Education for AGRICULTURE

INTERNATIONAL RICE RESEARCH INSTITUTE

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Foreword

Since its inception 24 years ago, the International Rice Research Institute (IRRI) has organized training courses in all areas relevant to rice research and production. To date, more than 3700 scholars and fellows from 71 countries have undergone training at IRRI. Training programs leading to university degrees have been undertaken jointly with the University of the Philippines at Los Baños (UPLB) and with several other leading agricultural universities in different parts of the world.

In 1983 the Institute, in collaboration with the Committee on Science and Technology in Developing Countries (COSTED) and the Asian Association of Agricultural Colleges and Universities (AAACU), planned a symposium to review the present state of agricultural education in the context of the opportunities now existing for a learning revolution. Also, it was felt that a thorough review of the emerging human resource needs and requirements of the government sector, agricultural universities, agribusiness, and farmers in the coming decade would be useful. It was also at this time that the Technical Advisory Committee of the Consultative Group on International Agricultural Research initiated a comprehensive review of the training activities of the International Agricultural Research Centers.

With the endorsement of IRRI's Academic Council the plans for the holding of the symposium were prepared by an organizing committee composed of representatives of UPLB, the Southeast Asian Regional Center for Graduate Study and Research in Agriculture, AAACU, and consultants and senior staff of IRRI concerned with training programs. The participants in the seminar, whose names and addresses are included at the back of this book, came from leading agricultural universities in Asia, Africa, North America, and Europe as well as from ministries of agriculture and education, international and national research centers, funding agencies, agribusiness entities, and farmers' organizations.

IRRI was privileged to host the symposium on November 12–16, 1984. The primary objective was not only to assess the present needs of agricultural education and training but also to suggest methods for bringing together the resources and capabilities of all sectors involved in this great endeavor.

I am especially grateful to the members of the organizing committee for their efforts in handling the myriad details of the symposium: M. D. Pathak, chairman, T. R. Hargrove, D. R. Minnick, F. T. Rivera, and B. R. Tripathi, all of IRRI; F. A. Bernardo, AAACU; R. Radhakrishna, COSTED; D. L. Umali, FAO/IRRI; Suraphol Sanguansri, SEARCA, and C. B. Perez, Jr. and O. F. Sison, UPLB.

It is hoped that the recommendations formulated during the symposium will be helpful to institutions and individuals engaged in the task of creating a cadre of well trained agriculturists responsive to the needs of practical farming, research, education, extension, public administration, and private and public sector industry.

A primary message of the participants was the need for continuously updating the knowledge and skills of teachers and agriculture graduates so that they can extend effective assistance to the farmers and fishermen whose guests we all are on this planet. In this context, it was stressed that the wisdom contained in the following poem of Rabindranath Tagore should always be kept in mind by educational institutions —

"A lamp cannot light another lamp
unless it itself is also lit

A teacher cannot truly teach unless
he himself is also learning"

M. S. Swaminathan
Director General

Recommendations

The pace of development of highly trained manpower for agricultural and rural development needs considerable acceleration. This will be possible if agricultural universities, international and national agricultural research centers, private sector agribusiness entities, and farmers' organizations all pool their resources and knowledge to introduce relevance and excellence into the content and methodology of training programs. The resources of these organizations could be meaningfully integrated to assist nations to develop a corps of agricultural technicians and graduates capable of responding to present and emerging problems of development. It was with this end in view that the participants at the Symposium on Education for Agriculture identified the primary needs of agricultural training and education and proposed the following recommendations to strengthen its role in rural and national development.

THE ROLE OF AGRICULTURAL UNIVERSITIES IN RESEARCH AND TRAINING

The following recommendations were made concerning the role of agricultural universities in national research and training programs:

- Strong linkages, both formal and informal, should be developed between agricultural colleges/universities and national research agencies to give the former credibility with farmers.
- To disseminate their research findings for solving the practical problems of agriculture, the universities should maintain linkages with the extension bureaus of the ministry of agriculture.
- Research policy should not only envisage problem-solving research but also provide for adequate basic research to promote continuous and sustainable productivity increases.
- National conferences should be held to plan and coordinate research activities.
- A newsletter should be published by agricultural colleges and universities for libraries, scientists, teachers, extension agents, farmers, and agribusiness executives to provide horizontal communication.
- In addition to providing training at the graduate and postgraduate levels, agricultural colleges and universities should mount short-term, nonformal training courses for the development of skills; train research workers in new skills and techniques; train trainers who will be responsible for training large numbers of middle level workers; train farmers and

specific clienteles concerned with agriculture; and develop training materials and documentation of training programs.

- Rural women should be trained in modern methods and techniques of agricultural production, and more women should receive graduate and postgraduate education.
- Programs should be organized to meet the short-term training needs of faculty members on a priority basis.
- The training of research workers in interdisciplinary and problem-solving approaches to research should be undertaken.
- Human resource development programs should pay attention to both the qualitative and quantitative dimensions of training.
- As a follow-up of this Symposium, a survey should be undertaken to evaluate the "state of the art" of the research and training capabilities of the different agricultural colleges and universities in the region to determine the scope for future collaborative activities.

THE ROLE OF UNIVERSITIES IN NONDEGREE TRAINING

Nondegree training may take many forms, e.g., field days and training courses for farmers and local leaders, in-service training sessions for extension staff, updating courses for former graduates, apprenticeship training for young faculty, assistance with curriculum development by other institutions, and preparation and dissemination of teaching materials.

Several problems and constraints that hamper the effective implementation of nondegree training programs were identified as: difficulties in integrating nondegree programs into the universities' activities and in allocating resources to support the programs; the absence in most universities of incentives that encourage senior faculty to engage in nondegree training; and the existing research-training polarity of the faculty plus committee work, which may not leave much time for other activities.

Intensified collaboration between universities and the International Agricultural Research Centers (IARCs) in nondegree training would be mutually beneficial. However, such collaborative work should be built on the principle that an in-country training program is an in-country responsibility. Therefore, national authorities should determine their specific training needs and priorities. The IARCs, both individually and collectively, could then identify what support they could extend, particularly through training-of-trainor's programs. Consortia of universities and IARCs could pool their resources.

Specific recommendations follow:

- The universities should conduct short-term and medium-term nondegree training for farmers, youth, rural women, entrepreneurs, staffs of

banking institutions, agribusiness managers, and administrators either by themselves or in collaboration with the ministry of agriculture.

- A clear delineation of the roles in training of all major agencies concerned would be useful to avoid duplication of effort.
- The establishment of mediating mechanisms should be considered in which the training agencies, main employers of trainees, farmer organizations, and nongovernment and other private organizations would be represented to review agricultural training needs, develop collaborative training strategies, facilitate communication links, and solve problems.
- Contractual arrangements between universities and government departments as well as joint ministry-university staff appointments would be beneficial to both.
- Universities should give explicit recognition to faculty members who pursue nondegree training.
- Evaluation methods for the assessment of work performance in teaching, research, and extension (including nondegree training) need to be developed to recognize achievements in all these areas; such evaluations should be made part of the staff development system.
- The IARCs should develop suitable evaluation methods for assessing work performance; the indices for measuring the impact of training should include an assessment of the progress made in improving the productivity, profitability, stability, and sustainability of the major farming systems in the command area of the university.
- With respect to training provided at IARCs, the existing language situation limits the participation of trainees from countries where English is neither spoken nor taught at the school level; in this case, in-country training would be more beneficial.
- Only trainees/participants appropriate to the level of the program who can provide leadership and ensure impact upon return to their country of origin should be selected.

THE ROLE OF INTERNATIONAL RESEARCH CENTERS IN ASSISTING AGRICULTURAL UNIVERSITIES

Agricultural universities in less developed countries are hampered by limited resources for facilities, staff development, staff maintenance, and institution building. A very high percentage of the operational budgets goes to salaries, and very little to the resource back-up for faculty. Meeting the special needs of students from socially and economically disadvantaged families is a problem.

- Admission of more students from rural areas, many of whom may be first generation learners, should be accompanied by special training.

- The curricula should promote interdisciplinary practical work to equip the students with broader perspective for analyzing field problems.
- More attention should be given to retraining and further strengthening PhD level staff.

Agriculture is highly location-specific; hence strong national agricultural knowledge systems are essential. IARCs acting individually may have a limited impact, but their collective strength is considerable and can save cost.

- Hence, methodologies for organizing training consortia consisting of IARCs, UN and bilateral agencies, agricultural universities, and national research systems should be developed. This will also lead to more effective IARC-national center interactions and more meaningful partnerships in scientific pursuits between the two types of institutions.

Training programs at the IARCs may be classified as longer-term (9 months or more), including sabbatical and postdoctoral assignments and scholarships for MS or PhD degrees; or shorter-term individual or group courses (from 1 week up to 9 months), including a variety of formal nondegree or special methodology oriented training programs. The IARCs should help agricultural universities meet their countries' manpower requirements. Specific recommendations follow.

- Collaboration should extend to research, technology transfer, and production programs.
- The IARCs that have gained considerable experience in technology transfer activities with government line agencies should help promote closer relations among research and extension centers that would at the same time link together IARCs, agricultural universities, national research centers, and non-governmental organizations.
- IARC-developed nondegree training programs should be offered at national centers to make the courses more suitable and relevant to local conditions, to reduce costs and reach many more trainees, and to accelerate the development of training capabilities within the country.
- Staff maintenance can be improved by collaborative research projects, postdoctorals, and exchange of staff. IARCs can assist agricultural universities obtain funds through collaborative research projects.
- IARCs can help countries explore effective approaches to strengthen linkages among agricultural universities, national research centers, and other related line agencies.

THE NEEDS OF FARMERS, THE PRIVATE SECTOR, GOVERNMENTS, AND UNIVERSITIES

Farmers require availability of agricultural inputs, technology and extension services, and markets (domestic or export). With increasing population, per

capita farm size decreases. Therefore, farm productivity must increase while at the same time farm real incomes must increase. Resources are becoming scarce and must be optimally used. The farmer should be able to make crucial commodity or farming systems choices with time and changing market demands and opportunities. A substantial proportion of rural women are landowners, farmers, laborers, or traders in their own right, and a significant minority of household heads, particularly among the poorest groups, are women. The type of extension system observed by a country is determined largely by its socio-political system. A knowledge acquisition system, where the control resides in farmers' own organizations, seems to have greater potential for enhancing impact on production, but delivery systems, where control resides in the government extension service, seem to be more prevalent and may serve the needs of small and marginal farmers better. Demonstrations in farmers' fields will have maximum impact on farmers' acquisition of production skills. In addition, farmer visits to an agricultural university and/or receipt of a certificate from the university for training provides a psychological reward. The following recommendations were made vis-a-vis farmers:

- To develop any extension education plan we should know the actual needs of the farmers of today and the potential needs of the farmers of tomorrow.
- The extension workers must have practical knowledge and skills, aptitude in communication, ability in organizing people, and empathy for farmers.
- The scope of extension agencies needs to be enlarged to include the participation of primary and secondary school teachers.
- Common misperceptions of rural women's roles, reflected in imprecise use of language like "farmers' wives," "laborers' wives," or "housewives" must be corrected through studies of women's roles in agriculture and household decision-making (particularly in the financial sphere).
- Religious leaders, with their influence on the community, can be effective channels for agricultural and rural development.

The agribusiness sector is made up of commercial firms dealing with fertilizers, seeds, agrochemicals, large plantation farms, livestock and poultry, food processing, and agricultural machinery; private financing institutions; private consultancy firms; etc. The large private firms tend to hire graduates from prestigious universities/colleges and pay them relatively well compared with government agencies, regulatory bureaus, or the extension service. These graduates must possess competence in general education, general agriculture, basic communication, and basic management and have practical skills, too.

Moreover, some computer literacy may soon become not only desirable but necessary. Small agribusiness enterprises need different types of trained gradu-

ates compared with large corporations. Research positions in the private sector require training in specialized fields. Certain government-imposed job security (statutes) requirements can pose a problem to private sector employers.

The government sector is composed of the regulatory bureaus, extension service, public research institutes/centers, and public financing institutions. Employees not only need practical and technical skills in agriculture but also should have a strong service commitment. Financial incentives and rewards (better pay and other fringe benefits) should always accompany the desired missionary ideal of civil servants.

Universities and colleges require trained and motivated staff for teaching and research — persons with an independent learning ability and flexibility to cope with changing times and job requirements. For greater relevance, agricultural universities/colleges need to increasingly perform an extension service function (e.g., nonformal education, information/technology packaging, dissemination) in collaboration with the government extension service. For universities and colleges, the following recommendations were made:

- The agricultural university/college should be able to assist farmers directly or indirectly through the extension service workers by providing up-to-date nondegree training programs and short courses. New or more suitable technologies and practical skills as needed and determined by the farmers should be offered in these courses. Public school teachers also need to be trained in elementary agriculture.
- There should be sharing or complementation of educational facilities/resources to train staff for the many agricultural universities/colleges within a nation or region. Moreover, there is a need to broaden the network by which a certain university or research institute can serve the training needs of many countries in a certain specialized discipline.
- Quality of manpower is more crucial and important to consider than quantity of graduates. With quality graduates, surplus manpower becomes a lesser problem.
- There is a need to attract students into agriculture, including its allied fields (e.g., agribusiness, agricultural engineering, food technology), especially those coming from the farming sector, with the hope and expectation that they may have a development and service orientation toward the sector.
- The curriculum needs to be periodically reviewed to provide up-to-date training (including appropriate or new technologies, practical skills, etc.) for students to fit the requirements of the clientele better. An institutional resource system should be created to review the curriculum constantly.
- There is need to integrate in the curriculum, primarily through some of the existing courses, the various concepts needed in integrated agricultural or rural development such as population education, nutrition edu-

cation, ecology and environmental management, utilization of indigenous resources, energy conservation, and geography.

- Agriculture graduates should have the knowledge, skills, values, and attitudes needed for development. Commitment to service and development of the many small farmers is necessary, especially on the part of extension workers. This, however, has to be complemented with material incentives and perquisites needed by all human beings.
- The idea of a new postgraduate specialization, farming systems, was suggested to train people to act as the coordinators or managers of farming systems programs. Moreover, analytical research in farming systems is necessary. Basic courses in agronomy and animal science should underscore the need for a farming systems approach. The aim is to provide specialists who can help to redesign land and water use plans based on sound principles of ecology, economics, equity, energy conservation, and employment generation.
- The research function in a university/college, just as in a government or private research institution, requires specialized training of staff in various disciplines. Likewise, research management training is needed by many staff of agricultural universities/colleges and research institutions. Good management holds the key to maximizing faculty output and to achieving time-specific targets, and hence the importance of training in research management cannot be overemphasized.

MAJOR CONSTRAINTS TO HUMAN RESOURCE DEVELOPMENT

Constraints to the development of the necessary range of human resources may have to be analyzed with reference to the role six groups of factors could play:

1. Attitudes in society toward development and modernization in agriculture and in the rural areas
2. The policies and practices of governments
3. The nonspecialized sectors of the educational system
4. The specialized sectors of the educational system
5. The donors
6. The IARCs

This section deals primarily with 2 to 6, with 1 at least partly reflected in 2.

Policies and practices of governments

If the policy of government toward agriculture is not supportive, its decisions and budget allocations for the development of human resources to support agricultural change are likely to be restrictive. Responsibilities for policy,

action, and manpower development for agriculture are usually divided among several agencies or sections of government, none of which will necessarily take into account the manpower needs of the private sector. Policies may concentrate on certain important commodities or may be influenced by the experiences of the recent past and the near future, so that government agencies are not able to implement a longer-term developmental view of agricultural manpower needs.

Social outlook and government practice may constrain recruitment from rural people, scheduled castes and tribes, ethnic minorities, and/or women. Rewards may be less for agricultural professionals than for others, resulting in the conference disease, the brain drain, and movement into the private sector. Limited foreign exchange may restrict the availability of equipment for training. Conversely, substantial importations of foreign equipment may discourage local industry and the training of local engineers and technicians.

Non-specialized education

Many of the professionals who provide agricultural and rural development services come from urban backgrounds, as educational opportunities are scarcer in rural areas, often poorer in quality (particularly in respect to languages, applied science, and mathematics), and often biased towards an urban outlook hindering recruitment of rural dwellers. Though rural life is rich in culture, tradition, and technical knowledge relating to plants and animals, educational systems do not seem able to capture and interpret these resources. Even where schooling is free, rural families may discriminate against daughters in education for economic and social reasons. The subjects offered to girls at school are often less technical and less scientific. All of this tends to restrict the entry of rural women into education and subsequent professional training in agriculture.

Specialized education for agriculture

In training institutions that are not exclusively concerned with agriculture, the subject is often regarded as inferior. The curricula of agricultural training institutions may be out-of-date or of limited relevance. Particular weaknesses often include inadequate attention to the actual practices of agriculture and the existing systems of rural life and production, and insufficient practical content. Agriculture is studied as a theoretical subject (a branch of literature). Even so, many curricula are unduly and exclusively oriented to production, neglecting postharvest operations like storage, processing, and marketing. Biomass utilization is most often neglected. Other subjects inadequately treated are management, economics, law, policy and administration, government

organizations, and the needs of other branches of government and of the private sector. Many courses and texts are taken from other environments, particularly those of developed countries. Significant subject fields may be omitted altogether, including human sciences, agricultural climatology, experimental methods and statistical procedures, and the physical, social, and economic geography of the country. Other lacks are linkages between and across disciplines and those among agricultural education, extension, research, and the world of work.

Facilities, staffing, and equipment are often inadequate, and large classes restrict both individual attention and practical laboratory work. Staff members are often so poorly paid that they have to take on additional jobs that restrict their teaching time and may exclude research. Though promotion may depend on publications, the funds, facilities, and time for research are often inadequate, which can rapidly lead to a decline in the content and quality of teaching for both first and higher degrees. Where research is possible, it may be biased towards subjects of interest to international journals, while locally important topics and local journals are neglected.

The demand for higher education has in most cases not been accompanied by appropriate expansion or even maintenance of training of support staff, technicians, and future extension workers.

Donors

Donors who fund education and training for agriculture may insist on their own countries as the venue, even though the material taught, the problems investigated, and the environment are not relevant. The equipment and support facilities are often far superior to those to which the student will return. Perhaps recipient countries do not make their own purposes and needs sufficiently clear to the donors. Donors (and IARCs) do not always see their role as one of promoting national self-sufficiency in the production and maintenance of manpower for agricultural and rural development. Competition among donors may lead to unnecessary duplication in training.

IARCs

Where national leadership and manpower planning are not sufficiently strong, and where IARCs do not operate collectively or in concert with other donors, there is the risk that the separate influence and prestige of the individual Centers may distort the pattern of human resource development. The training capacity of the Centers meets only a very small fraction of the total requirement for training in developing countries because both their facilities and the time that research staff can spare for training are limited.

THE COMPUTER REVOLUTION AND ITS RELEVANCE TO TRAINING

With the advent of the microcomputer and the subsequent floppy disk technology, the computer has become a viable tool in the learning process. Because of the computer's ability to assist in coping with the Information revolution, it is becoming an increasingly important option in Asia. Computer aided instruction (CAI) is superior to other methods in updating and adapting software for local needs. This computer methodology adheres to basic, validated principles of educational research. In addition, it has the ability to store and to recall rapidly large amounts of information that heretofore have not been available. More specifically, CAI, in addition to acting as an adjunct to the lecturer:

- permits the instructor to assume more responsibility in the domain of interpersonal instruction and problem solving;
- provides more time for active rather than passive instruction and learning;
- self-evaluates for the learner and the instructional process;
- is easily transportable, transferable, and convenient to store;
- is amenable to copublication and translation;
- provides the learner options to explore information needs in a mode of interactive dialogue; and
- incorporates readily different sensory devices such as sight, touch, and sound, subsequently impinging on the affective domain.

CAI thus has the potential to be used in universities, research institutes, extension training institutes, and farmer training programs. Still, CAI is in a state of infancy. Realizing the resource limitations of the computer revolution, the role of the IARCs should be to:

- develop CAI software packages that can be adapted to local needs,
- train human resources of the national systems to adapt CAI packages to suit in-country needs,
- provide a model for CAI methodology, and
- catalogue CAI instructional software pertinent to agriculture training.

There should be a conscientious effort to coordinate these CAI activities among various IARCs to interact with the national systems, which are extremely diverse and must ascertain their own needs. National systems should institute training programs designed to facilitate development of their own CAI software using in-country human resources. National systems should then interact among themselves and with IARCs to build a cost-effective system.

CAI is but one of many methodologies available for learning. It is not a panacea, nor does it replace the instructor. Rather, it is a learning option that may redefine the teacher-student relationship by releasing the teacher to

assume a more humanistic role and provide increased opportunities associated with instruction in problem solving.

JOINT TRAINING PROGRAMS BETWEEN IARCs AND UNIVERSITIES

The policy of joint training programs between the agricultural universities and IARCs needs further strengthening. In addition to cooperative graduate programs, nondegree programs should also be included wherever appropriate. The nature of these cooperative programs will naturally depend on the availability of personnel and facilities at the agricultural universities.

The following specific recommendations were made:

- The expertise and course work available at agricultural universities should be used more extensively for MS and PhD programs. Where possible, the professors should be actively involved in the research project as co-advisers of the students. This arrangement may include part of the thesis work at the university or at an appropriate site within the country, and part at the IARC or at its outreach sites.
- Appropriate arrangements should be developed among the national coordinating agency, agricultural universities, and IARCs for implementation of this program.
- Where feasible, national or regional nondegree training programs should be undertaken jointly between IARCs and universities.
- The IARC training programs should be complementary to the training efforts of the agricultural universities, and the IARCs should progressively transfer the production-oriented training programs to the universities or appropriate national institutes.
- The universities and the IARCs should maintain communication and follow-up on the work activities of alumni and exchange annual reports and other relevant publications.
- For greater integration into national programs, IARCs should participate in the development of annual work plans for training and research. Appropriate donors could be invited to joint meetings.
- The IARCs should explore the possibility of assisting the universities in their staff development and institution building activities.
- IARCs and universities should make an effort to include women as managers, teachers, and students in their joint training programs.
- IARCs should assist in the planning and implementation of national research and training programs when requested.
- The national programs should also tap the special expertise and experience of nongovernmental organizations within a country for inclusion in cooperative programs with IARCs.

Training Implications of Recent Progress in Rice Research

M. S. Swaminathan

IRRI has identified six areas of immediate concern to ecologically handicapped areas and to resource-poor farmers: responses to yield gap, ecological concerns, economic concerns, energy concerns, employment concerns, and equity concerns. IRRI's development approach is to strengthen collaborative efforts with the national research systems that are in the best position to undertake location-specific research. IRRI's training programs are a complementary effort to enable development of a research system capable of generating location-specific technology and accelerating the process of reducing yield gaps at the farmer's level. The relevance of IRRI's training programs is continually monitored by the Academic Council in close consultation with the national systems. Approaches to minimize the difficulties of traning participants arising from their inadequate knowledge of English are given.

The direction of IRRI's major research thrusts has been set out in the Institute's Plan for the Third Decade as well as in the Report of the Second Quinquennial Review Mission. Both documents place considerable stress on the need for greater scientific attention to ecologically handicapped areas and to resource-poor farmers. The Program Committee of the IRRI Board as well as the full Board have also given valuable guidelines on methods of achieving this objective. The major pathway of responding to the needs of different rice-growing areas and resource-poor farmers has been the strengthening of collaborative research with national research systems that are in the best position to undertake location-specific research. For this purpose, annual work planning meetings are held between the concerned scientists from the national research systems and IRRI. These discussions have shown clearly that the felt needs of national research systems vary, depending on the stage of evolution achieved in a particular country in (a) the development of a dynamic rice research system capable of generating location-specific technology, and (b) the progress made in bridging the gap between potential and actual yield in farmers' fields at currently available levels of technology. Based on IRRI's ability to respond to such felt needs, national research

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programs assess the relevance of IRRI's work from the point of view of finding solutions to their own problems.

Various seminars and conferences held at IRRI, as well as the annual work planning meetings, have indicated that six areas of concern need careful and adequate attention. They are responses to the yield gap, ecological concerns, economic concerns, energy concerns, employment concerns, and equity concerns.

THE YIELD GAP

The countries of the world having more than 1000,000 ha planted to rice can be broadly categorized into three groups based on average yields (Table 1). If 6

Table 1. Average yield of paddy in countries with a rice area of 100,000 ha or more.

