange rates cannot persist, the results provide a basis for continuing a strong wheat research program in Ecuador.

As Thai cassava production expanded in the decade of the seventies, the Ministry of Agriculture took action to strengthen the cassava research effort. CIAT was heavily involved in this effort offering training opportunities. In 1983, to further strengthen the Thai national program, an experienced CIAT breeder was stationed in Thailand where his efforts were fully integrated with the Thai program.

From initial introductions from CIAT and crosses made locally involving Thai and CIAT germplasm the variety Rayong 3 was released and is rapidly expanding in area planted. This variety yields about the same as Rayong 1 (the standard variety grown on about 1.3 million ha) but has higher starch content. Rayong 3 is only the tip of the iceberg.

The Thai program has a whole series of new clones in the pipeline using local and CIAT germplasm and some of these will shortly be released as varieties. Thus with the first real contact and cooperation starting in 1975-1976 the Thai program has now reached a high level of effectiveness and competence that is resulting in new varieties for farmers.
CIAT maintains a small regional bean team in Central America to backstop national programs in the region. In Costa Rica, for example, improved varieties developed by CIAT in cooperation with national programs entered on-farm testing in 1982. Surveys conducted between July 1984 and July 1985 showed that today, some 60 percent of the Costa Rican bean farmers are using these new varieties. Fully two-thirds of the area is planted to the new materials.

The use of these new varieties is reflected in production and importation statistics. In the timespan of 4 years, production has almost doubled and is now at 23 thousand tons. And while in 1980/81 Costa Rica needed to invest more than 9 million dollars for the importation of beans, today the country is fully self-sufficient.

In 1985, ICARDA showed an increased level of cooperative activities with the countries in the region. Agreements of collaboration now exist with 11 countries in West Asia and North Africa, including Pakistan at the extreme eastern end, Morocco in the west, Turkey in the north and Ethiopia in the south. ICARDA is currently operating four substantial programs of international cooperation: (1) the IFAD-funded Nile Valley Project now entering its seventh year of operation in which ICARDA and national research scientists, administrators and farms in Egypt, Sudan and Ethiopia join hands in the improvement of all production aspects of faba bean, a most important staple food. Yields on farmers' fields involved in the project doubled or more.

The cooperative program with Tunisia is being extended to the other countries in the Maghreb, especially Morocco. The 4 years of cooperation with Tunisia has produced several results such as the release of three new barley varieties, the development of successful disease and pest control programs in faba beans and chickpeas and the initiation of a comprehensive farming systems research program in a semi-arid area west of Tunis.

Cooperation with the Syrian national programs includes research on crops (cereals, food legumes and forage crops), steppe and range management and farming systems especially soil and water aspects. Joint experiments are conducted at all Syrian research stations relevant to ICARDA's mandate and on hundreds of on-farm trials.

In August 1985, ICARDA was able to fill in an essential component of its mandate by initiating a major long-term high-altitude research program on the arid high plateau of Baluchistan in cooperation with the Arid Zone Research Institute at Quetta, Pakistan and with funding from USAID.

Intensive contacts have existed with Jordan, Cyprus and Lebanon from ICARDA's early years and cooperation with Turkey is growing rapidly. Trainees from all 24 countries regularly participate in residential training, specialized short courses or in-country workshops. Training of Third World scientists and technicians also receives major emphasis at IRRI and CIMMYT. CIMMYT, for example, is building a new training facility. During 1984, 514 rice research scientists from 44 countries participated in various training and education programs of IRRI. Collaborative graduate program agreements
were established with 19 agricultural universities in different countries where IRRI nominees complete course work but conduct their thesis research at IRRI.

In addition IITA is helping to strengthen Africa institutions through training and collaborative research. More than 3200 persons, 90 percent from African countries, have been trained at IITA.

The soon to be expected implementation of a rainfed agricultural information network (RAIN) will support the efficient flow of research information between research agencies and institutions serving the farmers in West Africa and North Africa. And at ILCA, animal breeding and nutrition studies focus on the further strengthening and elaboration of the national research networks that ILCA has established in these topics. A total of eight ILCA networks are now in operation; they are made possible by the excellent computing, documentation and laboratory facilities ILCA provides and which backstop the research and training activities of these networks.

A new network for Africa is the IRTP-Africa. IRTP has operated in Africa in the past, but it is hoped this new network will help the IARCs working with rice - IRRI, IITA and WARDA - to better coordinate their work in Africa.

GLIMPSES INTO THE LIVES OF OUTSTANDING SCIENTISTS IN THE CGIAR SYSTEM

Sometimes it is worth pausing to reflect that scientists, drawn from many nations, are the real pillars of the CGIAR system. Annual reports and research highlights list the accomplishments of the international centers working in collaboration with national programs, but the individuals who have made those accomplishments possible are rarely singled out for praise. Success is considered part of the job. Hundreds of scientists at the international centers are doing excellent work and there is not enough room to mention all of them. Here then, I would like to focus briefly on the lives of two scientists within the CGIAR system who are about to retire.

