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Report of a Workshop

إمكانيات تقوية الادارة في البحوث الزراعية الوطنية

POTENTIALS FOR STRENGTHENING MANAGEMENT IN NATIONAL AGRICULTURAL RESEARCH

Amman, Jordan
7 to 10 October 1984

Ministry of Agriculture, the Hashemite Kingdom of Jordan

isnar

International Service for National Agricultural Research

The International Service for National Agricultural Research (ISNAR) began operating at its headquarters in The Hague, Netherlands on September 1, 1980. It was established by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force, for the purpose of assisting governments of developing countries to strengthen their agricultural research. It is a non-profit autonomous agency, international in character, and non-political in management, staffing and operations.

Of the thirteen centers in the CGIAR network, ISNAR is the only one which focuses primarily on national agricultural research issues. It provides advice to government, upon request, on organization, planning, manpower development, staff requirements, financial and infrastructure requirements, and related matters, thus complementing the activities of other assistance agencies. Additionally, ISNAR has an active training and communications program which cooperates with national agricultural research programs in developing countries.

ISNAR also plays an active role in assisting these national programs to establish links with both the international agricultural research centers and donors.

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POTENTIALS FOR STRENGTHENING MANAGEMENT IN NATIONAL AGRICULTURAL RESEARCH

The proceedings of a regional workshop held at Amman, Jordan, 7 to 10 October 1984

Organized jointly by the Ministry of Agriculture, the Hashemite Kingdom of Jordan, and by the International Service for National Agricultural Research

April 1985

Ministry of Agriculture, the Hashemite Kingdom of Jordan

International Service for National Agricultural Research

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Program

Sunday 7 October – Relations Between National Agricultural Research Systems and Regional/International Organizations

0900–0930	Registration	
0930–1030	Welcome:	Dr. William K. Gamble
	Opening Address:	H.E. Mohamed Al-Bashir, The Minister of Agriculture, Hashemite Kingdom of Jordan
	Keynote Address:	Dr. William K. Gamble
1030–1100	Coffee	
1100–1230	Address:	The Director General, AOAD
	Address:	The Director General, ICARDA
	Address:	The Representative of FAO
1230–1330	Lunch	
1300–1430	Short Address:	The Representative of CIP
	Circulated Address:	The Director General of CIMMYT
	Short Address:	Regional Representative to the CGIAR
	Short Address:	General Secretary of FASRC
	Discussion	
1430–1445	Introduction to Working Groups	
1445–1515	Coffee	
1515–1630	Working Groups	Methods of strengthening working relationships between national agricultural research systems and 1. FAO/AOAD, 2. International Agricultural Research Centers, 3. ISNAR
1930	Reception	Hosted by H.E. the Minister of Agriculture (Jordan)

Monday 8 October – Linkages within National Agricultural Research Systems

0900–1030	Plenary Session	Reports of Working Groups
1030–1100	Coffee	
1100–1230	Keynote Address:	Dr. Lawrence R. Przekop, ICARDA
	Discussion	

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1230–1330	Lunch	
1330–1445	Short Addresses:	Dr. Thomas Sutherland (AUB) Dr. Subhi A. Qasem (Univ. of Jordan) Dr. Mahmud Duwayri (Univ. of Jordan) Dr. Mohamed Besri (Hassan II Institute) "The Role of the University in National Agricultural Research"
1445–1515	Coffee	
1515–1630	Working Groups	Linkages between national agricultural research systems and 1. policy-makers, 2. extension/farmers, 3. educational institutions

Tuesday 9 October – Manpower Planning and Personnel Management in National Agricultural Research

0900–1030	Plenary Session	Reports of Working Groups
1030–1100	Coffee	
1100–1230	Keynote Address: Discussion	Dr. Byron Mook, ISNAR
1230–1330	Lunch	
1330–1430	Working Groups	Management challenges in 1. manpower planning for agricultural research, 2. improvement of conditions of service for research personnel, and 3. the assessment of training needs
1430–1500	Coffee	
1500–1630	Plenary Session	Reports of Working Groups
1930	Dinner	Hosted by the Director General of ISNAR

Wednesday 10 October – Conclusion

0900–1030	Plenary Session	Theme: Implications of this Workshop for Strengthening Management in National Agricultural Research
1030–1100	Coffee	
1100–1230	Closing Session	

SUMMARY

Dr. William K. Gamble

Director General
International Service for National Agricultural Research (ISNAR)

Note: During the closing session, Dr. W.K. Gamble presented a summation of the workshop. It seemed appropriate to place this paper at the front of the report, because it recapitulates, in condensed form, the main ideas generated by the meeting.

I wish to try to briefly summarize a few implications that for me have emerged from the meeting. It is not our practice in a meeting such as this to try to develop resolutions or recommendations.

Let me first emphasize the four reasons why we suggested and sponsored this meeting in cooperation with the Ministry of Agriculture of the Hashemite Kingdom of Jordan.

The first reason was for ISNAR itself to become acquainted with you to further the dialogue on how we may increasingly and better carry out our mandate in this region, to be a service to help strengthen national agricultural research. The second reason was to provide an opportunity for other international and regional organizations to interact with you to see how we can all work together more effectively. The third reason was to give each of you here an opportunity to meet, to exchange ideas among yourselves, and to develop a better knowledge of one another, your problems and your solutions. And, fourth was to discuss the specific subjects of the meeting.

For me, I have rarely been in a meeting where I have felt that the objectives of the meeting have been so fully met or where I have observed and participated in such active discussion by all members of the group over the full period of the meeting.

I believe we have discussed the rationale, benefits, needs, issues, and mechanisms related to the subjects of relationships, linkages, and manpower planning and training as they concern us in this region. These have been well documented in the reports of the working groups, and consensus was reached on them. They will be edited and published as a part of the proceedings of the meeting to be shared with you and others.

I wish to think of this meeting as a starting point rather than the end of an activity. It is out of this meeting that I hope and expect the implications to be felt on:

- ourselves as individuals who participated in this meeting;
- through us on our own organizations or national systems;
- through us, our actions, and our work, on policy makers in national systems;
- on the interrelationship and programs between the institutions we represent and international/regional and bilateral organizations.

We opened the meeting with a look at eight issues that directly affect or are a part of our organization:
- the policy environment;
- research planning and programming;
- organization;
- manpower planning and training;
- funding of research;
- linkages;
- information flow;
- management.

Somehow, I believe in each day's discussion on relationships, linkages, and manpower planning, we kept coming back to these eight issues and found interrelationships among them for each topic and implications for our own programs.

What are the implications? I believe we recognized the uniqueness of each country and the need to find solutions that would fit each particular country's state of development, manpower situation, cultural, social, and economic condition. However, while recognizing

uniqueness, we found suggestions and ideas that have been tried in one place which can be modified and adapted to a wider group. I believe we reached consensus that we can do more than we may have done in the past to plan and program our own research systems (including research in universities) in order to present our cases more effectively to policy-makers, regional and international organizations, and to better manage existing resources for a greater productive benefit to the producers. I believe we have discussed ideas that we can carry home for further discussion with our colleagues in national programs, regional, and international organizations, which can be tried, evaluated, modified, adopted, or discarded. I believe each of us will go away from this meeting a bit more convinced that even in a small way we can influence policy and by building convincing cases we can truly affect important policy discussions. And, finally, I believe we have reaffirmed the potential synergistic effect of what can come from cooperation, first among national organizations, and second as a result of cooperation with regional/international and bilateral donors.

But I hope we are also going away from this meeting with the firm understanding that none of this is easy, or will automatically happen. We must work at it, and if we work at it together the result will be more effective than if each goes his own way. Communication, information flow, linkages, planning don't just happen. They require hard work, dedicated people, openness, and resources if they are to be carried out. I, as Director General of ISNAR, can assure you of our cooperation and our support to assist in these endeavors. In 1986, ISNAR will again sponsor a similar opportunity for us to get together again in this region. I am certain that other international, regional, and bilateral organizations also stand ready to cooperate with you.

However, the first task is with you. The first implication - that is, how you work together in each of your own countries to develop a time "system", that in its totality is really better than the sum of its parts, rather than, as in some cases, cooperate in a negative sense and not use opportunities to work together to make optimum use of resources.

These, gentlemen, are my observations and comments as we come to the closing session of this meeting. I will leave with a very positive feeling toward you and the outcome of our discussions. I hope you share this feeling.

I thank the Ministry of Agriculture of the Hashemite Kingdom of Jordan for joining with us and for supporting so well the organization of this conference. My thanks to each of you for your valuable time, your contribution to the ideas of this meeting, and to all the future contacts we may have.

PROCEEDINGS

INAUGURAL ADDRESS

His Excellency Mohamed Al-Bashir

Minister of Agriculture
Hashemite Kingdom of Jordan

Translated from Arabic

In the name of GOD the Compassionate, the Merciful.
Ladies and Gentlemen,

It gives me great pleasure to welcome you as participants and guests at this scientific meeting, which is the first of its kind, the aim of which is to investigate the means by which agricultural scientific research systems in our area may be supported, and which we in Jordan have the honor of hosting.

Agricultural scientific research in Jordan is a vital institution, coming under the aegis of the Ministry of Agriculture. It is, in fact, one of this Ministry's oldest agencies, having been set up in the early nineteen fifties from an awareness of its significance and the requirement to develop Jordanian agriculture. The improved varieties and practices that we find in our farming today are the fruit of that auspicious beginning.

Until relatively recently, Jordanian agriculture relied on traditional expertise and experience, to the extent that there was a prevailing belief among our farmers that these methods could not be changed. But that has lately been shown to be invalid, with advanced farming technology and practices taking their place in our farming. The farmer has started knocking on the doors of research and extension centers, seeking advice and guidance. As a result, output in certain crops has increased to the extent that we are looking for ways to handle the surplus.

Conscious of the importance of merging research and extension together, we have brought the two institutions into one. We are satisfied, after all, that research is the main support for extension and, conversely, that extension constitutes the long arm of the former. Thus agricultural scientific research has assumed its new guise, and Jordanian farming must rise to the challenge.

When the concept of food security is put forward at the domestic or regional level, development, improvement, growth, and self-sufficiency come to mind. How are these to be achieved? By imported knowledge and experience or by trial and error? In the long term, importing know-how brings its risks, whereas trial and error (i.e. scientific research) has at least one virtue, namely new generations of researchers and specialists are trained and taught.

Jordan's situation is like that of many Third World nations; she faces a torrent of packaged technological offers, outwardly a mercy but inwardly a pain. Being carried away on this current means intellectual subordination and inertia. We really have no alternative but to be self-reliant, scientifically familiarizing ourselves with our resources and so proceeding to study the problems, determining the priorities, and thus implementing the solutions. And not only that. We must proceed in that direction with dedication and patience. We can make the leap, but if we fall, it would be violent and perhaps lethal.

The Ministry of Agriculture has nurtured the scientific research agency and assumed its welfare since its inception in the early fifties, and within its means has provided it with the support and expansion it has required. That will not be forgotten on this occasion, but we must also record our thanks and acknowledgment to all those Arab and foreign organizations and institutions that, with us, have played their part in the work.

In highlighting the principle of participation, cooperation, and the utilization of others' experience, the Ministry of Agriculture pinpoints the excellent cooperation currently in effect between the Research and Extension Department and various institutions. Among these institutions, but not exclusively, are the following:-

Local:	The University of Jordan, Faculty of Agriculture
	The Royal Scientific Society
Arab:	The Arab Organization for Agricultural Development (AOAD)
	The Arab Center for the Study of Arid Zones and Dry Lands (ACSAD)

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International: The International Potato Center (CIP)
The Netherlands Potato Center
The US Agency for International Development (AID)
The German Agency for Technical Cooperation (GTZ)

Regional: The International Center for Agricultural Research in the Dry Areas (ICARDA)

Despite the modest nature of the means and incentives available to our Ministry for agricultural scientific research, it has been possible, over not more than thirty years, to set a number of landmarks on the road followed by Jordanian farming; for example:

1) The introduction of modern methods and materials into the cultivation of cereals.

2) The introduction of covered cultivations, now at an advanced stage.

3) The introduction of high-yield root stocks and varieties of vegetables and fruits.

4) An increase in agricultural output by introducing means to control pests, insects, and plant diseases.

5) An increase in the irrigated area, as a result of soil, water, and fertility research.

6) Awakening an awareness of modern farming among the farmers themselves.

The course of agricultural scientific research calls today for appraisal and assessment, as is the case for any other dynamic institution, particularly since new variables have come on the scene. We, in our situation, therefore, welcome the initiative taken by the International Service for National Agricultural Research (ISNAR), which is devoting itself to offering advice to agricultural scientific research systems, for their development and the finding of solutions to their problems. Accordingly, we welcome the holding of this seminar in Jordan, trusting that thereby constraints of and appraisal for agricultural scientific research systems in the other countries of the region will be brought to light.

In conclusion, I reiterate my welcome to you all. I thank those of ISNAR, headed by Dr. Gamble, its Director General, and his associates, for their fine initiative in holding this high-level assembly in Jordan, wishing you all the success in your deliberations, and our guests a happy and comfortable stay in our country. I hope that this seminar will be a precursor to a series of international and regional activities aimed at the support of agricultural scientific research.
Thank you.

KEYNOTE ADDRESS

POTENTIALS FOR STRENGTHENING MANAGEMENT IN NATIONAL AGRICULTURAL RESEARCH

Dr. William K. Gamble

Director General
International Service for National Agricultural Research (ISNAR)

Your Excellency, Gentlemen,

I am very pleased to have this opportunity to meet with you, to discuss the potentials for strengthening management in national agricultural research. This workshop is to deal with three specific aspects of managing agricultural research:

1. strengthening relations between national agricultural research systems (NARS) and regional/international organizations of similar concern;

2. improving linkages between NARS and their own national clients;

3. improving manpower planning and personnel management in national agricultural research.

As a part of my presentation, I wish to say something about ISNAR and in particular to note some of our findings concerning the essential elements for agricultural research to deal with these three aspects.

ABOUT ISNAR

ISNAR, as many of you know, was established by the Consultative Group on International Agricultural Research (CGIAR) in 1980. It is a non-profit, autonomous agency, international in character, non-political in management, staffing, and operations. ISNAR was created to help strengthen national agricultural research capabilities in developing countries. The objective is to help improve National Agricultural Research Systems to better plan, organize, carry out, and evaluate agricultural research, using their own human, natural, and financial resources. This involves helping a country work towards the best possible way to organize and manage its overall agricultural research program, or to help countries solve specific problems relating to individual components of their research systems. The work includes examination and recommendations concerning issues like planning, programming, structure, financing, staffing, and the linking of the research system to policy-makers, extension services, producers, and other groups.

ISNAR aims to improve relations and to provide the bridges necessary between the NARS and the output of the international agricultural research centers, as well as to help promote cooperation in the field of agricultural research between NARS and donor agencies.

ISNAR's program consists of four main activities. These are cooperation with NARS on development of their systems, research on agricultural research systems, training and conferences, and publications and information.

ACTIVITIES AND ISSUES

In its first four years ISNAR has worked with 25 to 30 countries which requested its assistance in review, analysis, and planning of their NARS or major parts of the system. These countries represent a diversity in size, population, and agricultural resources, as well as in the range of organizational structure of national agricultural research, political systems, and socioeconomic conditions, plus a geographic balance.

In working with these countries we have found uniqueness in each situation, which requires an in-depth study or analysis to achieve the necessary understanding. As you are all aware, an agricultural research system is more than the various organizations that conduct research; the system also includes the mechanisms through which the programs and operational means and procedures of these organizations are determined, as well as the linkages among them and other entities which contribute to or utilize the research activities.

As a basis for the review and analysis of NARS, it is important that ISNAR should have an understanding of the role of agricultural research in a national system. In October 1983, when some of us met in Cyprus at a meeting sponsored jointly by FAO, ICARDA, and ISNAR, I noted some essential roles of a research system, regardless of size and complexity. I believe these are worth repeating:

1. to make available to the government, in an appropriate form, key elements of information derived from reliable, properly interpreted research results, on which sound agricultural development policies and plans can be based;

2. to make available to the agricultural producers and the services that support them, in a suitable form and through appropriate channels, detailed technical and socioeconomic information, as well as improved production materials and techniques, based on sound farmer-oriented research, which can be used to plan and implement the production of crops, livestock, trees, and fish;

3. to develop and maintain in active research positions a body of well-trained national scientists in appropriate disciplines, capable of working together to solve problems and to interpret scientific advances for the benefit of national development.

It is important to note that as ISNAR examines the way in which NARS services are provided, it follows a predetermined review process which has enabled ISNAR staff to see the structure, elements, and processes of the system. The objective of the review and planning process is to describe the system, its strengths and weaknesses, and to identify priority areas for follow-up or in-depth study. The outcome is not a project preparation, or a document with detailed operational recommendations. It is a general system analysis. It serves as the basis for policy dialogue and as a guide to the identification of priority issues for follow-up work which can be developed into operational activities. The report provides the leaders of a national system with an authoritative overall statement of their national system which they can use in informing their own policy-makers, as well as the donor community, of their overall situation and needs.

Experience shows that the structure, planning, resources, and management of the NARS can enhance or limit the creativity and effectiveness of the people within it. However, while poorly provisioned and run systems produce some useful results with effective people in them, the opposite is not necessarily the case. It is not just people within the NARS who matter, but also others who influence it.