Group I	
Average yield exceeding 4 t/ha	
Iran	Italy
Colombia	Korea, Republic
China (including Taiwan Province)	Korea, DPR
Peru	Japan
USA	Egypt
	Australia
Group II	
Average yield between 2 and 4 t/ha	
Pakistan	Dominican Republic
Sri Lanka	USSR
Burma	Philippines
Malaysia	Vietnam
Ecuador	Afghanistan
Venezuela	India
Cuba	Bangladesh
Mexico	Thailand
Indonesia	Nigeria
Group III	
Average yield below 2 t/ha	
Zaire	Kampuchea
Mali	Ivory Coast
Guinea	Liberia
Sierra Leone	Laos
Tanzania	Brazil
Malagasy	Nepal

t/ha per crop is considered a feasible average yield with currently available technologies for irrigated or adequately rainfed areas, 11 countries — Group I — have a yield gap of less than 33%. Group II countries have a yield gap varying from 33% to about 67%, and Group III countries have a yield gap exceeding 67%. Various factors such as area under irrigation and the state of development of mutually reinforcing packages of technology, services, and public policies influence the yield gap. Therefore, the precise manner in which IRRI can respond in its collaborative programs with each of these country groups will vary.

Group I countries

Some of the research priorities of Group I countries are: (a) raising the yield ceiling further, (b) achieving yield stability through greater attention to soil and plant health care, (c) improving cropping intensity, and (d) developing input-output pricing policies that can stimulate both production and consumption. Countries that are rice exporters are deeply interested in grain quality based on consumer preference.

Emphasis in the IRRI irrigated rice breeding program continues to be on the development of improved germplasm with high yield and yield stability, superior grain quality, and shorter growth duration. Incorporation of diverse genes for disease and insect resistance is accorded high priority. We now have numerous breeding lines in advanced stages of testing that have intermediate amylose content and intermediate gelatinization temperature. These should have much greater consumer acceptance. The improved germplasm is made available to national programs through the International Rice Testing Program (IRTP) nurseries and through direct requests from scientists. IRRI sent out 88,204 seed samples of improved breeding lines in 1983 and a similar number in 1984. These lines are being extensively tested in national trials. Some have been named as varieties, and many are being utilized in hybridization programs. The widespread adoption of disease- and insect-resistant varieties has had a profound effect on rice production in many countries.

To develop improved germplasm with short growth duration, cold tolerance, good grain quality, and multiple disease and insect resistance, a shuttle breeding project was started with the China National Rice Research Institute. Similar projects involving shuttle breeding are in progress with Korea and Thailand for developing rainfed lowland rices with cold, drought, and submergence tolerance. Such cooperative research can solve some difficult problems in enviromental adaptation. Another approach to yield improvement is the exploitation of hybrid vigor. In China this year, hybrid rice covered more than 7 million ha. China has plans to plant hybrids on 10 million ha next year. As an alternative to the cytoplasmic genetic system, the search for effective chemical pollen suppressants for rice should be intensified.

Another area of collaboration with Group I countries is institution building. A dynamic national research system is a must for stimulating and sustaining a dynamic national production program. Thus, IRRI participates actively in the development of the China National Rice Research Institute at Hangzhou.

Group II countries

In Group II countries, there are both technological and socioeconomic constraints to improving average national yields. Such countries require increased support from all the three major networks coordinated by IRRI, namely, the IRTP, the International Network on Soil Fertility and Fertilizer Evaluation for Rice (INSFFER), and the Asian Rice Farming Systems Network (ARFSN). An integrated internetwork approach has been initiated so that both technology development and income generation of rice farming systems can receive adequate attention. With the active participation of IITA, WARDA, and IRAT in Africa, CIAT in Latin America, and national research systems everywhere, the IRTP coverage and content are being continuously improved.

Rice-based farming systems research looks at different upland crops that can be grown before and after rice. There are many problems in growing upland crops because of the poor soil conditions after rice. Because IRRI has no mandate to develop upland crop varieties, collaboration with national research centers like the Institute of Plant Breeding of the University of the Philippines at Los Baños and other international centers such as CIMMYT (corn and wheat), ICRISAT (peanut, sorghum, and chickpea), CIAT (forage crops), and IITA (cowpea, soybean, and sweet potato) has been strengthened to develop varieties of upland crops that fit the rice-based cropping systems. Other non-CGIAR centers like AVRDC and INTSOY as well as agencies like IADS and bilateral programs all help in improving the impact of farming systems research. Through these collaborative efforts IRRI identifies the varietal characteristics needed under different environments and cropping systems to ensure the flow of better varieties to different national programs.

The present collaboration on rice-wheat systems between IRRI and CIMMYT is being expanded to other international centers like ICRISAT, CIP, and IITA. Collaboration includes on-farm cropping system research and on-station component technology research for a target environment, especially varietal evaluation and other agronomic techniques for the various crops in the system. The pattern of internetwork and intercenter cooperation and feedback is indicated in Figure 1.

Group III countries

Many Group III countries have a large untapped production reservoir. Some have harsh environments and soil problems as well as severe socioeconomic

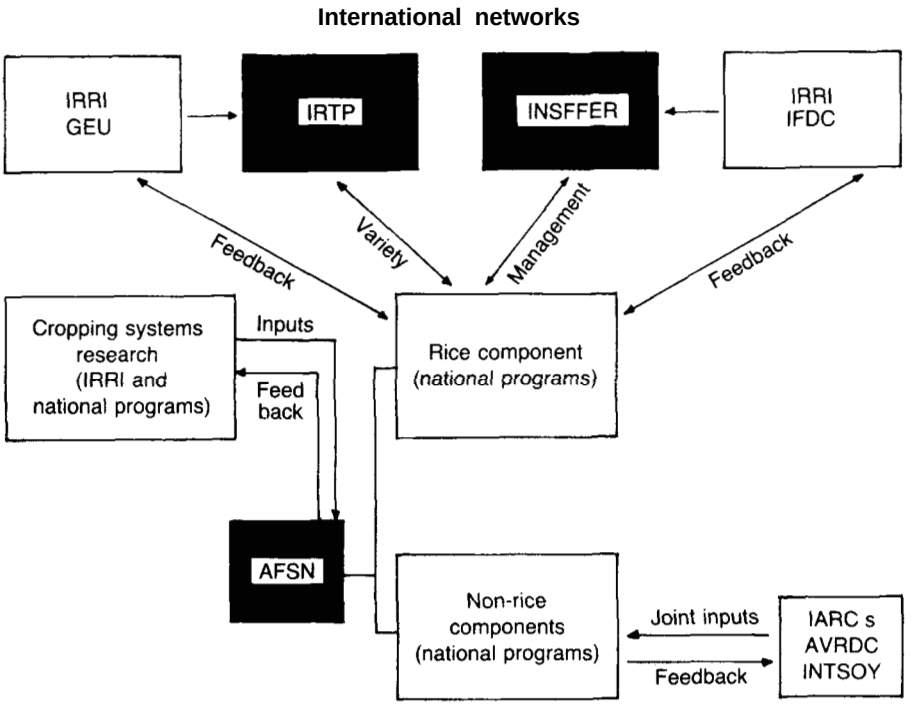


Fig. 1 Internetwork coordination.

difficulties. The first step is the organization of a multidisciplinary analysis to identify the precise ecological, technological, economic, institutional, and sociopolitical constraints responsible for the yield gap. A carefully designed malady-remedy analysis will help in the formulation of both short-term and long-term research and development strategies. With financial support from USAID, IRRI has recently started a cooperative program in rice research in the Malagasy Republic.

Thus, IRRI's approach is to work with national research systems in a manner that will be most meaningful to them.

ECOLOGICAL CONCERNS

Some of the common criticisms made against the yield improvement pathway associated with the so-called "Green Revolution technology" are as follows:

- The replacement of large numbers of locally adapted cultivars with a few high yielding strains leads to extensive gene erosion.

- Monoculture with the same genetic strain and with the same crop throughout the year promotes pest epidemics.
- Exploitative agriculture depletes soil fertility and promotes soil cro-sion.
- The application of large quantities of inorganic fertilizers and pesticides causes water pollution and leads to the accumulation of toxic residues in the plant-animal-man food chain.

IRRI scientists are conscious of the need to avoid these negative ecological impacts. Some of the steps taken for developing ecologically sound research technologies are the following:

International Rice Germplasm Center

Extensive and systematic collection efforts in the past 14 years have added more than 40,000 rice cultivars and wild rices to the world's repositories of rice germplasm. Acquisitions from remote rice areas have not only saved many land races from extinction but have also greatly enriched the genetic resources available to rice researchers. These efforts represent a truly collaborative venture among the many national centers in Asia and Africa, IARCs (IRRI, IITA, and IBPGR), and regional centers (WARDA, IRAT, and ORSTOM). All the collected materials have been preserved at two or more sites, with IRRI conserving the base collection at the International Rice Germplasm Center (IRGC). See Table 2.

Such collaborative efforts in genetic conservation, evaluation, and use are expected to grow in the next decade because increases in human population will call for more intensified crop production and use of marginal lands. Rice scientists have no alternative but to implement more extensive evaluation and use to cope with the emerging needs. The Genetic Evaluation and Utilization (GEU) Program of IRRI provides a model that is now being widely emulated.

Table 2. Rice collections in different continents.[a]

Continent	Cultivars	Wild species
Asia	122,039	2,200
Africa	26,514	1,157
North America (USA & Mexico)	18,200	c. 100
Central & South America	8,615	0
Europe	2,014	600
Total	177,382	4,057

[a]Excluding IRRI's holdings of 69,400 *Oryza sativa,* 2,890 *O. glaberrima,* and 2,800 wild species.

Meanwhile, the search for and collection of remnant rice germplasm in the most remote corners of the world needs to be continued and completed. The task will be physically more arduous than in the past. The wild rices will receive more attention in future collections. IBPGR has provided an experienced plant collector for this purpose.

IRGC at IRRI will continue its work on characterizing and preserving the newly collected rices as well as rejuvenating large segments of older acquisitions for long-term storage and preservation at duplicate sites. It will expand its coordinating role in consolidating existing collections of other centers with the holdings at Los Baños so that maximum security can be provided to every accession while redundancy can be minimized.

Many centers face technical difficulties in planning or maintaining cold storage facilities. The experience gained at IRRI will help these centers improve the security and efficacy of cold storage facilities.

As the sizes of collections at different centers continue to grow, evaluation efforts become more burdensome and expensive. Means and ways will be sought to speed the exchange and comparison of evaluation results. Based on evaluation findings of multilocation tests, small "core" collections for various purposes are being constituted by problem-area scientists to facilities use by rice breeders in overcoming the major stress factors.

Sound management of germplasm banks calls for trained scientists and continuity in personnel. Again, the experience of IRGC could exert a multiplier effect through manpower development. While investment in the hardware components of storage and conservation is increasing, the software component of management, evaluation, classification, and utilization is receiving inadequate attention. IRRI proposes to organize a one-year diploma course on Genetic Resources Conservation and Management with the help of IBPGR and the Nordic Gene Bank.

Integrated pest management

IRRI is actively promoting integrated pest management procedures based on a suitable blend of varietal resistance, biological and cultural control, and need-based chemical control. Continuous monitoring of new biotypes in the most popular varieties is in progress.

Soil health care

Research relating to the maintenance of soil health is a high priority area. Detailed attention is being given to both soil toxicities and deficiencies and to the physical and microbiological aspects of soil health. The main soil problems limiting rice yields in rainfed lowland rice tracts have been identified as salinity, iron toxicity, acid sulfate problems, peat soil problems, and nitrogen,

phosphorus, sulfur, and zinc deficiencies. The main growth limiting factors in upland soils are aluminum and manganese toxicities and iron and phosphorus deficiencies in acid soils.

ECONOMIC CONCERNS

The high cost of inputs, need for subsidies, difficulties in developing pricing policies that can stimulate production and consumption at the same time, and the cost, risk, and return structure of the technological package all receive attention from the economists and social scientists of IRRI and national programs. Both the constraints and consequences of programs place stress on the socioeconomic aspects of technology development and transfer. The Asian Rice Farming Systems Program helps train young economists from national research systems in methods of analyzing the economic implications of different rice farming systems.

ENERGY CONCERNS

A common criticism of new technology is its reliance on nonrenewable forms of energy. A major research thrust of IRRI is therefore the substitution, to the extent possible, of renewable sources of nutrients for fertilizers based on fossil fuels. Biological nitrogen fixation (BNF) has potential both in low input farming as an alternative nitrogen source and in high input farming as an additional nitrogen source in integrated fertilizer management. Green manuring and straw incorporation (wherever straw is burned) are also being promoted.

Considerable progress has been made in the following areas of research:

- establishing a germplasm bank of azolla and green algae,
- identifying nitrogen-fixing organisms in rice soils and determining the quantity of nitrogen fixed by these organisms and the factors that influence their activity,
- developing cultural practices to enhance BNF in rice fields,
- establishing a cooperative research network on BNF in rice fields,
- training scientists who will strengthen the national capabilities for conducting research on BNF, and
- assessing the economic viability of UNF technologies under different wage rates and soil and environmental conditions.

EMPLOYMENT IMPACT OF NEW TECHNOLOGIES

Although labor diversification and drudgery reduction and not labor displacement are the aim of scientific rice farming. problems of unemployment and underemployment can be aggravated if the impact of new technologies on

employment is not taken into consideration prior to their popularization. In addition, there is need for research that can provide greater opportunities for gainful employment in rice farming areas. With financial support from USAID and with technical collaboration with the appropriate national agencies of Indonesia, India, the Philippines, and Thailand, a project for enabling small-scale rural industries to take up the fabrication and marketing of IRRI-designed farm implements is in progress. This has stimulated the growth of many small manufacturers in rural areas.

The University of the Philippines at Los Baños and IRRI have jointly undertaken a testing *cum* demonstration project entitled "Prosperity through Rice." This special project, funded by the Asian Development Bank, focusses attention on whole-plant utilization. The aim is to help in the better utilization of the straw, bran, and hull.

A training program on whole-plant utilization in rice was held in January 1985 in collaboration with the Carlsberg Laboratory, Copenhagen.

Under the Asian Rice Farming Systems Network, the employment aspects of resource utilization and management are priority matters. Greater scientific attention to unfavorable environments will also help in improving the income and employment opportunities in rainfed areas. About two-thirds of upland rice in the world — an estimated 12 million ha — is cultivated in unfertile environments subject to many constraints — drought, low pH, soil deficiencies and toxicities — that aggravate the incidence of the most important disease and insect pests. At present, the mean rice yield in infertile upland areas is estimated at less than 1 t/ha. The objective is to raise this ultimately to 3 t/ha. Although such an increase might have only a slight impact on total rice production, it would have a very favorable impact on the net income for the poorest rice farmers. An international conference on upland rice was held in Jakarta, Indonesia, in March 1985 to review recent research results.

EQUITY CONCERNS

A question frequently asked is whether new technologies have built-in seeds of social discrimination. It is now widely accepted that high yield technologies are generally scale neutral with regard to their relevance to farmers with varying sizes of farm holdings. The technologies, however, are not resource neutral, since more inputs are needed for higher output. In addition to IRRI's work on the substitution of noncash inputs for purchased inputs, we are studying government policies that can stimulate the adoption of new technologies by all farmers irrespective of their innate input-mobilizing potential and risk-taking capacity.

The Asian Rice Farming Systems Program and Network are designed to optimize the returns from available resources to small farmers. During 1983 national programs expanded their on-farm research to 188 sites in 12 countries

in Asia. The methodology of site selection, site description, design, and testing developed by IRRI and further refined in the Asian Rice Farming Systems Network was followed with some modifications to fit country situations. Indonesia, Thailand, Sri Lanka, Nepal, Bangladesh, and the Philippines have implemented the pre-production phase (multilocation testing and pilot production programs) of the methodology, while the Philippines implemented the production phase in Iloilo in 1983, covering 35,000 ha and involving 25,625 farmers. In Nepal, 17,000 ha were covered in five districts of the Central Development Region.

Under the Network 42 sites in 12 countries were involved during 1984 in cropping pattern testing in farmers' fields and at experimental stations. In most comparisons, promising alternative cropping sequences were biologically and economically better than dominant farmers' cropping patterns. Cropping intensity of alternative cropping patterns was generally higher than dominant farmers' cropping pattern. Other areas of collaboration are upland crops varietal testing before and after rice, farm implements for intensive cropping, long-term cropping pattern and fertilizer studies. insect management and rice-wheat integrated trials, and crop-livestock research. In varietal testing, IRRI distributed 107 trials before rice and 171 trials after rice in 11 countries. Six countries participated in the collaborative research on farm implements using the rolling injection planter. Rice-wheat integrated trials are a joint project of IRRI, CIMMYT, and national programs, focussing on the identification of better varieties that fit in rice-wheat systems. A new collaborative project on crop-livestock research with IDRC support was initiated in June 1984 in the Philippines, Thailand, and Nepal.

Another aspect of equity relates to the impact of new technologies on gender-specific occupations. Women play a significant role in rice production. Hence, a conference was organized in September 1983 to consider all aspects of women in rice farming systems. The following actions have been taken to implement the recommendations of the conference:

- An Inter-Center Seminar on Women and Agricultural Technology, co-sponsored by ISNAR and the Rockefeller Foundation, was held at Bellagio, Italy, in March 1985.
- A task force has been set up by IRRI with specialists from national research and development institutions, representatives of donor agencies, and several IRRI scientists.
- A short-term consultant joined IRRI in August 1984 to help in developing the framework for a research network on Women in Rice Farming Systems (WIRFS).

It is anticipated that the WIRFS network will initially include Bangladesh, India, Indonesia, Nepal, the Philippines, and Thailand. As the network gains experience, it is hoped to expand membership to include other countries in

Asia and possibly also in Africa. The main objectives of network research would be to:

- increase women's production and productivity,
- reduce drudgery without causing unemployment,
- diversify on-farm and off-farm income-generating activities for women,
- help improve women's participation in both technology development and transfer,
- promote the transfer of relevant skills to rural women in order to increase their earning capacity, and
- assess the benefits derived by women from the currently available packages of technology services including credit supply and public policies.

The network will focus on rice-based farming systems to conform with IRRI's mandate. However, it is understood that to produce meaningful results of relevance to technology developers, policy makers, and planners, this will involve research in the wider biophysical, institutional, economic, social, and cultural context within which rice farming systems operate. This means specifically that:

- a farming systems approach will be used to take account of each of the farm's enterprises;
- women's agricultural roles will be considered in relation to their multiple, interrelated economic and domestic roles; and
- focus will be on women within the household and the community; men's and children's complementary roles and responsibilities will also be considered, the family being taken as the unit of study for this purpose.

It is also proposed that initially the WIRFS network and the Asian Rice Farming Systems Network will be linked informally through joint meetings, workshops, and monitoring tours. This should lead to the development of methodologies for closer collaboration between the two networks and possible integration of the networks after a few years.

TRAINING

Training continues to be a very important part of IRRI's program. The relevance of ongoing programs is continuously monitored by the IRRI Academic Council in consultation with the national research systems. For example, in 1985 new courses are being introduced in management and utilization of genetic resources, statistical techniques in agricultural research, and agricultural communication (Fig. 2). An earlier course on rice production training is being rescheduled once every 2 years.

Course title	Schedule													
	From	To	J	F	M	A	M	J	J	A	S	O	N	D
Statistics*	Feb 4	Apr 5												
Genetic Evaluation & Utilization**	Feb 4	May 24												
International Network on Soil Fertility & Fertilizer Evaluation for Rice	Feb 4	May 24												
Cropping Systems Training Program	Feb 4	Jun 28												
Agricultural Engineering I Agricultural Engineering II	May 27 Nov 18	June 14 Dec 6												
Upland Rice Training Course	Jul 22	Nov 8												
Agricultural Communication*	Jul 22	Nov 8												
Integrated Pest Management	Jul 22	Nov 19												
Irrigation Water Management Training	Aug 26	Oct 4												
Agricultural Economics	Oct 14	Dec 13												
Rice Genetic Resources Conservation and Utilization Training Course*	Aug '85	Jul '86												

*New course

*Emphasis on hybrid rice

Fig. 2 IRRI nondegree training program 1985 calendar.

If scale neutrality is a major aim in technology development, language neutrality has to be an important goal in knowledge transfer. To minimize the difficulties in knowledge transfer due to inadequate knowledge of English, the following five approches are being expanded:

- learning by doing (techniracy),

- joint training programs in countries at the degree and nondegree levels,
- computer-aided instruction,
- autotutorial instruction, and
- multilanguage copublication.

Coupled with practical fieldwork (i.e., learning by doing), it is hoped that the above techniques will help in improving the mastery of the subject by scholars from countries where English is not widely used. Joint training programs with national agricultural universities and research systems are being expanded. A joint training program was organized in Bhutan in May 1984 in both the local language and English.

CONCLUSION

Land is a shrinking resource for agriculture. and most of the densely populated Asian countries will have to produce more and more food from less and less land in the years to come. IRRI is strengthening its collaborative relationships with advanced institutions in developed countries for harnessing all recent scientific tools including those in biotechnology and genetic engineering to solve specific field problems. An intelligent blend of new and conventional techniques may alone help us to solve some of the emerging problems in coupling high productivity with stability of production. For this purpose, we need a dynamic education system capable of continuous adjustment to current and emerging needs in the farm sector.

Status, Constraints, and Challenges of Education at Agricultural Colleges and Universities

F.A. Bernardo

Agricultural colleges and universities face four major constraints: faculty and facility development, coordination of research and extension functions with the Ministry of Agriculture, balancing theory and practice in education, and balance of emphasis between undergraduate and graduate programs. Their major challenges are ensuring that research and teaching are relevant to development needs, increasing their institutional capability in rural development, and fostering staff concern for and attention to development issues. Eight issues must be considered in determining the mission and orientation of agricultural colleges and universities: high level education vs. vocational and technician training, small farmer vs. larger farmer orientation, special training programs to improve skills in technology development and integration, academic freedom vs. directed research and development, role in extension, development of low input technologies and local manufacture of production inputs, production of raw materials vs. processing of high value products, and regional/national policy issues and guidance.

To review agricultural education in proper perspective, it is important to recognize the concept of an agricultural system. According to Mosher (4), the agricultural system includes four fundamental components, viz., farming, commercial agri-support activities, non-commercial agri-support activities, and agri-millieu. Desai (2) goes further by recognizing ten agricultural subsystems with the agricultural education subsystem as one. However, many of the other subsystems depend on the agricultural education subsystem for manpower training. This subsystem develops researchers for the agricultural research subsystem; trains the executives and other levels of manpower for the agri-supply, agri-processing, and

Director of SEARCA and President of the Asian Association of Agricultura1 Colleges and Universities.

agri-distribution subsystems; and trains extension workers for the agricultural extension subsystem. It also imparts knowledge directly to farmers or to the agricultural production subsystem. It must he added that other target groups for the agricultural education subsystem are itself and the government policy decision–makers who directly or indirectly affect agricultural productivity.

CONSTRAINTS AND CHALLENGES

The following generalizations apply especially to agricultural colleges and universities in Asia, although some may apply in South America and Africa as well.

First, agricultural colleges and universities in the developing countries of Asia are relatively young as professional schools of higher learning. Many were vocational schools or diploma schools for decades before they attained professional status. Most are no more than 25 years old as professional schools of agriculture. As young institutions, with the exception of those that have been well funded by the government and/or by bilateral or international funding agencies like USAID and the World Bank, many leave much to be desired in terms of faculty development, laboratory facilities, and libraries. Quite often, funds for maintenance and operating expenses are inadequate.

Second, agricultural colleges and universities in Asia, with the exception of some like those in Japan and South Korea, have been inspired by the U.S. land grant concept and have tried to adopt the attendant trilogy of functions—instruction, research, and extension—with varying degrees of success. The agricultural universities in India have been quite successful in this respect, but in most other countries the responsibility for agricultural research is quite dispersed in different agencies, and agricultural extension is done largely by the Ministry of Agriculture. Coordination of agricultural research and extension in such cases is quite a challenging task, and agricultural universities can perform only limited functions in research and extension.

Third, the agricultural curriculum in many tertiary institutions tends to be heavy on theory and deficient in the practical aspects of farming. This situation prevails in most cases where the institution does not have an adequate farm or commercial farming enterprises (poultry, piggery, orchards, etc.) where students can gain farming and agribusiness experience.

Fourth, many agricultural colleges and universities have offered masters and doctoral degree programs too soon, before achieving adequate institutional maturity. In many cases, the professors lack research experience, and the laboratory and library facilities are good only for the undergraduate level of instruction. In these cases, the graduate programs compete with undergraduate programs, inevitably resulting in the weakening of the latter.

In broad terms, the challenges of agricultural colleges and universities may be classified into three areas of concern, as follows:

1. Developing relevant instructional programs, including nonformal education, to produce the necessary manpower for accelerated agricultural and rural development.
2. Developing strong institutional capabilities not only in instruction but also in research and extension to provide the intellectual leadership, stimuli, and support for agricultural and rural development.
3. Developing a distinct institutional orientation or ideology to define the nature, extent, and intensity of their involvement in agricultural and rural development in particular and in national/regional/international development in general. Strong leadership and sense of mission are necessary in this case.