Carlos Ochoa, (shown on the right), was originally a wheat breeder until he realized that potatoes, domesticated in the Andes and a basic staple there, deserved more attention. Dr. Ochoa was born in Cuzco, Peru, in 1920, and grew up in the home of potato. He switched research interests to potato after farmers kept coming to him for information about how to improve the crop.

Dr. Ochoa immediately broke new ground when he investigated potatoes. The first order of business was assessing how many distinct varieties Andean farmers cultivated, how many wild relatives of the crop existed, and where they could be found. Virtually no published information was available on these crucial questions. A tireless field worker, he roamed the highlands of Latin America in search of traditional varieties and wild potatoes to enrich the breeding pool. He joined CIP in 1974, and as head of the newly formed taxonomy department, continued to make collecting trips, covering over 25,000 kilometers by jeep, horseback, and on foot. He scoured steep slopes as high as 4,600 meters and worked his way across hot, flat plains near sea level in search of useful genetic material for potato breeding.
Dr. Ochoa has been instrumental in building and organizing CIP's world collection of potato germplasm. He personally collected some 10,000 accessions of cultivated potatoes and about 1,800 samples of wild relatives. The urgency of preserving wild species before they become extinct has spurred his collecting missions. In all, he has described 50 potato species, a major contribution considering how important it is to clarify plant relationships for breeders.

It is not enough simply, however, to collect and classify germplasm samples; in order for them to become a resource, accessions must be evaluated and tested to uncover useful traits. Dr. Ochoa has always been aware of the importance of evaluating germplasm accessions and has forged collaborative working relationships with scientists in various disciplines, such as virology and entomology.

Dr. Ochoa's legacy embraces the great diversity of potato germplasm he has assembled, the valuable genes he has introduced into the breeding pool from wild species, his original publications, and his guidance and inspiration to students. His forthcoming monograph, The Tuber-bearing Solanums of South America, is eagerly awaited. He has instilled the importance of safeguarding and using the treasures of plant genetic diversity in his students and they will help carry on this vital task.

Across the world in the Philippines, Dr. Felix Ponnamperuma, (shown on the right), a native of Sri Lanka, has focused on soil chemistry as it applies to rice. Dr. Ponnamperuma has worked on completely different aspects of agricultural research than Dr. Ochoa and their lives illustrate the principle that improved crop production depends on the coordinated skills of scientists from many disciplines.

When Felix Ponnamperuma joined IRRI in 1962 he immediately set about to close the information gap on the chemistry of flooded soils and its effect on the nutrition of rice. By 1965, significant results had been obtained and he published a much-cited article, "Dynamic Aspects of Flooded Soils and the Nutrition of the Rice Plant." Dr. Ponnamperuma and co-workers continued to pursue studies on soil chemistry, and in 1972, published another landmark contribution, "The Chemistry of Submerged Soils," in the important review journal, Advances in Agronomy.

Such studies provided valuable information to agronomists concerned with managing rice production on problem soils. The work of Felix and his colleagues has uncovered numerous constraints to improved rice production, such as boron toxicity in coastal saline soils and fields irrigated with geothermal water, aluminum and iron as detrimental elements to rice growth in acid sulphate soils typical of some swampy areas, and zinc deficiency as a widespread nutritional disorder of rice on neutral, waterlogged peat soils. Further contributions have been made by pointing out how water management and the incorporation of straw into the soil can improve soil quality and the growth of rice, tailoring fertilizer applications to soil conditions and crop needs, and exploiting the genetic diversity of rice germplasm as a substitute to soil amendments.
his co-workers have shown that flood fallowing will render acid sulphate soils more productive by reducing iron toxicity. Studies on the chemical and physical properties of nearly 200 wetland soils in the Philippines, Korea, Taiwan, Vietnam, Pakistan, Nigeria, and Colombia have established optimum soil pH levels for rice cultivation. The results of his work have helped boost rice production over millions of hectares and open up areas formerly inhospitable to the crop. He and his co-workers have screened rice germplasm to find lines suited to adverse soils. Modern rice cultivars tolerant to multiple soil stresses are now widely grown in South and Southeast Asia.

In 1983, Dr. Ponnamperuma's accomplishments received much deserved international recognition when he was elected simultaneously as a Fellow of the Soil Science Society of America and the American Society of Agronomy. Furthermore in 1984, he was awarded a D. Sc. degree from the University of London for his pioneering work on the chemistry of submerged soils and the nutrition of rice plants.

The hard-working and productive lives of Drs. Ochoa and Ponnamperuma allow me to return to a major theme of this report: the importance of conserving, evaluating, and utilizing the genetic diversity of crops, plants and animals. The research thrusts of these outstanding scientists converge in the area of exploiting germplasm for increased crop production. Their distinguished careers have been geared to understanding and using the variability of crop plants and overcoming constraints to agricultural production.

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