ISNAR's experience with national systems, through its review and analysis and other activities for serving them, allows us to identify issues in a number of areas which require priority attention by both NARS and ISNAR. These issues and their resolution provide ISNAR and NARS with information required for effectively working together to improve the programs of NARS to better play their role in agricultural development. These issues are also at the very center of the specific aspects of this meeting.

1. Policy Environment

A favorable policy environment which recognizes the importance and role of research in the development process is essential for a research system to produce effective results with efficient use of its resources. In many countries there are frequent statements by politicians about the importance of agriculture and agricultural research. However, the policies practised, the political support, and the funds allocated, contradict their statements. The question arises, therefore, as to what can be done to improve the policy environment and how this may be achieved.

The policy environment, in my opinion, can be changed only through political and public support. This usually means increased recognition of the importance of agriculture, better definition and articulation of the role of agriculture in the development process and results. Two key elements are involved: results and information. If agricultural research is to have the support it needs, it must produce a readily usable product and provide information on the product that can be readily understood by policy-makers and producers. Governments are interested in development and visible product outputs.

Some of you will say that, we must first have the support and then we will produce the results. This is true; support is required first, but in my observation many of us in agricultural research have missed many excellent opportunities to use available support to focus sharply on priority problems that could have given us highly visible products of immediate use. Rather, we have chosen more "interesting" and "scientific" activities for the utilization of available resources.

Here, let me mark my first point concerning strengthening relationships between NARS and regional/international organizations. It is my firm belief that these relationships are possible and effective only when there is a strong national research program and a policy environment that promotes such interchange. However, I would like to put

my statement forward also as a question to the group. IS THE STATEMENT VALID? IF SO, HOW DOES EACH OF US IN HIS RESPECTIVE COUNTRY REALLY WORK WITHIN AVAILABLE RESOURCES TO STRENGTHEN RESEARCH PROGRAMS AND IMPROVE THE POLICY ENVIRONMENT? OR, IS THIS NOT A REAL ISSUE? I hope you will discuss the matter during the course of this meeting.

2. Research Planning and Programming

The careful choice of priorities and best opportunities is probably the main issue to consider when discussing an agricultural research system capable of supporting a country's agricultural development. Two different but related processes must be considered in this action. One is the identification of the problem areas on which to target the research effort; this is the planning side of the process. The other is the definition of the research effort itself, that is specific topics and the scientific avenues that will be pursued in attempting to reach the established research and development objectives; this is the program formulation side of the process. Although the NARS is part of a larger scientific and economic policy environment, agricultural research policy-making is rarely linked to overall economic development planning and budget determination.

The overall process may be considered to involve decisions at three levels:

- Agricultural research policy;
- Individual institutions;
- Research programs.

At the policy level, the decisions are made by politicians. The bases for these decisions are the national agricultural policy, the research needed to support this policy as put forward by the researchers, and the total resources which the government as a whole feels able to provide for agricultural research.

The assessment of the research needed to service the national agricultural development plans and to meet the needs of the producers is the role of the individual research institutions. Where there is more than one major research institution, the assessment of the total needs must be aggregated to arrive at a national total.

These assessments are in turn based on the aggregate of the individual programs proposed by the research workers in the institutions after review by the research directors and their advisory committees. It is assumed that these programs will have been formulated in response to broad objectives set first at the policy level and, second, by the institute director.

There is, therefore, a two-way flow throughout the system and it is essential that this operates freely and continuously. Decisions at each level depend upon guidelines or information flowing from the other levels. Within this, the institutional level has the critical dual role of interpreting broad policy objectives and ensuring that programs are formulated to support them, while at the same time supplying information on which those same guidelines can be formulated at the policy level.

At the institutional level, there is the added function of deciding how the institution can best implement the proposed programs, what resources are needed, and how these should be allocated. (Resources in this context includes physical facilities, equipment, staff, and operating funds.)

It is clear that "planning" is needed at each of the three levels to cover the work to be done, the resources needed, and how the work should be organized. To avoid confusion, however, an arbitrary distinction is made between planning and programming, although both processes are part of a whole and are closely connected. When "planning" is used without qualification, it refers to those levels in the system at which decisions are made by politicians, i.e., policy levels above. "Programming", on the other hand, is used to signify the process at the operational levels within the system, i.e., the institutional and program levels at which decisions are made mainly by professionals in research, in response to the general objectives and broad priorities set at the political levels. It is recognized, however, that planning at all levels is an essential activity.

The question I wish to put before you is, WHAT IS THE IMPORTANCE GIVEN TO PLANNING AND PROGRAMMING IN YOUR OWN RESEARCH PROGRAM? And, I wish to make the statement that I consider realistic and effective planning and programming to be essential elements in strong national programs. I also consider planning and programming to be essential prerequisite for effective interaction between NARS and regional/international organizations, for effective linkages between NARS and national clients, and to provide the basis for manpower planning. What does realistic and effective planning and programming mean to you?

3. Organization and Governance

The organizational structure can facilitate or limit the functioning of the agricultural research system and its

capacity to turn out the expected product. The major structural problem which constrains the operation of national agricultural research concerns the way the research system is governed, how the country seeks to determine priorities, link resource allocation and management, and allow the flexibility needed for creative agricultural research. There appears to be two parts to the structure of the NARS. One might be called hard – the government's structure and method, the number of ministries, etc. – and this is difficult to change. The second consists of the councils and committees which are more for internal communications and which may be changed more easily.

There are many different institutional arrangements for agricultural research. Four typical situations are that research is in or under:

1. One line ministry (usually agriculture);
2. Several line ministries (e.g., agriculture, livestock, forestry, fisheries, rural development, plantations);
3. Several line ministries, publicly funded commodity institutes, agricultural and other universities, and some institutes of technology;
4. A national science or agricultural research council.

I believe that, regardless of structure or organization, those systems which seem to be successful have in common the capability to respond to needs and to identify, resolve, and interpret findings in terms of problems of the client groups. They also have the institutional flexibility to adapt to changing conditions. There is little evidence to support any single structure as "the best", since there is great variability among countries and in the effectiveness of even similar structures among countries. However, it appears that there may be some advantage to a structure with research as an operationally autonomous unit within a line ministry or a national science or agricultural research council.

Here, I will put my third question to you. IN YOUR EXPERIENCE, WHAT ARE THE ADVANTAGES AND DISADVANTAGES OF DIFFERENT TYPES OF ORGANIZATION AND GOVERNANCE OF AGRICULTURAL RESEARCH IN RELATION TO EFFECTIVENESS OF THE RESEARCH PROGRAM? AND, DO DIFFERENT TYPES OF ORGANIZATION AND STRUCTURE FACILITATE OR HINDER INTERRELATIONSHIPS WITH REGIONAL/INTERNATIONAL ORGANIZATIONS AND LINKAGES?

4. Manpower Planning and Training

The ability, attitudes, and education of the people in the NARS, and overseeing it, are crucial elements in its success. These depend upon local cultural and social factors, educational opportunities, and management of the system. There are two main areas in which people need to be effective. One is in their technical ability and aptitude to do scientific and technical work. The other is the human relations areas in managing and cooperating to solve problems. Common problems in NARS are a high turnover rate of staff and the failure to retain experienced people. The optimum use and distribution of people to make the most of their training and skills after they have returned from training, is frequently inadequate. The procedures for making sure the right people are doing the right job, and gearing promotion to do the same, often prove inadequate.

The problems are obvious and common to many countries. WHAT DOES ONE DO ABOUT THEM? I understand that in this region there is a high degree of mobility and a considerable outflow of well-qualified staff from some countries. I believe we again go back to the policy environment. A favorable policy environment usually carries with it good staff morale, favorable staff conditions, and staff commitment.

Linkages and interrelationships with other institutions are directly related to staff quality, experience, and outlook. With high-quality staff, cooperation is usually easy. However, the linkage depends also on a perception of equality, and international organizations sometimes have some staff who do not operate from perceived equality, but rather a feeling of teacher and pupil. The question I put before both the representatives of regional and international programs and national leaders is: HOW CAN WE DEVELOP A SENSE AND A REALITY OF EQUALITY IN OUR WORKING TOGETHER? AND, WHAT HAVE BEEN YOUR EXPERIENCES, BOTH POSITIVE AND NEGATIVE, ON THIS SUBJECT?

The issue of manpower planning is also, of course, directly related to research programming and priorities. One first needs a well-defined program and an inventory of available staff, and then you can begin to plan to fill present and future needs. Your experiences in manpower planning and related training will be important discussion items.

5. Funding of Research

The amount of money available for agricultural research is a limiting factor in most systems, as is its instability in

many systems. The NARS is often marginal in the process of resource allocation in the national budget.

The funding of research seems to be the issue common to all national programs, both underfunding and instability of funding. BUT HOW CAN THESE PROBLEMS BE OVERCOME? There is no better way to assure reasonably adequate funding than to have a well-defined program which has established its priorities and which produces a highly useful product that is seen as highly useful by producers, consumers, and policy-makers. Again, your experiences will be of much interest to all of us. WHAT ARE THE SUCCESS AND FAILURE STORIES FROM WHICH WE CAN LEARN?

6. Linkages

Appropriate linkages, formal and informal, between the different elements of the NARS, are vital. Effective linkages which can only be developed by strong NARS should have a synergistic effect to increase the productivity and efficiency of research to the distinct benefit of producers and consumers. In general, two separate sets of linkages are important to research capacity:

a. client/research links with clients, ranging from farmers and extension workers to policy-makers and planners;

b. research/research links which include other national research and education institutions, and regional and international entities, especially IARCs.

The overall question arises: WHY ARE LINKAGES SOMETIMES NOT WELL ESTABLISHED; WHAT SHOULD THEY BE; WHAT INHIBITS THEIR FUNCTIONING?

In examining linkages, we can identify several specific kinds.

Research/policy. Links with policy and planning levels frequently do not exist, usually because there is no mechanism for allowing research results to be communicated to policy-makers. Where they do exist, they usually need to be strengthened.

Research/extension. Relations frequently need to be improved, and more effective formal and informal links with extension are required.

Research/producer. Despite the production orientation of NARS, research links with producers are often weak.

Research/research. In general, better links are required. The precise linkages necessary depend upon the country, but without them it is difficult for informed research to occur.

Research/education. Although the education system provides manpower for the NARS, the potential for productive relations between them is largely untapped in many systems.

Linkages are very important for research systems and we need to study and determine the appropriate linkage mechanisms in different types of systems and to identify types of education and training for researchers conducive to their being active in such links. I have noted a number of different links I believe important. WHAT ARE YOUR EXPERIENCES AND SUGGESTIONS IN REGARD TO THESE?

7. Information Flow

A NARS is one part of an agricultural knowledge system focused on the country concerned, but stretching across the world. It generates certain kinds of knowledge, but in turn requires others if the knowledge it generates is to be useful in helping agricultural producers. Knowledge, expressed as information, to enable necessary action, needs to flow freely within the overall system if agriculture is to develop for the people's well-being. Information, however, does not flow easily in most systems, whether it is between different sets of researchers or research and clients. The chances of it flowing are improved if appropriate linkages exist, if information collection, storage, and retrieval services exist, and if specific people have responsibility for information dissemination. Four types of communication are found to be important in a NARS: with potential users, with world sources, with the national research system, and with policy-makers. This multi-directional communication of ideas, information, and experiences is missing in many systems, and even two-way communication frequently does not happen.

Communication is an essential ingredient in linkages. Studies and training are required to utilize present information and to determine guidelines for improved information sources and services. There are many information sources and services in existence, but many of these are underutilized. WHY? ARE THEY INAPPROPRIATE? ARE THEY UNKNOWN? ARE THEY DIFFICULT TO ACCESS?

8. Management

The need for effective management cuts across all of the above seven issues. In each area the leadership and ability of

the managers is crucial. Management is the process which can allow the system to operate better, and improving management skills to enable people to make right choices will strengthen the system. Research management involves people, material facilities, finances, and information. Several key management tools are missing in many systems: control over funding, personnel policies, and monitoring and evaluation procedures.

A strong NARS is also a well-managed system with strong leadership. CAN WE IMPROVE MANAGEMENT THROUGH TRAINING? IF SO, WHAT KIND, WHERE, AND BY WHOM? AND, WHO SHOULD BE TRAINED?

We have examined a number of issues and raised a number of questions for consideration in relation to the subject of this workshop. While I recognize that we will not find answers to all of them, I hope that through this meeting, through the discussions, and through the informal fellowship, you will all be stimulated to strive for ever higher standards for research; but always keeping in mind that research is the base for development and must be seen as an integral part of the development process.

STRENGTHENING MANAGEMENT IN NATIONAL AGRICULTURAL RESEARCH

Dr. Mohamed Hassan El Jack

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Khartoum

It is indeed a great honor and privilege for me to address this distinguished gathering on behalf of the Director General of the Arab Organization for Agricultural Development, Dr. Hassan Fahmi Jumah, who was keen to attend and contribute to this very important workshop, but he regrets that an urgent unforeseen commitment keeps him from joining us, leaving me with the heavy, yet pleasant, task of addressing such an outstanding group.

AOAD is an organization of the League of Arab States, established in 1971, with its headquarters in Khartoum, Democratic Republic of Sudan. It specializes in agricultural development, with an inter-governmental character and having offices, programs, and institutional ties in all of the member states of the League of Arab States. AOAD orients its actions toward reinforcing the national agricultural research system as a whole, with the purpose of generating and adapting appropriate technology to those local agricultural conditions that are important for national development. AOAD places priority on agricultural development, complementing its actions in this field with initiatives in other areas, such as sector planning, agricultural credit, commercialization and trade, projects, and agro-industries. In response to its immense responsibility, AOAD, during the last decade, can claim, with modesty, that it has succeeded in creating an atmosphere of togetherness and cooperation between the agricultural scientists and policy-makers. Realizing the sad fact that our member states - which once were sources of food - are becoming increasingly dependent upon food imports reaching frightening figures annually. Production growth rates are declining, while consumption growth rates are increasing. The only option left to us for remedying this imbalance is to collectively seek scientific solutions to production problems and combine efforts to accomplish our common goal of ensuring adequate food and a decent life for our citizens.

AOAD, fully aware of the challenges and the magnitude of the problems facing agricultural development and the goal of an adequate supply of food, has sincerely sought cooperation and collaboration with organizations working in the region, concerned with agricultural development, whether local, regional, or international.

AOAD, in its continuing endeavor to foster ties and cooperation with kindred organizations, held a successful meeting with ISNAR in August 1983 at Khartoum. The discussions were most encouraging and constructive, and yielded a draft agreement of collaboration which will soon be signed by the directors of AOAD and ISNAR. Areas of cooperation include:

1. Strengthening the national research system, or subsectors thereof, that are of direct interest to governments and national institutions; they are necessary for the generation and adoption of technology required in the improvement of agricultural development programs;

2. Strengthening subregional research systems, which is a priority for the respective countries and is necessary for the generation, transfer, and adoption of agricultural technology;

3. Elaboration of projects or national programs which more efficiently utilize available technologies that are adaptable to local conditions.

AOAD is really happy with, and looks forward to implementing, this agreement with ISNAR. As a beginning, AOAD and ISNAR will jointly launch a critical scientific survey of all agricultural research organizations in the Arab states, providing information on planning and programming of agricultural research, human resource planning for agricultural research, and documentation of information on agricultural research (resources, support, inputs, outputs, etc.)

When analyzed, the data will furnish a basis for a study which will be discussed in a symposium and will be a strong base for further collaboration and future linkages between national agricultural research systems and international/regional organizations. AOAD is strongly committed to strengthening such linkages and looks forward to the deliberations and findings of this important workshop. Be assured that it will exert all of its efforts to adopt and implement your recommendations whenever feasible.

Before leaving this platform, allow me to express, on behalf of our Director General, Dr. Hassan Fahmi Jumah and myself, our sincere appreciation and gratitude to Dr. William Gamble for the generous invitation extended to us, and our thanks are extended to the Hashemite Kingdom of Jordan for hosting this workshop and for their generous hospitality.

Special thanks are extended to H.E. Mohamed Bashir, Minister of Agriculture, for his interest and guidance in this workshop.

STRENGTHENING NATIONAL AGRICULTURAL RESEARCH MANAGEMENT THROUGH COLLABORATIVE RESEARCH - ICARDA'S EXPERIENCE

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The International Center for Agricultural Research in Dry Areas (ICARDA)

1. INTRODUCTION

The International Centre for Agricultural Research in the Dry Areas (ICARDA) was established in 1977 by the Consultative Group on International Agricultural Research (CGIAR) to undertake research and training relevant to the needs of developing countries, particularly in West Asia and North Africa. Although ICARDA concentrates on rainfed agricultural systems in areas with limited winter rainfall, research is also extended to the irrigated sector where it is logical and cost-effective to do so.

The center is organized into four main research programs: Farming Systems Research, Pasture Forage and Livestock Improvement, Cereals Improvement, and Food Legume Improvement. These are supported by several units and departments, including the Training Coordination Unit, the Communication and Documentation Department, Computer Services, and the Genetic Resources Unit.

The region in which ICARDA has its primary focus extends from Pakistan in the east to Morocco in the west and from Turkey in the north to Sudan in the south. To address the problems of this region, the center has adopted a farming systems research approach wherever relevant. ICARDA works closely with two sister centers, CIMMYT and ICRISAT, for the improvement of two of the most important crops in the region, wheat and chickpeas. In addition, ICARDA has been assigned a principal responsibility by the CGIAR for the improvement of barley, faba beans, and lentils globally.