SPECIFIC ISSUES ON MISSION AND ORIENTATION

The third challenge of agricultural colleges and universities deserves greater space in this paper. The programs, projects, and activities of any institution to a large extent are determined by its mission and orientation. It is therefore important to discuss some important issues concerning the mission and orientation of agricultural colleges and universities. These are:

- high level education vs. vocational and technician training,
- small farmer vs. large farmer orientation,
- need for special training programs to improve skills in technology development and technology integration,
- academic freedom vs. directed research and development,
- role in extension,
- development of low input technologies and local manufacture of production inputs,
- production of raw materials vs. processing of high value products, and
- regional/national policy issues and guidance.

The remainder of this paper will discuss these issues.

High level education vs. vocational training

Agricultural universities provide training for the high level manpower requirements of the country both at the baccalaureate and postgraduate levels. Many surveys of manpower requirements in agriculture show, however, that there is a need for vocational and technician training programs, i.e., training below the degree level. These sub-professional training programs are offered in some agricultural colleges and universities, but in most cases they are offered by vocational and technical schools.

Agricultural universities have a responsibility to know the demands for particular types and quality of manpower in their service areas so that they can gear their training programs to real needs. Lack of concern for actual manpower needs could cripple the national production system by not providing the right talent for the right training in the right amount at the right time. Agricultural universities must work with government agencies and private industries to determine the knowledge students must learn and the skills and attitudes they must develop to prepare them to play their roles in an expanding or growing national economy that is not necessarily limited to agriculture.

This manpower assessment should serve as the basis for making distinctions between training at the professional level in agriculture and training at the vocational and/or technician level, and for preparing appropriate curricula and training programs to meet actual and anticipated manpower needs.

Small vs. large farmer orientation

Asian farmers are, by and large, small farmers cultivating small parcels (2 ha or less) of farmland. FAO includes in its definition of small farmers: agricultural laborers, landless tillers of the soil, tenants, shifting cultivators, and even small fishermen. There is wisdom in maintaining a strong bias for small farmers, for they are the great majority whose income must be increased to enable them to purchase more goods and services and thus stimulate more economic productivity. The large farmers usually have access to more resources, information, and services from agricultural service agencies and therefore need less help from agricultural universities. However, the universities can have a strong bias for small farmers without ignoring the needs of large and progressive farmers. After all, progressive farmers arc taxpayers, and large farms, as long as they exist, have a role to play in agricultural and rural development.

One of the problems of agricultural universities is how to sustain a sharp focus on the problems of small farmers. Professors and scientists tend to expand or proliferate activities in many directions over the years and then forget this important target clientele even before they are able to do something for them. This poses a challenge to the leadership of the universities. The leadership must constantly remind the professors and scientists to stay on the right track by clearly defining the problems of the rural poor.

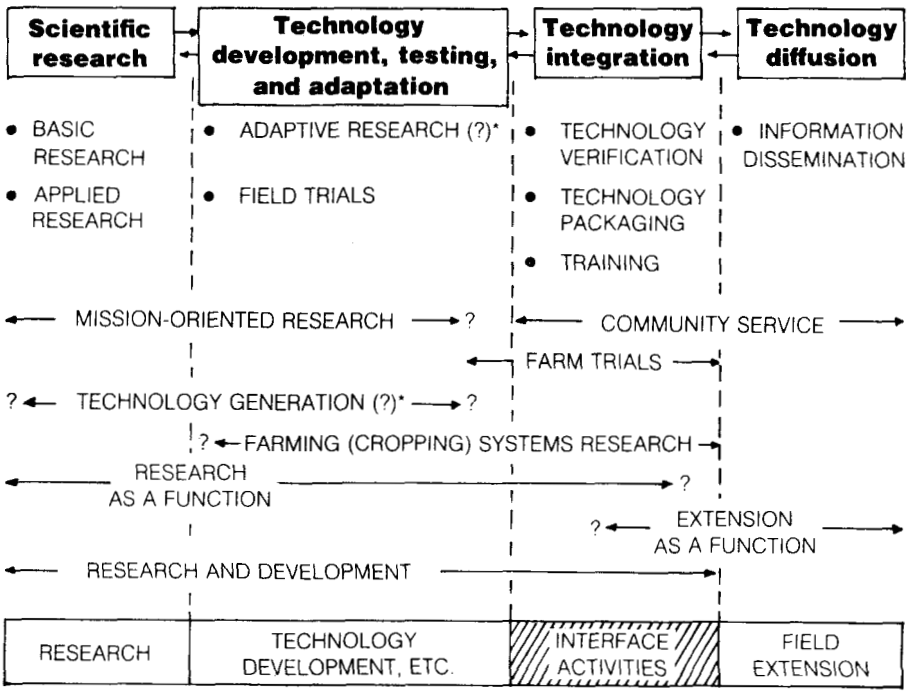
Training in technology development and integration

The research–extension process is a complicated continuum of activities starting with problem identification and scientific research and culminating with the diffusion of useful technologies. McDermott (3) makes a distinction between scientific research and technology development, saying that scientific research is the process of discovering new knowledge by abstracting and

studying single variables, while technology development is the opposite, as it is a process of bringing together bits and pieces of knowledge to produce something.

The research–extension process is a complicated series of activities, and the confusing terminologies that clutter the literature are presented in Figure 1. In this graphical presentation, it appears that technology development and technology integration (consisting of technology verification, technology packaging, and training of personnel) are areas needing closer attention. Technology integration is the gray area where research and extension functions must overlap.

The manpower requirements for technology development and integration, in general, cannot be met by existing training programs in agricultural universities because of inherent weaknesses. Students are usually trained to undertake scientific research. As a consequence, they are trained to think in terms of single variables. They also develop the habit of thinking on their own. They



*Confusing terminologies that are better not used.

Fig. 1. The research-extension process (adapted from 1).

become individualistic and nonconformist, characteristics that do not lend themselves to cooperation. In contrast, technology development and integration require an interdisciplinary approach and frequent consultation with field extension agents and farmers or end users of technologies. This approach requires proper values or attitudes, which students trained in scientific research do not usually develop.

It is therefore important for agricultural universities to design training programs in technology development and technology integration where the proper orientation, values, and attitudes needed for interdisciplinary work can be inculcated and developed. This should include training in fieldwork involving biologists, physical scientists, and social scientists as well as extension agents and farmers. The possibility of training socially oriented biological and physical scientists and biological and physical science oriented social scientists must also be explored.

Academic freedom vs. directed research

The essence of a university lies in the academic freedom it fosters and protects. To deny professors their academic freedom is to weaken the spirit of intellectual enterprise in the academic community. Yet, it is important for developing countries with limited scientific manpower and physical and financial resources to direct scientific and technological talent and energies toward the solution of real problems and constraints to development. How can we resolve the conflict between academic freedom and relevance of research and development efforts in the university?

Fortunately, the sources of research support in most developing countries, whether national or international, either dictate the priority research thrusts or imply them through their screening process. At the same time, there are some funding agencies that cater to basic research and afford professors the opportunity to undertake research without regard to practical application. This system of research funding is a built-in mechanism to reduce possible conflicts between academic freedom and directed research and development in universities.

Be that as it may, research capabilities in agricultural universities in developing countries must be harnessed properly. A central body like the Indian Council of Agricultural Research or the Philippine Council for Agriculture and Resources Research and Development must establish research priorities and coordinate research efforts to prevent wasteful duplication or misdirection. In this regard, agricultural universities must take the opportunity to provide intellectual leadership in identifying research and development problems and determining national as well as zonal priorities, strategies, and approaches; in assessing the efficiency and effectiveness of a national agricultural research system with the end in view of suggesting improvements; and in

providing training programs to change attitudes or values and to improve research and research management capabilities.

Role in extension

In many Asian countries, agricultural extension is the responsibility of the Ministry of Agriculture rather than of agricultural colleges and universities. In the Philippines, agricultural extension as a function of an agricultural college or university is supportive of that of the Ministry of Agriculture, which is responsible for agricultural action programs in the field. The extension functions of the universities are limited to training of extension agents and farmer leaders, publication of research findings and their dissemination through extension agents or mass media, action research pilot projects in agricultural and rural development to test innovative approaches in extension, and technical backstopping of the line agencies.

Since most agricultural research is done in universities or university-based research centers, the extension responsibilities of the agricultural colleges and universities deserve utmost attention. Unless there is close collaboration between agricultural universities on the one hand and the ministry in charge of agricultural action programs on the other, the national agricultural extension service will be ineffective.

It should be emphasized here that agricultural universities, to be true to their mission as agents of change, must use their energies and resources to explore ways and means of facilitating and making more effective the diffusion of new technology in the villages. They must lead in analyzing constraints to agricultural and rural development, in removing bottlenecks, and in opening up new avenues for government agencies whose primary function is to disseminate information to the farmers.

Low input technologies and local manufacture

Agricultural technologies requiring low production inputs should serve the interests of small farmers, who cannot afford the high costs of seeds, fertilizers, and pesticides. Most fertilizers and pesticides in developing countries are imported and cause a drain of scarce foreign exchange. However, there appears to be a limit to what one can do without fertilizers and pesticides. Even with the use of composts, legume intercrops, and crop varieties that are responsive to fertilizers and resistant to pests and diseases, national agricultural production could be unstable without inorganic fertilizers and pesticides. Agricultural universities have the responsibility to study the extent to which low input technologies can be developed and at the same time to provide intellectual leadership in exploring possibilities of developing small- and medium-scale fertilizer and pesticide industries using indigenous materials.

Raw materials vs. processing

History shows that a predominantly agricultural economy tends to perpetuate itself as a producer of raw materials for domestic consumption and for export. Net earnings of producers of raw materials are usually very meager compared to those of domestic traders and exporters, yet. farming to produce the raw materials and selling at prices dictated by the traders and foreign markets have become a way of life for the small farmers of developing countries.

An important area of concern is obviously the processing of raw materials into high value products, an activity that usually yields high returns on investments. Instead of just supplying raw materials, farmers must learn how to process high-grade consumer products, not only to increase the value of their farm produce but also to reduce problems of storage and shipping of bulky raw materials; utilize by-products of processing for feeds, energy, or other marketable goods; and create more employment opportunities in rural communities.

Regional/national policy issues and guidance

Economic and social development. National action programs of the Ministry of Agriculture and other government agencies are usually production-oriented. In fact, national goals are usually expressed in terms of increases in agricultural production to meet domestic food requirements and export potential. As a consequence, agricultural research centers and extension agents concentrate on increasing farm production per unit area or per unit time, sometimes forgetting that increasing farm production can be harmful to the farmers.

Over the years, the experience of various countries in varying stages of development has shown that neither a rise in GNP nor an advance in agricultural production necessarily leads to a higher standard of living or the increased well-being of a nation. All too often, increased farm production depresses the market price, increases post-harvest handling problems, renders the environment unhealthy, and concentrates wealth in the hands of traders. These consequences only succeed in giving rise to apathy and discontent among the masses, who are constantly beset by the problem of sheer survival.

Agricultural universities, particularly those supported by public funds, must provide the government with the necessary policy studies and guidance for developing markets, establishing price policies, arranging the supply of inputs either by private business or public agencies, and undertaking relevant research and extension projects to ensure that the benefits of development are shared by the majority of the people. The universities must show the way to achieve economic progress under conditions of social justice.

Production vs. population explosion. The twin problems of agricultural production and population growth should be foremost in the agenda of many

developing countries. Growth rates, particularly in Asia, have been outstripping modest gains in agricultural production. In 1934–38 Asia was a net exporter of some 2 million tons of foodgrains, but in 1948–52 it became a net importer of 6 million tons. This net importation increased to 17 million tons in 1960, 34 million tons in 1966, and 47 million tons in 1975 (5).

The Asian Association of Agricultural Colleges and Universities (AAACU) has designated population education as one of the responsibilities of agricultural colleges and universities. Although such education should start at the elementary and secondary school levels, it is the consensus among agricultural universities in Asia to take positive steps along the following lines:

- integration of population concepts in the various curricula of agricultural degree programs to create among students greater awareness of population problems;
- undertaking research on food production, population growth, rural employment and underemployment, rural-urban migration, employment-generating activities, etc; and
- integration of population education in the nonformal training of farmer leaders, rural women, and out-of-school youth and in the training of agricultural extension agents, since they are in frequent contact with the rural people.

In a seminar-workshop jointly sponsored by FAO and AAACU held in Manila in 1979, the participants agreed that each agricultural university must have at least one full-time senior officer whose main job is to strengthen population education in degree, nondegree, and nonformal programs.

Mechanization vs. labor. This is a controversial issue. There is a prevailing sentiment that mechanization is undesirable because it displaces human labor and creates a social problem. On the other hand, the related issue of efficiency vs. equity must be addressed properly. To what extent shall we sacrifice efficiency to accommodate more people on the farm? Agricultural universities, being the fountainhead of knowledge in agricultural development, must study this problem and help the government to make wise policy decisions. For one thing, if mechanization will not only increase efficiency in farm production but also promote local manufacture of needed machinery and spare parts and generate demands for new skills and services, perhaps it should be encouraged. Studies on this type of employment-generating mechanization should be made by agricultural universities.

Agricultural research. Many national leaders and politicians do not fully appreciate the role of agricultural research, which is probably the reason why support for agricultural research in many developing countries is usually less than 1% of the national budget. It is therefore important that agricultural colleges and universities undertake studies of returns to investments in agricultural research that can serve as a basis for convincing legislators and national leaders to appropriate more funds for research,

Linkage of services. In developing countries, where most of the farmers are small, possess low levels of education, and are handicapped by scarce resources, all the agricultural services must function as a unified whole if rapid agricultural development is to be expected. Development of the countryside requires the interplay of various inputs and services in proper proportions and sequence. While there are many institutions and services involved in agricultural development work, the roles of a strong agricultural university, an equally strong Ministry of Agriculture, and the government marketing agency are of paramount importance. The university, as the manpower training and research center; the Ministry, as the government agency in charge of implementing national production programs in agriculture; and whatever agency is in charge of setting prices and purchasing farm products must all have strong and enduring linkages and working relationship based on mutual respect and appreciation of each other's role.

In this regard, agricultural colleges and universities must take the lead in studying how the linkages with the Ministry of Agriculture and other agencies can be institutionalized and possibly internalized. Studies on this matter should serve as bases for policy decisions to create an effective infrastructure and network of services supporting agricultural and rural development.

REFERENCES CITED

1. Bernardo, F.A. 1984. Problems arising from the dichotomy of research and extension. AAACU seminar-workshop paper. Jakarta, Indonesia.
2. Desai, D.K. 1973. Planning a progressive agricultural infrastructure: the future of agriculture. Alden Press. Oxford. England.
3. McDermott, K. 1976. Strengthening the linkage between research and extension. AAACU publication.
4. Mosher, A.T. 1971. To create a modern agriculture. Agricultural Development Council, New York.
5. Wortman, S., and R.W. Cummings, Jr. 1978. To feed this world: the challenge and the strategy. John Hopkins university Press, Baltimore and London.

The International Agricultural Research Centers and Agricultural Education in Developing Countries

A. H. Bunting

The number of people from developing countries trained in the IARCs is modest, but their impact is large because of the special qualities of IARC training and the responsible positions they have come to hold. Training by the Centers is intended to help to increase the output of food, but it also has seperate, global goals that may not be sufficiently concerned with the general development needs of individual nations. The different Centers cooperating with one country could help significantly to advance national capability by working collectively with national authorities and donors to assess manpower needs, resources, and priorities, and with the universities to strengthen national professional training, as wel1 as research, for agricultural and rural progress. To do this, they would have to extend their present largely separate interests in applied science towards a collective concern with national development.

Since the International Rice Research Institute began to provide training in 1962, more than 17,000 people have been trained at the International Agricultural Research Centers (IARCs). Table 1 shows the total numbers of participants in different categories trained by each of the Centers up to 1983. While the total is small compared with the number of people trained in national and other institutions, often with the help of multilateral and bilateral donors, during the same period, many of those who have acquired part of their training and experience at the Centers are now national and international leaders who have made highly significant contributions to progressive change in agriculture and in the rural areas and to agricultural education and training in the developing countries.

Former participants in training at the Centers constitute the most important channels of continuing communication between the Centers and the nations that they were established to serve. Consequently, the IARCs have come to accept that they are both research and training institutions. Moreover, all the

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Table 1. Participants in training/technical skill development programs of the International Agricultural Research Centers.

Center (period)	Total persons	Duration		Type		
		Longer than 9 months[a]	Less than 9 months	Postdoctoral	Degree-related	Individual programs and courses
CIAT 1969-1963	2,459	483	1,976	46	179	2,234
CIMMYT 1966-1983	2,913	429	2,484	88	198	2,627
CIP 1978-1983	587	249	338	[b]	101	486
IBPGR 1979-1983	898	182	716	–	182	716
ICARDA 1975-1983	362	93	269	21	18	323
ICRISAT 1974-1983	825	187	638	69	118	638
IFPRI 1975-1983	80	80	–	–	–	80
IITA 1972-1983	2,872	347	2,525	85	262	2,525
ILCA 1975-1983	340	45	295	9	36	295
ILRAD 1978-1983	432	63	369	30	33	369
IRRI 1962-1983	3,451	854	2,597	217	637	2,597
ISNARC	–	–	–	–	–	–
WARDA 1973-1983	1,128	47	1,081	–	47	1,081
Total[c]	16,347	3,059	13,288	565	1,811	13,971

[a]Includes all degree-related and postdoctoral programs.
[b]No data on hand.
[c]Conferences, seminars, and workshops only.

Centers in developing countries were established near universities in which agricultural science is important, and productive relationships exist and are continuing to evolve between these sister institutions. All of the Centers have in addition developed relationships with other universities and with other training and educational institutions in their host countries and elsewhere in both developing and developed countries. As a result, the Centers are closely

and continuously associated both with the national Agricultural knowledge systems of many developing countries and with the world community of agricultural knowledge.

The budgeted cost of the organization by the Centers of training and conferences, taken together, was $13.5 million in 1984, about 8% of the total of their core budgets. This sum does not include those costs of training that were met from special projects, nor the unknown costs of the staff time and physical resources used by the research programs and centrally-budgeted services of the Centers to support training and conferences. The value of the total resources devoted to training alone is not known, because it is not feasible to cost the components separately, but for 1984 it could well have been $25 million, and possibly considerably more.

Bacause training activities are therefore both strategically and financially important at the Centers, the Technical Advisory Committee of CGIAR (which assembles the funding for the IARCs) decided in 1983 to undertake a study of training. The study has included a series of visits to all 13 of the Centers and to 18 developing countries, meetings with more than 600 present and former training participants, and more detailed case studies of 6 countries by distinguished national scientists. This paper is based on the interim and incomplete results.

TRAINING AT THE CENTERS

This section briefly reviews the types of training offered at the IARCs, their objectives, advantages, and modes of interaction.

Types of training

We have found it convenient to classify the training offered at the Centers broadly as follows:

Longer-term training. Longer-term means 9 months or more at or in close association with a Center. This includes postdoctoral training, training related to higher degrees (usually MS or PhD), and longer-term sabbatical attachments for research workers and university teachers. The degree-related work brings the IARCs (which are not degree-granting institutions) into close relation with universities in their host countries and elsewhere.

Shorter-term individual or group courses. These are either given at a Center or in a Center's program elsewhere and are mostly less than 9 months and sometimes as short as 1 week. There are two broadly different types:

- short-term attachments for specific investigations or to acquire specific techniques and skills, and
- research-related training in production or crop improvement procedures in which the participants produce or help to breed a commodity

themselves. In so doing, they learn not only the procedures but also the rationale and techniques of the relevant methods of investigation, usually including studies of existing production systems.

The two types may be combined, for example where an initial period of production training leads to a period of individual attachment to some more specialized activity.

Shorter-term training. Various kinds of short-duration training occur away from the Centers, often in cooperation with regional or national institutions, with varying degrees of participation by staff of the Centers. This is usually called "in-country" training, and in the case of CIMMYT it often uses the "call" system.

Other activities. A number of very important activities associated with training, such as workshops, conferences, and seminars, take place at the Centers or elsewhere. Also included are library, abstract, information, and documentation services, as well as publications of many kinds including training manuals, newsletters, bulletins, and annual reports. We have not studied these activities in detail, nor are they considered in this paper.

Advantages of training at Centers

The IARCs have some clear advantages over other types of training institutions. Ten of the Centers work in developing country environments on topics important to developing countries. They are well equipped and well staffed, and their funding, if not abundant, is adequate. They are also assured of at least a degree of continuity—none is intended to be a project of limited life. Their programs are innovative and in general meticulously executed and efficiently reported. They are multidisciplinary and increasingly interdisciplinary; they include significant work in relevant branches of the human sciences; and they are advancing rapidly (even if separately) in their understanding of the existing systems of rural life and production in developing countries. They are also largely free of the external pressures—political, bureaucratic, and financial—which afflict so many otherwise comparable institutions in developing countries.

Virtually all training at the IARCs is practical and based on research. Research workers, including many of the most senior ones, give part of their time to training, usually with marked enthusiasm. Training supports research and adds to the intellectual and practical equipment of research workers and other professional workers in agricultural science. It is usually related to cooperation with a national program, and so it helps to make the Center more aware of national needs and problems and of its potential contributions to development in the nation.

Above all, the IAKCs attempt to maintain continuing contact with their participants, often for many years. This can have a profound effect by

enabling former trainees to feel that they are part of a worldwide profession and that they can seek help and advice from friends in a prestigious international institution. These contacts are not always as good as many of us would like. They also entail some dangers (for example, where advice from a Center to a former participant does not coincide with purposes or practice in his or her national system); but there is no doubt about their value, in general, to the participants, to the Centers, and to the nations.

Diversity and dispersion in Centers and nations

The IARCs and the nations with which they cooperate are extremely diverse, differing in virtually every respect. General statements about what "the Centers" should or should not do, or about what " the developing countries" need are not likely to be useful. Furthermore, the Centers act individually to attain their goals, defined in terms of particular commodities or of production systems for particular environments. Each Center cooperates with a large number of nations, and most nations cooperate with several Centers. In the 18 countries we visited, the smallest number of cooperating Centers was 4, the largest 10, and the median about 7. But in each nation the Centers usually work separately, even when they are side by side at the same station or involved in the same subject area, which has led to not a little confusion. Though some signs of change are apparent, cooperation among the Centers has been concerned mainly with demarcating boundaries and spheres of responsibility or influence.

Where cooperation is really needed—to support the development programs of the nations—the Centers operate as a system only where the national authorities are strong and determined enough to induce them to do so. Here we encounter another weakness of the CGIAR institutions: The Centers are primarily *scientific* in orientation, with relatively little corporate knowledge or experience in *development* in individual nations.

SOME WORKING CONCEPTS

We have consequently attempted, throughout our work, to understand the relationships between training and development. For this purpose, we have formed the following working concepts.

Knowledge and knowledge systems

Knowledge we take to include information, concepts, techniques, and skills that are maintained, increased, disseminated, and used in knowledge systems.

The agricultural knowledge system has five major components:

- The existing stock of knowledge in the minds and memories of men and women, particularly the producers; in books and periodicals; in libraries, archives, filing cabinets, and notebooks; and in maps and other factual records of many kinds.
- The means of increasing knowledge—experience, surveys, other means of collecting information, and, above all, experimental research—obtaining and analyzing new information, applying concepts to organize it, and using it to improve techniques and skills.
- The means of testing and developing knowledge (including techniques and skills) to suit it for practical use in new methods and processes. 'This is the "development" part of "research and development. "
- The dissemination of knowledge, including skills and methods, to people who need it in order to work more effectively in any part of the knowledge system. This component includes education and training of actors of all sorts, including the producers themselves. It also includes publications, information and abstracting services, conferences, workshops and seminars, and spoken or written communications among individuals.
- The practical application of new and improved methods to achieve desired objectives.

In many nations, the knowledge system is fragmented between the public and the private sectors, and further fragmented within each of them. In an extreme but I hope imaginary case, agricultural research might be carried out by one or more autonomous parastatals plus the research organizations of the seed, fertilizer, crop protection, and export commodity industries; the university might be the concern of the Treasury while other branches of agricultural education are scattered among the Ministries of Education, Agriculture, Animal Health and Production, and Cooperatives and Rural Development, or delegated to state or provincial authorities; and agricultural extension might be attached to the Office of the Prime Minister. Moreover, the producers, who are expected to use the products of the knowledge system to raise larger crops of cheaper products, are all too often seen as targets who are expected to receive gratefully and apply the products of the research component, delivered to them by extension, rather than as essential contributing and executing partners in the system.

Knowledge systems and development

Development itself is nothing new; we were all underdeveloped once. Development has been driven by the desires of people for better lives, for wealth, for power, and no doubt for much more. In the process the resources available, plus any others which became available at acceptable cost, have

become more productive of required goods and services. Development has frequently been inequitable, usually turbulent, often violent, and seldom pleasant. It involves both social and technical change, the latter implying new applications of knowledge and knowledge systems.

Knowledge, including research, is often a necessary condition for development in agriculture and in the rural areas but it is seldom or possibly never a sufficient condition. If family, household, or community needs or effective demands off the farm or outside the community for surplus products are too small; if the output delivery systems (including transport, markets, stores, processing plants, wholesaling, retailing, exports, financial support, and fiscal regulation) are defective; if the essential resources for production are too scarce, too costly, or too unreliable; and if the policies of governments are inappropriate and their practices ineffective or even adverse, then rural people may be unable or unwilling to use the new and potentially more productive methods generated by the knowledge system. The conventional elements of the knowledge system-research, training, and extension—have never been able to induce rural people to do things for long that are not to their advantage (of which they, and not the development managers, research workers, educators, and extentionists, are the final judges).

Conversely, where these conditions are sufficiently satisfied, weaknesses in the knowledge system may indeed become the main constraints on development. But we must beware of claiming too much. Sometimes development has proceeded under the stimulus of economic or social opportunity using methods already known. Thus, thousands of hectares of chewing cane and a considerable output of fresh vegetables sprang up in a few months alongside the newly completed all-weather road between Kano and Zaria in Northern Nigeria. But even more significant is the historical fact that African rural people, without benefit of research, education, or extension, incorporated the many New World crops which were brought to Africa after 1492 (including maize, cassava, groundnut, sweet potato, "Irish" potato, beans, tetraploid cotton, tobacco, and cacao) into indigenous systems, including mixed and sequential cropping. We should not underestimate the innovative potential of "traditional" producers; and I believe that some agricultural researchers and teachers make active use of it.

ASSESSMENT OF TRAINING BY THE CENTERS

We have considered training in relation to five groups of actors: the participants, on whom training has its first effects; the nations, on whose progress the participants must have positive effects if the training is to be regarded as successful; the Centers, which provide the training experiences and are closely interested in the outcome; the donors, which fund the work of the Centers and also cooperate with the nations through bilateral arrangements; and the Con-

sultative Group, which is responsible for the system as a whole and so for its collective service to the developing countries. I propose here to concentrate on the participants, the nations, the donors, and the Consultative Group, but the Centers and their work will always be at the hub of the discussion.

The participants

Most training participants nowadays, including those in production or improvement courses, are qualified professionals by the standards of their nations, many having master's or doctoral degrees.

Difficulties encountered. At the start, many participants encounter difficulties. They often travel a long way to a foreign country, a strange culture, and a large and prestigious multidisciplinary institution. They are separated from their families and friends. There are some difficulties about the length of courses (those who say they are too long are rather fewer than those who say they are too short) and about the wide spread of professional levels among the participants in some courses. But most participants overcome or become reconciled to these difficulties well enough.

The biggest single impediment appears to be language. The CGIAR system is largely Anglophone, and English is increasingly the principal language of agricultural science around the world. It seems sensible for the Centers to help all participants who wish to do so to master enough of the English language to read it and to use it in professional as well as social conversation. But at the same time, and for a considerable time to come, those who teach and work at the Centers, and particularly the Anglophones, must be encouraged and helped to learn at least one other appropriate and widely used language, perhaps Spanish, French, Arabic, or Portuguese. In colonial times, some of us were induced to do this by the simple but effective expedient of denying us all salary increments after the first until we had passed the spoken examination in the local language.

Formal classroom or tutorial teaching of language is usually costly, slow, or both. For many people it seems that one of the most efficient ways of learning a language nowadays is by the use of double-track instructional tapes with appropriate texts. But one ingredient does not yet exist—a series of instructional tapes and texts in professional language. This is a task in which the IARCs and appropriate university faculties and language institutes could usefully cooperate. We believe that in the main languages, particularly in English, there would be sufficient demand to pay tor at least a significant part of the cost of production. At least the ways and means of doing this should be explored urgently.

Effects of training. We were impressed by the former participants we met; and this was reinforced in every nation we visited by the testimony of

senior scientists and administrators. Many of the participants told us that the experience had changed them, not only by giving them new knowledge and skills, but by altering their attitudes to both intellectual and physical work and by increasing their motivation, their determination, their capacity to innovate, and their confidence. Of course, many people who have not worked at IARCs have these attributes; the Centers have no monopoly, but they seem to be able to have an effect on relatively large numbers in a surprisingly short time. I have already reviewed some of the features of the Centers which seem to me to explain this phenomenon. In addition, there appear to be several more personal reasons. One most commonly quoted was that, whereas earlier training had been theoretical ("the study of agricultural science as a branch of literature'' was George Axinn's phrase), at the Center the knowledge become practical, particularly in improvement or production courses. As a Cameroonian colleague once said to me, it is the difference between *savoir* (which may be good enough for a developed country) and *savoir faire* (which, he implied, was what Cameroon really needed).

There are many other reasons: travel itself; life and work in a different environment or in a similar environment in which things are done differently and perhaps more successfully (as when a participant goes from semi-arid Africa to Syria or India); association with people of many nations and many disciplines to achieve common purposes; sharing with prestigious senior colleagues the austere pleasures and pride of long hours of hard but skilled work in the field; working with good equipment, facilities, and libraries; helping to produce, in a relevant environment, relevant experimental results that really work; meeting and working with real-life producers of crops and livestock; and, as I have already remarked, the continuing personal link that helps the lone research worker to feel part of a larger world.

Of course many of these personal effects are produced in many people who have been trained under able masters in other advanced institutions in both developing and developed countries. But it seems evident that the IARCs are providing something that, if not unique, is at the present time both rare and required in the developing nations.

The nations

The nations from which trainees come have different perceptions of training at IARCs, with implications for the Centers' relations with national knowledge systems.

National perceptions of training. Whatever less positive attitudes may have existed in some cases in the past, the nations seemed not only to be pleased with the training their nationals have received but also to want more. That the training is provided free is, in my view, less important for them than the

quality and even the uniqueness of what is provided. To send a staff member away for training costs a nation something anyway, in other opportunities foregone and perhaps in the cost of a temporary replacement. Indeed, some nations do pay for some of the training they require.

The nations value training at the IARCs not only for its effects on the trainees but also for the continuing link it can provide, through the participants, with the research of the Centers and with the international advances in agricultural science to which they contribute. For many sorts of project work for higher degrees, they see the IARCs as more suitable locations than the institutions in developed countries from which they have received so much in the past.

Some nations have used training at the Centers to strengthen the links among the different parts of their national agricultural knowledge system. When Indonesia began to cooperate with IRRI, she sent research workers, extension leaders, and managers of agricultural and rural development projects together to production courses there. Previously they had known little about each other. Salman Padmanagara told us that "they came back hand in hand"—a phrase that has rung in my mind ever since. The improved understanding that this shared experience engendered soon bore fruit in "in-country" training and thus aided the substantial advances that have made Indonesia self-sufficient in rice and have ensured, we were told, that no one goes hungry in the country today. 'This sort of history can be repeated for several other nations in Asia and Latin America.

Almost all the senior people to whom we spoke told us that the Centers should be doing more training at one level or another. Some wanted more production and improvement courses, though we believe that for any one country this is a phase. The Philippines and Indonesia send few people to IRRI nowadays for such courses; they can do most of what they need at that level themselves. But IRRI's new cooperation with Bhutan will surely include courses of those sorts.

Others wanted more higher degree training and were concerned that financial stringencies at the Centers were decreasing the opportunities for it. Not all these requests were equally impressive. Of course, any research service or academic institution must have its due proportion of fully qualified research workers; but some countries have more qualified people than they can afford to employ, and at least one employs so many that there is not enough budget left to enable them to do their work, implying weakness in national manpower planning and budgeting.

For lack of planning and an articulated national approach to Centers and donors (and this is far from easy), some nations have become accustomed to accepting all offers, and then handling the outcome as best they can to meet needs as they arise. This distresses some Directors-General, who feel that if a person who has been trained in maize ends up working on coffee they have

lost him or her and wasted their money in the process. Moreover, we found to our regret that the authorities in some countries do not know enough about the IARCs to make appropriate choices among the offers. Some national officials appeared to expect the Centers to meet all their national knowledge-related needs, including the training of extension workers. This is high praise of the Centers, but it may also reflect weaknesses in the nation, including incomplete contacts among the different components of a fragmented national knowledge system. Perhaps it also reflects a habit of dependency and underestimates the central need to build up the national agricultural knowledge system to make it as self-sufficient as possible so that it can cooperate with the Centers and other external agencies, not from weakness, but from strength. Further, it may imply that some people see the Centers as bilateral assistance agencies, which is not their function—except perhaps indirectly when they provide training and other services under contract to a multilateral or bilateral aid donor, an important role to which we shall return.

I think, moreover, that the IARCs may already have reached the limits of what they can do, particularly in respect to higher degree training, unless more staff and facilities can be provided. There are limits on funding, on residential capacity, and on logistic and personal support for participants. There are also limits on staff time and teaching capacity, particularly during that most demanding part of any higher degree course when the candidate is analyzing results and preparing his or her thesis. It is at this time that the most concentrated and rewarding part of the teaching must take place—when one presses the candidate to think rigorously and critically; to draw valid conclusions and express them in clear, unequivocal, and economical language; and to specify the directions and methods for further inquiry or for application. These are tasks for the research supervisor, who may not always have the teaching experience necessary for them, since he or she has been selected and appointed as a research worker, not as a quasi-university teacher. These tasks cannot normally be assigned to the training staff, and they should not be passed off to the academic supervisor in the university unless he or she has been closely associated with the research itself.

But there is the larger question: whether the Centers should expand their own work in training rather than work with the national knowledge systems to develop their own dissemination and training capabilities. It seems to me that, just as in the case of improvement and production courses, the next step must be to advance "in-country" training for higher degrees as well. We must consider now what part the IARCs, along with other agencies, could play in such a development.

Centers and national knowledge systems. The universities of a nation are intended to constitute the apex of the knowledge-disseminating (educational) system as well as a significant part of the knowledge-increasing (research) system. It is therefore proper that the IARCs, in addition to cooperating with

national agencies for agricultural research, should also cooperate with agricultural faculties and universities. They do this, not merely to make their degree-related training possible, but because the agricultural faculties and universities bear the main task of ensuring the flow of graduates of suitable quality to maintain and advance the national agricultural knowledge system, through which alone the Centers can hope to achieve the purposes for which they were established. IRRI has established an Academic Council, which among other things has the task of overseeing the relations between IRRI and the substantial number of universities with which it cooperates in the Philippines and in many other countries. This was a wise step for IRRI and for its service obligation to the many rice-growing countries of the world, but it raises many questions. Most, if not all, of these universities have relations with other Centers. Are there then to be as many Academic Councils as there are Centers? Or should there be one vast Academic Council for them all?

Or should we also look at the matter from the point of view of the individual nations? The nations, and not the regions, are the units within which development actually takes place. By what means are the eight Centers which work in Indonesia to organize their relations with the Institut Pertanian Bogor (IPB)? Would it be useful first to articulate the activities of the eight Centers in Indonesia so that the total of their contributions is more than the sum of its parts and strengthens the national knowledge system as a whole, including the IPB and the other universities, and not merely the individual commodity components separately? Ought not the CGIAR system to work increasingly as a system in each nation? In this way, the Centers could become members of a development-supporting collective, rather than being the separate units, promoting research in particular fields, that they are now.

Indeed, an advance of this kind might help to lessen the financial constraints (amounting to a relatively few millions of US dollars a year) that the CGIAR donors have imposed on the Centers in recent years. In those same years, money for agricultural and rural development has not in fact been in short supply; billions of US dollars have been allocated by members of CGIAR for the purpose. Perhaps if the Centers were seen to be collectively articulated to support development in the nations, rather than working separately to advance applied science in terms of their mandates, attitudes might be changed.

If cooperation of this sort could be achieved at the national level, the IARCs might well be invited to cooperate collectively with the agricultural universities and the national agricultural development agencies of the nations to review and develop curricula and standards. Indeed, we were asked in one country whether one of the Centers could not do just this. particularly for first degrees. The first reason for this question was the fear that the standards of the universities of that country were not keeping pace with advancing international standards in research and in the other sectors of the global agricultural knowledge system, which are in part being set by the work of the Centers. It

may also have been prompted by the remarkable assistance that the University of Ibadan and IITA have combined to give to the Republic of Benin by producing a considerable number of diploma students who now form the foundation staff of the Faculty of Agriculture at the University of Benin. All these students carried out their practical project work for Ibadan diplomas at IITA.

I believe that all this would be a substantial addition to the accepted tasks of the Centers. How to do it will require very careful study. But I suggest that it is essential to try.

As this work proceeded, the nations would become increasingly self-sufficient in education and training for agricultural and rural development. Moreover, they would increasingly be able to assist not only the Centers but each other by providing "in-country" bases for international courses (as some do already) in which the Centers could cooperate if necessary. For if we think forward to the tasks of the coming two generations, as agriculture is advanced in nation after nation, as it will have to be, until each is able to produce as much food, fuel, fiber, and other biological products as is economically and socially sensible, no conceivable expansion of the activities of the IARCs could enable them to cope unaided with the tasks.

The donors and the Consultative Group

Bilateral and multilateral donors continue to provide far more support than the Centers for professional and technical training of nationals of developing countries in matters related to agricultural and rural development. Most of these donors are members of the Consultative Group and support one or more of the Centers. Should they not make fuller use of their investment by using the Centers for the training (including higher degree training) that is included in their support for particular nations?. Should the nations not insist, for example, that the University of A, which is using overseas aid funds to help develop the Agricultural University of Developing Country B, engage the cooperation of the five IARCs already working in that hypothetical country—particularly when the donor concerned is also a major shareholder in the CGIAR system?

With all its imperfections, the CGIAR system now plays a leading role, alongside the advancing national institutions, in generating and disseminating new knowledge, skills, and processes to support the considerable changes that will be needed in Africa, in China, in the nations of the Indian subcontinent, and in Southeast Asia. The sponsors and donors who assist these changes could use the mechanisms of the Consultative Group to consider how best the CGIAR system could evolve to strengthen their cooperative efforts with the nations.

As I see it, a significant part of the action will lie in the growing cooperation between the IARCs and the universities and other leading components of the

agricultural knowledge systems of the nations. This cooperation will no doubt be buttressed by the International Federation of Agricultural Research Institutions for Development and by those sections of FAO which are concerned with research-related training. But the heart of the action, where the greater part of the work of training and research must actually be done, will lie in the nations. The Centers, with the help of the Consultative Group and its members, will stand close behind. Perhaps their greatest achievements will be recorded on the day when they have done their work so well that they are no longer needed.

Agricultural Training at IRRI

M. D. Pathak

IRRI offers research training at the postdoctoral, MS, and PhD levels and in short-term nondegree courses, and apprentice-type training primarily in short-term training courses. Special courses for senior officials of government ministries and funding agencies are also offered. Priority is given to candidates from developing countries who are working on rice-based cropping system. Since 1962, 3,700 scholars and fellows from 71 countries have participated in IRRI research and training programs. A 1980–81 survey of alumni showed that 90% were employed in research institutions and universities, with 56% being directly engaged in research. Most alumni reported their training was relevant, but that they were hampered by inadequate facilities and funds.

The objective of IRRI's training and professional advancement programs is to provide relevant training to national scientists and production specialists in order to strengthen rice and rice farming systems research and crop production programs. Training at IRRI covers a broad range of topics and can be categorized as research-oriented programs, instruction-oriented programs, and special orientation programs (Table 1).

RESEARCH-ORIENTED PROGRAMS

The research-oriented training programs comprise postdoctoral fellowships, MS and PhD degree programs, and special nondegree research programs.

Postdoctoral fellowships

Postdoctoral fellowships are generally full-time research programs that allow scientists from national rice programs and rice-based farming systems programs in developing countries to explore their research interests at IRRI. Fellows improve their research competence and at the same time contribute to the work of IRRI. A few scientists from developed countries who have special scientific skills may also be accepted as postdoctoral fellows to supplement the

Director, Research and Training, IRRI.

Table 1. Training Programs at IRRI, **1962-1984.**

Training programs	Total participants
Research-oriented programs	
Postdoctoral fellowships	241
Degree programs (MS and PhD)	679
Nondegree programs	511
Instruction-oriented programs	
Agricultural engineering	261
Agroeconomics	42
Cropping systems	470
Genetic evaluation and utilization	348
Integrated pest management	93
Irrigation water management	162
Soil fertility and fertilizer evaluation	133
Rice production (5 months)	601
Upland rice	46
Special courses (Farm management, cropping systems research methodology, statistics, research methodology, etc.)	113
Total	3700

expertise available at IRRI, but they are expected to find their own support, as funds available to IRRI are intended for scientists from developing countries.

There are three categories of postdoctoral fellows:

- *Postdoctoral Fellow 1:* Persons with up to 5 years of postdoctoral experience.
- *Postdoctoral Fellow 2:* Persons with 5–9 years of postdoctoral experience.
- *Senior Research Fellow:* Persons with at least 10 years of postdoctoral experience.

The Senior Research Fellows are considered equivalent to Visiting Scientists, except that the latter are generally professors from developed countries who come to IRRI on sabbatical leave to work on problems of mutual interest. Senior Research Fellows are provided accommodation, research support, a monthly stipend, and living allowances for the duration of their stay at IRRI. IRRI gives Visiting Scientists accommodations, research and logistical support, but no salary.

Senior scientists from countries that do not have the academic equivalent of the PhD degree are called Special Research Fellows and receive the same benefits given to Postdoctoral and Senior Research Fellows. Similarly, young scientists from organizations in the developed countries with which IRRI has collaborative research projects are called Collaborative Research Fellows. Their salaries are paid directly by the collaborating institutions, and they make their own arrangements for housing. Senior scientists from those organizations are called Visiting Scientists.

Degree programs

Degree training programs were initiated in 1962 when the first batch of scholars arrived at IRRI. In this program, students take their course work at a university but they conduct their thesis research at IRRI under the guidance of IRRI scientists. In the early years, the course work was done primarily at the University of the Philippines at Los Baños. Arrangements have since been made for students requiring a broader selection of courses to study at universities throughout the world. From 1963 to 1984, scholars in IRRI's cooperative degree programs received 372 masters degrees with 187 doctoral degrees. The degrees were awarded by 65 universities, 17 of them in developing countries (Table 2).

Table 2. Number of graduates under IRRI's cooperative program with various universities, 1963–1984.

Region/University	Country	MS	PhD	Total
Asia				
UP Los Baños	Philippines	306	67	373
UP Diliman	Philippines	8	3	11
Asian Institute of Technology	Thailand	10	-	10
Indian Agricultural Research Institute	India	1	8	9
Postgraduate Insititure of Agriculture	Sri Lanka	5	1	6
Thammasat Univ.	Thailand	3	-	3
Others[a]		6	11	17
North & Central America & Europe				
Cornell Univ.	United States	3	17	20
Univ. of California at Davis	United States	2	6	8
Univ. of Hawaii	United States	5	2	7
Purdue Univ.	United States	3	3	6
Louisiania State Univ.	United States	1	4	5
Oregon State Univ.	United States	1	4	5
Michigan State Univ.	United States	-	4	4
Stanford Univ.	United States	-	3	3
Wageningen Agricultural Univ.	The Netherlands	1	3	4
Others[b]		17	51	68
Total		372[c]	187[c]	559[c]

[a] India – 4 universities; Japan – 3; Korea – 1; Malaysia – 1, Philippines – 4

[b] Cuba – 1 university: Canada – 2; U.S.A – 23; Germany – 3; United Kingdom – 4; France – 1; Australia – 3.

[c] Including one or two students who have graduated in cooperative programs with each of he 13 univercities in Asia and 35 universities in Australia, North and Central America, and Europe.

These cooperative arrangements have several advantages. They encourage collaboration between IRRI and universities; they are less expensive and enable IRRI to accept almost double the number of students that could be handled if they came to IRRI for both course work and thesis research; and, for the scholars enrolled at universities in their home countries, there is less difficulty in adjusting to student life, especially for those who have already been employed for several years.

In addition, students from certain universities in Japan, West Germany, Belgium, and the Netherlands with which IRRI has agreements for collaborative research come to IRRI to work on collaborative projects. They use their research findings to fulfill the degree requirements at their universities.

Nondegree programs

Scientists associated with national organizations who are interested in coming to IRRI to do experimental work or to learn new techniques, without pursuing a degree, are accepted as full-time Research Fellows, usually for 6 months to 1 year. The duration of such a fellowship should be long enough to enable the Research Fellow to conduct at least one experiment, analyze the data, and write a scientific report under the supervision of an IRRI scientist.

INSTRUCTION-ORIENTED PROGRAMS

Instruction-oriented programs are scheduled courses, special training courses, and courses offered abroad.

Scheduled courses

Short-term courses are highly oriented to research methodology and production. Participants spend about half of their time in classrooms learning the basic aspects of the problem and the other half m the field or laboratory. They plan and conduct experiments with minimum supervision from instructors. Such programs emphasize the integration of formal and nonformal methods of curricula organization, giving equal importance to learning through classroom lectures and learning through work experience.

Agricultural engineering training course. This 3-week course, offered to cooperators in IRRI's farm machinery program, includes all aspects of design, manufacture, and field evaluation of IRRI-designed machines. It consists of classroom lectures, practical shop work such as the assembly of IRRI farm machines, and field work to develop competence in the operation and maintenance of appropriate machines.

Agroeconomic research methodology training course. This is a 2-month course in

which participants learn to handle the economic component of multidisciplinary research in rice and rice-based cropping systems. The role of economists working with biological scientists in the development of technology is emphasized. In the first 2 weeks the participants attend a rice production course; in the following 6 weeks there are lectures, discussions, and field and classroom exercises on the methodology and procedures of economic research.

Cropping systems training program. In this 5-month course participants are trained to design and conduct applied and adaptive research for rice-based cropping systems in their own regions, identify and solve production constraints in various crops and cropping systems, and apply important crop science concepts to improve the use of farmers' resources. They study site description and selection, design of cropping systems, testing of cropping patterns, appropriate techniques for crop production and protection, and profitability analysis of introduced cropping patterns. Every scholar participates in the design and operation of two rice-based cropping systems trials.

Genetic evaluation and utilization. This 4-month training program is built around IRRI's genetic evaluation and utilization (GEU) program. The participants study the various types of rice culture and the GEU pest and agroecologic problem areas. They learn techniques of screening for varietal resistance or tolerance, as well as hybridization methods and evaluation of progenies. They are encouraged to produce F_1 seed using the most promising varieties from their countries, and to take the seed, along with other selected breeding materials, back home for evaluation and use. Thus, the scholars become important agents in accelerating the pace of plant breeding work in their countries. They work under the direction of a GEU scientist and present a seminar on their accomplishments at IRRI and on problems and progress in their varietal improvement programs at home.

Integrated pest management training course. In a 3½-month course, plant protection staff are trained to design and implement integrated pest management programs that reduce crop damage, maximize profits, and protect the environment. The course covers basic rice production; principles, economics, and ecology of rice pest management, identification, biology, and integrated control of rice pests; monitoring techniques and economic thresholds to be used in decision-making and development; and implementation of pest management programs. It emphasizes practical field training.

Irrigation water management training course. This 6-week course emphasizes means of improving the performance of irrigation systems through better understanding of irrigation water management and related soil, agronomic, socioeconomic, and communication factors. A 10-day field exercise in a Philippine irrigation project provides first-hand experience in the application of improved management concepts.

INSFFER training. This is a 4-month course that complements the applied aspect of the International Network on Soil Fertility and Fertilizer Evaluation

in Rice — a collaborative project among national programs, IRRI, and the International Fertilizer Development Center. The objective of the course is to strengthen the scholars' capabilities in theoretical and practical aspects of fertilizer use, biological nitrogen fixation, and experimental techniques. The participants train in soil fertility and fertilizer experiments for rice and in the factors that affect crop responses. They also take an intensive short course on azolla and soil microbiology. Total soil health care and integrated nutrient supply are emphasized.

Rice production training program. Rice production and extension specialists learn applied research techniques and methods of disseminating new rice technology in a 5-month course that covers soil and water management, pest management, and socioeconomic factors; statistical procedures for research analysis; and communication skills — factors that affect rice production. This course has undergone continuous change since its inception in 1966. Participants help design and conduct at least two applied research trials and take part in a field day. They organize a 2-week rice production course to gain practical experience in training others. Former participants have played key roles in the extension of rice production programs throughout the developing world.

A 2-week Rice Production Training Program is a highly condensed version of the 5-month course. It is designed primarily for junior researchers and extension workers. Foreign scientists working in developing countries and a few farmers are also accepted for training, depending on the availability of classroom space and other facilities.

Upland rice training course. This course lasts 4 months and provides training in the principles of rice production under rainfed upland conditions. It deals with the ecology and physiology of dryland rice, understanding and management of problem soils, crop management, soil and water conservation, pest management, and varietal improvement with emphasis on resistance to blast, drought, and problem soils.