2. COLLABORATIVE RESEARCH IN THE REGION

From its headquarters near Aleppo in northern Syria, ICARDA is unable to directly address the problems of much of the vast and diverse region it seeks to serve. This can only be done through close collaboration with the various national programs. As an international research organization, ICARDA is also unable to directly interact with more than a small handful of its ultimate clients, the farmers of the region. Thus, it must rely on the national research programs and the links between them and the extension services, and other agricultural support organizations. Clearly, for ICARDA to be effective, strong national research programs are a prerequisite. A major objective of the center is therefore to support and strengthen national programs.

The subject of this workshop is the strengthening of research management, a topic that ICARDA has so far made little effort to address directly. Nevertheless, through various collaborative research and training activities, a number of observations can be made which are relevant to the subject of research management. Before discussing some of these, three contrasting collaborative projects will be described briefly for illustrative purposes.

2.1 Collaboration with the Syrian National Programs

Because Syria is the host country, there is a special relationship between the Syrian national agricultural research program and ICARDA. Collaborative research started as long ago as 1977, but the relationship was formalized with the establishment of a collaborative program with the Agricultural Research Centre (ARC) in 1981. The program subsequently expanded to include the Steppe and Range Directorate and the Soils Bureau. In 1983, ACSAD also became involved as a collaborator in the cereal verification work. In the 1983/84 season, more than 300 cooperative trials were conducted on cereals, food legumes, forages, and pasture species on 14 research stations throughout Syria and on approximately 100 farmers' fields. More than 93 national scientists and research technicians were involved in the collaborative program, and about 80 participated in one or more of 10 different training activities organized by the program in the 1983/84 season.

Among the many highlights of the collaborative program have been the release of one durum wheat (cv. Sham 1) and

one bread wheat variety (cv. Sham 2) in Syria, and the verification/demonstration in on-farm trials of the large potential yield increases which are possible in chickpeas through the winter sowing of cultivars resistant to ascochyta blight and tolerant to cold. Other highlights have included confirmation of the substantial benefits of phosphate application on barley, even in relatively dry areas; the identification of superior lentil cultivars; successful trials on the mechanization of lentil harvesting; and very promising trials and demonstrations of medic pastures.

The work is coordinated by a full-time ICARDA senior scientist. He works in close collaboration with the directors of the national organizations concerned who, in turn, are responsible for coordination within their respective organizations. An annual meeting of all participating scientists reviews past results and plans the work for the coming season. In addition, an annual report of the program is published jointly.

2.2 Cooperative Research in Tunisia

The form of cooperation with the Ministry of Agriculture in Tunisia differs from that in Syria for many reasons. Perhaps two of the most important are that ICARDA has no independent facilities in Tunisia and no plans to develop such, and that there are more scientists with M.Sc. and Ph.D. degrees in the Tunisian agricultural research system than in the Syrian system. However, the availability of senior scientific manpower is still considered an important limitation in Tunisia and, at the request of the Tunisian government, ICARDA now has four senior scientists located there. In 1980, ICARDA posted a barley breeder/pathologist to Tunis, and this was followed in 1981 with the posting of a food legume breeder. In 1984, a collaborative project on farming systems was established, with funding from IDRC. A senior scientist was posted to Tunis from Aleppo to help coordinate project activities from ICARDA's side and also to act as the ICARDA representative in North Africa. Recently, an agronomist was recruited by ICARDA for the collaborative farming system project. In all aspects of the cooperative projects, ICARDA scientists work in teams together with their counterparts, representing different disciplines from the Tunisian national program. True partnerships in the research have been developed. An annual coordination meeting is held to decide on the overall workplans and to agree on the assignment of specific tasks to the various collaborating scientists.

Although collaboration with the Tunisian national program is relatively new, substantial progress has already been made. For example, the national barley breeding program has developed to a stage where it now needs very little support from the ICARDA cereal scientist. At the request of the Tunisian government this scientist now devotes most of his efforts to pathology. As a result of the cooperative research, three barley varieties are due to be released soon: Early Russian/Apam for the wetter areas, and Roho and WI 2198 for areas with less than 400 mm of annual precipitation.

2.3 The Nile Valley Faba Bean Project

This project differs substantially from the projects described above: it addresses a single crop, two countries are involved (Egypt and Sudan), substantial special funding is available from IFAD to support the project, and there are no expatriate scientists located with the national programs. The Nile Valley Project (NVP) started in 1979 and to date has received more than $7 million from IFAD. It is by far the largest of ICARDA's outreach projects and one of the more successful.

The project aims to increase faba bean production through a program of on-farm, multi-disciplinary research, with limited back-up research on experiment stations where needed. Training, improved communications, conferences, visits, and the supply of capital equipment and facilities have all been important features of the project. Because both Egypt and Sudan have a large number of well-trained scientists, it was decided at the outset that no expatriate scientific staff would be recruited. The only full-time senior ICARDA staff member is the director of administration, who is ICARDA's representative in the Cairo office. The project is based on sub-contracting research to individual scientists, who carry the extra workload in addition to their normal duties. There are two national coordinators (one responsible for research, the other for administration) in each country, and the director general of the ARC, Sudan, acts as a standing consultant. The priorities and activities of the project are discussed annually, by all participating scientists, at the annual coordination meeting. Following this, the program committee (comprising the national coordinators, consultant, director of administration NVP, food legume program leader-ICARDA, and deputy director general - international cooperation - ICARDA) meets to finalize the details of the budget, workplans, and the details of the contracts for the scientists.

The project aims to integrate the efforts of scientists from different disciplines, institutions, and countries. In 1984, 17 Egyptian and 18 Sudanese scientists, representing 13 different institutions and research stations, were contracted by the NVP on a part-time basis. The administrative model of the NVP has been cited by several governments,

development agencies, and review missions as a novel and successful approach to collaborative research. In 1984, the NVP conducted a pilot production project on the Zeidab Scheme in northern Sudan. Improved practices were applied by 77 farmers on a total area of 140 hectares.

The pilot farmers achieved, on average, 76% higher yields, and an increase in net benefit of almost £120 per hectare, compared with adjacent farmers using traditional practices. Similar successes have been achieved in Egypt where, for example, in farmer-managed trials in Kafr-El Sheikh Governorate, average yield increases of 58% were recorded following the use by farmers of the recommended plant population, fertilizer application, and weed-control practices.

3. INDIRECT EFFECTS OF COLLABORATIVE RESEARCH ON NATIONAL RESEARCH MANAGEMENT

The three collaborative projects described above differ substantially in their management, depending mainly on the number of well-trained senior national agricultural scientists in the countries concerned. As a policy, ICARDA tries to make use of national scientists wherever possible for carrying out the research. However, in all three projects, a substantial part of the management responsibility has been borne by ICARDA, especially on those aspects for which the national programs face particular difficulties. These may include the purchasing of items abroad, access to foreign exchange, clearing imported goods and seeds, paying casual labor, development of improved facilities, and the repair and maintenance of equipment. In addition, the telex facilities in the ICARDA Cairo and Tunis offices are also made use of extensively by the national programs.

Thus, at least in part, the success of these collaborative projects can be attributed to their ability to circumvent some of the management bottlenecks of the national programs, rather than through any attempt to influence or strengthen the national management systems. This circumvention has allowed national scientists to move ahead with their project activities with the minimum of time lost from local management difficulties. This circumvention is a feature, not only of ICARDA projects, but also of many collaboration projects between national programs and foreign organizations. Nevertheless, although this approach overcomes immediate difficulties for the project concerned, it cannot be regarded as a long-term solution. Clearly, it is important that management issues are faced squarely and that long-term solutions are found to overcome the constraints.

Several positive effects on national research management may also be attributed to the collaborative research projects described above. In particular, the mechanisms established for research planning and coordination could usefully be adopted by national programs for their own internal planning. Regular meetings of scientists from different disciplines and institutions, to review past research and plan future cooperative activities, are a powerful management mechanism. Such gatherings of scientists are valuable for scientific debate and installing a sense of participation. However, when hard management decisions are called for, a smaller forum may also be needed. The program committee of the NVP has proved to be very effective in this regard. All three collaborative projects described above have contributed substantially to the development of manpower in the national programs through training and related activities. The identification of training needs has been an important activity in all cases. The projects have also helped to strengthen the reporting abilities of the national programs through association with science writers and publishers. Several well-produced, but generally inexpensive, reports and manuals have been published, and the experience gained by the national scientists should prove valuable even after the projects have terminated.

4. DIRECT INVOLVEMENT IN MANAGEMENT

ICARDA has so far had little direct involvement in strengthening agricultural research management at the national level; a situation which is likely to continue at least in the immediate future. The only area in which a small attempt has been made to address management issues is on the subject of experiment station management. In 1984, ICARDA held three training courses on the mechanization of field research. Two courses were held in Syria (one on planting, the other on harvesting) and one in Egypt. Training in the maintenance and correct use of field plot research equipment is regarded as an important contribution to improving the efficiency of the experiment stations in the region. Funding is now being sought to continue and expand this activity. It is planned that future training courses will also include other research station management issues in addition to mechanization.

5. ACKNOWLEDGEMENTS

The author wishes to thank both ISNAR and the Ministry of Agriculture of the Hashemite Kingdom of Jordan for organizing and hosting this workshop. The issues to be addressed are extremely important, and the outcome of this meeting should have major implications for improving the efficiency of agricultural research in the region.

FAO'S EXPERIENCE IN STRENGTHENING RESEARCH MANAGEMENT CAPABILITIES AT THE NATIONAL LEVEL

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INTRODUCTION

FAO has always promoted research in its fields of competence under a mandate written into its constitution which, inter alia, states in Article I:

"The Organization shall promote and, where appropriate, shall recommend national and international action with respect to scientific, technological, social and economic research relating to nutrition, food, and agriculture. It shall also be the function of the Organization to furnish such technical assistance as governments may request."

Over the past four decades FAO has evolved policies and programs to fulfil this mandate. For instance, FAO's co-sponsorship of the CGIAR, together with the World Bank and UNDP, is a reflection of how the organization interprets and pursues its mandate. The scope and nature of FAO's research activities also reflect the broad concept set forth in its constitutional mandate. The emphasis is on assistance at the national level.

It is a truism that the productivity of agricultural research is greatly influenced by the style and quality of management. This does not obviate the need for a critical mass of well-trained scientists, supporting staff, adequate financial and physical resources. Good management provides a favorable environment for research and enables research workers to utilize their knowledge and available facilities effectively and expeditiously. In recognition of this fact and in response to its constitutional obligation, FAO has always striven to improve research management capabilities in member countries through high-level advisory missions under the regular program, and through institution-building projects under the field program.

FAO-organized conferences, seminars, and workshops have served as a venue for the exchange of experience and know-how among research managers and administrators. Regional and national seminars organized by FAO place great emphasis on participative techniques to promote interaction between and among participants and consultants.

The approaches used have tended to differ in different regions, depending on their stages of development and natural resource endowment. However, in all cases, the cost-effectiveness of research, under existing socio-economic conditions, has been a major guiding principle.

HISTORICAL PERSPECTIVE

The first attempt by FAO to come to grips with research management issues at the national level was at an FAO European meeting held in London in October 1951. It was convened as a result of a desire expressed by European governments, through the FAO European Committee on Agriculture. The proceedings were published in June 1955 under the title "The Organization of Agricultural Research in Europe." (FAO Development Paper No. 29 Agriculture.)

A survey carried out in various European countries in preparation for the meeting revealed that the administration and financing of agricultural research differed and depended largely on factors such as the sizes of the various countries, their constitutions, their geographical and economic situations, the types of farming, the relative importance of farmers' organizations. The meeting, after discussing the many problems involved in the organization and effective coordination of research recommended:

1. Each country should have a central organization entrusted with the promotion and the coordination of agricultural research work, and if not otherwise provided for, ascertaining the needs of agriculture.

The exact nature of the organization should be adapted to the local conditions, but it should include in its responsibilities the compilation of records of agricultural research work in progress in the country. It should be composed of persons selected as far as possible for reasons of scientific and technical competence.

2. The Food and Agriculture Organization of the United Nations be asked to arrange for a discussion, at an early date, on the standardization of the information on agricultural research to be collected by national bodies. Such standardization is desirable as a basis for preparation of national lists of current and projected research work and of research workers on a comparable basis, thus facilitating their international use. In such a meeting, consideration should be given to the form of similar records already existing. The Food and Agriculture Organization of the United Nations should also consider, as soon as the information is available, means of facilitating the exchange of such information on a regional and world basis.

3. Countries provide for the maximum direct interchange of information between scientific and technical workers through visits to institutions in other countries, temporary exchanges of workers, and through participation in symposia or working groups to discuss specialized subjects. The meeting particularly emphasized the importance of such small technical meetings in the development of research. Special consideration should be given to travel by young scientists and to the promotion of scholarships for post-graduate study by students who appear to have unusual aptitude for research.

4. Countries should develop inter-country cooperation, particularly where geographic, agronomic, and/or language factors make such cooperation relatively easy, and where the countries concerned are faced with common problems. Such cooperation has already developed among the Scandinavian countries, and also between Portugal and Spain.

5. Consideration be given by the Food and Agriculture Organization of the United Nations to the holding, at some future date, of a small meeting to discuss the methods which might be used in any country in determining the relative national importance of proposed research projects.

The recommendations of the meeting, while not attempting to provide a blueprint for research organizations, have some features which have characterized FAO's approaches in strengthening national research systems in subsequent years.

FAO has been active in strengthening national research management capabilities in the Arab countries. There is hardly a country in the region with a major agricultural enterprise where FAO has not cooperated with the national research system in the implementation of research projects; particularly those involving institution building and special research skills.

Between 1970 and 1981, a total of 130 projects worth $190 million were executed by FAO in countries of the Near East and North Africa. At least 62 projects involved the strengthening of national research capabilities. Out of the $190 million, about $124 million came from UNDP, $65 million from Trust Funds (FAO/Government Cooperative Programme), and $1 million from the FAO Technical Cooperation Programme. The large proportion of Trust Funds is living proof of the confidence the Arab states have in FAO.

In 1980, a mission consisting of two FAO staff members and a UNDP consultant visited a number of countries in the North Africa and Near East region to review the development and strengthening of agricultural research in Arab countries. The mission examined the status of agricultural research in Algeria, Tunisia, Sudan, PDR Yemen, and Jordan - all countries with which FAO has had close collaboration in research.

One of the recommendations of the mission was a program for strengthening research management. This theme has kept recurring in many FAO-organized missions in all regions. The need for better management applies as well to development programs. FAO's current and planned activities have taken cognizance of this fact.

Following the 1951 European meeting, a number of expert consultations, conferences, and seminars were organized by FAO in Central America and Mexico (FAO 1956), Africa (1966), a global expert panel in FAO Rome (FAO 1969), and Latin America (FAO 1976).

The pattern of research organization that has emerged in many developing countries has tended to bear some relation to their political history and the systems under which the leaders who guided the development of research were trained. Thus it is not surprizing to find that the research and technology transfer organizations in anglophone and francophone Africa reflect their former British and French/Belgian connections. The national research systems have been and are still evolving. In those countries which have been independent for a long period,

such as India, a national identity is emerging, regarding the way the research system is organized and managed.

In recent years, there has been increasing focus on management functions (planning, organization, control, coordinating, and evaluation). Research management issues have been discussed at length by FAO-organized seminars, workshops, and expert consultations in Rome (1981), Latin America (1983), and the Near East (1983).

FINDINGS OF AN FAO/UNDP STUDY

During the period 1970-81, FAO executed some 790 research projects in developing countries involving a total commitment of $757 million (Table 1). An evaluation study conducted jointly by FAO and UNDP based on the experience of 75 completed and ongoing agricultural research projects in 12 developing countries provided the following information on the organization and management of agricultural research.

Reseach Organization and Management

The responsibility for agricultural research tended to be dispersed among several ministries, although in the majority of cases the main responsibility for research lay with the Ministry of Agriculture (Table 2). In the past ten years, responsibility for the development of all research and technology has increasingly been delegated to a separate ministry. There was no evidence that shared responsibilities resulted in a healthy competition leading to increased productivity. The dispersion of the research effort tended to promote undue duplication and hinder inter-sectoral approaches. In some countries, constant changes were taking place in the organizational structure at the national level. At the time of the study only six of the twelve countries reviewed had had their system of research organization in place for more than four years.

In some countries, the execution of agricultural research is primarily handled by government departments. In others, the responsibility is shared with autonomous or semi-autonomous organizations. While there is no magic formula for an ideal research management structure at the national level, experience in FAO indicates that autonomous research organizations are, on balance, the most effective.

Research Planning and Coordination

The research planning and coordination procedures varied greatly in the sample of 12 countries. External aid agencies tended to influence policies and priorities on research unduly in some countries, especially in those countries where contributions by external aid agencies exceeded 25% of the local expenditures on research. Externally funded programs invariably follow the project mode. Such projects draw heavily on the already scarce national, human, financial, and physical resources, and thereby cause a distortion in the pattern of resource allocation.

The procurement of adequate funds, trained manpower, and their effective management are still a major bottleneck in most developing countries. Many countries still experience difficulties in retaining highly qualified staff in research - a reflection of the poor career structure and poor environments for research that one encounters in many national research systems.