Special training courses

Special short courses are offered on an *ad hoc* basis to meet the requests of national programs. Several courses have been held at IRRI or at national research training centers in collaboration with national scientists or to assist the national scientists offering these courses.

A 3-week Farm Managers' Course has been conducted for several years. It deals with the practical aspects of experiment station management — seedbed and land preparation, fertilizer application, planting, weed control, insect and rat control, rice crop production, seed processing and storage, water management, installation of underground irrigation systems, labor distribution and management, care and maintenance of the experimental farm, and record keeping.

A special course covering experimental sampling and analytical techniques involved in Field Research on ^{15}N in Rice has been conducted for five Indonesians in collaboration with the International Fertilizer Development Center.

With the increasing importance of rice-based cropping systems; IRRI offers special courses on Breeding Techniques and Procedures for Developing Improved Varieties of Upland Crops, with emphasis on the grain legumes commonly grown after rice throughout Asia. The participants in these special courses are national scientists who actively collaborate in these studies.

IRRI offers a special course on Pest Control Systems Relevant to Cropping Systems Environments. The course includes field and laboratory training in entomological theory, field practice, and visits to outreach sites in the Philip pines where entomological studies are conducted by IRRI scientists.

Courses on Disease Control in Cropping Systems Environments include lectures on theories of disease control, field practice, and a visit to Philippine sites where disease control studies are conducted.

In response to requests from national organizations, IRRI occasionally accepts one or two staff members for on-the-job training in Library and Documentation work for a 1-month period. Because of staff constraints, however, only a limited number of candidates can be accepted.

IRRI is often asked to offer special courses on Statistical Analysis of Research Data. Because the Statistics Department is fully occupied throughout the year, only a limited number of candidates can be accommodated. Courses last up to 3 months.

Courses offered abroad

Sometimes, in collaboration with national rice research programs, IRRI offers short courses at other locations in order to help national organizations start their own training programs. These courses usually address certain biological or physical constraints that do not occur in the Philippines, such as deepwater rice, or areas of research, such as hybrid rice, for which national programs have more expertise and facilities than IRRI. Occasionally, IRRI scientists help organize and offer a series of lectures, generally on research methodology, in other countries.

New courses

An Agricultural Communication Training Course will be offered for the first time in 1985. It will provide intensive training in writing, editing, production management, and audiovisual production to information officers of agricultural improvement programs in the Third World to hlep them interpret, simplify, and popularize research findings and to disseminate improved agri-

cultural technology to extension agents and farmers. The course will provide instruction in principles of editing, editing research publications, copy marking and proofreading, graphics and design, typesetting, printing, photography, printing production management, and audiovisuals.

The proposed course on Statistical Procedures and Computer Applications in Agricultural Research will be offered to statisticians of national agricultural research organizations. The 2-month course will cover practical aspects of statistics and computing as related to crop research. Participants will learn new statistical procedures and research techniques and become familiar with the use of microcomputers for the management of agricultural research data. They will take the 2-week rice production course followed by 6 weeks of lectures, group discussions, case studies, and computing exercises.

The first training course on Rice Germplasm Conservation and Management will start in 1985. The 1-year course will include a 3-month expedition to collect germplasm, participation in the 4-month GEU training program at IRRI, concentrated instruction in the academic and operational aspects of genetic conservation, and field laboratory work in characterizing the collected rices. The participants will be awarded a diploma of "Associate of The International Rice Research Institute" in Genetic Resources Conservation and Management.

SPECIAL ORIENTATION PROGRAMS

From time to time, special orientation programs are organized for senior officials of ministries of agriculture and national and international agricultural organizations who are involved in policy making and research management. The typical program is composed of a 1-month study tour of agricultural research and management at IRRI and a few national organizations. Participants spend 1 week at IRRI getting acquainted with recent innovations and facilities in agricultural research and training. They visit some of IRRI's outreach stations and offices and certain stations of the participating Ministry of Agriculture to become acquainted with national food production programs. Visits to other countries to observe national research and training systems can be arranged on request of the organization.

To date, senior officials of the Indonesian Agency for Agricultural Research and Development, the United States Agency for International Development, the Indian Ministry of Agriculture, and the West African Rice Development Association have participated in this program.

ELIGIBILITY AND CONDITIONS

As a general procedure, candidates for training are nominated to IRRI by the national systems that employ them, with the assurance that the candidates will

return to work on rice or rice-based cropping systems. In countries where there are IRRI representatives, liaison scientists, or national coordinators, they interview the candidates to ascertain their eligibility for admission. In countries where IRRI does not have outreach staff, the candidates may be interviewed by visiting IRRI scientists, or the applications may be sent directly to IRRI. All applicants for IRRI's training and educational programs are evaluated by the standing committees of the IRRI Academic Council.

IRRI receives a large number of applications for its training and educational programs every year. In the research-oriented programs, priority in selection is given to:

1. Candidates from research or educational institutions engaged in rice and rice-based farming systems in the developing countries, particularly those that have collaborative research and training programs with IRRI and for which funds are made available by special grants to cover training. IRRI endeavors to locate support for candidates who lack funding.
2. Candidates from other research or educational institutions engaged in rice and rice-based farming systems whose training is sponsored by national or other organizations.
3. Candidates from countries or localities with unfavorable production environments that IRRI believes have received insufficient research attention. IRRI will endeavor to locate funds for their training if special grants are not available.
4. Candidates from developed countries nominated to IRRI under existing agreements that include funds for their research training at IRRI.
5. Candidates from developed countries whose applications are not sponsored by funding agencies, but whose research work would complement the work at IRRI. Such candidates, when accepted, do not receive accommodation or living allowances from IRRI.
6. Candidates who lack affiliation with a national organization but possess expertise of direct interest to IRRI.

In the nondegree training programs, the candidate selection process reflects two guidelines—to help national systems improve expertise in the area of research methpdology and to select candidates who will give IRRI's training endeavors the greatest impact. Acceptability for a nondegree training program is based an:

- the number of openings available for the candidate's country,
- the candidate's eligibility for admission, and
- the importance of the training to the national program that employs the candidate.

To enhance group homogeneity and facilitate communication, IRRI sets minimum requirements for acceptance in short-term training courses: A candidate must be the holder of at least a BS degree in agriculture or a related

subject; 25-45 years of age; a junior researcher, scientist, or professional from a national organization or other agency working on rice or rice-based cropping systems; proficient in English; and physically fit.

For candidates who have been selected on IRRI funding, IRRI covers travel and shipping expenses, board and lodging, a stipend for incidental expenses, insurance, local travel in connection with the research, research support, a book allowance, and university fees of degree scholars. Funds for these are available to IRRI from its core training funds, collaborative country program funds, or other special project funds. Also, IRRI administers the fellowships/scholarships of other candidates and bills their sponsoring organizations for the costs.

IRRI ALUMNI: PROFILE AND CONTRIBUTION

From 1962 to October 1984, there were 3,700 scholars and fellows in the various training and professional advancement programs at IRRI (Table 3). About a third were in research-oriented programs, while the rest were in instruction-oriented courses. Eight out of ten scholars and fellows came from Asia, where 90 percent of the world's rice is grown (Table 4). Most trainees came from countries that have the largest areas of rice, though the small numbers from Burma and Vietnam are a reflection that IRRI collaborative programs with these countries were initiated only recently. The nationality of the scholars/fellows in different training programs is also related to the number and nature of educational institutions in those countries. For example, most postdoctoral and senior research fellows were from India, which has many universities with PhD programs; for the same reason, the number of MS and PhD students from India was one of the lowest.

There have been relatively few students from Africa and Latin America because IRRI coordinates training with International Agricultural Research Centers such as IITA, WARDA, and CIAT. These Centers accept most of the candidates from the continents in which they are located in their own training programs, but those requiring more specialized training are referred to IRRI.

The largest numbers of research scholars and fellows were in the plant breeding, agronomy, agricultural economics, plant pathology, and entomology departments, which are production-oriented programs (Fig. 1). The largest numbers of trainees were in the rice production, cropping systems, and GEU training programs (Fig. 2).

In 1980-81, a mail survey of all IRRI alumni was conducted to obtain information on the role they were playing in national programs, the relevance and effect of their training at IRRI, and their contribution to food production in their countries. The initial response of the survey was about 36%, but this increased to more than 50% following two reminders. The responses from the Philippines, Thailand, Bangladesh, and Indonesia ranged

Table 8. Total number[a] of IRRI trainees, 1962 to October 1984.

Country	Postdoctoral fellows	Degree programs		Nondegree programs	Short-term and special courses	Total
		MS	PhD			
Asia and Oceania						
Philippines	25	109	55	62	351	602
Indonesia	2	32	21	46	345	446
India	90	8	24	31	236	389
Thailand	5	54	16	42	254	371
Bangladesh	9	64	28	20	189	310
Sri Lanka	5	25	9	33	197	269
China (except Taiwan Province)	23	23	3	23	106	178
Burma	1	14	-	13	115	143
Pakistan	8	14	7	18	84	131
Malaysia	3	2	1	14	89	109
Korea	13	11	14	43	23	104
Vietnam	3	4	4	16	53	80
Japan	23	3	8	38	4	76
Nepal	2	15	2	2	45	66
China (Taiwan Province)	-	28	1	12	-	41
Laos	-	-	-	7	18	25
Iran	-	-	-	6	6	12
Fiji	-	-	-	1	6	7
Kampuchea	-	-	-	1	5	6
Bhutan	-	-	-	1	4	5
Australia	-	1	1	1	-	3
Solomon Islands	-	-	-	-	-	3
Iraq	-	-	-	1	2	3

continued

Table 3. continued

Country	Postdoctoral fellows	Degree programs		Nondegree programs	Short-term and special courses	Total
		MS	PhD			
Turkey	-	-	-	-	2	2
Papua New Guinea	-	-	-	-	1	1
Israel	-	-	-	-	1	1
Afghanistan	-	-	-	-	1	1
Subtotal	212	407	194	432	2140	3385
Africa						
Nigeria	2	5	1	3	20	31
Egypt	1	-	2	7	12	22
Tanzania	-	3	-	1	14	18
Sierra Leone	-	-	-	3	11	14
Senegal	-	1	-	7	5	13
Mali	-	-	-	3	5	8
Ghana	1	1	-	2	4	8
Sudan	-	-	-	1	7	8
Liberia	-	1	-		6	7
Kenya	-	-	-	2	5	7
Malagasy Republic	-	-	-	1	2	3
Upper Volta	-	-	-		2	2
Ethiopia	-	-	-		2	2
Somalia	-	-	-	1	1	2
Uganda	-	-	-		1	1
Ivory Coast	-	-	-	1		1
Morocco	-	-	-	1		1
Gambia	-	1	-			1
Cameroon	-	-	-		1	1
Subtotal	4	12	3	33	98	150

Latin American and Carribean						
Colombia	3	6	1	3	3	16
Cuba	-	-	-	9	4	13
Mexico	-	4	1	2	3	10
Brazil	-	1	-	-	3	4
Guyana	-	2	-	-	1	3
Peru	1	1	1	-	-	3
Ecuador	-	1	-	-	2	3
Dominicar Republic	-	-	1	-	1	2
Panama	-	-	1	1	-	2
Venezuela	-	-	-	2	-	2
Trinidad	-	-	-	-	2	2
Costa Rica	-	-	-	1		1
Chile	-	1	-	-	-	1
Jamaica	-	-	-	-	1	1
Paraguay	-	-	-	-	1	1
Subtotal	4	16	5	18	21	64
Others						
United States	7	7	13	9	10	46
Germany	8		10	4	-	22
United Kingdom	3	1	3	7	-	14
Netherlands	1	3	2	5	-	11
France	1	-	-	1	-	2
Belgium	-	-	1	1	-	2
Canada	-	-	2	-	-	2
Switzerland	-	-	-	1	-	1
Italy	1	-	-	-	-	1
Subtotal	21	11	31	28	10	101
Total	241	446	233	511	2269	3700

[a] Excludes the 2-week rice production training course and other special short-term programs.

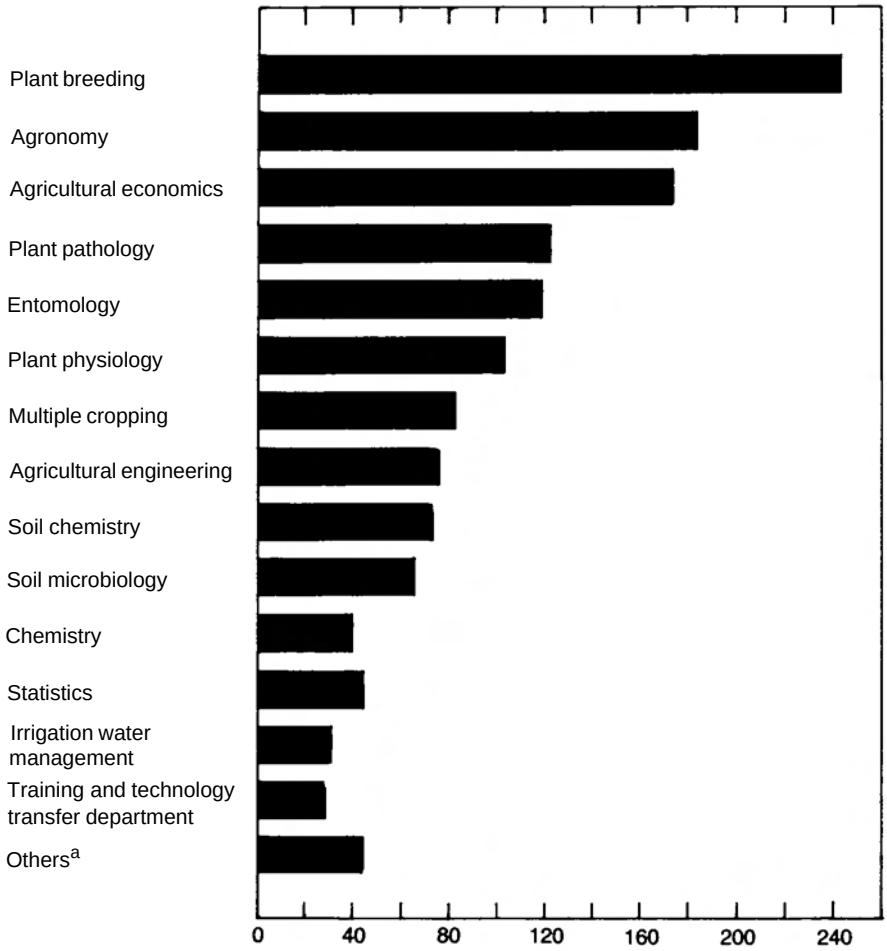
Table 4. Number of IRRI-trained scientists from the main rice-growing countries.

Country	Total rice area (thousand ha) (ha x 10^3)	Trainees at IRRI (no.)
India	39,800	389
China (except Taiwan Province)	33,200	178
Bangladesh	10,500	310
Indonesia	9,400	446
Thailand	6,854	371
Brazil	6,000	4
Burma	4,800	143
Vietnam	4,631	80
Philippines	3,112	602
Japan	2,278	76
Pakistan	1,503	131
Malagasy	1,200	-
Korea, South	1,203	104
Nepal	1,182	66
China (Taiwan Province)	776	41
Sri Lanka	719	269
Malaysia	697	109
Nigeria	600	31
Egypt	425	22
Colombia	413	16
Cuba	210	13
Senegal	81	13

between 60 and 80% and were selected for more in-depth analysis about the relevance and impact of IRRI training programs.

The survey showed that 72% of all trainees and scholars came to IRRI from government agricultural agencies, 17% from agricultural universities, 5% from private corporations engaged in rice research and production, and 6% from other organizations. Nearly 98% returned home after completion of their training programs at IRRI.

At the time of survey, about 90% were employed by government research institutions or agricultural universities. About half of the alumni of both the research–oriented programs and the short courses were engaged in research, and one in seven were in administration (Fig. 3). The sharp contrasts were the proportion in instruction - 27% of the alumni of research–oriented programs compared with 6% of the alumni of short courses - and the proportion in extension - 21% of the alumni of short courses compared with 2% of the alumni of the research-oriented programs. Quite a large number of alumni were heads of research institutes, and at the time of the survey 98 of the participants from Asian countries had received national recognition awards for



[a]International Rice Testing Program, Experimental Farm, and Library Documentation.

Fig. 1. Distribution of IRRI scholars and fellows by field of specialization, 1962-84.

a wide variety of contributions such as development of high-yielding varieties, institution of appropriate crop production practices, or design of agricultural implements.

Most of the trainees and fellows had bachelor's degrees prior to their training at IRRI. However, the alumni of the research-oriented programs tended to pursue higher education and, at the time of the survey, the majority had PhD degrees. There was, however, little change in the academic attainment of alumni of the short-term training courses (Fig. 4), suggesting that the

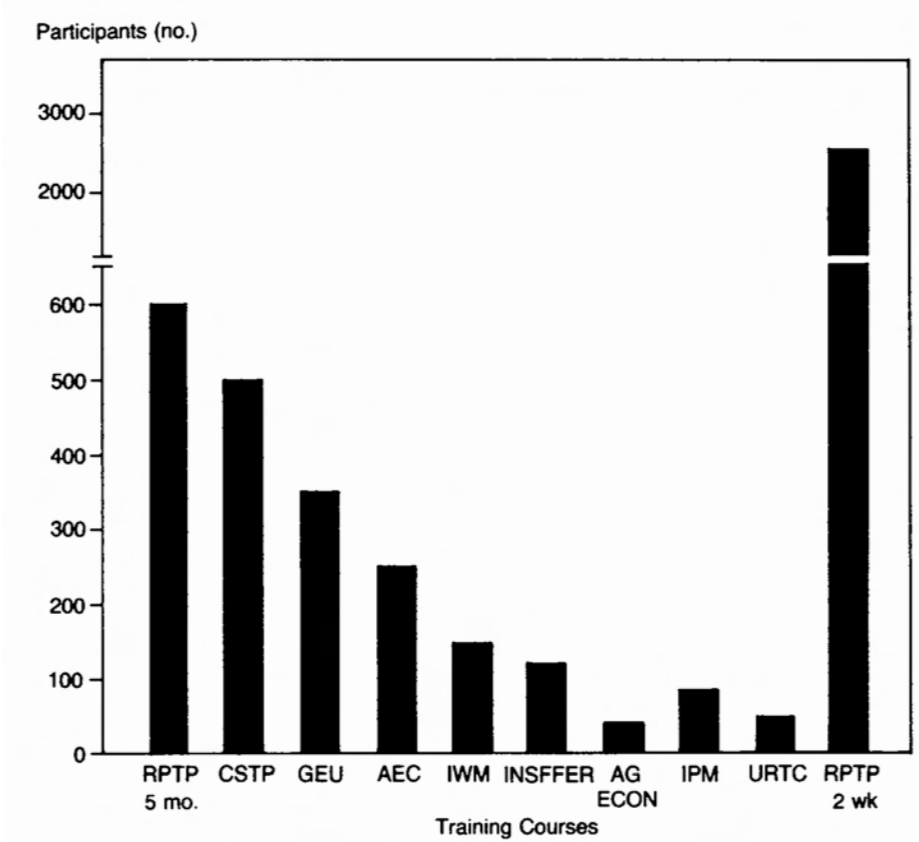


Fig. 2. Distribution of participants in IRRI formal training courses, 1962-83.

alumni of research-related programs had greater opportunity and drive for academic advancement than those in short training courses.

The nature of the employment of IRRI alumni before and after their training at IRRI is shown in Table 5. This information is grouped in five-year cohorts to show changes in work responsibilities. Most trainees at the time of coming to IRRI were assigned to research, followed by extension and instruction. The same pattern was reflected in their employment status immediately after training, as shown by the 1977-80 cohort. However, beyond this period, as evidenced in the cohorts of 1962-66, 1967–71, and 1972–76, there was an increase in administrative assignments, reflecting promotions to positions with broader responsibilities.

Table 5. Occupations of IRRI Asian alumni, by cohort.

	Cohorts (%)			
	1962-66	1967-71	1972-76	1977-80
At time of training	(N=59)	(N=173)	(N=166)	(N=437)
Administrative	2	2	4	5
Research	56	45	69	70
Extension	10	29	14	14
Instruction	32	23	13	11
At time of survey[a]	(N=62)	(N=175)	(N=168)	(N=440)
Administrative	31	22	17	8
Research	34	45	55	68
Extension	8	15	14	13
Instruction	27	18	15	11

[a]N includes those who were studying and were out of work at pretraining.

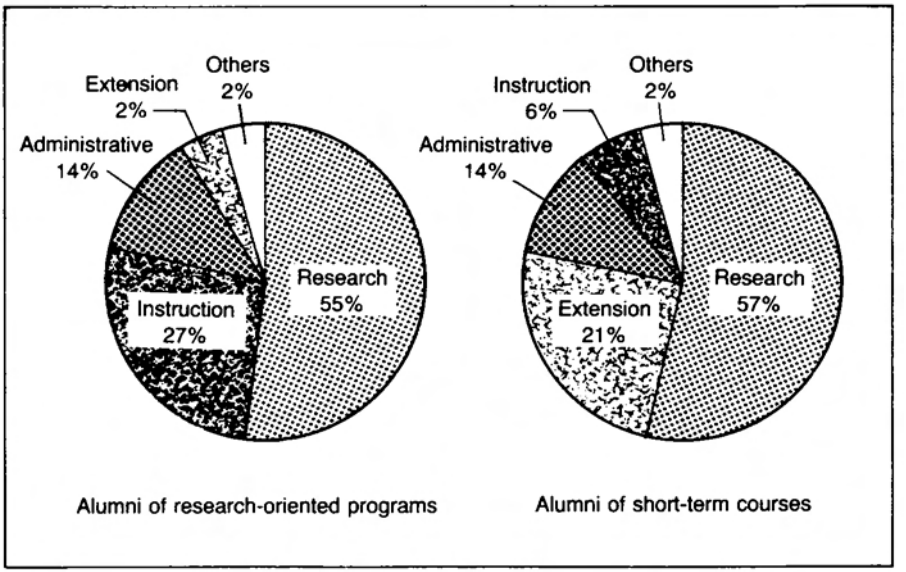


Fig. 3. Assignments of IRRI-trained Asian scientists in their respective countries, December 1982.

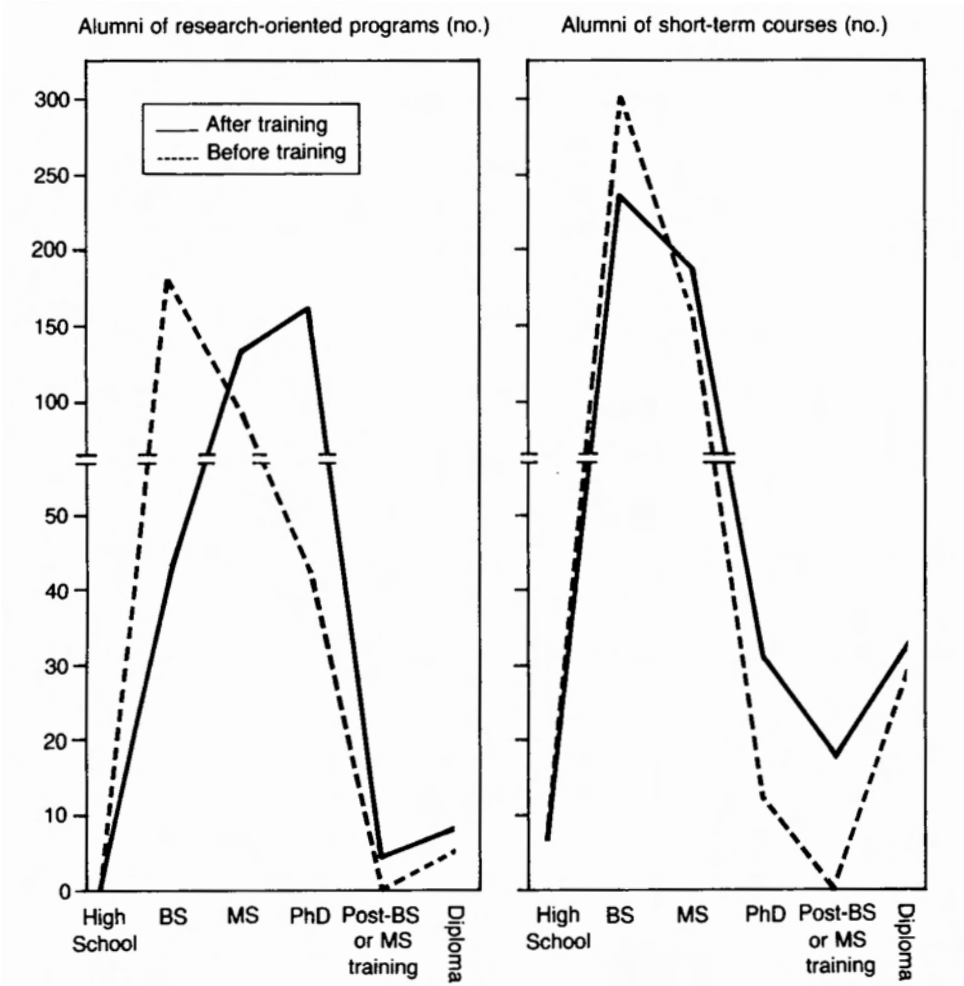


Fig. 4. Highest educational attainment of IRRI Asian alumni before and after training.