The FAO/UNDP study revealed that an adequate minimum level of physical facilities for research exists. There was no shortage of equipment. In some cases, the degree of sophistication compares favorably with that in developed countries. However, unreliable supplies of water and electricity were a major constraint in Africa and Asia. Adequate housing and facilities in isolated research establishments were also frequently neglected. Inadequate library and information facilities prevail in many countries.

Research-Extension

Liaison Difficulties of communication between research institutions and extension agencies have been observed by FAO for a long time. This was found to be a major constraint in the sample of countries included in the FAO/UNDP study. The lack of impact from research has often been attributed by research staff to a communication barrier between research and extension.

Problems have arisen in establishing lines of communication and decision making on technology transfer even where research and extension were under unified direction. Differences in education opportunities available to research and extension personnel and even more so the burden of the extension personnel (sometimes there is only one extension worker to 5,000 farmers) account largely for the poor communication and lack of research impact. Current thinking in some quarters within FAO indicates that the problem is at the interface between research and extension. There is a grey area in the research-extension continuum which has not been adequately analyzed. This needs, in our view, urgent attention.

CURRENT AND PLANNED ACTIVITIES

Recommendations arising from expert consultations and

Table 1. UNDP and FAO Assistance to National Agricultural Research[1]

Region	Total		Type of Project (numbers)		Size of Research Component (numbers)		
	No.	Value (US$ million)	Institution Building	Production Support	Major[2]	Intermediate[3]	Minor[4]
Africa	239	222.6	94	145	56	59	124
Asia and the Pacific	231	234.9	99	132	65	117	49
Latin America & the Caribbean	128	71.7	42	86	45	22	61
North East and North Africa	130	190.0	62	68	28	32	70
Europe	58	37.6	35	23	16	17	25
All Regions	786	756.8	332	454	210	179	397

Source: UNDP and FAO

[1] Excludes regional, inter-regional and global projects in agricultural research as well as research projects in forestry and fisheries.

[2] Projects with a research component of over 75 percent.

[3] Projects with a research component of 50–75 percent.

[4] Projects with a research component of less than 50 percent.

Table 2. Characteristics of Agricultural Research Systems in Twelve Countries

Country	Most agricultural research under a single ministry	Research as a central responsibility	Research carried out primarily by ministries	Research carried out primarily by semi autonomous agencies	Central Research With only advisory powers	Agricultural Coordinating Body With directional powers	Separate system of service for most agricultural research scientists	Research on an agro-ecological zone basis	Active research/extension liaison	Research institutions active in extension
Algeria		X	X		X				n.a.	X
Burma	X	X		X					X	...
Brazil	X	X		X		X	X	X	n.a.	
Egypt	X	X	...	...			n.a.			
Indonesia	X	X	X			X	...	X	...	
Kenya		X	X		X			...		
Nigeria	X	X	...			X	n.a.	...	X	
Pakistan			X			...		...		
Peru	X	X		X		X		...		...
Senegal	X	X		X		X	X		X	
Tanzania		X		X	X		X			
Thailand	X	X	X		X		n.a.	X		

(... = partial or intermediate situation)

Source: National Agricultural Research: Report of an Evalution Study in Selected Countries.

seminars organized principally by FAO, and others, all seem to agree that the capacity of the research systems is largely limited by inadequate trained manpower and financial resources. However, the poor management of existing human, financial, and physical resources is considered to be an even greater bottleneck. In response to requests from member governments, FAO has decided to concentrate, in the short-term, on measures intended to improve the efficiency of the research system through better management. FAO's policy is to assist developing country member nations to strengthen their national research capabilities and become self-reliant. The organization is also constantly striving to promote technical cooperation among developing countries and to encourage collaboration between developed and developing country institutions in the fields of research and technology development. FAO's role in these efforts is, in the main, catalytic and supportive.

The long-term goal is to facilitate the availability of relevant national expertise and capacity for productive and cost-effective research. As such, even when support is provided at the regional level, the main targets are the individual participating countries. It is also FAO's policy to support those activities which have a more or less assured continuity, through national efforts, as long as the need for them exists.

With the above principles in mind, and taking into account the limited financial resources available in the regular program, FAO's strategy has been to strengthen ongoing national programs in the field of agricultural research planning and management in order to enable them to function as sub-regional centers and promote technical cooperation between developing countries on a regional and sub-regional basis. The training is structured to facilitate follow-up at the national level.

To this end, FAO organized an expert Consultation on Strategies for Research Management Training in Africa toward the end of 1983 to bring together informed opinion from developing countries, agencies, and organizations willing and able to offer assistance in this area. Although sub-Saharan Africa was the main focus for the consultation, the research management training needs identified by the meeting, and the strategies proposed, apply to all developing regions. The areas of emphasis will, however, differ from region to region and indeed from country to country.

In addition to regional seminars and workshops on institutional and program management, a number of national courses are envisaged. The national courses are tailored to the specific needs of each country and range from coverage of all four management functions to specific aspects of management. National research management workshops will concentrate on the transfer of skills. In some countries training activities will deal specifically with the interface between technology generation and technology transfer.

The FAO approach is pragmatic and action-oriented. The training is largely intended for trainers. Eventually we hope to prepare agricultural research management manuals to guide national institutions and others wishing to offer such courses themselves.

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THE ROLE OF THE INTERNATIONAL POTATO CENTER IN STRENGTHENING NATIONAL AGRICULTURAL RESEARCH MANAGEMENT

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INTRODUCTION

The International Potato Center (CIP) was established in Lima, Peru nearly twelve years ago. It is one of 13 research centers supported by the CGIAR. Its basic objective is to improve and expand potato production in developing countries. It was established in Lima, because the Andean region is the center of origin of potatoes. Because of its location, CIP has an inexhaustible source of germplasm material for breeding and selection of new potato varieties suitable for different environments and stresses. It may be said that CIP's germplasm material is the backbone of its research as well as that of many breeding programs throughout the world.

In order for CIP to build bridges between its headquarters in Lima and developing countries, it has established seven regional offices in developing countries: two in South America, one in North Africa, one in East Africa, one in Egypt, one in India, and one in the Philippines. This regional network has helped tremendously in establishing close contacts between CIP and national programs and an awareness of problems of national programs. The regional network also helped in shaping the research strategy of CIP's core program.

Research at CIP's headquarters is organized in departments and in ten research trusts dealing with all aspects of potato research. All research activities are supported and complemented by a sizeable training and communication program.

FINANCIAL SUPPORT

Research execution and its management in most developing countries suffers from a common handicap. National investment in agricultural research is by any measure pitifully low (Table 1).
Although public expenditures on agricultural research between 1951 and 1970 increased more rapidly in developing countries than in developed countries, total investment in agricultural research in developing countries is still too low to pay for planned development projects. The low level of investment in research has not provided adequate funds to staff research services with adequately paid competent personnel or to provide scientists with facilities of good quality and with adequate equipment or supporting services to sustain proper project implementation and research continuity. As a result, many capable and well-trained research workers have been frustrated and unmotivated.

CIP is not an agency for providing funds for development projects. However, like other international centers, CIP can exercise great flexibility in responding to national requests for financial and technical assistance.

Over the years, CIP has supported cooperative research programs with national scientists. Such support has included supplemental funds for salaries, supplies, and equipment. In many cases, grants to support cooperative research with national scientists have been obtained through CIP from international organizations. In 1984, two grants were obtained to conduct cooperative research on potato production from true seed in Egypt. These two grants were obtained from IDRC, Canada, and GTZ, in West Germany, through CIP's regional office in Cairo and amounted to several hundred thousand dollars for three years. These grants have helped the Egyptian national potato program greatly in formulating a better plan for

Table 1. Public expenditures on agricultural research in selected regions

Region	Expenditures (million US$)				Increase rate
	1951	1958	1965	1970	1951-1970
North America	225	333	448	478	2.1
Europe	68	119	244	290	4.3
Middle East & N. Africa	19	26	38	47	2.5
Developed countries	405	679	1,126	1,324	3.3
Less-developed countries	49	77	163	236	4.8
World total	454	756	1,289	1,560	3.4

Source: Adapted from J.K. Boyce and R.E. Evenson, National and International Agricultural Research and Extension Programs.

potato improvement and have made it possible to build and purchase supporting research equipment, supplies, and services. But above all it helped a team of scientists to be mobilized in a coordinated manner for a specific objective.

It is surprizing how far even a little money can go in initiating a piece of greatly needed research. In one of the countries of the Middle East, a scientist requested from CIP about US$ 500 to build an on-farm rustic potato store that he had been trying to build for some time. The scientist was not able to build it because he had no research funds; not because the government was short of money, but because the scientist was required to go through a lengthy and nightmarish bureaucratic procedure.

Because it can exercise flexibility in using modest amounts of money to support national research projects, CIP has been able to finance, through a simple procedure, many small and worthwhile cooperative research projects in the Middle East directly through its regional office. Such flexibility has been effective and welcomed by national scientists.

SCIENTIFIC EXPERTISE AND SCIENTIFIC MATURITY

Research and its management requires an adequate number of competent and dedicated scientists and research administrators. But the availability of a large number of scientists in a country is no guarantee of agricultural progress unless the scientists are competent and mature.

Unfortunately, the developing world is short of agricultural scientists who understand farming. One reason is that more urban students than rural students obtain agriculture degrees. Urban students have not grown up on farms, and in many cases are taught agriculture by professors who have little or no farming experience. In the worst situations, they obtain their agricultural degrees from colleges where practical farming is not stressed.

These deficiencies in training are later expressed while they are performing their jobs. It can be observed in their inability to identify problems, define objectives, design experimental procedures, and finally can be seen in their research results, which in many cases are unrelated to farmer's problems.

College education in agriculture should ensure learning in the following basic areas:

1. Basic and practical farming skills;
2. Specialized education in an agricultural discipline;
3. Management.

The number of agricultural scientists in the Middle East varies widely from country to country. On the one hand, Egypt is blessed with a large number of graduates from national and foreign agriculture colleges. On the other hand, newly developing countries, such as the Yemen Arab Republic and the People's Democratic Republic of Yemen, suffer from an acute shortage.

CIP has contributed significantly by training nationals from newly emerging countries and in up-grading the scientific competence of older developing nations. It has been offering the following types of training opportunities:

1. Training of mid-career scientists for 1-3 months in a specialized field;
2. Practical training offered to field or laboratory technicians for up to six months or for a full crop-growing season;
3. In-country theoretical and practical workshops and seminars;
4. Regional and international conferences, seminars, and workshops;
5. Regular exposure of scientists to the latest in potato science through the distribution of publications, slide sets, and training materials.

CIP's training of agriculturists from the Middle East can take place in Lima, at CIP's station near Tanta, Egypt, in any country of the Middle East and, if necessary, in any place in the world.

Training opportunities in Lima are limited to those who have good command of the English or Spanish languages. To overcome the language problem, our policy has been to send a small number of key specialists from the Middle East for training in Lima or anywhere else and to utilize such trainees to train others in the Middle East in Arabic. The advantages of such a policy are:

1. Low training costs;
2. Increased effectiveness because it is done in Arabic and because it is conducted by local specialists, who know the area and its agricultural problems better than trainers from outside the region.

The Republics of North and South Yemen have indicated their desire to train their agriculturists through this method, and CIP will be happy to help in planning and implementing such a training program.

The International Potato Center provides training opportunities to individuals or programs on the basis of country needs and not on the basis of personal, political,

and administrative favors. Training is an expensive process, and therefore every effort should be made by CIP and national programs to select trainees who can benefit from and can utilize their training when they return to their duties.

PLANNING AND COORDINATION OF RESEARCH

Research planning and coordination are complex tasks, and few countries do them well. Wortman and Cummings stated that:

"In most cases, agricultural planning is merely a statement of general objectives and allocation of funds with little or no specification of how the objectives are to be achieved. In others, it consists primarily of developing budgets for public agricultural agencies. Effective planning needs to embrace, in considerable detail, the target, what is to be done, how it is to be done and how much should be done being conditioned by available resources of finance and technical manpower."

Those who have been working in international agriculture will see much truth in what Wortman and Cummings have stated

In the Middle East, for example, many countries in which the potato is an important crop do not have what can be called a well thought out plan for potato improvement, and in some cases research is without a real purpose or goal. Research is planned, executed, and coordinated poorly. Many scientists have inadequate salaries, and their research is inadequately financed. Many scientists work in isolation of each other, and in some cases they don't know each other. Under such circumstances there is little hope of breakthroughs in crop improvement.

CIP's regional office in the Middle East is helping several countries to draw realistic national plans for potato improvement and, in some cases, help has been given to plan certain segments of research within a national plan, such as seed tuber production, or control of potato tuber moth, one of the most serious pest problems in the Middle East.

MANAGERIAL SKILLS

This subject can scarcely be separated from the subject of research planning and coordination.

The success of any national plan for agricultural development depends on many factors, among which "good management" is probably the most important. Good plans are bound to fail if they are not managed well at all levels of the administrative and research pyramids.

Over the years, CIP has been upgrading the managerial skills of its own core and regional scientists by offering them short, intensive courses in well-known business schools. Similar opportunities have been offered to a few research managers and scientists in developing countries through visits to CIP's headquarters in Lima to observe and discuss the philosophy of CIP's research planning and implementation. Most visits are made to coincide with the annual review of CIP, during which all core and regional scientists gather for two weeks to discuss their ongoing research and research plans for the future. Such exposure has been most helpful in upgrading the managerial skills of research administrators.

CONCLUSION

May I conclude this presentation by quoting from Wortman and Cummings under the heading "Where Responsibility Rests."

"A national government must set goals, establish policies, and take actions considered to be in the interest of its own people. Therefore, the single most important factor in the success of accelerated agricultural programs will be the willingness of governments:

- "To commit funds and people to ambitious programs, and to sustain that support long enough to permit progress;
- "To arrange for government agencies - agriculture, industry or commerce, planning, finance, education, public works, transportation, communications, and even foreign affairs - to work in concert toward established goals, overcoming entrenched interests where necessary;
  and
- "To encourage business and industry to make the contributions that can best be handled by the private sector.

"The government, by its own action or inaction, will shape the country's agricultural progress. Agricultural development in any country is largely a matter of choice for the government, not one of external entities."

To facilitate all of the above, there is no substitute for good management by all concerned.

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STRENGTHENING NATIONAL AGRICULTURAL RESEARCH ORGANIZATIONS: OME LESSONS LEARNED BY CIMMYT

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INTRODUCTION

The mandates of the international agricultural research centers (IARCs) call for them to orient their research, training, and technical assistance activities toward increasing the absolute availability of world food supplies, with particular emphasis on food production in the developing world. IARC research activities are to concentrate on those critical aspects of food production in the developing world that are not being adequately addressed elsewhere, which offer the potential of widespread benefits for food security, either regionally or globally, and which address the problems of producers in low-income, food-deficit countries. These products include research output, such as improved germplasm; the development of more effective and practical research procedures for tropical and subtropical agriculture; training and national staff development activities; consultation assistance; and information services.

RELATIONSHIP BETWEEN IARCS AND NATIONAL RESEARCH PROGRAMS

Given the fact that IARCs are not national agricultural research enterprises, the effectiveness of their products for helping to increase production in the fields of developing-country farmers is almost wholly dependent upon the adaptive and transmission capacity of national agricultural research, extension, and production organizations, coupled with wise stimulatory economic policy in the developing world. The strengthening of national capacity, in turn, depends in large measure on the substained determination of national governments to promote agriculture and to recognize in resource allocation the critical importance of public services in support of food production. In the final analysis, only national organizations should carry the responsibility for formulating technologies and recommendations for their farmers. The IARCs, with properly focused research, training, and technical assistance programs, can of course help to facilitate national action. However, the IARCs cannot be a substitute for strong and effective national research enterprises.

Developing-country research programs today are at very different stages of development. Some have a relatively good human resource base and research infrastructure. The relationship of these more advanced national institutes with the international centers is more on a collegial basis. The provision of improved germplasm, collaboration on specific reseach problems, and some training and consultation assistance are the primary requirements of these national programs. Other national programs have yet to develop a firm research base, and look to the IARCs for greater amounts of research support, training, technical assistance, and consultation services. Finally, a considerable number of national programs face such severe human resource and research constraints that they rely heavily on the IARCs for all types of assistance and services, including the deputing of IARC staff to work directly within a national research enterprise. The international centers must be sensitive to these variations in national research capacities and must tailor their programs and services accordingly.

I would like to make several additional points about the relationships between international agricultural research institutions and national research enterprises in the developing world. First, it has been my experience that as national programs strengthen, they tend to increase rather than decrease their interest in expanded research collaboration with the IARCs and find the products of the IARCs, particularly improved germplasm and new research procedures, to be of greater value to national research efforts. In effect, they find themselves in a better position to exploit more effectively the potential benefits of the products and information of the IARCs.

Second, it is erroneous to view the development of national program research capacity as a constantly improving evolutionary process. Unfortunately, there frequently is an ebb and flow in national research capacities. I have seen a number of national programs move towards self-sustaining performances only to be stymied or decimated by bureaucratic restrictions, resignations, transfers, promotions, budget restrictions, or political reorganizations. In far too many developing countries, particularly the densely populated ones, I have also seen that when a scientist reaches a senior grade, he prefers the status quo, the known, rather than risking a "secure" position through supporting new research initiatives and their application, which involve greater risk-taking.