Most trainees in the research–related programs indicated that they found the research aspects of the training most useful, while participants of the non–research courses emphasized the training in research as well as in practical fieldwork (Table 6).

The research trainees indicated that the major constraints that they found on their return home were inadequate facilities and funds (Table 7). However, most of them felt that the training at IRRI was applicable to the conditions existing in their countries. The inadequacy of budget and research facilities

Table 6. Aspects of IRRI training most useful to job of alumni respondents from Asia, by training program.

Useful aspect	Alumni (%) Research oriented (N=230)	Short-term courses (N=409)
Research experience	46	30
Lectures and discussions including seminars and course work	21	32
Practicum induding field work and special projects	10	15
Training in production of rice and other crops	4	11
Others, including acquaintance with peers and senior scientists	7	1
All aspects	9	10
No useful aspect	2	0.5

Table 7. Constraints reported by IRRI alumni in the application of their training upon their return home.

Response constraint	Research Alumni (%) Philippines	Bangladesh	Indonesia	Thailand
None	21	19	33	69
Inadequate budget and skilled manpower	32	4	19	15
Inadequate facilities	26	54	38	8
Inadequate support of agency or superior	10	15	0	0
Training not appropriate to subsequent job	8	8	5	4
Concepts learned were difficult to adapt	3	0	5	4

was also reflected in the survey of the immediate supervisors of the IRRI alumni in their respective countries (Table 8). Moreover, none of the national program leaders surveyed found IRRI's training unsatisfactory; the ratings were: extremely satisfactory, 35%: moderately satisfactory, 62%; slightly satisfactory, 3%.

Table 8. Assessments of national program leaders regarding constraints the IRRI alumni face.

Constraint	No. of responses	Program leaders' response (%)			
		Highly serious	Moderately serious	Not serious	Total
Inadequate budget	136	17	41	42	100
Inadequate facilities	132	8	42	50	100
Inadequate manpower support	127	11	43	46	100
Inapplicability to subquent job	125	4	14	82	100
Difficulty in adapting concepts learned	116	5	29	66	100

PROFESSIONAL ADVANCEMENT OF IRRI JUNIOR RESEARCHERS

IRRI assistant scientists, senior .research assistants, research assistants, and research aides, known as Junior Scientists, have been the backbone of its research and training programs. IRRI has aided their professional advancement on a case by case basis since its first years.

In 1974, a formal professional advancement program was set up to improve the efficiency, competence, productivity, and motivation of employees in their present jobs and to create a reservoir of qualified personnel from which workers can be selected to fill more responsible positions. Over 250 junior staff members have taken advantage of IRRI's various professional advancement programs. Master's degrees have been completed by 228 staff members under the program, and 8 have received doctoral degrees. In the degree programs, candidates pursue their course work at a local university, usually the University of the Philippines at Los Baños, either on a three-unit-per-semesterbasis or on a full-time basis for up to 1 year. They use their ongoing research program at IRRI in the preparation of their theses.

Junior researchers may also receive nondegree training in research laboratories. Selected candidates are sent by IRRI to undertake specialized training abroad. Such training includes short courses, training in special methodology, or implementation of certain aspects of collaborative research programs with expert scientists in specialized laboratories both in developed and developing countries.

Sometimes, on-the-job training is offered at IRRI by scientists from developed countries. In these cases, IRRI invites scientists from research laboratories in developed countries to train junior researchers at IRRI. These programs

usually last 2–3 weeks and consist of a series of lectures and practical demonstrations.

IRRI also encourages junior researchers to participate and deliver papers at conference and workshops to sharpen their research and communication skills. For each junior researcher, IRRI covers the expenses of attending one scientific meeting per year in the Philippines. For a small number of junior researchers, participation in scientific meetings abroad is supported.

Status of Agricultural Education and Challenges for International Agencies

H.K.F. Hoffmann

The common needs of developing countries are improvement of curricula and teaching methods at the undergraduate level, emphasis on relevant research and research coordination, and involvement of the educational institutions in rural development. Regional programs for postgraduate studies should be established to cater to the needs of small countries that cannot support postgraduate education. FAO and other international agencies could assist in these efforts through collection and spread of information relevant to the needs of agricultural universities, acting as a forum for the discussion of strategy options in higher agricultural education, production and dissemination of training manuals and teaching materials, provision of technical assistance, and rendering advice on institutional policies, program development, and resource use in agricultural universities.

This paper will emphasize issues connected with institutional and program development at universities and institutions of equivalent status as seen by international agencies, particularly the Food and Agriculture Organization of the United Nations (FAO). University level agricultural education will, however, not be dealt with in isolation, because it forms part of wider systems of education, research, and extension. In the following section, the objectives of agricultural education will be reviewed, and thereafter its present status, achievements, and constraints. The last two sections will deal with strategies for future development and with the role of FAO in support of such strategies.

OBJECTIVES OF AGRICULTURAL EDUCATION

The primary objective of agricultural education is to train manpower for the agricultural and rural sector—a broad range of development workers in extension, research, experimentation, formal teaching, produce marketing and

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input supply, credit, planning and administration, and farming itself. In most of these areas, there is need for people trained at two broad levels:

- University-trained people for policy formulation and administration at national, provincial, and district levels and for key positions as subject matter specialists, for example, in research or extension.
- Field staff, mostly trained at the post-primary/secondary or post-secondary level, for the execution of development activities, operating at the grass roots level in direct contact with primary producers and/or assisting senior specialist staff.

The manpower training task of agricultural education institutions has always been their foremost and often exclusive function. Yet that function has been questioned with regard to training for rural development by universities. I am sometimes asked what people with graduate and postgraduate degrees have to do with rural development. The answer is straightforward: In all countries, whatever their geographical location, political orientation, or present level of development, policy formulation and decision-making for agricultural and rural development, as well as the planning, administration, and evaluation of programs and projects, are predominantly the responsibility of people trained at universities or institutions of similar status. This is a fact that is unlikely to change. Moreover, indications are that the educational level of decision-makers and administrators in developing countries will rise further because of the increasing number of younger people who have obtained advanced degrees in their home countries and abroad. University level education in agriculture and related subject areas has had, therefore, and will continue to have, a long-term decisive influence on the attitudes, knowledge, and skills of men and women who are likely to be appointed to leading positions in rural development agencies and to remain in such positions for a period of 20 years or more. If this leadership training function is accepted, then three conclusions must be drawn that should determine the main characteristics of higher level teaching programs in agriculture:

- In order to make a more determined effort toward improving the situation of the rural poor, it is most important to foster among agriculture students appreciation and understanding of the problems and aspirations of the least advantaged rural groups, including small farmers, sharecroppers, landless workers, marginal women, children, and youth.
- All students, whether they will work later on as generalists or as specialists, must learn to appreciate that agriculture, and even more so rural development, represent broad and complex systems that farmers and the general public regard as organic wholes rather than as collections of individual subject areas.
- While an adequate amount of factual knowledge relevant to current requirements has to be acquired by the students, their drive and their abilities to analyze situations, search for possible solutions, decide and

implement programs, and acquire new skills, knowledge, and techniques have to be systematically fostered to ensure dynamic approaches to new and unforeseen problems that they will undoubtedly encounter in their future jobs.

Formal teaching at the undergraduate level and the offer of postgraduate programs should not be the sole activity of agricultural universities. Research is an indispensable complement: Without serious engagement in original research activities with a view to advancing the frontiers of agricultural science and technology, a university does not deserve its name. Beyond teaching and research, and equally important, lies the area of participation in direct rural development action. Various kinds of activities may be taken up, e.g., the organization of in-service training for field extension staff, the planning and evaluation of rural development projects, work with farmers and rural communities in the vicinity of the institution, responsibility for rural communications (radio, newspapers), and elaboration of strategy options for rural development. Wherever feasible, such activities should be planned in close cooperation with the national development agencies concerned.

STATUS OF INSTITUTIONAL DEVELOPMENT

During the past 25-30 years, impressive progress has been made in many developing countries, both quantitatively and qualitatively. On the African continent, for example, where in the 1950s the institutions offering undergraduate programs in agriculture could be counted on one hand, there now exist close to 150 faculties of agricultural sciences that teach first degree curricula, 75 of which offer postgraduate programs as well (2). Similar developments, perhaps of less dramatic dimensions, have taken place in the other regions. Concurrently, in several Asian countries, higher level agricultural education has been reorganized through the establishment of agricultural universities, i.e., institutions bringing together the major agricultural sciences (including agriculture, veterinary medicine, forestry, fisheries, rural home economics, basic sciences, etc.), and their investment with responsibility, to varying degrees, for instruction, research, and extension. With some exceptions, institutional capacity for teaching agricultural curricula at the undergraduate level is now sufficient in most countries, although the offering of postgraduate programs is adequate only in some. In fact, in almost half of the 46 African nations for which data are available, the current output capacity of graduates with a first degree exceeds the estimated number of university level agricultural personnel needed by the year 2000 (e.g., Egypt, Nigeria, Algeria, Guinea, and Libya). In other countries (e.g., Tanzania, Ethiopia, Niger, and Zambia) agricultural training capacity is inadequate. With respect to major subject areas, training capacities at the first degree level in veterinary science and in forestry appear to be deficient in a number of countries (3).

Undergraduate curricula

The most common duration of undergraduate curricula in agriculture is 4 years (5 years for veterinary science) after a period of 10-13 years of general education. In most countries, first degree programs are rather general in nature, aimed at giving an insight into the scientific and technical processes of agriculture. Yet, often the students' understanding of "agriculture" as a dynamic and integrated production system is not sufficiently stressed. In addition, in many institutions the essential socioeconomic dimension does not receive adequate attention, neither in instruction nor in research — for instance, the potential influence of technological advances in the plant or animal sciences on the farmers' economic situation, their social status, and their personal aspirations or the specific needs of marginal groups. Also, there is in many institutions too much uncritical acquisition of factual knowledge from books rather than emphasis on developing the students' ability to use their personal initiative in analyzing problems, looking for solutions, and arguing in a scientific manner on the basis of information found by themselves in field experiments, research reports, and reference books.

Subject matter specialization at the undergraduate level is common. To provide opportunities for options allows students to test personal interests and talent and forms a good basis for subsequent postgraduate work. However, specialization should be built on a sound knowledge of "agriculture" in the sense described above. Only then will it be possible for the outgoing students to appreciate the potential applicability of specialized knowledge in a narrow subject area to frequently complex farmers' problems that usually require an interdisciplinary approach. Where, as is the case in a few countries including China, agricultural curricula are organized according to narrow subject specializations from the first year of study onwards, teaching staff and students alike become "experts" in, e.g., plant pathology or agricultural microbiology, but many find it difficult to see their subject as an integral part of "agriculture."

Greater efforts are still needed by some institutions to recruit students from rural areas to study agriculture and to facilitate their entry through special pre-entry courses. Since many of the students come from urban backgrounds, it is essential that they obtain firsthand knowledge of farmers' work, problems, and desires. For this purpose, farm practice, part of which should be arranged outside the university campus, is crucial. However, due to large student numbers and/or lack of transport, fuel, and finance, student farm practice has not been implemented to the extent desirable. The same applies to the detachment of senior students as part of the first degree program to field offices of development agencies, which can provide most beneficial experiences.

Postgraduate programs

Programs leading to a postgraduate diploma, MSc, PhD, or their equivalents have been introduced by many institutions. These programs consist mostly of course work and research requirements in selected subject areas, but the relative weight given to these two components varies from 100% course work in some programs, primarily at the postgraduate diploma and MSc level, to 100% research plus dissertion preparation for a few PhD programs. At least in some countries more emphasis could be placed at the MSc level on developing the students' ability to diagnose problems and to seek solutions in a scientific manner, rather than merely feeding them with a wealth of factual information. There are even institutions where much of the course work is repetitious of earlier undergraduate courses. On the other hand, research work for MSc and PhD degrees needs to be backed up by advanced studies in selected key subjects in order to secure a balance in the program as a whole.

Some postgraduate programs have been initiated without first establishing a sound base in the form of adequate staff resources and physical facilities and a viable research program. Realistically speaking, no university is equally strong in all subject areas it covers. While the offer of postgraduate programs by the foremost national institutions is a legitimate aspiration, there should be an assurance that the existing resource situation warrants their establishment.

Program content

Whether the curricula are "general" or "specialized," they need to be kept up to date. There are institutions where the curricula formulated 25-30 years ago are still in use or where only minor adjustments have been made in the meantime. There are also some institutions that have included in their teaching (and research) programs non-traditional subjects such as computer science, ecology, post-harvest loss prevention, integrated farming systems, rural development, remote sensing, energy management, agro-forestry, and aquaculture. In India, for example, a center for advanced studies in energy management in agriculture is being established at the Punjab Agricultural University in Ludhiana and a similar center dealing with post-harvest technology at the G.B. Pant University of Agriculture and Technology in Pantnagar. The Beijing Agricultural University in China has a fine center for remote sensing. There are other examples, but they are exceptions. As a rule, curriculum adjustments and the creation of new programs happen quite slowly.

Even with respect to more conventional subject areas, the situation is not satisfactory, especially at the postgraduate level. For instance, on the continent of Africa only three institutions offer MSc or PhD programs in irrigation/hydrology, one in range management, two in agricultural marketing, a few in

the other socioeconomic subjects, four in fisheries, two in wood technology and conversion, and two in wildlife management and national parks. In other important yet scarcely represented subjects such as horticulture, plant protection, and food science and technology, more than two-thirds of the institutions in Africa offering postgraduate programs are located in one country, Egypt. At least partly as a result of this situation, the number of trainees studying for advanced degrees in selected developed countries., at high cost and often with reduced benefit, is rather large.

Research and outreach programs

A vigorous research program is an essential element in any institution of higher agricultural education. There is of course no point in "rediscovering the wheel," but the search for solutions to technical, social, and economic problems that limit agricultural and rural development requires substantial contributions from all agricultural universities and colleges. Their research work should be part and parcel of the national agricultural research program. Furthermore, the results of their research need to be transformed into messages for farmers and other end users and then fed back into the teaching programs.

Unfortunately, some institutions are only marginally involved in research and development work. Furthermore, too often research undertaken by agricultural universities and faculties neither responds to recognized local needs nor is coordinated within the institutions themselves or with the research work of other educational and research establishments. The preparation of research results for application, e.g., through larger-scale field testing and/or the production of extension leaflets, is frequently left entirely to other agencies.

Having made a plea for active research involvement, one should not overlook the danger, in some institutions, of over-involvement of academic staff in research and consultancy work, often under contract with other organizations and not always related to the home institution's programs. In such cases less time and effort is devoted to scheduled teaching and, as a result, the quality of instruction may suffer. Taking into account staff and other resources, a proper balance between teaching, research, and outreach activities needs to be established and maintained.

While there appears to be a consensus that the operation of outreach programs should be among the functions of agricultural universities and colleges, the extent of the institutions' responsibility for field extension work and their role vis-à-vis the extension function of other agencies is under discussion in some countries. No doubt, agricultural universities and colleges need to have access to an extension practice area where research results and alternative extension approaches can be tested. In that respect, the social laboratory idea as put into practice in several Asian countries has shown good

results. I would like to pay a particular tribute to the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) for its foresight and its sustained support over many years of efforts to establish, maintain, and increase the impact of social laboratories in Asian universities and colleges.

Extension approaches should be especially concerned with the kind of initiatives that promise support to small farmers, landless farm laborers, and other rural poor. A cooperative program with the Ministry of Agriculture and other development agencies concerned and a clear delineation of functions, e.g., with respect to the responsibility for extension staff training and employment or for the production and dissemination of extension materials, need to be established. On the other hand, agricultural universities and colleges should offer their intellectual and physical resources for cooperative action within the limits of availability. But it seems there is still too great a reluctance on the part of university administrators and professors in many institutions to adopt this approach with determination and zeal. Often valid explanations are given concerning staff and other resource limitations. In some cases, however, reasons have not been convincing. Examples of constructive cooperation in extension between agricultural universities and state agricultural departments under contractual arrangements have been reported in India and a few other countries.

One problem which has emerged in some institutions in relation to research and/or outreach activities stems from their almost complete dependence for funds on resources outside the university. Financial support from ministries, corporations, or private companies is welcome, but it should not be allowed to narrow the institution's capacity to decide on its basic policies and programs.

Staff and physical resources

The inadequacy of staff (both academic and support) and/or of physical resources (lecture and laboratory facilities, farm facilities, equipment, transport, literature, supplies, student dormitories, staff housing, etc.) is the most significant constraint. Sometimes neither national governments nor donor agencies fully appreciate that well qualified staff and at least a minimum amount of space and equipment are essential if first-class teaching, research, and outreach programs are to be mounted. Some may also fail to realize that, according to our experience in various countries, a period of 10-15 years is needed to train key academic staff to the MSc/PhD level and to let them gain professional experience before they can be regarded as fully qualified senior staff members. At least the same period of time is usually necessary to build up the institution's physical facilities in support of the programs offered.

The speed of the physical build-up and, to a lesser extent, that of staff training are conditioned by the availability of finance. However, in a number

of institutions other factors such as the unavailability of students qualifying for entry; the failure of those trained abroad to return home; the scarcity of land (including farmland); or the temporary unavailability of construction materials or of equipment, fuel, or electricity have also heavily influenced the institution building process.

STRATEGIES FOR FUTURE DEVELOPMENT

Two types of strategies for improving agricultural education in developing countries will be discussed here: location-specific and regional.

Location-specific strategies

There are lessons to be learned from the experience of various countries that should be taken into account when national strategies for higher agricultural education are planned. Such strategies must be largely location-specific, depending on each nation's policies, manpower needs, current institutional status, and resources. No model, however sophisticated and well thought out, will be able to fit all situations. The first strategic consideration, therefore, concerns the question: What are the goals and aspirations of a particular country, and what measures are needed in order to ensure that its agricultural universities and colleges become true development institutions in support of these goals? This is, in my view, more important than the legitimate desire to match international academic standards. Proposed action programs of agricultural universities and colleges, e.g., concerning new teaching programs, the revision of existing curricula, the linkage of different educational programs, and institutional cooperation in research, must be tailored to current and future national requirements, even though there are certain needs that are common to most countries, such as:

- quality improvement of curricula and teaching methods at the undergraduate level,
- increased emphasis on relevant research and on research coordination, and
- more forceful involvement of the educational institutions in rural development action.

In the efforts towards quality improvement of undergraduate curricula, the aim must be to produce graduates who are well trained and well motivated. To this end, the relevance of teaching programs in the national context has to be kept under continuous review, preferably jointly by the educational institutions and the main employing agencies. Agreed curricular adjustments, e.g., the replacement of obsolete courses by new ones, should be implemented without undue delay; the blockage of improvements by students or other

groups as has happened in several Latin American countries should not be allowed.

A related measure to be considered is the better preparation of academic staff for their tasks as teachers, as researchers, and, where applicable, as extension workers. There must also be recognition of achievements in teaching and extension and not only in research—a matter which is often discussed but rarely implemented. At a few US universities special workshops for academic staff have been organized to improve the quality of instruction. These workshops have also served to recognize the outstanding teaching achievements of individual professors. Such workshops could be held in the developing world.

Greater engagement by staff and students in research is a necessity in many agricultural universities and colleges. Ideally, all such research activities should form integral parts of a national research program. Where this is not feasible, the likely relevance of the planned research activities in the national or provincial context should be considered a valid criterion when decisions on research priorities and funding are made.

At least in some countries, the impact of research can be improved without large additional inputs through better coordination of programs and through imaginative approaches to cooperation among educational and research institutions. Such cooperation may well include the research (and to a lesser extent the educational) component of postgraduate programs. However, cooperation requires commitment and initiative on the part of the respective agencies' senior staff—including the administrators and professors of agricultural universities and colleges.

I have previously advocated more sustained engagement in rural development action through a variety of activities. Such engagement may benefit policy makers, field personnel, farmers, and agricultural industries, but the main beneficiary will be the university itself. Rural development work helps to establish and maintain a sound focus on "real" issues. It also enhances the credibility of the institution in the eyes of the general public.

Regional strategies

While strategy formulation for higher agricultural education should, in my opinion, have a distinct country focus, it needs at the same time a regional dimension. ("Regional" in this context refers to groups of countries which belong together on account of their geographical location, political orientation, ecological conditions, or ethnological composition.) This is of particular importance at the postgraduate level and for short-term, non-degree, specialized training.

There are few countries in the world that can afford the establishment and maintenance of specialized educational and research centers covering the entire

range of disciplines directly and indirectly concerned with agricultural and rural development. Poorer countries and, among these, especially smaller ones and those with varied ecological conditions have to depend to a large extent on opportunities for specialized training abroad and for the sharing of experiences offered by other countries. On the one hand, the increasing need for highly trained and specialized agricultural scientists, and, on the other, continuing economic constraints make it attractive for the "better off" countries as well to seek cooperation with other countries. There is room for a new thrust towards increased cooperation in higher agricultural education in most regions of the world. In Asia, the contribution of SEARCA and of other institutions in fostering postgraduate and special training programs open to students from various countries has been outstanding, and the trend to broaden the institutional base by making use of first-class facilities in a large range of universities and colleges in the region rather than depending on a few institutions is to be encouraged. I wonder, however, whether the time is not ripe to complement these efforts in a forceful and systematic manner. One way that promises positive results at reasonable cost would be the creation of regional networks of centers for advanced studies and research in selected key subject areas. This does not mean the establishment of a series of new institutions but rather the strengthening of existing ones to the point that they are able to offer high quality postgraduate training in specific areas for the benefit of students from the region. India's program of centers for postgraduate study and research (centers of excellence) in selected subjects under the leadership of the Indian Council of Agricultural Research is very relevant. The experience over the past 13 years with the establishment of 16 such centers based in agricultural universities and research institutions can give important hints on such a network's desirable objectives and outputs, essential inputs, administrative requirements, time horizon, etc. Factors that have contributed to the success of this program have included:

- a strong apex body overseeing the development of the centers and encouraging their use on a national scale,
- substantial increases of resources in terms of extra staff and physical facilities,
- the training abroad of Indian professors at top institutions in particular fields and the invitation of key professionals from such institutions for one or more terms, and
- the creation of the centers at institutions that already showed strength through scientific leadership in a certain field, a nucleus of highly trained staff, an appropriate research program, and basic infrastructure.

No doubt, it is easier to develop and maintain such a program at the national rather than at the regional level because of political implications, difficulties in resource allocation, language barriers, etc. However, the combined experience of programs such as the Indian one, of the International Agricultural Research

Centers operating in a region, of regional associations such as the Asian Association of Agricultural Colleges and Universities (AAACU), and of institutions such as SEARCA might provide a basis for the design of regional networks of centers for advanced study and research in specific subject areas. The African ministers of agriculture assembled for the 13th FAO Regional Conference for Africa (Harare, Zimbabwe, 16–25 July 1984) approved a regional strategy and plan of action for strengthening agricultural education and training in the continent. This strategy and plan of action include the development of a series of centers for advanced studies and research in selected key subject areas for the benefit of the African region as a whole or of groups of countries within that region.

FAO'S ROLE IN HIGHER AGRICULTURAL EDUCATION

FAO's concern for agricultural education and its mandate to deal with this subject are clearly spelled out in its Constitution in Article I (Functions of the Organization): "The Organization shall promote and, where appropriate, shall recommend national and international action with respect to the improvement of education and administration relating to nutrition, food and agriculture, and the spread of public knowledge of nutritional and agricultural science and practice (1)." While this legal basis for FAO involvement in agricultural education is important, of at least equal importance is the conviction, developed through many years of experience, that agricultural education must be an integral and essential component of any agricultural and rural development effort. An organization that fosters increased agricultural production and works for improved levels of living of the people in the rural areas is therefore forced to give priority attention to agricultural education. FAO accepts this challenge in the belief that various forms of agricultural education, from farmer training to agricultural courses in high schools and technical colleges to university programs at the undergraduate and postgraduate levels, when linked together in a comprehensive national system, can make significant, even decisive contributions to rural development in its broadest sense. On account of FAO's longstanding experience and its expertise drawn from many different countries and institutions, and in view of its technical nature without linkage to any political system or organization, we believe we are in an ideal position to offer appropriate services to our 156 member countries. We see our role primarily as being a catalyst.