These realities provide a strong justification for viewing the IARC network as a permanent dimension of the world's agricultural research system. They also imply that the range of IARC activities must continue to change as national programs strengthen over time, and that the IARCs must continue to assume leadership in exploring new scientific frontiers which may lead to future reseach breakthroughs on the world food production front. Indeed, the international centers, perhaps uniquely, are in a position to engage in research activities of widespread utility which would not be adequately funded in the context of a national research enterprise, but which can be justified at the international level.

Nevertheless, in the years ahead, it is vital that the IARCs do not lose sight of their purpose: to conduct mission-oriented research to increase food production in the developing world. By mission-oriented research I mean the organization and application of research resources toward specific and concrete objectives; e.g., to increase the quantity, quality, and dependability of crop production in the developing world. Much of this research is of an applied nature and draws on the existing stock of scientific knowledge to solve specific problems. Such research should not be viewed as second-class research, nor incapable of adding to the frontiers of knowledge in a particular scientific discipline.

MARGINAL LANDS: AN INCREASING CHALLENGE

Despite the tremendous food production successes achieved in recent decades in Asia and parts of the Middle East and Latin America, developing-country governments face even greater production challenges to feed future generations. First, while we cannot neglect the more-favored environments, where substantial yield improvements are still achievable and necessary, it appears that the major unexploited production gains must be made through the application of new technologies – which are economically viable and sustainable – to the more marginal crop environments of the developing world.

Some 600 million people live in the semi-arid tropics and more than one billion live in tropical and subtropical areas characterized by serious biological constraints of moisture and temperature stress, soil fertility and toxicity problems, and diseases and pests. The number of people inhabiting these less-favored areas is increasing at an alarming rate. Africa, in particular, is in a critical situation, having experienced declining per capita food production for more than a decade. Although some of the biological limitations are simply too overpowering to overcome with current techniques, newly applied science and technology can ameliorate many of the important constraints found in these marginal lands.

AGRICULTURAL RESEARCH AND DEVELOPMENT

In order for policy makers and administrators to commit scarce resources to agricultural research, they must believe that results will have a positive economic development impact within a reasonable time. Yet, for the gap between actual and potential yields to be substantially diminished, agricultural development programs must be built on an integrated foundation of: (1) research to generate improved technologies appropriate to the production circumstances of farmers; (2) investments in the rural sector in land and water resource development, input production and distribution systems (including credit), and transportation and grain storage facilities; and (3) policies which stimulate increased agricultural productivity in ways consistent with the wise use of endowed resources.

Despite the fact that some 50 to 80 percent of the population in the Third World countries directly engages in agriculture and animal husbandry, the agricultural sector in many developing nations is still the economic "ugly duckling" that is exploited for the benefit of the minority urban sector. In too many countries, relatively low priority is still given to agricultural sector investments in crop research, water resource development, rural roads, input delivery systems (for seed, fertilizers, pesticides), credit, and grain storage facilities. This situation must change.

Farmers in many developing countries have also suffered from government food policies designed to placate the more vocal and organized urban groups. Too often, these domestic "cheap food" policies are reinforced by easy-term food aid and/or surplus disposal programs sponsored by food-surplus nations. Such policies have, time and again, retarded agricultural development in food-deficit

developing nations. Obviously, humanitarian food-aid in times of emergencies caused by wars and natural disasters, such as droughts, floods, frosts and disease epidemics, is a very different matter.

MANAGING RESEARCH ENTERPRISES

Although volumes have been written on methods to increase the effectiveness of managers and administrators, little has been written on the peculiarities of administering groups of research scientists in a coordinated fashion and directing their talents toward organizational objectives. There are inherent conflicts that make the task difficult. First of all, those who finance agricultural research are interested in the end product (an increase in agricultural productivity), whereas the product of research organizations is the means to increase agricultural productivity. Thus, it is often difficult to evaluate the performance of a research organization or for that matter an individual within the research service.

From an internal perspective, research managers must also accept the fact that a scientist often knows more about his specialization than they do. In order to be creative, a scientist requires flexibility, a minimum of regimentation and bureaucratic encumbrances, and a significant quantity of specialized services. The scientist generally looks to his professional peer group within his own discipline for his motivation, professional recognition, and the evaluation of his performance. He often owes more loyalty to the discipline than to the bureaucracy he serves. He commonly publishes his findings for, and in the language of, his colleagues, not his administrators. On the other hand, good administrators are traditionally expected to limit the number of important decisions they must make, establish routine procedures, make predictable demands on the organization, and minimize the deviations from bureaucratic norms.

Organizationally, most scientists prefer to be grouped in departments composed of colleagues with similar interests and skills (i.e. department of plant pathology or plant protection) where continued professional stimulation is available and advancement opportunities are clear. Recent experience seems to indicate that a more efficient way of conducting applied and adaptive research is to mount multidisciplined, goal-oriented research teams focusing on a particular crop or problem. This system of organization, however, may leave the individual scientist isolated from his disciplinary support and with his avenues for promotion unclear.

In field-conducted biological research, the timing with which logistical and support services are performed may be absolutely essential to the validity or the usefulness of the research results. A matter of days in the availability of fertilizer supplies, irrigation schedules, the application of pesticides, etc., may render completely invalid an entire year's research effort. Yet it may be difficult within existing bureaucratic structures for administrators to react on such short notice. For these and other reasons, the administration of dynamic agricultural research programs is a difficult task indeed.

Effective research programs, capable of developing useful methods and materials for revolutionizing crop production, require continuity of both scientific personnel and program objectives. It generally takes a minimum of eight to ten years of creative, dedicated and adequately supported research work in various disciplines to produce the information and materials (improved varieties) from which higher-yielding production practices can be formulated. The transfer of new production technologies often also requires research entrepreneurs who are able to anticipate and sense when political leaders – often because of serious pending food or foreign exchange shortages – are willing to make important changes in agricultural development strategies.

The agricultural extension programs in developing nations have frequently been accused of not transferring the improved technology, already available from experiment stations, to farms, thereby contributing to the perpetuation of low yields and food shortages. In all too many cases, the "new technologies" emerging from experiment stations have not been capable of increasing yields adequately within acceptable levels of risk to the farmer.

It is clear that without the development of dynamic research systems, agricultural extension services have little to extend to farmers in the way of improved technology. With a growing trend for part of the technology generation process to be conducted "on-farm", that is, on the fields of representative farmers for whom the technology is being developed, and with extension agents participating in this process, I am confident that developing-country agricultural research and production systems can and will become more effective in the years ahead.

CONCLUDING COMMENTS

The organization and effective management of national agricultural research systems in developing countries is a difficult and demanding task. A few of the minimum requirements for achieving this goal follow:

1. A research management team that is effective in

informing policy makers and administrators – who generally are outside the agricultural ministries – of the very high return of well-managed and sustained investments in the nebulous field of research. Only through effective communication can the financial and human resources be mobilized and sustained to address the important issues of resource productivity and protection;

2. When financial resources are limited, planning becomes essential. Human and financial resources must be directed toward high-priority goals, and meaningful objectives and time frames must be established that will lead to the achievement of those goals. The research direction of creative personnel, however, must be of a motivating and encouraging type, rather than a controlling model;

3. Research must be organized in such a way that the talents required to address and solve a problem can be mobilized and directed across disciplinary and bureaucratic boundaries;

4. A reward and incentive working environment must be created that will attract and retain well-trained and highly motivated scientists over a sustained period of time. Only by such continuity of effort can difficult problems be addressed and solved.

There are many other well-documented management principles that apply to the development of effective research organizations. It seems to me, however, that the four noted above are often neglected: yet they are essential if national agricultural research systems are to meet the critical challenge of providing a better and more productive life for present and future generations.

REPORT ON THE RESEARCH ACTIVITIES OF THE CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH (CGIAR)

Dr. Aladdin Daoud Ali

Near-East Representative to CGIAR

THE CGIAR

The Consultative Group on International Agricultural Research (CGIAR) was organized in May 1971 to bring together countries, public and private institutions, international and regional organizations, and representatives from developing countries in support of a network of international agricultural research centers and programs. The basic objective of this effort was then, and is now, to increase the quantity and improve the quality of food production in the developing countries. The research supported by the Group concentrates on those critical aspects of food production in the developing countries that are not adequately covered by other research facilities, and which are of wide usefulness, regionally or globally. Currently, the CGIAR network is involved in research on all of the major food crops and farming systems in the major ecological zones of the developing world.

The international centers' research and training activities deal with crops and livestock that encompass three-quarters of the food supply of the developing countries. These centers have made significant contributions toward increasing food production in the developing countries.

Disseminating research results is an integral part of the centers' objective - to accelerate food production in the developing countries. Dissemination is achieved through publications, conferences and seminars, the maintenance of information systems, and - more importantly - by training scientists from developed and developing countries and by providing technical assistance to national and regional research programs.

The concept of a consultative group grew out of the need to build on the earlier successes of a small number of international agricultural research centers sponsored by the Ford and Rockefeller Foundations in the 1960s.

The CGIAR has been very successful in mobilizing support. In 1972, 15 donors contributed about $20 million in supporting five international agricultural research centers. In 1984, 37 donors contributed $170 million to 13 international centers.

Operating informally and by consensus, the CGIAR continues to serve as an example of effective, flexible, and successful collaboration between the industrialized and developing worlds.

THE 13 CGIAR CENTERS

CIAT:	Centro Internacional de Agricultura Tropical, Colombia (International Center for Tropical Agriculture)
CIMMYT:	Centro International de Mejoramiento de Maiz y Trigo, Mexico (International Center for the Improvement of Maize and Wheat)
CIP:	Centro International de la Papa, Peru (International Potato Center)
IBPGR:	International Board for Plant Genetic Resources, Italy
ICARDA:	International Center for Agricultural Research in the Dry Areas, Syria
ICRISAT:	International Crops Research Institute for the Semi-Arid Tropics, India
IFPRI:	International Food Policy Research Institute, USA
IITA:	International Institute of Tropical Agriculture, Nigeria
ILCA:	International Livestock Centre for Africa, Ethiopia
ILRAD:	International Laboratory for Research on Animal Diseases, Kenya

IRRI:	International Rice Research Institute, Philippines
ISNAR:	International Service for National Agricultural Research, Netherlands
WARDA:	West Africa Rice Development Association, Liberia

Over the years these centers have made significant contributions to increases and improvements in agricultural production, particularly of grain crops, legumes, rice and potatoes, which have been highly beneficial to many of the developing countries. They have also developed new cropping patterns for vast agricultural areas of the world, and have thereby greatly contributed to improving farmers' incomes in the poor countries.

In the past two years the CGIAR has undertaken a review of the research activities and accomplishments of the various centers. The outcome of the review can be summarized as follows:

1. The Consultative Group reviewed research activities conducted by CIP, IITA, ICARDA, and WARDA, and recommended that the research programs in these centers should be further developed to ensure their wider utilization by the developing countries. It also recommended the need to reorganize some of the activities of certain other centers (i.e., CIMMYT and ICARDA), with a view to eliminating duplication of effort and ensure proper coordination;

2. Field studies were conducted to determine the impact of the CGIAR system on national research programs in developing countries, and on world agricultural production, aiming at providing the participating countries with a better understanding of the centers and the group, and hence effectively facilitate the development of their own research programs;

3. The introduction of irrigated agriculture patterns in ICARDA research projects, considering the potential for improving agricultural production in semi-dry areas of the region;

4. Research centers should provide training programs for the leaders and technicians of national research programs in developing countries. Despite the financial constraints faced by these centers and the resultant impact on the execution of training programs, the CGIAR stressed the need for giving more attention to training in the light of its significance in building up the capabilities of developing countries and the strengthening of their national research programs.

IMPROVING THE EFFECTIVENESS

We believe that the CGIAR system must be further strengthened, particularly in the spheres of increased cooperation in transmitting research results to developing countries, increased training activity, the exchange of expertise, and the increased representation of the developing countries in the organs of the Consultative Group. Such measures would be expected to increase the effectiveness of the CGIAR system and consequently to strengthen the programs of the national research centers.

A FRAMEWORK FOR BUILDING EFFECTIVE LINKAGE PATTERNS IN SUPPORT OF NATIONAL AGRICULTURAL RESEARCH PROGRAMS

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INTRODUCTION

The National Agricultural Research Systems (NARS) of West Asia and North Africa are vital components in a network of organizations working to establish food security for the growing population of the region they serve. In organizational structure, the research systems vary from country to country, but all share common functional attributes. Research operations within national agricultural programs are broadly characterized to include the following activities:

1. identification of research topics which reflect national agricultural priorities, opportunities, and production problem areas;

2. definition and formulation of the research program objectives according to prescribed criteria;

3. mobilization and effective utilization of required financial, physical, and human resources to achieve the goals of the program;

4. development and maintenance of a collaborative network of national, regional, and international agencies and organizations to support and enhance NARS operations;

5. establishment of a communications network to include farmers, policy-makers, and other users of research program information;

6. evaluation of program performance and revision, as needed.

Of course, there are other institutions involved in support of national agricultural development programs at the national level, as well as regionally and internationally. All of these institutions have a role to play in the development effort. The success achieved in improving agricultural productivity will, in large measure, be the result of a well-managed and integrated national program.

The focus of this paper will be an examination of mutually supportive, collaborative mechanisms to enhance the operation of national agricultural research programs of the region. It is clearly limited to serve as a generalized reference resource on the parameters of linkage for participants in this workshop. Identification of major management issues involved in developing effective collaboration and communication networks will remain as the considerable challenge of the working groups in their deliberations.

LINKAGE: CONCEPT, PROCESS, AND MODELS

In its simplest terms, linkage can be defined as the act of linking, or state or manner of being linked. For example, an organizational chart (organigram) is a schematic representation of the hierachical relationships that exist within a given organization; it reveals how the functional groups are related, establishing the chain-of-command for program operations.

At a higher level of analysis, the nature of interactions that occur between the sub-entities of the organization has to be considered. Linkage at this level consists of interaction patterns established between elements of a system to ensure functioning of the system.

In a broader context, the exchanges that take place between the organization and national, regional, and international entities can be similarly identified and described.

Stiffin has classified these interaction patterns (linkages) into the following categories:

1. Enabling - Relationships with other entities concerning the control of authority and allocation of resources needed by the organization.

2. Functional - Relationships of the institution with those organizations which perform functions and provide services complementary to the mission of the institution, to include groups supplying inputs and utilizing outputs.

3. Normative - Relationships of the institution with other organizations which incorporate norms and values relevant to the doctrine and program of the institution.

4. Diffused - Informal relationships of the institution with elements in the society which cannot clearly be identified by membership in formal organizations.

In the agricultural development process, the linkage principle is applied to strengthening the relationships between the national agricultural research system and extension services, credit and other governmental agencies, regional and international organizations, higher education and training institutions, the farmers and other user groups. Typical linkage concepts applied in establishing productive interaction patterns between and among these entities include dialogue, participation, target group orientation, accountability, and technology development.

The most recent linkage model proposed for agricultural development emphasizes the central role of the farmer. The Training and Visit (T&V) System of Extension was developed through support of the World Bank and is the most widely known program mechanism focused on the user of crop improvement technologies. The term "utilizer system" is used by FAO and others to emphasize the role of rural people in processes through which the utilization of new opportunities (technology, markets, inputs, prices, land reform, and so forth) is promoted. Linkage activities inherent in the utilizer system approach include: fact-finding in rural areas, pretesting crop improvement technologies with farmers, developing appropriate recommendations (packages) for dissemination, delivering the improved production information to farmers, monitoring and determining impact on agricultural production.

RESEARCH SYSTEM STRUCTURE: LINKAGE PARAMETERS

The organizational structure of the research system should be a direct response to the goals of the national agricultural program, reflecting the country's political and administrative traditions. Within the institutional setting of the research system, there is a set of procedures, methodologies and decision criteria to guide the planning, development and implementation of the research program.

In an integrated planning process of national agricultural development, there are distinct operational levels of the research system to be considered, to include:

1. Policy Making Level - It involves normative planning in support of national agricultural program goals.

2. Planning Level - It involves strategic planning for determination of research program objectives, consistent with its institutional mandate.

3. Execution Level - It involves operational planning for research project activities, within the constraints of available resources.

Development and implementation of the research program requires a high level of effective and efficient interaction (linkage) between research workers, directors, and management personnel. Interaction patterns within the organization are enhanced through the following means:

1. directed exchange of relevant written information;

2. liaison between groups and levels with a common interest;

3. publicity and accessibility of research program information throughout the organization.

To ensure the efficiency of the organization and the functioning of the different groups involved, consideration should be given to the following aspects of research system structure:

1. avoidance of unnecessary functional overlap with existing entities within or outside the research system;

2. institution of new entities as required by changing circumstances and national agricultural program priorities;

3. clarity of procedures and rules to be adhered to by all operating parties of the organization;

4. mutual consultation, evaluation and redirection of program activities by concerned parties.

From the management perspective, decisions on national research system program priorities should include

provisions for the establishment of new patterns of intrainstitutional collaboration. The scope and magnitude of these decisions will depend on the unique structure and organization of each national program, of course.

INTERINSTITUTIONAL COOPERATION AND COORDINATION

The collaboration of national institutions in the promotion and financing of production research technology is essential for national agricultural research. The national agricultural training system, particularly at the university level, is the primary source of technical personnel to staff the research program. International institutions and bilateral programs for agricultural development can provide support for essential national research activities. The planning of linkage strategies must start with identification of these key institutions and preparation of a profile on their physical, financial, and human resources.

The major groups involved in the national agricultural development and research process include:

A. planning and financing agencies - responsible for the formulation of overall strategies and allocation of resources;

B. operating agencies - responsible for implementing research programs and policies to include research centers and extension services;

C. supplying sectors (public and private) - engaged in supplying goods and services for increasing agricultural productivity to include seed production organizations, fertilizer manufacturers, agrochemical industries, rural credit banks, etc;

D. training agencies - responsible for development of manpower with adequate technical and managerial skills for agricultural development, through both degree-level and on-the-job training;

E. producers - including farmers and agricultural product industries, they constitute the primary groups involved in efforts to increase production, income, and access for agricultural products.

The diversity, magnitude, and structure of interactive patterns of cooperation and coordination between and among these groups are most clearly understood through analysis of specific national agricultural programs: the case study approach. It remains outside the scope of this paper to include particular case studies for analysis, but a reasonable expectation can be advanced that participants in the working group of this workshop will draw on their considerable first-hand experience and expertise to provide such detailed information.

In terms of the generation, validation, and transfer of new technology through national agricultural programs, regional and international organizations exist to support these efforts, to include:

A. International Agricultural Research Centers (IARCs) - a global system of thirteen centers, operating under the Consultative Group for International Agricultural Research (CGIAR), is funded by a consortium of private foundations, bilateral and multilateral assistance agencies. The centers carry out research on all important food crops, on livestock and farming systems. They also provide technical training and support for the design and implementation of agricultural research systems in developing countries;

B. Food and agricultural organization (FAO) of the United Nations - provides consultants and funds in support of agricultural research and development activities;

C. The Arab Center for Studies of Arid Zones and Dry Lands (ACSAD) - contributes to research and technical studies in agriculture for Arab nations of West Asia and North Africa, funded by the Arab League;

D. Bilateral/Multilateral Donor Agencies and Foundations - the Ford Foundation, German Agency for Technical Cooperation (GTZ), International Development Research Center (IDRC), United States Agency for International Development (USAID), World Bank, and similar organizations. A complex set of programmatic, political, and administrative factors determines the extent to which these donor agencies and foundations may become collaborators in national agricultural development and research programs.

MANAGEMENT INTERVENTION STRATEGIES FOR LINKAGE

The development of productive and supportive patterns of interaction among entities within the national agricultural system, as well as with other national, regional, and international institutions, requires highly skilled manpower. Management is of the essence. It must be alert, dynamic, and responsive to local and national needs. Above all, it must be aware of the interdependence that exists between the farming sector and the research, extension, training, planning, and financing sectors that constitute the national agricultural development effort.

Major management functions include planning, organizing, staffing, guiding, controlling, and evaluating the affairs of the organization. Management serves to handle, coordinate, integrate, and supervise organizational resources towards measured goal achievement.

The concept of intervention is very similar to that of management. An intervention is a systematic effort of relatively short duration. It strategically applies resources to manipulate seemingly causal elements. These elements are part of an ongoing development process. The manipulation aims to permanently reorient that process in directions deemed desirable by the intervening party. An intervention is no more than a temporary additional force in a set of forces which determine the direction of the development process. The effectiveness of manipulating seemingly causal elements is determined by the extent to which the analysis by which the causal elements were identified was a sound one, and by the adequacy of the strategy selected to bring about a deliberate change.

Management of linkage in national agricultural research systems requires careful analysis, strategic planning, integration of institutional resources, and effective utilization of communication channels. An intervention strategy to achieve linkage among the entities within the research system requires a set of methods and instruments prescribed by the standing operating procedures of that system. In this case, because the intervention is intrainstitutional and the procedures are consistent with the norm, the probability of achieving productive linkage mechanisms is high. It is, by structure, a controllable environment.

Intervention strategies to achieve linkage with other governmental agencies in the national agricultural program call for a different approach. This approach should be consistent with the established procedures for cooperative/collaborative interinstitutional activity; it is, at best, an influenceable environment.

In both cases, inter- and intrainstitutional linkage success is tempered by obstacles well known to management. They include, but are not limited to:

1. Unavailability - funding and personnel constraints for adequate implementation of the linkage intervention strategy;

2. Unpredictability - changes in program policy traditions of the organization that tend to impede intra- or interinstitutional initiatives by management personnel;

3. Prevention - governmental policy that clearly prohibits national organization initiative to establish linkages, particularly for international interaction.

CONCLUSION

The impetus for seeking linkages must be a mandate for management personnel at the research system level. While intrainstitutional linkage may result in a more effective utilization of available resources, linkage of research systems with other national and international institutions can contribute to the acquisition and generation of useful technological information, the promotion and financing of production technology research, and the training of technical personnel. The process of intervention, if effectively implemented, is one by which management may optimize the achievement of institutional goals.

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THE ROLE OF THE UNIVERSITY IN NATIONAL AGRICULTURAL RESEARCH

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INTRODUCTION

A true university has three main broad responsibilities, which hold also for any good faculty of agriculture, and define the university's role in national agricultural research. These are:

1. educating and training young scientists;

2. generating new knowledge through its research program;

3. disseminating this new knowledge by a variety of means, such as papers in scientific journals, research bulletins, or in some cases by "advisory" or "extension" service. The extension service can be an effective agent for assessing the needs of the industry.

The extent to which these three functions are linked varies a great deal from country to country. In the United States, the Land Grant university shows a very close linkage - all three functions are the responsibility of each department.

Strong emphasis is placed on research and extension, as well as instruction, and many faculty members have joint appointments in instruction and research or in research and extension. Appointments in instruction and extension are less common because of the conflicting demands of the two responsibilities. In many other countries, however, the linkage is much less close.

The extension service is almost always a department of the ministry of agriculture. Research also is generally housed within a ministry, with little direct involvement with or responsibility to the faculties of agriculture.

I wish therefore to examine the university's role in each of the three areas of education, research, and extension.

THE ROLE OF THE UNIVERSITY IN NATIONAL AGRICULTURAL RESEARCH

Education and Training Role

To produce good research relevant to the needs of their country, scientists must receive a strong and demanding education, which must begin in the very earliest years, of course. Those early years are outside of our mandate today, but they must not be forgotten. We will focus on university education and training, both undergraduate and graduate.

Undergraduate Education and Training - the Ideal

Undergraduates must have a solid base in the sciences before proceeding to the applied and practical subjects of agriculture. They should also get a thorough introduction to the social sciences, to make them aware of the social environment in which they will work.

Much more emphasis, in my view, needs to be placed on developing students' abilities to do "critical thinking" and problem solving, instead of the current tendencies in many areas of the world (and few are exempt!) to concentrate on "memorization of facts" for later regurgitation in relatively undigested or unanalyzed fashion.

Undergraduates should be introduced, at least, to the wide array of modern research equipment at a relatively early stage, to dispel any fears about the complexity or mystique surrounding them; by the end of their graduate work they will feel completely comfortable. Especially is this true of the computer. Students must graduate "computer literate" in this scientific age.

A thorough introduction to efficient use of the library will pay handsome dividends for reserch-oriented students. I venture to suggest that most of us in this room never had a very thorough training in use of the library and either "muddle our way through" after reaching the building, or

have to rely on help from the library staff for everything we want.

Finally, and most important of all, our students desperately need intensive practical training on a university farm for a minimum of six months and preferably one year. As you are all well aware, rural youth seldom get the opportunity for high school education, much less university education. This is true for much of the world, and even in the US and Europe, an ever decreasing percentage of students of agriculture have farm backgrounds or even rural backgrounds, as migration to the large cities continues. At AUB, our students grow up on the balconies of Beirut, Tripoli, Sidon and Zahle. We used to get them also from the balconies of Baghdad, Amman, Damascus and all over the Middle East - but the "events in Lebanon", as they are euphemistically called, have, in the course of the past ten years, effectively dried up the supply of students from all but Lebanon, essentially. These urban youth then have zero experience with farmers or farming, and to develop into effective researchers (or other agricultural scientists) it is mandatory that they have the opportunity to learn at first hand what agriculture is all about.

The farm experience should preferably involve training in field experimentation, designing experiments, laying them out, collecting the data, and analyzing the results. Though this is normally reserved for graduate training, the earlier the introduction the better, even if on an informal "field basis". All of the above constitutes perhaps the ideal in undergraduate agricultural training.

Undergraduate Education and Training - the Reality

The reality unfortunately is all too often far short of the ideal. We find professors with impressive degrees, frequently from the world's best universities, but now entrenched in their ivory towers and no longer dynamic and productive in research - indeed frequently no longer even interested. Even if they are still interested, they frequently have little opportunity to carry on a research program. They are generally unfamiliar with farmers or farming, since they themselves are products of the same system as the present generation of students. Their learning is all too often "book-learning". At AUB, and even at Colorado State, where I formerly taught, less than half of the faculty in my opinion have strong backgrounds and abilities in practical agriculture.

Many professors have likewise failed to keep abreast of the dynamic developments in modern agriculture, and unfortunately help to promote the image of agriculture as a backward industry. In most of the developing world, agriculture as a profession falls very low on the scale which generally runs from medicine through engineering, law, business, arts and sciences and finally, agriculture! "If you can't get in anywhere else, agriculture will always take you" - so goes the dictum! This has always amazed me, for in truth agriculture probably has much more to do with the health of a nation than does the medical profession.

A well fed nation is generally healthy and has little need for doctors of the medical profession. Yet the medical profession has done an incredible job of boosting its prestige and fostering its image. It is long past time that we in agriculture began to tell our story - which includes remarkable increases in efficiency and productivity, far higher, indeed, than most other industries in the developed world, such as steel, coal, auto, and health. We need to tell the real story and proceed to recruit our fair share of the outstanding students from the entering group each year.

Graduate Education

Graduate education is much more expensive in manpower, facilities, and equipment. Yet it is important that universities engage in graduate programs as part of the necessary research endeavors. High quality master's programs, sharing many of the features described above for undergraduate training, are mandatory to give students training in their home environment, tackling problems relevant to their future research careers. We at AUB are still concentrating on high quality master's programs, on which an excellent reputation has been built over the past 30 years. But we find it difficult to compete with Cornell, Davis California, Wisconsin, Wye College, Wageningen, and the others in contemplating moving into a Ph.D. program. But here again, linkages can be established, and indeed already have been, between foreign universities, domestic universities, national agricultural systems, and the international organizations. Students may go to North America or Europe for two years of intensive training toward the Ph.D., complete the comprehensive or "prelim" exams, then return home to conduct research in their home country under cooperative arrangements with the agencies there. We have had several experiences with master's students even, who returned to Botswana, Zambia and Kenya to complete their research before returning to Colorado to defend their dissertations.

THE RESEARCH ROLE

Here again the optimum scenario is of dynamic, productive faculty deeply involved in "basic" research designed to underpin the "applied" research of the NARS from the ministry of agriculture. If you ask me what I mean by "basic" and "applied", I will remind you of Werner von

Braun's definition a few years ago: Basic research is what I am doing when I don't know what I'm doing! I like that definition and feel that far too much has been made of the differentiation, which has also been the basis of much intellectual snobbery. I believe that most really significant discoveries have been made by scientists engaged in the most applied of problems, in agriculture as well as in other disciplines. In any case, university professors have many things in their favor; they frequently have fairly large numbers of colleagues within their own discipline, a high concentration of scientists with similar or identical interests.

They have ready access to scientists in support or complementary fields such as biochemistry, physiology, statistics, and genetics. They have access to excellent libraries and powerful computers. They should be productive.

Again the reality is frequently far different. Professors complain of teaching loads that are far too high, and the pressure of preparing lectures, grading papers, and counselling with students leaves little time for research, which is all too easily pushed into the background and forgotten altogether after a few years. We find professors unfamiliar with industry needs for reasons previously pointed out and not properly trained to service the agricultural industry. Academic freedom has given them the apparent right to tackle whatever problems they please, regardless of their relevance to the farmer's needs in his fields. Again, the regulations governing promotion make many young professors concentrate on building a lengthy and impressive list of publications instead of worrying about the farmer's problems. And finally, instead of cooperation and symbiosis with the NARS, we frequently find competition and jealousies. The result is a lack of real and relevant productivity all around, and the industry has in many cases taken to doing its own research, and rather effectively, it must be admitted. Feed companies, seed companies, and drug companies in the U.S., all have impressive research programs. In Lebanon, many agricultural supply companies are doing their own applied research. They can't wait for either universities or NARS.

THE EXTENSION ROLE

Well-trained, dynamic, effective communicators servicing agriculture with ready answers to all its questions, while at the same time assessing industry's needs and relaying these to the research teams - such might be the ideal extension service. The reality is far short of this: a cadre of workers who are frequently far too many in number, poorly trained, underpaid, unrecognized, discouraged, totally unequipped to do their job, with no means of transport to even reach the farmers, no media equipment, no bulletins to distribute, and frequently no research results to "extend" to the farmers in any case.

This is a very discouraging picture of an agency which should be one of the key linkages in the flow of information in agricultural research systems. But it is unfortunately all too true in many if not the majority of developing countries. The extension personnel are considered to be second class citizens compared to researchers and teachers, and the positions in extension have been used by some ministries as a means of handing out favors to young people to get them onto the government payroll, whether or not there is a real job for them to do or they are qualified to do the job; hence the frequently overwhelming numbers of bodies in the service; of course this is not a universal truism. We must point out that there are countries with excellent extension programs, which could be used as models for others in the region. But most services do need urgent attention as key agents in the system of linkages.

Suggestions for Strengthening the Role of the University

My presentation has without doubt been on the pessimistic side, and I am not at all pessimistic about agriculture, in truth. I have tried to point out our own shortcomings, as viewed objectively, I hope, and honestly, by one who has spent esssentially his entire career in universities. It has been suggested that we are good at diagnosing our ailments in agriculture, but how good are we at prescribing cures? I would like to make a few specific recommendations for your consideration and discussion.

The image. We must make intensive efforts to improve the image of agriculture, particularly in the developing world, where indeed the most rapid changes are currently occuring. This will be a medium- to long-term project but will pay high dividends in the recruitment of more top students (our best now are as good as any, let me assert; but we do not get our fair share) and in the morale of the faculties.

Recruitment. We must recruit strong students with, if at all possible, backgrounds in agriculture and a commitment to the industry. This is becoming easier, in fact, with the growth of larger agricultural businesses in the developing world. Children of such businesses are entering faculties of agriculture, with a well-developed appreciation of the larger agriculture picture and with an acquaintance with much of modern technology. We should more actively recruit them.

Curricula. Training must be rigorous at all levels; strong

science in the basic years and intensely practical in the later. All agriculture faculties must acquire a farm to provide the necessary orientation to real life farming practices and to foster the ability to relate to farmers in all ways.

Graduate Training. Graduate training should be available in all faculties of agriculture if at all feasible financially. The research for both the master's and the doctorate should be done in country, even when no Ph.D. is offered. Students studying abroad should be enabled to return, with the joint support of the faculty, the NARS, and international organizations, to carry out reseach relevant to the needs of the farmer. Such linkages are more difficult to work out but will pay handsome dividends in the future.

Teaching loads. The teaching loads of at least some faculty members should be markedly reduced so they can develop worthwhile research programs. They should be given support to do this, and rewards for accomplishing it, recognizing that this may be extremely difficult within some or even most civil service systems.

Salary levels. Salary levels in universities and research bodies must be increased to make education and research more competitive with the private sector. No country could, or even should, make its educational system completely competitive with the private sector. But no amount of effort to improve image, recruit good students, strengthen curricula, and support research will ever succeed on a lasting basis if highly capable personnel cannot be retained in the face of competition from the private sector. Most of us realize that we do not enter university service to get rich; there are other rewards. But to render universities more effective in their role of supporting national agricultural research systems, a thorough review must be undertaken of the system of remuneration of the personnel employed.

THE ROLE OF THE UNIVERSITY IN NATIONAL AGRICULTURAL RESEARCH

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INTRODUCTION

Let me at the outset make four introductory remarks which I believe will be helpful in discussing the role of the university in national agricultural research efforts.

1. My statements will relate mostly to the role of the university in agricultural research in the Arab countries, because the Middle East region is the focus of this workshop. This does not mean, however, that the points I will be raising may not apply to countries with similar environments;

2. There are at present 68 universities in the Arab countries, including the two American universities in Cairo and Beirut. Of these universities, only 38 have colleges of agriculture, and only eight have fully organized veterinary colleges. While addressing the role of universities in national agricultural research, however, the points raised will not be restricted to the role of these colleges but rather to the whole spectrum of disciplines in any university which may have potential input into the national agricultural research effort. These disciplines, which usually have no organic connection with colleges of agriculture and veterinary medicine, include biological sciences, chemistry, physics, geology, economics, sociology, public health, and various engineering disciplines;

3. From a historical perspective, most of the universities in the Arab region were established in the 1960s and hence came into being after agricultural research activities had been established within the structure of the ministry of agriculture. Thus the universities have had to break into an environment in which other institutions, mainly ministries of agriculture, already had a claim on the agricultural research in their countries. While seeking a role for the university in national agricultural research effort, it is vital to keep this historical perspective in mind, because it relates to the issue of which institution perceives itself as having the right and responsibility for the organization and implementation of research activities in the country. The perspective becomes even more important in national situations where a mandate for agricultural research has not yet been clearly defined;

4. The total number of agricultural scientists in the Arab countries qualified to Ph.D. or equivalent level was estimated in 1982 to be three thousand. Two thirds of the scientists are working in the universities; the rest are in the national agricultural research institutions. About 55% of the total number are working in Egypt alone. In Egypt and Sudan the numbers of agricultural scientists working in the national agricultural research system are close to those working at the universities. In the rest of the countries the number of agricultural scientists working at the universities far exceeds that in national research systems.