New approaches to higher agricultural education and interesting experiences happen in many countries and institutions throughout the world. One of our tasks, as we see it, is the collection and spreading of information that is of wider interest, e.g., on promising experiments with new types of curricula, on experiences with different institutional structures, on alternative approaches to staff training and resource use, on existing educational institutions, and on

their teaching programs and resources. This information function is performed through expert meetings, training sessions, publications, and personal advice.

A second main task is to act as a forum for the discussion of strategy options in higher agricultural education. For example, an Expert Consultation on the Contribution of Agricultural Faculties and Universities to Development was held by FAO in 1977, followed by regional workshops on the same theme in Asia (organized by AAACU), Africa, and Latin America.

A third area is the production and dissemination of training manuals and teaching materials. For example, under contract with FAO, the Centro Inter-Universitario de Desarrollo, an institution representing a large number of public and private universities in Latin America, has produced a series of teaching modules dealing with different aspects of rural development. Similar initiatives are under way in Africa (in cooperation with the Center for Integrated Rural Development in Africa, Arusha, Tanzania) and in Asia (in cooperation in AAACU). Another example is the production of a manual on the management of agricultural schools and colleges, dealing with questions of curriculum development, teaching methodology, personnel and financial management, resource use, etc.

FAO's involvement in higher agricultural education is perhaps best known for its technical assistance activities. Over the last 10-15 years numerous universities and colleges have been supported, in a few cases in the form of cooperative efforts together with UNESCO, the World Bank, or bilateral aid agencies, through the assignment of temporary personnel and the provision of equipment, literature, and fellowships for training abroad. One of the most important large-scale projects in higher agricultural education supported by FAO is the advanced center program in India.

In recent years, we have been called upon with increasing frequency to advise on institutional policy, program development, and resource use of agricultural universities and colleges in many developing and developed countries. This trend towards short-term assignments of top-class consultants and FAO staff is expected to increase. In Africa, for example, a series of planning missions and meetings will identify subjects to be covered at the proposed centers of advanced study and research, possible locations of such centers, essential inputs, and related costs; at the same time, efforts will be made to enlist the cooperation of potential co-donors. A similar approach will be taken where the objective is to increase the impact and efficiency of individual institutions through quality improvement of undergraduate and other teaching programs or where, for example, the main problem is lack of cooperation with other national institutions in research or extension.

In all our efforts, we promote the use of existing expertise and of organizations and institutions that are already in place. Cooperation among individual scientists, institutions, and countries to the benefit of all is the ultimate goal. In

the promotion of our program of Technical Cooperation Among Developing Countries, national as well as international institutions and organizations such as IRRI or AAACU have an important role to play. FAO has therefore supported these educational and research bodies over many years. Within the limits of our capability, we shall continue to do so in the interest of strengthening higher agricultural education wherever this is needed.

REFERENCES CITED

1. Basic Texts of the Food and Agriculture Organization of the United Nations. 1970. FAO, Rome.
2. Directory of Agricultural Education and Training Institutions in Africa. 1984. Food and Agriculture Organization, Rome.
3. Training of Manpower for Agricultural and Rural Development in Africa. 1984. Doc. ARC/84/3 for the 13th FAO Regional Conference for Africa, Harere, Zimbabwe, 16–25 July 1984, Food and Agriculture Organization, Rome.

Human Resource Development Issues in Agriculture

H. A. Ables

Human resources can be categorized into three levels: high level administrators, researchers, and trainors; middle level technicians, extension workers, and support services personnel; and operative level farmers and their families. HRD institutions have to deal with the basic issues of the kind of jobs they should train for, expected knowledge and skills of graduates on completion of training, and the requisites of quality of service, cost of training, and social equity. The problems faced by HRD institutions include increasing costs, flight of academic staff, curriculum design, changing economies, the knowledge explosion, and the new media. HRD programs are affected by extra-institutional, intra-institutional, and inter-institutional factors.

Human resource development (HRD), used here synonymously with manpower development, manpower training, and education, is aimed at producing qualified persons who have the training and experience to perform assigned tasks. These personnel are expected to render efficient and effective service; for every endeavor there should be the right number of human resources available at the right time in the right place and employed in the right jobs.

Human resources in agriculture can be categorized into three levels: the *high level* composed of administrators, teachers, researchers, and trainors; *middle level* technicians, extension workers, and people who render support services; and *operative level* farmers and their families who produce, market, and process farm commodities.

There are two major approaches to human resource development: formal and nonformal. The formal approach is made up of programs and activities in the graded/degreed educational system: primary, secondary, diploma, collegiate, post graduate. The nonformal approach is made up of programs and activities undertaken by training institutions; nonformal, skills-oriented courses take the form of seminars, workshops, short courses, and training conferences. These nondegree programs are also known as in-service training, continuing education, and lifelong learning.

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The institutions that dispense either or both of these approaches are classified as schools, colleges, universities, training centers, institutes, or programs; any of these can be government-supported or private. There are also combinations of nongovernment and government-supported programs.

This paper deals with issues that encompass the problems, obstacles, and factors affecting the efficiency and effectiveness of human resource development in agriculture.

Three general questions applicable to all kinds of HRD institutions may be posed:

- What jobs should HRD institutions train for? This would also include questions on the magnitude of need for particular skills. What are the conditions of service after the completion of training? Problems of career choice and retention may also be considered.
- What basic skills need to be developed? For countries that do not have the human resources to be trained at an advanced level, will there be a need for expatriates?
- How can quality of service, cost of training, and social equity be given consideration in HRD?

Specific issues or problems can also be posed. For educational institutions, the relevant issues are increasing costs of operation, flight from teaching of academics (including loss of trained manpower), curriculum design, changing economies, the knowledge explosion, and the new media. As one undertakes curriculum design he or she necessarily comes to grips with the questions of balance between general and professional education, between theoretical and field/experiential training, between scientific training and human values.

For training institutions, the issues include changing demands, changing clientele, new information or subject matter, innovative methods and media, and training of trainors.

Other issues that may be cited are: lack of training in research/academic management, the monolithic nature of some research/academic organizations, and the issue of quality. One of the conclusions in a 1982 Asian regional workshop on agricultural manpower (1) was: "There is general concern about the quality of the manpower now becoming available and there is a prima facie case for reducing student intakes and improving facilities for teaching and research."

I have chosen to adopt three categories of factors that affect HRD programs: extra-institutional, intra-institutional, and inter-institutional factors.

Extra-institutional factors are made up of international and national economic trends, national policies affecting the rural and urban sectors, sectoral needs for human resources, and the growth of knowledge and technology.

Intra-institutional factors include organizational decisions, policies on incentives and rewards, available resources, institutional viability and morale, personnel needs and goals, and management problems.

Inter-institutional factors include standard-setting mechanisms (e.g., accreditation), cooperative linkages (e.g., consortia), and competitive recruitment.

The framework for reviewing constraints to human resource development in agriculture is shown in Figure 1.

Some propositions are presented below in order to stimulate conceptual thinking about these factors, promote collation of some generalizations about human resource development and its constraints, and thus contribute to theorizing about the problem.

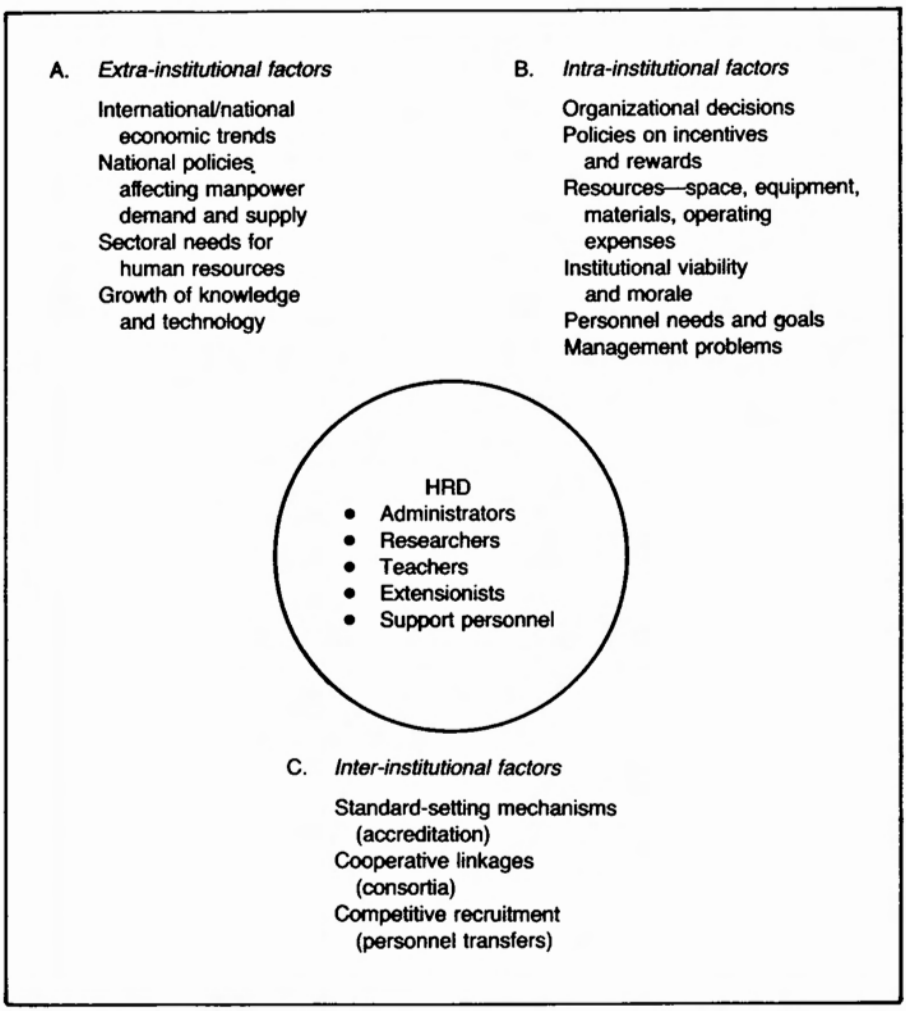

Fig. 1. Framework for viewing factors affecting human resource development.

A. *Extra-institutional factors*

1. The character of national and international economic trends determines to a great extent the level of activity in HRD.
2. National development policies tend to affect manpower supply and demand and hence HRD.
3. Shifts in sectoral needs (e.g., from agriculture to manufacturing) tend to cause changes in the focus of HRD programs.
4. The faster the acceleration of growth of knowledge and development of new technology, the greater will be the demand for HRD.

B. *Intra-institutional factors*

1. Institutional decisions to organize/reorganize/strengthen unit functions tend to increase the demand for HRD.
2. Increasing incentives and rewards tend to be directly related to intensified HRD activities and programs.
3. The amount of institutional resources (funds, space, equipment, training capabilities) tends to be directly related to the intensity of HRD activities in an organization.

   Corollary: The more severely lacking these resources are, the more depressed are the HRD activities.
4. The higher the level of institutional morale, the greater is the intensity of HRD activities and the greater is the level of staff retention.
5. The greater the disparity between personnel needs and organizational goals, the less effective is HRD.
6. The greater the incidence of management problems, the greater will be the perceived need for HRD.

C. *Inter-institutional factors*

1. The greater the acceptability of common standards and standard–setting mechanisms, the more accelerated is HRD among similar organizations.
2. The greater the extent of cooperative linkages among institutions, the greater are both the perceived need for and eventual number of HRD activities.
3. The keener the competition for talent and skills, the greater is the tendency for institutions to increase HRD activities.

It is hoped that these hypotheses will sensitize training systems administrators to the conceptual nuances of HRD. Generalizations should be applicable to HRD systems in all professional areas. The severity of incidence of constraints or lack thereof will inevitably vary from one country to another.

As far as the International Agriculture Research Centers (IARCs) are concerned, these factors may not loom so large, or they may not be relevant. What IARCs may be more concerned with are questions such as the following:

- How relevant and applicable is a regional training course to the national who has to return to a different working environment? How can the

IARC design the training so that transplanting the technology requires the least adjustment on the part of the participant?

- What follow-up strategies should be undertaken to correct some of the flaws in training and help the participant in readjusting to his or her home environment?
- Are there valid and reliable measures for selecting participants for training in order to optimize training effectiveness?
- How specialized should training programs be, given the complexities of agriculture in developing countries?

For the Philippines, some generalizations may be advanced that may be applicable to many other countries:

- There is an oversupply of manpower in agriculture but an undersupply of quality manpower.
- This has been brought about by proliferation of degree-granting programs in a country beset by a dwindling economy and lack of employment opportunities.
- The availability of cheap formal education drives out the need for nonformal education.

The issues presented in this paper are not so much of a physical or material nature as they are policy, social, and human factors, and therefore they are more difficult to resolve. Along with other human endeavors, they present a continuing challenge to all of us.

REFERENCE CITED

1. Proceedings of UNESCO Regional Workshop on Professional and Technical Manpower Requirements for Agriculture in the Asia-Pacific Region, Hawkesbury Agricultural College, Australia, 10-18 July 1982.

Status and Thrusts of Education for Agriculture in India

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Education for agriculture in India is marked by a great variety of programs offered by a great variety of institutions, including secondary and higher secondary schools, state agricultural universities, agricultural faculties of certain central universities, agricultural faculties of many state-level general universities, research institutes, and other agencies. Nevertheless, the country has a shortage of well-trained agricultural manpower at every level and inadequate expertise in education and management. Thus a two-fold expansion of the system is necessary: First, institutions and programs must be established; second, the principles of the educational and management sciences should be applied and relevant international advances in science and technology internalized.

For historical and political reasons, education for agriculture in India is marked by a great variety of programs offered by a great variety of institutions (1, 2, 3). Agriculture is included as a subject in the curriculum at the secondary and higher secondary school levels. In some schools, agriculture is offered after the secondary stage as a 2-year preparatory program for entry to the BSc (Ag) program, while some agricultural schools offer a 2-year terminal diploma program after the secondary stage.

At the university level, bachelor's, master's, and doctoral degree programs are offered in a wide range of disciplines by the state agricultural universities (SAUs), the agricultural faculties of certain central universities, the agricultural faculties of many state-level general universities, certain research institutes of the Indian Council of Agricultural Research (ICAR), and other agencies. The sciences and humanities faculties of the many general universities also offer bachelor's, master's, and doctoral degree programs in agriculture-related disciplines.

A variety of certificate and diploma training programs at the undergraduate and postgraduate level are offered by the departments of the state governments, the SAUs, and research institutes of ICAR. Numerous short-term skill training programs are offered for farmers by departments of the state govern-

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ments, by the SAUs, and by the Krishi Vigyan Kendras financed by ICAR. ICAR organizes short-term in-service refresher programs (summer institutes) for teaching/research scientists working at the SAUs and at its own research institutes. ICAR also mounts a variety of short-term in-service training programs in various aspects of agricultural research and educational management for senior management personnel working in the SAUs and ICAR.

Opportunities for advanced training in foreign countries are available to Indian agricultural personnel under various international and bilateral programs.

INSTITUTIONS FOR AGRICULTURAL EDUCATION

The institutional system for imparting professional agricultural education includes 23 SAUs, 3 agricultural colleges that are units of central universities, 31 agricultural colleges affiliated with general universities, and the 37 research institutes, 5 project directorates, and 9 national research centers of ICAR as well as some 10 research institutes belonging to other agencies/ministries.

State agricultural universities

The SAUs, established under acts passed by their respective state legislatures, are the most important component of the agricultural education system in India. They have the comprehensive and exclusive statewide responsibility for undertaking all kinds of education, research, and training programs deemed necessary for the development of the agricultural economy of their states. Their principal source of funds is their state governments, but the central government has also been providing liberal assistance through ICAR for their establishment and development. As they grow and develop, their range of educational and training programs is expanding. It is expected that eventually the SAUs, in collaboration with their state Departments of Agriculture, Animal Husbandry, Fisheries, Forestry, etc., will offer all the educational and training programs for human resource development for agriculture at the state level, while ICAR institutes, in collaboration with the SAUs and international institutions, will offer specialized and advanced level programs to augment and upgrade the overall capability of the agricultural education and training system in the country.

The distinctive features of the SAUs are:

- statewide responsibility for teaching, research, and extension functions;
- integration of the teaching, research, and extension functions at all levels of university administration;
- unified administration, complementarity of colleges and departments, and multi-disciplinary teamwork in the development of programs for education, research, and extension;
- the colleges as the constituent units of the university for ensuring proper

Table 1. Educational fields, degree programs, admissions capacities, and number of colleges in the SAU system.

Educational field	Degree programs and the no. of universities offering			No. of colleges	Total admissions capacity	
	Undergraduate	Master's degree	Doctoral degree		Undergraduate	Postgraduate
Agriculture	23	22	19	44	5490	2506[a]
Veterinary science	19	19	16	22	1600	450
Agricultural engineering	10	6	3	10	530	200
Home science	13	8	5	13	670	115
Dairy science	7	13	2	7	180	200
Fisheries	5	2	1	5	150	55
Forestry	1	1	1	1	50	12
Food science and technology	1	1	-	1	50	6
Horticulture	3	21	12	3	80	-
Marketing/banking and cooperatives	2	-	-	2	80	-
Sericulture	1	-	-	1	30	-

[a]Including horticulture.

standards and quality; no affiliation is allowed;

- education based on a flexible course credit system and continuous internal evaluation;
- acceptance of the philosophy of service to agriculture and the rural community, and emphasis on programs that are directly and immediately related to the solution of the social and economic problems of the rural people;
- specialized training programs for rural youth and adult men and women who are not degree candidates;
- quick communication of new knowledge to students, extension workers, and farmers;
- corporate management with adequate powers under the University Act;
- organizational and operational autonomy; and
- adequate and liberal financial support from the government.

The range of bachelor's, master's, and doctoral degree programs presently being offered by the SAU system plus their admission capacities are given in Table 1. In addition to the degree programs, the SAUs also offer a variety of training programs to farmers, functionaries of the state departments concerned with agricultural development, and personnel of the banking, input supply,

and technical service sector serving agriculture. ICAR coordinates and supports the educational and training functions of the SAUs.

The 23 SAUs cover all major states of the Indian Union. A Central Agricultural University is being planned for the 7 states/territories of the North Eastern Hills Region during the VII Plan (1985-90).

Agricultural colleges of central universities

There are three agricultural colleges functioning as constituent colleges of central universities, viz., Vishwabharati at Shantiniketan, North-East Hill University at Shillong, and Banaras Hindu University at Varanasi. The duration of the undergraduate program is 3 or 4 years, and only North-East Hill University has no postgraduate program. The average admissions capacity is 60. These colleges are fully financed by the Ministry of Education and ICAR.

Agricultural colleges affiliated with general universities

When the SAUs were established most of the then existing agricultural colleges were brought under the SAU system. However, 31 such colleges continued to function as affiliated colleges of general universities. These institutions are run mostly by the private sector with financial support from philanthropic organizations and societies. They also receive grants from the state and central governments to a very limited extent. Their undergraduate programs are almost all of 3 years duration, and about half offer postgraduate education. Admissions capacity ranges between 40 and 400. In general, most of these colleges do not have adequate physical facilities for effective education and research. They also have not adopted educational innovations adopted by the SAUs like integration of teaching and research and internal evaluation. Consequently, the educational programs of these colleges are quite weak in comparison to those of the SAUs.

The ICAR system

ICAR has established 37 research institutes, 5 project directorates, and 9 national research centers. Large concentrations of scientific manpower, equipment, and facilities exist at these institutions, and ICAR is increasingly using their resources for specialized and advanced level educational and training programs in their respective specialties. Two of these institutes, viz., the Indian Agricultural Research Institute in New Delhi and the Indian Veterinary Research Institute in Izatnagar, already enjoy university status and offer master's and doctoral programs. Several other research institutes do so in collaboration with other universities. Most of these institutes also offer

short-term training programs in their respective specialities for scientists and technicians to train new manpower as well as to update existing manpower.

It is intended to intensify the use of ICAR research institutes, project directorates, and national research centers for specialized and advanced level educational/training programs in a manner complementary to their research function. These institutions, in collaboration with the SAU system and international institutions, are expected to perform the vital function of continuously augmenting and improving the overall capability of the national system of education for agriculture.

Research institutions outside the SAU-ICAR system

A number of other institutions are also engaged in educational and training activities in agriculture-related fields such as sugar, rubber, coffee, meteorology, radioisotopes, and nutrition.

HUMAN RESOURCE DEVELOPMENT NEEDS

In spite of this very large capacity system offering a wide range of educational and training programs, the country is still experiencing a shortage of well-trained agricultural manpower at practically every level from farm workers to senior management personnel. The capacity of the system needs to be augmented, therefore, and progams for expansion are underway in a number of fields in the SAU system as well as in the ICAR institutes. Inland fisheries, farm forestry, agrometeorology, veterinary science, agricultural engineering, home science, horticulture, educational technology, and research management are receiving particular attention. Capacity at the postgraduate level is also being established in certain emerging fields, viz., plant and animal biotechnology, agricultural communications, and computer applications. Strong emphasis is being placed on the development of technical manpower using the resources of the ICAR institutes. A UNDP-assisted project on Postgraduate Agricultural Education and Research, operational since 1972, is being further expanded to cover several new fields of high priority.

The SAU system is being strengthened to provide strong training support to the various level functionaries of the state Departments of Agriculture, Animal Husbandry, Fisheries, Horticulture, etc. The regional research capability of the SAU system is being strengthened through the IDA-assisted National Agricultural Research Project, and the Training and Visit System of extension is being introduced throughout the country. The National Academy of Agricultural Research Management at Hyderabad is being strengthened to expand training programs in various aspects of educational technology and research management. Scientific development of curricula is being emphasized throughout the system (4).

The basic thrust of this national effort in the broad field of education for agriculture is two-fold:

- to establish rapidly institutions and programs for the human resource development necessary for national agricultural development within the national system for education and training, and
- to provide for continuous improvement in the efficiency of the national system through the application of the principles of the educational and management sciences and through accepting and internalizing relevant international advances in science and technology.

International inputs are needed to meet both these thrusts. In the establishment of new institutions and programs, it is imperative that full advantage be taken of the most recent worldwide advances in the science and technology of education and training for development. For continuous improvement, the system should have access to the advances being made elsewhere so that those that are relevant to national situations can be accepted and internalized, leading to continuous updating of the capability of the national system.

In spite of an overall paucity of resources, the country has been funding agricultural education, research, and training programs on a rather liberal scale, and overall availability of resources has not been a serious constraint to the efficient operation of the system. Inadequate availability of expertise in the educational and management sciences and technologies appears to be the biggest constraint on the efficiency of the agricultural education, research, and training systems and hence on the agricultural production system in the country.

ROLE OF INTERNATIONAL AGRICULTURAL RESEARCH CENTERS

The International Agricultural Research Centers (IARCs) of the CGIAR system are uniquely placed to assist national agricultural research and education systems in developing countries because of the following characteristics:

- They have easy access to the global advances being made in various sciences and technologies relevant to agriculture.
- They have the means to operationalize such advances in their areas of responsibility.
- They can easily interact with the national systems in developing countries to refine and modify relevant advances to suit specific situations and to assist the national systems in internalizing them.
- They can easily establish intimate, person to person and institute to institute linkages with national systems for long-term efforts that are essential to impart to the national systems the capacity for self-improvement.

It would therefore be proper for the IARCs to offer their services to the

developing countries for the establishment not only of needed national institutional capabilities to deal effectively with the currently identified problems of agricultural education, research, and technology transfer but also of the capabilities required for continual self-improvement of the national systems themselves. More specifically, the IARCs could expand their technical assistance programs to include the following services:

- training in scientific formulation of educational, research, technology transfer, and technical support services programs;
- training in management and improvement of research, technology transfer, and technical support services systems; and
- consultancy services for reviewing, designing, and establishing national systems and programs for agricultural education, research, technology transfer, and technical support services

In order to provide such comprehensive services in an integrated and cost-effective manner it may be desirable for the IARCs to coordinate their efforts and provide consultancy services on a consortium basis.

REFERENCES CITED

1. Association of Indian Universities. 1983. Handbook of agricultural education. New Delhi.
2. Chandrika Prasad. 1981. Elements of the structure and terminology of agricultural education in India. United Nations Educational, Scientific and Cultural Organization.
3. Gautam, O.P. 1981. Growth of agricultural education. Indian Council of Agricultural Research, New Delhi.
4. Indian Council of Agricultural Research. 1978. Report of the Review Committee on Agricultural Universities. New Delhi.

Research and Training at the Agency for Agricultural Research and Development in Indonesia

I. Manwan

The goals and activities of AARD are reviewed, particularly with regard to scientific manpower development. AARD has an extensive program that places PhD and MSc candidates in universities, both local and foreign, and conducts in-service training of several kinds. There is a need for Indonesian universities to provide training in research management and for more collaboration between research and education in general.