   This disparity will probably persist in several countries for many years to come. When discussing the role of universities in agricultural research, it is important to remember the differences existing in distribution of qualified manpower among various institutions and the need to cultivate the expertise of manpower working in the universities in the overall national effort.

SOME ISSUES IN THE ROLE OF UNIVERSITIES IN NATIONAL AGRICULTURAL RESEARCH

1. *The issue of mandate.* All Arab universities were established with clear objectives and functions. The declared objective of each university is to serve the needs of society through three functions: manpower training (teaching), research, and direct technical services. Thus the research function was given to the university, in many cases without clearly stating how they should coordinate their research efforts with already existing research institutions. A few countries have developed

coordinating mechanisms, mainly through research councils and research committees, but the issue of how to consolidate efforts of various research institutions remains to be resolved in most countries of the region;

2. *Type of research.* Reviews of the titles of work published by agricultural scientists working in the universities reveals that the problems tackled are relevant to the agricultural sector of the country. However, how many of these publications attempt to answer particular questions raised by farmers, and how many of these research activities are consistent with national development objectives is controversial. Part of the controversy comes because many countries have no agricultural research plan with clearly defined priorities. Common criticisms of university research are:

   - that research is too academic and does not relate to the real problems faced by farmers. In this context it is charged that scientists in universities tend to go more for research projects that are attractive for publications than to tackle the practical problems that limit productivity in the farmers' fields;

   - that reseach efforts in the university are more oriented toward disciplines than commodities and hence lead to a fragmented output with little relevance for farmers.

The researchers at the university defend their research, and they raise the following points:

   - that they are overloaded with the teaching function and hence have little time to devote to problems that are more time-consuming;

   - that the facilities, assistant help, and operational funds allocated to them are insufficient for and/or inconsistent with those required by applied and developmental research.

Before we leave this issue the following remarks may help to clarify the situation.

   - Several countries have developed plans and/or mechanisms to insure more congruence between what scientists in universities are researching and the needs of the country.

   - The fact remains, however, that many universities have built-in promotion mechanisms which force scientists to conduct attractive short-term research problems that may or may not address farmers' needs. Many universities insist on a certain number of publications to qualify faculty for promotion from one rank to the next. With the limited time and facilities available for research in the universities, researchers find themselves caught up on the "publish or perish" syndrome, with little consideration of the practical value of their work. Furthermore, most universities insist that research acceptable for promotion must be published in internationally recognized journals. Researchers find it difficult to satisfy this criterion with studies of local problems that may not be acceptable to international journals.

GUIDELINES FOR STRENGTHENING THE ROLE OF UNIVERSITIES IN THE NATIONAL AGRICULTURAL RESEARCH EFFORT

There is no need to belabor the importance of involving universities in the national agricultural research effort. They are a valuable national resource, and they stand to benefit from their involvement.

In many situations studied by the writer, all parties actually have welcomed an increased role of the universities in meeting society's needs. What remains to be determined, however, are the following:

1. the definition and establishment of a national organizational framework under which all research effort, including that of the university, can be directed towards the attainment of national objectives;

2. the utilization of tools and incentives which are conducive to more productive and efficient research.

NATIONAL ORGANIZATIONAL FRAMEWORK

Experience in developing countries has shown that the more successful models of national research effort have an organizational framework (or body) which has the power and tools to implement the following:

1. The definition and formulation of a national agricultural research plan with clearly defined priorities. Of course, such a plan must be consistent with national development objectives and farmers' needs. In defining such a plan three main groups should participate: policy-makers responsible for the development of the agricultural sector; research leaders and scientists in the national agricultural research system, including university scientists; the clients of the research output - farmer leaders, leaders of farmer organizations, and leaders of organizations offering services to farmers.

Experience also shows that the more detailed the plan is, the more easily it can be translated into individual research topics.

2. The organizational body should determine the institutions capable of implementing projects emanating from the plan as well as the clients who are most likely to benefit from each project. Here again the universities must be included.

3. The organizational body should define methods and mechanisms for monitoring and evaluating implementation of research programs. The university scientific community may again play a role in the evaluation process of research output.

4. The organizational body should have financial resources to at least partly support the cost of research projects and, in particular, the operational cost of research programs.

TOOLS AND MECHANISMS WHICH STRENGTHEN PRODUCTIVE RESEARCH

1. *National research teams for major commodities and/or research areas.* The formation of national teams responsible for the implementation of each of the major commodity programs has proven to be a helpful mechanism in cultivating the expertise of manpower available in the country, including those working in the university. It is also a mechanism which facilitates an integrated multidisciplinary approach to problems. When forming such teams, the responsibility of each member of the team must be spelled out. In addition, the appointment of a national team leader to serve as a focus for communication, monitoring, and coordination has proven to be effective.

2. *Contract research.* As much as possible, institutions and/or individuals implementing research programs, including the universities, should be contracted by the "organizational body". The contract should have a program document showing objectives of the research program, major materials and methods, where the program will be implemented, individual researchers responsible for implementation, duration (with starting and termination dates), costs, type, and form of the final product.

   The contract should spell out any incentives or financial support given to the implementing institution, sources of support, and conditions and modes of fund distribution.

3. *Graduate studies.* Many universities of the region have programs to qualify candidates for the master's degree and some for the Ph.D., in a range of sciences, including agriculture. The orientation and integration of these graduate studies, especially thesis research topics, in the total national effort of agricultural research, provide an excellent opportunity for all concerned to best cultivate such activities. While implementing such graduate study programs, facilities, manpower, and other support available to the university, as well as other national research institutions, may be integrated to strengthen research output. Integration should become part of the policy of the university.

4. *Special workshops, farmer field days, consultation.* It should be the policy of the university, the "organizational body", and the other national research institutions to involve the university scientific community in all activities which strengthen the production and dissemination of research output.

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THE ROLE OF THE FACULTY OF AGRICULTURE, UNIVERSITY OF JORDAN, IN NATIONAL AGRICULTURAL RESEARCH

Dr. Mahmud Duwayri

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INTRODUCTION

The Faculty of Agriculture was established in 1973 by royal decree. It was envisaged that this new faculty should be a non-traditional one as compared to those in the Arab world, since it was to emphasize agricultural research as well as teaching. This philosophy is very well reflected in the relatively lower teaching load compared with other faculties in the university.

To fulfil its aspirations, the faculty embarked upon conducting research on important crops in the national economy, mainly wheat in rainfed agriculture, tomato in the irrigated sector. Staff members and researchers were encouraged to form teams to work on the problems facing these important commodities. The Faculty of Agriculture started with four departments: Crop Production and Protection; Animal Production and Protection; Soils and Irrigation; Agricultural Economics and Extension. In 1980 the structure was reorganized and expanded to six departments: Department of Plant Production; Department of Animal Production; Department of Soils and Irrigation; Department of Plant Protection; Department of Agricultural Economics and Extension; Department of Nutrition and Food Processing. Undergraduate enrolment in 1984/1985 was 994; there were 37 graduate students.

GRADUATE STUDIES

One of the important landmarks in the history of the faculty is the graduate program, which started in 1977. The M.Sc. degree is granted in the Departments of Plant Production, Plant Protection, and Soils and Irrigation. Research topics are chosen from the important problems facing agriculture in Jordan, and in most cases involve two years of field work. So far, 53 students have been granted M.Sc. degree, and currently 37 students are enrolled in the same program. I have said that real agricultural research in Jordan began with the graduate program in 1977. I still think so and hope to start the master's program in the other three departments very soon. Diploma programs are in preparation in all six departments. Many of the graduate students are offered scholarship from the Ministry of Agriculture or the Deanship of Graduate Studies, and there are other sources of scholarships to encourage attraction of high-quality graduate students.

PRESENT RESEARCH ACTIVITIES IN THE FACULTY OF AGRICULTURE

The faculty is heavily involved in research projects at the national level in cooperation with regional and international agencies:

1. improvement of cereal crops, funded partially by the Ford Foundation and involving scientists from the Ministry of Agriculture and ICARDA;

2. improvement of food legume crops partially funded by IDRC and in close cooperation with the Ministry of Agriculture, particularly in the demonstration phase;

3. improvement of tomato crops funded partially by the National Planning Council, through the Deanship of Research, University of Jordan;

4. agricultural Production in the semi-arid zone and areas suffering from desertification, funded by the European Economic Community;

5. there are more than 100 small research projects being carried out by our staff which involve soils, irrigation, poultry feeding, management, fattening, plant protection, farming systems;

6. the staff published more than 90 research papers in the last year;

7. the staff have participated in 33 national, regional, or international meetings or workshops in the past year.

In conclusion, it can be said that the Faculty of Agriculture is the most active body in agricultural research in Jordan, through graduate studies, research projects in cooperation with the Ministry of Agriculture, or other national or regional institutes. However, more coordination is needed. Furthermore, an extension system to get our results to the farmer needs to be worked out. I am sure that the future is very bright in this direction.

THE ROLE OF HASSAN II INSTITUTE OF AGRONOMY AND VETERINARY MEDICINE IN NATIONAL AGRICULTURAL RESEARCH

Dr. Mohamed Besri

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Hassan II Institute of Agronomy and Veterinary Medicine

INTRODUCTION

The Hassan II Institute of Agronomy and Veterinary Medicine was founded in 1966 to provide agricultural manpower for Morocco. Eighteen students enrolled in the first class and 11 of them graduated in 1972. During the last 18 years, more than 3,000 students have graduated from the institute. The areas of specialization are diverse, including agronomy, veterinary medicine, food industry, wood technology, rural equipment, agricultural machinery, sea food science, landscape architecture. There are about 320 staff members working at the institute.

In less than 20 years, the institute has progressed considerably in teaching activities and agricultural research. This has been possible because of the continuity of the research program and stability of Moroccan staff members, the integration of the research activities in the student curriculum at both undergraduate and graduate levels, the general research policy adopted by the institute and, finally, by the assistance of international cooperation.

In order to understand the place of the Hassan II Institute in national agricultural research, it is necessary to describe in some detail the higher agricultural education system in Morocco.

THE HIGHER AGRICULTURAL EDUCATION SYSTEM IN MOROCCO

Students who have completed high school and obtained the Baccalauréat pass a competitive examination to enter the institute. Each year, 5 to 6,000 students sit for this examination and only 600 are enrolled.

All agriculture students participate in a common first year curriculum referred to as Année préparatoire aux Etudes Supérieures en Agriculture or APESA. At the end of the year, the students' scores are used to divide them between the different sections of the Institut Agronomique (Rabat and Agadir), the National School of Agriculture (Meknès) and the National School of Forestry (Salé). The Institut Agronomique has 11 sections: agronomy, veterinary medicine, food industry, wood technology, rural equipment, topography, agricultural machinery, horticulture, landscape architecture, plant protection, and sea food science. The two first sections require six years (M.Sc level) while the others, including the National School of Agriculture and Forestry, require only four years (B.Sc. level).

Master of Science Level (Ingénieur d'Etat)

The six-year agriculture program is divided into three cycles of two years each.

First Cycle

The first cycle contains all of the basic sciences (mathematics, physics, chemistry, social science, plant biology, animal biology). The first cycle is common to both the six year agriculture program and to veterinary medicine.

Second Cycle

All agriculture subjects are studied during the second cycle. These include: animal sciences, plant production, social science, soil science, mechanical engineering.

Third Cycle

At the end of the second cycle, the students choose a specialization, to be pursued during the fifth and sixth years.

Most students are sent abroad for their fifth year. They may be placed in French, Belgian, American, English, Danish, or other universities. The universities are selected for the specialization they offer.

At the end of the fifth year, the students return to Rabat for a year of individual work. They prepare, write, and defend a thesis and are awarded the degree Ingénieur Agronome.

Bachelor of Science Level (Ingénieur d'Application)

The four-year program is divided into two cycles of two years each. Students receive courses in various fields during three years and three months and prepare their B.Sc. thesis during the last six months.

THE RESEARCH ORGANIZATION AT THE INSTITUTE

In many universities of developed countries, research activities have little to do with the agricultural problems of Third World countries. Some of our technicians were trained in these universities. Upon returning home they experienced many difficulties in adjusting to the new situation. Many of them wished to continue their research under the same highly sophisticated conditions in which they had been trained.

At the Institut Agronomique we avoided such situations. The research programs are defined according to national needs and are integrated into the general teaching curriculum at the undergraduate and post-graduate levels. The professor, with his student, must undertake the research and adapt it to the local situation. This research policy does not mean that the Institute is completely isolated from the outside world. On the contrary, the success of this research policy is due, in part, to international cooperation.

Organization

The M.Sc. students start their research work during their stay abroad (fifth year) and continue through the sixth year in Morocco. The research for the B.Sc. degree is done during the fourth year of studies, from January until July.

The students of the six-year program are sent abroad for the fifth year, as mentioned. The foreign university is chosen according to the major field of study chosen by the student. For instance, one who would like to specialize in citrus production might be sent to the University of California. They take academic courses and begin their research projects, which are defined by Moroccan advisers and must contribute to solving a Moroccan agricultural problem. During his stay abroad, the student has the opportunity to learn new techniques and become acquainted with how research on any problem is undertaken.

After one year abroad, students return for their sixth and last year of studies. They bring with them new techniques and new ideas. They continue working on their research projects and write a thesis. They defend their thesis at the end of the year before receiving the Ingénieur Agronome Degree, which is equivalent to the M.Sc. degree.

Control of student research progress

During the year reserved for the thesis, the student must present his research project before starting his experiments. The subject is introduced and the techniques and materials to be used are described.

Then the student gives a seminar based on a literature review of the problem and two progress presentations during the course of his work. All students of the department must attend every presentation, regardless of specialization. This familiarizes every student with the research topics and special techniques used. He is also able to gain experience by discussing and criticizing his fellow researchers. People outside of the institute (farmers, technicians, investigators) are also invited to participate in these seminars and presentations.

Defense of the thesis

The student is permitted to type and reproduce his thesis only after he has completed his four presentations and obtained the approval of his research supervisor. A jury consisting of five to eight examiners (professors from the institute and specialized technicians from outside) is selected. The student presents and defends his thesis before this jury. If successful, the jury proposes that he be granted the ingenieur degree.

Department staff member training

As we said earlier, there are about 320 staff members in the institute, of whom 250 are Moroccans. Most of the Moroccans are educated to the M.Sc. level and need doctoral training. In order to develop strong research programs necessary to sustain a third cycle at the institute and to participate more actively in national agricultural research, the institute has created a doctoral program. For this doctorate the research is to be done locally, and on a problem which has great significance for the development of national agriculture.

Integrated research programs

The two levels of research activities of the students (M.Sc., B.Sc.) and the staff member doctoral candidate can be independent or part of integrated research programs. Each

department tries to cover diverse aspects of problems facing the agricultural development of the country. This research strategy allow many departments to have a broad view of the country's most important agricultural problems, to evaluate them, and to choose problems for future study. For the students, this strategy has the advantage of giving them some freedom in choosing the subject of their research work.

But, the whole is more than the sum of its parts, and this is true for agricultural research. We have initiated an integrated research and development program. The objective of the program may be the improvement of a crop, development of the agricultural activities of an area, or some other activity. Many departments participate collectively in the elaboration and the realization of multi-disciplinary research projects.

Integrated research programs may be initiated at the request of the Ministry of Agriculture, and they are taking on more and more importance in the research and development activities of the institute. Some of this research is financed by the Moroccan government and some by international organizations.

At the moment, about 20 integrated research programs are active. Some are conducted in some African countries, like Guinea and Mauritania.

Extending research knowledge

The Institut Agronomique et Vétérinaire Hassan II has an active program to disseminate research results.

Seminars, symposia, etc.

In the institute we have four professional associations:

- National Association for Plant Production, Plant Breeding and Plant Protection
- National Association for Animal Production
- National Association for Soil Sciences
- National Association of Irrigation and Drainage

All of these associations are joined in a federation called the National Federation for Rural Development. These associations and the federation organize seminars, symposia, and workshops on different aspects of agriculture The participants in these activities are nationals (private companies, administration, farmers, universities, etc.) or foreigners.

Other meetings are organized by the service of "Regular Training". This service can organize at any moment, on any subject and on the demand of the Ministry of Agriculture or private companies, any training session during which all current research information is presented.

Publications

Two journals are published in the institute. "Actes de l'Institut Agronomique et Vétérinaire Hassan II" is published by the institute alone, and "Hommes, Terre et Eaux" is published in collaboration with the different professional associations. These two journals allow students, institute staff members, and researchers from outside to publish their results. Papers are also presented in other national or international journals.

Thesis

The thesis is also a very important form of research diffusion. The examination committee is composed of professors from the institute, technicians from private companies, and scientists from the Ministry of Agriculture. Thesis information can therefore be readily utilized.

CONCLUSION

Each year, 150 master's theses and about 350 bachelor's theses in various agricultural sciences are prepared. There are also 250 doctoral dissertations projected for the next 10 years. All of the research activities are integrated into the student curriculum at both the undergraduate and graduate levels, and all research topics deal directly with national agricultural problems.

The research strategy of the institute emphasizes integrated research programs. Many departments participate collectively in the elaboration and the realization of multidisciplinary research projects.

MANPOWER AND TRAINING ASSESSMENT

Dr. Byron T. Mook

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INTRODUCTION

I would like to begin with a cliché. How often have all of us heard that a research program can be "only as good as the people who work on it"? Such words are good and high-sounding.

But how can an agricultural research manager actually go about ensuring that he knows what personnel resources he has and what he will need in the future? I would like to discuss these questions with you today.

Specifically, I will deal with three interrelated issues:

- What must a research manager consider in assessing the current manpower situation in his institute or research program?
- What considerations should be taken into account in estimating future personnel needs?
- What should the research manager think about in planning necessary in-career training for his personnel?

GENERAL CONSIDERATIONS

Before getting into discussion of these three issues, I would like to say briefly why I think manpower assessment is important, and why I believe that good manpower and training plans are a critical resource in the hands of any research manager.

In many countries - almost certainly including those represented in this room - it is likely that the number of people involved in agricultural research will increase significantly in the years ahead. Why? I would suggest two reasons. First, the economic returns to agricultural research are among the highest of any sector in which a government can invest - agricultural, industrial, or educational. Evidence that this fact is being recognized by policy-makers lies in the increased allocations being made to agricultural research at both the national and international levels. And second, the numbers of students emerging from tertiary level educational institutions who will demand jobs can be expected to grow substantially in the years ahead.

Such growth in the number of agricultural research personnel must be planned for. Good manpower assessment and manpower planning can therefore serve at least two purposes:

(a) to strengthen the case for more resources. A manpower plan for agricultural research can be (and almost certainly should be) a political document. Policy-makers are more likely to provide increased resources for research if they can base their decisions on a well-researched, well-documented, and well-argued case. "Wish lists" are not likely to be sufficient;

(b) to present the case for reform, over careers. Once again, policy-makers are not likely to be impressed with vague calls for improved salaries and "conditions of service". The burden of proof is really on agricultural research managers to show how existing rules can be used to improve the conditions under which their personnel work, and/or to make the case for changing those rules.

As research managers make manpower assessments and put together training plans to meet these objectives, they are likely to want to consider at least the following four subjects. In my presentation today, I will deal most directly with the first and the fourth.

(1) Recruitment. How many people should be recruited by an agricultural research organization and what qualifications should they have? Answers to such questions are clearly related to the availability of resources to support new personnel.

(2) Careers. What kinds of careers will be available to these new recruits? How will their performance as scientists and managers be evaluated? What kinds of grade and/or salary bars will they face?

(3) Incentives. What non-salary incentives can the research organization offer its personnel? What flexibility do research managers have to offer benefits related to postings, housing, transportation, medical care, and education for children?

(4) Training. How will the professional skills of research personnel be periodically updated?

ASSESSING THE CURRENT MANPOWER SITUATION

Let me begin, then, with the first of the issues which I noted at the outset of this presentation. What must a manager consider in assessing the current manpower situation in his institute or research program?

Really another phrase which might better describe this activity - in less pretentious terms - is "finding out what we have". In its first four years of work with national agricultural research systems (NARS), ISNAR has been continually struck by how little is known about the basic characteristics of research personnel. It is actually the exceptional national agricultural research system which is able to say quickly and accurately how many people it has on the payroll.

The first step in manpower assessment is therefore the collection of good personnel data. This task is one on which ISNAR has worked with the governments of Kenya, Somalia, and Zimbabwe, and most recently with the Department of Agriculture in Thailand. Much of what I am about to say is based on that experience in Thailand.

The Thai Department of Agriculture - like many national research organizations - maintains excellent personnel records. For each permanent employee, it keeps a bound book containing his/her entire personnel history. The amount of information contained in these books is impressive. Not only can one find out where and when an individual was born, where he/she went to school and in what subjects, when he/she joined the Department, etc. - but also considerable detail about family members, residence, military service, and time spent in fulfillment of religious duties.

The problem is that there is no means of aggregating these data. If the department wants to know something about a PARTICULAR INDIVIDUAL, the information is almost certainly contained in his/her file. But if it wants to know something about a PARTICULAR CLASS of persons (e.g., Ph.D.s), then the only way of doing so is to go through each and every file, one-by-one.

When ISNAR and the department began to work together on an analysis of conditions of service for research personnel, we soon discovered that we lacked the answers to a number of key questions. How many graduates were there in the department? How many with master's and doctoral degrees? What scientific disciplines seemed to be over- and under-represented? What were the age and sex distributions of department scientists? What recruitment trends over the past ten years could be identified?

The process of gathering information on such questions is laborious, but it can pay high dividends in the end. Working with ISNAR, the department designed a data sheet on which key educational and career information for each graduate could be tabulated. Then clerical personnel from the Records Section of the Personnel Division went through each of the personal files by hand. The resulting data were aggregated and computerized. The end-product was a database on graduate scientists in the department which provides for the first time a sound and complete basis for an assessment of current manpower.

What kinds of conclusions came out of this assessment? I shall present here only two, to give an idea of the kinds of uses to which such a database can be put.

One of the most striking characteristics of the 1419 graduates in the department is the high percentage of women (38%). ISNAR does not know of any other country which has such a high percentage of female graduates in agricultural research. Furthermore, many of these women are young - 50% of them are under 35, as compared with only 30% of male graduates. Even in absolute terms, there are more women than men in this age group.

The implications of such figures for research management are likely to be considerable. By 1994, assuming regular retirements (at age 60) and no attrition, the percentage of female graduates in the department will have risen to about 44%. Such figures are important, because they affect postings and therefore, most important, the type of research actually done. From information in the personal files on the place of formal assignment, we calculated that 34% of male graduates in the department work outside Bangkok as compared to only 20% of women graduates. As a result, if the percentage of women graduates in the department rises, a reasonable expectation would seem to

be that management will face increasing challenges in persuading people to work outside Bangkok.

Working from the personal files, ISNAR and department analysts got an accurate count of the numbers of graduate research staff in each salary grade. When we then compared these data with those on age and place of posting, we discovered that: (a) there was a very strong positive correlation between age and salary grade (i.e. very little evidence of promotion on the basis of merit), and (b) there was quite a strong negative correlation between age and postings outside Bangkok.

What are the management implications of this assessment? The main one concerns the changing shape of the personnel pyramid. As the current crop of younger people moves up in the department - and assuming only moderate recruitment, because of budgetary constraints - that pyramid will actually tend to become increasingly inverted.

ESTIMATING FUTURE MANPOWER NEEDS

Data such as that collected by the Department of Agriculture in Thailand are an essential prerequisite for beginning to grapple with the second issue I raised at the beginning of this presentation. What considerations must the good research manager take into account in estimating future personnel needs?

There are really two questions here. (1) How many people are needed (quantity)? And (2) what kinds of people are needed (quality)? The two are obviously interrelated. I would argue that there are two very different approaches in trying to answer them.

The first is what ISNAR and others have called the "unconstrained demand" strategy. The essence of this approach is a request to heads of research organizations or programs to state their manpower "requirements" over the next x number of years. How many people do you need? Of what type? What sort of qualifications should they have, and in which scientific fields?

The main problem with beginning to estimate future manpower needs in this way is that managers almost always state their "needs" too high. Why? I can think of at least three reasons. (1) A manager may feel that his request will be cut anyway, so he might as well overestimate. (2) Most agricultural reseach managers believe that their organizations have the potential of making great contributions to national development. And (3) many managers equate numbers of subordinates with bureaucratic power.

All true . . . But still, could one not argue that the effects of the "unconstrained demand" approach to manpower planning may actually be harmful to a research organization? Specifically, if the desired qualifications of new recruits are set too high - however many such recruits there are to be - there is the real danger of what is sometimes called an "inversion of the skill hierarchy". In plain terms, this means that the organization becomes top-heavy, with too many (self-perceived) leaders and not enough followers. For management, the usual way of avoiding such an inversion is to set narrow gates along the career paths which only a few people can get through. The problem with this "solution", of course, is that it usually leads to the stagnation of highly qualified people at lower grades.

But there is another approach. It might be called "constrained demand" - and the question it asks is not "how much is needed?" but rather "how much can be afforded?" The examples I shall use to illustrate this approach are drawn from ISNAR work with the Ministry of Agriculture in Kenya.

Five variables are critical to such "constrained demand" analysis. (1) Agricultural gross domestic product (AGDP). (2) The percentage of AGDP being spent on agricultural research. (3) The total bill for research salaries/benefits, expressed as a percentage of total research expenditure. (4) The total bill for graduate salaries/benefits; again, expressed as a percentage of total reseach expenditure. (5) The likely movement of existing graduate staff into higher salary grades over the next 5-10 years.

In Kenya in 1982, approximately 1.06% of AGDP was being spent on research. This figure was actually quite high in comparison with many other countries in Asia and Africa. About 55% of total expenditure on research was going to salaries/benefits, and about 15% was going to the salaries/benefits of graduates.

Our objective was to estimate what the situation would be like 5-10 years from now. To do so, ISNAR and the Ministry of Agriculture put together a number of different scenarios using different values for each of the above five variables. Just one such scenario will be summarized here to illustrate the utility of the "constrained demand" approach in estimating manpower needs. On the assumption of a 4% annual growth in AGDP, a 1.5% of AGDP expenditure on research continuance of the existing percentage of total personnel expenditure for graduate scientists and managers, and minimal "grade creep" (i.e. promotion

pretty much according to seniority), we concluded that the Ministry of Agriculture could afford a net addition of only 35-40 graduates per year. In other words, 6%-7% of total graduate personnel strength in 1982.

Such figures were disappointing - and challenging. Perhaps their most striking aspect was the contrast with the manpower estimates generated through the "unconstrained demand" approach. When research officials had been asked simply to estimate what they "needed", the figures were approximately 10 times higher. Furthermore, we estimated that if manpower growth continued over the next 10 years at the same rate as over the last 10, it was likely that almost 100% of recurrent expenditure for research would be spent on personnel by 1993.

PLANNING IN-CAREER TRAINING

Any approach to this manpower management function depends on how the first two functions described above have been carried out. It is only logical that staff training cannot be planned until you know what staff you have and what can be afforded.

After such estimates have been made, however, the reseach manager will probably want to go through three steps in planning training for his staff.

(1) A description/analysis of current pre-career training opportunities. What are the main institutions and programs that provide personnel to the national agricultural research system? What scientific and managerial fields do they cover well and which not so well? And what are their developmental plans over the next 5-10 years? Only through answering such questions can the training planner estimate what fields are likely to be inadequately covered in the NARS in the future.

(2) A description/analysis of current in-career training opportunities. Where are staff going for training now? What are the relative costs and benefits?

(3) An analysis of the actual demand for training within the NARS. This issue is almost certainly the most difficult of the three. There are really two schools of thought about in-career training. One - which might be called the apprenticeship school - argues that scientists and managers should improve their skills on the job. Proponents of this view contend that formal degrees are not all that important and that training "on-the-job" both minimizes disruption to the research organization and costs less money. An essential element of such an approach, of course, is the presence of senior scientists who can act as the "masters" of the "apprentices."

The alternative view is that advanced degrees are important, particularly in a world in which agricultural science and technology are changing so rapidly. Proponents of this idea argue that even senior research scientists and managers become outdated quickly unless they go for formal refresher courses; they therefore cannot be depended upon to train their staffs.

CONCLUSION

To end, I would like to discuss briefly one substantive issue and one methodological issue which seem to me to tie together much of what has been discussed.

The substantive one is difficult to present concisely and fairly in a brief period. It concerns the manpower and training planning implications of what many analysts have termed "the diploma disease". When we think about estimating future manpower needs and planning training, how important do we really consider academic credentials to be? If we insist that a middle-level scientist must have a master's degree, or a senior-level scientist a Ph.D., why do we do so? What is there about postgraduate studies that qualifies a scientist for professional recognition and advancement?

These questions are difficult to answer but they are critical. Let us look at the personnel situation in much of research and development 20-30 years ago. Many middle- and senior-level research professionals then were actually people who had only first degrees and who had learned much of what they were practising on-the-job. Why has the situation changed today?

I do not want to appear to be implying here that whatever changes have occurred have not had many positive effects. The dramatic advances made in agricultural science in the last 15 years have come about almost entirely through the efforts of scientists with postgraduate credentials. At the same time, however, an over-emphasis on academic degrees does have its costs. Not only are the degrees costly to acquire, but holders of advanced degrees usually start at higher salaries. In addition, higher and higher level positions must be found if the individual is not to become bored and dissatisfied. The question which every research manager and personnel planner must therefore continually ask is: Do the jobs I need filled really require post graduate degrees?

And now on to the methodological issue. What are the best

ways of actually going about the first critical step in manpower assessment: tabulating present staff? I have mentioned the ISNAR experience in Thailand, where data were gathered by clerical personnel going through each personal file. We estimate that simply the collection of basic information on the 1420 graduates in the Department of Agriculture took the staff of the Records Section in the Personnel Division at least 10 minutes per file, or about 240 hours of work.

The alternative might have been a questionnaire sent out to each graduate member of the department. In fact, such an approach had already been tried once before in Thailand with somewhat disappointing results. There were two problems: (1) a low response rate, and (2) the provision of questionable information. When the personal file and a returned data sheet do not agree, which is to be believed?

Here we come to the heart of the argument for a permanent, continually revised database on agricultural research personnel. If a department of agriculture, or a ministry, or an agricultural research council, maintains such a database, that information can become an always available management tool.

What is involved in actually establishing and maintaining a personnel database? I would single out three ingredients: (1) a commitment to make the database the central feature of an ongoing records and planning system; (2) a willingness to invest considerable time at the beginning to get the database set up; and (3) a modest microcomputer. With a small micro, any national agricultural research system can keep all its personnel records instantly accessible and easily updated. Total cost for all hardware and software: well under $15,000.

The benefits of such a database for the performance of the three management functions which I have discussed today - the assessment of current manpower, the estimation of future manpower needs, and the planning of training - are potentially enormous. As noted at the outset, good manpower assessment and manpower planning can both strengthen the case for more resources for research and present the case for reform.

RECOMMENDATIONS OF THE WORKING GROUPS

Summarized by Dr. Byron T. Mook

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Participants in the workshop were divided into three working groups to provide an opportunity for informal discussion of issues raised in the plenary sessions. Each group met separately, to consider these three topics:

Topic One - Methods of strengthening working relationships between national agricultural research systems and FAO, AOAD, international agricultural research centers, and ISNAR.

Topic Two - Linkages between national agricultural research systems and policy-makers, extension, farmers, and educational institutions.

Topic Three - Management challenges in manpower planning for agricultural research, improvement of conditions of service for research personnel, and the assessment of training needs.

Following are summaries of the groups' principal findings on these topics.

Topic One

The programs of international organizations and national organizations should be complementary.

The stronger the national program, the more able it will be to profit from cooperation with an international organization.

International organizations should avoid duplication of national efforts. For example, international organizations should involve national scientists in the formulation of programs.

International organizations should be conscious of existing balances in national programs. They should not barge into such programs unless the national systems have made clear commitments of support.

The number of expatriate scientists working in national programs should be kept to a minimum.

At the national level, there should be an institution to coordinate the programs of international organizations. This institution should ensure that each international program is supported by adequate national facilities and counterparts.

The programs of international organizations are often not well understood by the national systems. The organizations should make stronger efforts to explain what they are prepared to do, how, and when. ISNAR could be more active in providing a link between international organizations and national programs.

Topic Two

Research scientists should collect and analyze basic agricultural information which they feel would be useful for policy-makers to have.

Scientists should continually evaluate their research and make such evaluations available to the policy-makers.

In return, the policy-makers should encourage scientists to participate in setting national agricultural priorities.

Nevertheless, linkages between scientists and policy-makers are likely to remain largely informal.

Possible mechanisms to encourage linkages between scientists and educational institutions include: joint research teams, joint evaluation teams, and contract research; also, the participation of researchers in university teaching and in the supervision of university-supported research. A study to evaluate the relative efficacy of such mechanisms in a number of different countries would be useful.

Researchers and extensionists should work together in the formulation, implementation, and evaluation of programs (particularly those of an adaptive nature).

Improved communication between research and extension can be encouraged by bringing the two functions under the same administration.

Mechanisms to encourage research/extension linkages include: liaison officers, joint seminars, and joint field days.

Farmers should participate in identifying research problems and in evaluating research results.

Topic Three

Manpower planning. A prerequisite is a complete inventory of existing personnel.

Supply (graduates of the education system) must be reconciled with demand (requirements of agricultural research). Such planning should be the responsibility of a national institution working in close cooperation with both educational and research organizations.

Appropriate balances must exist between:

- different scientific specialities;
- scientists and managers;
- scientists and support personnel;
- different geographical locations.

Conditions of service for research personnel. The most important motivating mechanisms for scientists posted in the field include: good housing, access to transportation (for themselves and for their families), reasonable laboratories, and access to libraries and microcomputers.

Salaries for university scientists and non-university scientists should be comparable.

Training. There are two different subject areas: scientific and managerial; both are important, but the right person should receive training in the right subject.

There are three different types of training: degree; short, non-degree courses, either in-country or at international research centers; on-the-job training through collaborative research projects.

Some international organization should maintain a listing of training opportunities available at various universities and research centers around the world. Perhaps ISNAR.