The economy of Indonesia is based on agriculture: Over 70% of the population live in rural areas; agriculture is the major source of income for two-thirds of the rural households and one-tenth of the urban households; and about 60% of total employment is provided by agriculture, which contributes about 25% of GDP and one-third of export earnings. Over 17.5 million smallholder families are engaged in subsistence and cash crop farming on holdings averaging under one hectare each.

Over the past decade, the growth in agricultural production has exceeded 4% per annum. The driving force behind this has been the rice industry, where yields, using improved varieties, increased during the first three Five-Year Plans by an annual average of 4.9%.

The agricultural goals of the current Fourth Five-Year Plan (REPELITA IV, which began in April 1984) are essentially a continuation of those of the Third Five-Year Plan (REPELITA III, 1979-84). The first goal was to increase incomes in general and to expand exports and food production in order to achieve a prosperous society. The second was to improve the level of farmers' incomes and to expand work opportunities for the achievement of a stable and dynamic agricultural sector. The third goal was to create a sustainable source of production based on natural and manpower resources for the development of an efficient agricultural sector, commensurate with its potential. In REPELITA IV, these goals are continued, with particular emphasis being given to:

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- improving nutrition,
- generating gainful employment opportunities,
- improving production of raw materials to provide support for domestic industries, and
- maintaining an optimal ecological balance and conserving the environment while improving the utilization of natural resources.

RESEARCH AND TECHNOLOGY FOR DEVELOPMENT

Research and scientific activities in agriculture in Indonesia date back to the establishment of the Botanical Garden in 1817. Early programs on the collection and introduction of economic plants such as chinchona, tobacco, and oil palm led to studies on plant husbandry and on plant pests and diseases. The first experimental stations and research institutes were founded towards the end of the 19th century, and most of the research institutes that followed were established to support the production of commercial crops for export. The State Guidelines for 1973, 1978, and 1983, which were decreed by the People's Consultative Assembly, declared that research is needed for all the stages of national development. They also called for the strengthening of national capabilities in science and technology to support and provide guidance for national development. The generation and adaptation of science and technology have become the basic requirements for increasing agricultural output, which cannot be attained by using traditional farming practices.

In 1974, the Government of Indonesia established the Agency for Agricultural Research and Development (AARD) to:

- function as an effective national research coordinating apparatus,
- strengthen national research capabilities, and
- develop successful research programs.

Agricultural research has provided a significant contribution to achieving the goals of agricultural development and has received substantial attention as an object of national development. The research programs are directed to the needs of the country as a whole in accordance with the agricultural policy formulated at the highest governmental levels. As a part of these development activities, efforts have also been focussed on the strengthening of research productivity and improving its impact at the farm level.

Although agricultural research has generated improved technologies for development, considering the large variety of problems and production constraints there are still many challenges for these technologies to solve the agricultural problems confronting Indonesia. To adapt these technologies for solving these problems will require a large research effort.

While many different organizations in the country have a role to play in this process, the contribution of agricultural research is critical. Indonesia's

goals for the agricultural sector can be achieved only if we are capable of developing new packages of technological innovations that are profitable for our farmers to utilize and that enhance productivity and contribute to employment generation while meeting ecological and natural resources criteria. The task before us now is much more complex than a decade ago when we began our intensive efforts to increase rice production.

REQUIREMENTS FOR PRODUCTIVE RESEARCH

The task of institution building in the development of a national agricultural research system involves the carefully planned mobilization of human, physical, and financial resources. The principal constraint AARD now faces in achieving this goal is a lack of trained scientific manpower. Consequently, our activities have been directed to increasing both the quality and the number of Indonesian agricultural scientists capable of applying their skills to a wide variety of commodities. In each discipline and area, a minimum critical mass of scientists is necessary to sustain a research program. As these needs are translated into specific staffing requirements for each of our 23 research institutes and their several hundred subordinate units, the task we confront becomes formidable.

Planning for scientific manpower development has become quite complex, as we no longer view research as an activity carried out primarily by individual scientists, working largely independently of their fellow scientists. We now recognize that any given technical problem is multi-faceted, requiring the contribution of specialists from several disciplines. This multidisciplinary, team approach to agricultural research has in turn led us to adopt a program approach to project development to assure the optimal commitment of technical and financial resources.

The use of multidisciplinary teams as the basis for manpower planning and a program approach as the basis for research planning enable us to concentrate on strategic concerns and reduce the amount of short-term fragmentation of both research efforts and resources. Each of our 23 research institutes, 2 research centers, and 5 research coordination centers is now linking manpower planning to research planning, assuring a more orderly process of institutional development. We recognize the need for flexibility in this process. We also recognize the marked benefits we derive from using an organizing matrix that links manpower development to research programming. We are about halfway through AARD's projected plan of scientific manpower development that commenced in 1975 and goes through 1994–95. The actions we take in the coming decade must result in a rational balance of scientific skills at each of our research units. The specification of priority research program areas is unique to each institute; no "standard formula" can be used. Each research program, each cluster of projects, has different staffing

requirements in terms of skills and experience. By aggregating our research program/project planning efforts on an institute by institute basis we arrive at the unique mix of skills required for, say, our institute focussing on food crops in dry upland areas at Maros, our vegetable crops research institute at Lembang, or our smallholder rubber research institute at Sembawa. We recognize that, as our research priorities alter, so will our staffing needs.

The effective mobilization of scientific manpower for agricultural research, along with the other financial and physical resources required, is critically affected by the capacity for research management and administration. Many of our best young scientists have found that, upon completing their doctoral dissertations and returning to their institutes, it has been necessary for them to take on a new set of responsibilities related to institute management, a responsibility for which their formal academic training did not prepare them. It is therefore important to develop at Indonesian universities training programs in research management. This type of management can be separated into management by scientists as they carry out their research and management by administrators of research institutes, including the renovation of existing facilities and the construction of new ones, research programming, and project selection. Training modules should be developed for these two types of research management.

SCIENTIFIC MANPOWER FOR AGRICULTURAL RESEARCH

While agricultural research in Indonesia started in the 19th century and at the time of independence in 1945 the nation inherited a rather extensive although fragmented group of research institutes, there was essentially no trained manpower to staff them because no institutions of higher education in agriculture existed in the country until after World War II. Between 1920 and 1940, only 230 college graduates could be counted in the whole archipelago. When the AARD was established in 1975, it had only 16 PhD's, 204 MSc's, and 243 Sarjanas (BSc's) on its staff. By 1979 we were able to increase this to 27 PhD's, 44 MSc's, and 626 Sarjanas. As of April 1984, these numbers had increased to those shown in Table 1. Table 1 also shows the growth targets for scientific manpower for agricultural research during the decade ahead, which are more than double the size of the present staff. We must attempt this if we are to have in place by 1995 a research staff adequate to meet our research goals and fulfill the mandates given to AARD.

In addition to this permanent staff, AARD also retains a substantial staff primarily with entry level qualifications who work on a temporary basis while awaiting the official sanctioning of additional positions. In this category, there were 97 persons with BSc degrees, 280 with Ir or equivalent degrees, and 1 with an MSc degree — mostly young persons who had recently completed their academic training.

Table 1. Growth targets for senior staff, Agency for Agricultural Research and Development.

	PhD	MSc	BA, BSc, Ir, Drs
AARD staff, April 1984 on site	90	279	965
Honorary staff, April 1984	0	1	169
	90	280	1,134
AARD staff away on training, April 1984	142	237	0
	232	517	1,134
1963/94-95 training program	278	613	New staff
	510	1,130	
Target staffing for 1994/95	510	1,130	1,000

Table 2. Researchers in the Agency for Agricultural Research and Development, April 1984.

	Asssistant researcher		Associate researcher		Researcher		Senior researcher			Total
	A	B	A	B	A	B	A	B	C	
Agricultural economics	-	-	1	-	1	-	-	-	-	2
Soil science	21	1	5	2	2	-	1	1	-	33
Food crops	106	5	32	3	11	-	3	-	1	161
Horticultural crops	26	1	8	-	3	1	2	-	-	41
Industrial crops	32	2	11	4	3	-	2	-	-	54
Animal science	37	3	16	2	10	3	2	-	-	73
Fisheries	41	3	13	3	6	-	1	-	-	67
Estate crops	69	6	39	7	20	-	13	2	2	158
Total	332	21	125	21	56	4	24	3	3	589

Table 2 provides information on the number of staff in various fields, broken down by their status within AARD, as of April 1984.

AARD's training programs

In order to attain our long-term manpower development goals, AARD has developed a training package which focusses upon five areas: degree programs, in-service training programs, a re-entry program, a seminar and workshop program, and a sabbatical leave program. Each of these has an important role in our efforts to develop and sustain the scientific manpower required by AARD, as explained in the following pages.

Degree programs. Indonesia has 26 universities located in 25 provinces that offer courses in the agricultural sciences, but our current degree programs depend very heavily on only three: the Bogor Agricultural University, Padjadjaran University in Bandung, and the Gadjah Mada University in Yogyakarta. Under the proposed National Agricultural Research III, AARD has planned for 480 staff in PhD and MSc programs. Nearly 80% will study at universities within Indonesia. The demands placed upon the faculties of our agricultural universities for training, research, and consulting are thus very heavy, and the resources at their disposal are far from adequate. We help our universities by providing funds for research from our staff training budget. We also give other forms of supplementary assistance to the teaching faculty. Nevertheless, the resources of the local universities are inadequate, particularly for the supervision of student research. In some critical disciplines, our universities are themselves in the midst of institutional development programs and are unable to meet our expectations for assistance in training. Thus 100 out of 200 of our PhD trainees (500%) and 90 of our 280 MSc trainees (32%) will be sent to universities in North America, Western Europe, Australia, and elsewhere in Asia. Wherever possible, in order to assure the relevance to our needs of the research component (particularly of the PhD programs), those sent overseas will return to conduct their field research in Indonesia. We are also collaborating with local universities for our staff to do their dissertation research under the guidance of scientists at selected international research institutes. The principal criterion in seeking such collaborative training efforts is to identify external agencies with the capacity to assist us in meeting needs that AARD has defined through its own planning processes, in a manner that also meets the degree requirements of our Indonesian universities.

In-service training programs. Our in-service programs involve short-term, non-degree training both in Indonesia and abroad. For the training conducted within Indonesia we make extensive use of resources available at our universities and other specialized training centers. This type of training is particularly important when we need to develop specific skills for addressing an urgent problem such as disease or pest infestation. We also use this training for upgrading the skills of our staff who are not scheduled for degree programs.

Because of the substantial costs involved, the short-term overseas training program focusses upon the needs of individual scientists (or small groups) for training otherwise not available in Indonesia. Some of this training is conducted at international centers of the CGIAR system, and the remainder by national agricultural research agencies, universities, and specialized training institutions.

Re-entry program. Staff members who have completed PhD programs both in Indonesia and abroad face special problems upon returning to duty at their research institutes. On the average, they have been away from three and one-half to four years. Upon return, they are expected to provide leadership in

a research program area. For these younger scientists we conduct training programs on project preparation and research management. We also have an active in-house publication program, and we make special efforts to encourage staff to seek formal publication of their research results.

Seminar and workshop program. AARD conducts a variety of seminars and workshops designed to improve communication within the agency and to provide a forum for the discussion of problems/issues of importance among selected members of our staff.

Sabbatical leave program. A program which we are about to initiate will provide a six-month sabbatical leave to our senior research scientists to enable them to work at other research institutes conducting programs in their research areas. This will allow our scientists to keep up with recent developments and techniques and thus upgrade their own skills.

Linkages with agricultural education

Having already stressed the importance of well-trained scientists in a research program, it is therefore evident that the linkages between the agricultural research system in a country and that country's agricultural education system are extremely important. The eventual success of the research program will depend on these linkages. The problem in Indonesia is that the country's educational system still does not have the capacity to produce a sufficient number of qualified research personnel. The proportion of university graduates who are employed as researchers is still relatively small. Consequently, it is very important to consider ways in which the quality and capacity of Indonesian universities can be improved. AARD should also participate in this effort, since the Agency not only provides employment opportunities for university graduates and sends its best staff for postgraduate training to these universities but also has a large number of scientists with PhD's who could collaborate with the universities in upgrading their graduate programs. The first step may be to concentrate on a few selected universities — perhaps the University of Indonesia, the Bogor Agricultural University, the Bandung Institute of Technology, Padjadjaran University, Gajah Mada University, and Airlangga University. Collaborative efforts could be designed that would combine the strengths of both the universities and the agricultural research agencies. As an example, AARD could provide opportunities for the students to do their theses and dissertations in cooperation with programs of the Agency and using the laboratory and field facilities of AARD. The research staff could help guide these students in their research, thus reducing the university staffs load. This cooperation, as well as collaboration in other areas, would contribute to the development of agriculture in the country.

We are presently developing just such a collaborative program, for which we are seeking assistance from external funding agencies. In addition, we want

to create more collaborative activities with Indonesian universities in the area of non-degree training programs. We look forward to carrying out many successful programs with our universities for the achievement of a productive, stable, and sustainable agricultural sector that will contribute to the development of Indonesia.

Agricultural Education in Thailand: System and Problems

Yookti Sarikaphuti

The organization and administration of education for agriculture in Thailand are reviewed, and problems of the system are cited, chiefly the lack of coordination between the manpower planning sector and the production sector, deficiencies in the quality of agricultural graduates and in the curriculum, lack of interest on the part of graduates to take agriculture seriously as their occupation, and organizational weaknesses.

About 40 million of Thailand's 50 million people live in rural areas; they comprise about 5.5 million farm households and 1.8 million non-farm households. In 1983, agriculture contributed over 20% of GDP, generated 60% of exports, and provided full- or part-time employment for more than 70% of the country's labor force. Agricultural production grew at an average annual rate of about 4.2% during 1970–82. In the past two decades, this strong agricultural performance and the relatively even distribution of farm holdings have contributed to a substantial reduction in rural poverty. However, the rate of agricultural growth has fallen in recent years, from 5% per annum during 1970–75 to 3.5% per annum during 1975–82, because of a shift from expansion of cultivation into forested areas to expansion into poorer marginal lands. Average yields, which were always relatively low, have decreased. Future growth in agricultural output must come from intensification of production. This will require the provision of greater and more effective support services, a favorable policy environment, and increased use of purchased inputs.

Within the context of the principal national goal of growth with equity, the main objectives of the government's agricultural policy are:

- to increase agricultural production,
- to alleviate rural poverty and reduce interregional income disparities,
- to expand agricultural exports rapidly to help the balance of payments, and
- to better utilize the available land suitable for agriculture, provide protection against deforestation, conserve natural resources, and minimize the degradation of the environment.

Director general, Department of Agriculture, Ministry of Agriculture and Cooperatives, Thailand.

Efforts to pursue these objectives involve the following major strategies:

- the creation of an environment in which the private sector will have the needed incentives and confidence to boost production, marketing, and exports;
- the generation of technical packages to aid intensification;
- the demarcation of poverty areas in which line agencies are to focus their programs, particularly for agriculture, rural infrastructure (physical and social), and community development;
- the strengthening of agricultural support services delivery; and
- the establishment of a land use policy for better utilization of land suitable for agriculture and a clear demarcation of zones reserved for forestry and conservation.

AGRICULTURAL EDUCATION

Education in Thailand is in a period of transition following reforms in 1978 that introduced a new system comprising 6 years of elementary, 3-6 years of secondary, and 2-6 years of tertiary education. The elementary level is free and compulsory for all children above the age of seven. Secondary education aims to provide appropriate academic and vocational knowledge compatible with the learner's age, needs, interests, skills, and aptitudes that, ultimately, will be beneficial to his or her chosen career and to society. Tertiary (higher) education aims at the full development of human intellectual abilities to facilitate the advancement of knowledge and technology; higher education is offered in colleges, universities, and institutions of specialized studies, including open universities where students are not required to attend classes.

Under the National Education Scheme of 1977, secondary school students choose to follow either an academic or a vocational track following completion of 9th grade (lower secondary level). Those who choose the vocational track enter the national vocational schools and colleges to pursue a 3-year program leading to the Vocational Certificate (craftsman level) called Paw Waw Chaw (PWC). The schools and colleges provide basic vocational training skills in five areas: Agriculture, Trades and Industry, Commerce, Home Economics, and Arts and Crafts. Upon completion of their training, PWC graduates have traditionally been expected to enter the labor force. The social demand for further education and the disillusionment of employers with PWC graduates' skills and attitudes resulted in the addition of the Higher Vocational Diploma (technician level) called Paw Waw Saw (PWS) to the vocational and technical colleges.

The principal government agencies that implement the agricultural education system and utilize agricultural technology are the Ministry of Education, the Ministry of University Affairs, and the Ministry of Agriculture and Cooperatives. Each of these agencies is independent in terms of administra-

tion. Various units within them offer vocational education in agriculture.

Within the Department of Vocational Education (DOVE) of the Ministry of Education, 44 agricultural colleges offer 3-year certificate courses and 2-year diploma courses. DOVE also has an Agricultural Engineering Training Center, which functions as a teaching aids center in agriculture, runs pre-service and in-service training for agricultural teachers, and conducts formal diploma courses in farm mechanics. Besides certificate and diploma programs, including a diploma program for those who graduate from high school with a sufficient vocational course background, DOVE institutions offer short courses in selected agricultural subjects to farmers, both at the colleges and through 37 mobile units that offer training in villages and on farms. The proposed Future Farmer Education and Training Program will accept young farmers aged 15-20 years who have a minimum of 6 years of education.

The Institute of Technology and Vocational Education (ITVE) of the Ministry of Education was founded in 1975 to provide students graduating from vocational and technical schools with the opportunity to further their education to the degree level—a recognition on the part of the government of the need to promote and fully develop the vocational education program. ITVE was singled out as a special type of educational institution, taking on the role of a technical university. Two years later, the Ministry decided to transfer 28 technical institutes and colleges from DOVE and ITVE. These 28 institutes have been renamed as campuses of ITVE and compromise 10 agricultural, 10 technical, 4 commercial, 3 home economics, and 1 arts and craft institutes offering a wide variety of courses at the 3-year certificate level and the 2-year diploma level. Students at the diploma level may continue for one further year to obtain a Diploma in Vocational Teacher Training. This course was specially designed to meet the increasing demand for vocational instructors.

The vocational school and college enrollments in agriculture in 1981 were 26,131 at the certificate level and 7,630 at the diploma level.

University level training in agriculture (a 4-year degree program) commenced in 1943 with the establishment of Kasetsart University. Provincial universities providing agricultural degree training were established in 1964 at Chiang Mai in North Thailand, in 1965 at Khon Kaen in Northeast Thailand, and in 1968 at Prince of Songkhla University in Southern Thailand.

In response to student pressure to provide degree training for diploma level graduates, the Mae Joe Agricultural College at Chiang Mai, one of the oldest agricultural education institutions in Thailand, which was established in 1934 by the Ministry of Education as a regional agricultural teacher training school, was reorganized and upgraded in 1974/75 to become an Institute of Agricultural Technology. The Institute, now under the control of the Ministry of University Affairs, offers bachelor's and master's degrees in agricultural technology with emphasis on farm practices to diploma holders after an additional 2 years of training. In 1975, the Bang Pra Agricultural College under ITVE

received approval to grant bachelor's degrees in agricultural education on a similar basis to Mae Joe; it now also provides degree training in agricultural technology, plant sciences, and animal sciences. The Chao Khun Taharn Agricultural College, formerly under DOVE, was transferred to King Mongkut's Institute of Technology under the Ministry of University Affairs as the Faculty of Agricultural Technology in 1979. It offers a 3-year certificate course, a 2-year diploma course, and a bachelor's degree in technical agriculture. There are also 25 private institutions throughout the country which provide some agricultural education. They offer certificates and diplomas for 2-3 years of study.

In the Ministry of Agriculture and Cooperatives are schools operated by the Department of Royal Forestry and the Department of Livestock to produce graduates for their own needs. These activities are ongoing and stem from direct agreements in principle between the Departments and the Office of the Civil Service Commission.

The Forestry School of the Department of Royal Forestry admits about 250–300 high school graduates with science and mathematics backgrounds each year. Diplomates of the 2-year program can join the Department at a higher rank than otherwise.

The Para-Veterinary School of the Department of Livestock admits about 250–300 high school graduates with science and biochemistry majors every year. Some diplomates of the 2-year course can join the Department if there are vacant positions.

PROBLEMS OF AGRICULTURAL EDUCATION

As agricultural education is conducted both inside and outside of educational institutions and represents a major activity covering the whole of the country and involving diverse organizations, there are a number of problems related to its implementation.

The first problem concerns the employment situation of agriculture graduates at different levels. There is a lack of coordination between the manpower planning sector and the production sector in agriculture. In addition, there is a lack of reliable data on manpower requirements. The twin effects are unemployment and the failure to meet production objectives. Employers have to shoulder the expense, time, and effort involved in retraining new employees. At the same time, unemployment rates are expected to increase. As it would be difficult to restrict the rate of acceptance at educational institutions, unemployment could be reduced by another admittedly difficult route—expanding work opportunities in areas that require people with agricultural education, e.g., extension, research, and agro-industries.

The second problem relates to the quality of graduates. Many agricultural graduates are unable to demonstrate an ability to think and to apply the

knowledge gained from their academic background. This problem is partly the result of the increasingly fragmented nature of the courses being taught. One solution, in addition to more integrated courses, might be an agricultural "project" or "special problem" to teach the practice of applying knowledge to real situations. There is currently an emphasis in the curriculum on maximizing the number of subjects studied rather than providing time for practical work in a fewer number of subjects. Further, lecturers themselves often do not have much practical experience. The lack of practical training facilities (both locations and equipment) is a contributing factor. Even when practical training is arranged, the locations are often unsuitable for exposing students to actual agricultural problems.

The third problem lies in the philosophy of the curriculum, which has been strongly influenced by American educational philosophy. This influence has often been exerted through American advisors who have worked on various projects relating to agricultural education. The curriculum for the bachelor's degree is narrow and that for agricultural vocational training very broad. This might be suitable for a developed country that wants specialists to deal with a well educated farming community or, at the level of vocational training, to provide a basis for further study. In the case of Thailand, which is still in an earlier phase of development, a broader education at the bachelor's level and more narrow vocational training are more desirable.

The fourth problem relates to the continuity of the curriculum. At present, the curriculum is apparently designed to terminate by itself, but modern graduates are inclined to pursue yet higher academic levels. The agricultural curriculum should be a continuum from the first to the last stage. Continuity of the vocational level curriculum with that of the higher level of education should be planned in order to allow graduates of the former access to the latter. On the other hand, the major objective of vocational training in agriculture should be to prepare students for employment rather than to continue to higher education, so policies and directions for agricultural education have to be established. For instance, the introduction of new vocational courses at the diploma level for students from general education has taken place without sufficient provision for teachers, textbooks, or equipment. As a result, the program has turned out sub-standard outputs.

The fifth problem concerns the failure of the system of agricultural education to induce qualified graduates to take up agriculture seriously as their occupation. Moreover, agriculture graduates of all levels often try to evade venturing into agri-business because they lack either the self-confidence or the practical experience. Such problems can be addressed by the agricultural education institutes and by experienced instructors with the use of proper equipment. However, it is the duty of the state to stimulate these people to turn to agri-business, probably with the organization of agricultural production projects and good marketing systems to enhance the economic and social

level of agriculturists, thereby making the profession look more secure.

The sixth problem relates to the organization of agricultural education outside the school system, an area of great importance. To work on upgrading the academic knowledge and capabilities of agriculturists is a difficult task that has to be carried out continuously and efficiently. At present, public interest in the development of a good system outside the schools has not been realized. Higher education institutions with experience in rural development and technological research should be requested to find ways and means to improve the situation, and there should be an agency or personnel designated to coordinate the system.

Finally, there is a lack of communication skills and problem-solving abilities among some agricultural extension personnel. These areas are considered to be underemphasized by the tertiary educational institutions.

Private Sector Involvement in Agricultural Training

B.N. Fox

In developing countries there is a need for more technicians—rather than technologists— who can relay to farmers agricultural innovations and developments in a practical, scientific, but readily understandable manner. The Train the Trainers approach has the most impact. Interagency cooperation involving both the private and public sectors can be instituted to develop international agricultural training programs.

The old adage says that to give a man a fish will feed him for a day, but to teach him to fish will feed him for life. Implicit in this adage is the fact that commodity aid is a short-term expediency, and, although it is essential in disaster situations, it must not be used as a substitute for local food production. This paper revolves around how the private sector can help provide the necessary "fishing rods" for agricultural development. In this context, what can the private sector reasonably expect from academic institutions and what, in fact, does it receive? What can agricultural education reasonably expect from the private sector and what does it receive? What are the constraints involved and what has been achieved so far? What are the long-term objectives of private sector involvement in agricultural training? What are we asking from governments and international agencies, and what are our plans for the future?

THE EXTENSION SERVICE

Unfortunately, official extension services sometimes become remote from the practicing farmer. The results of producing too many highly qualified graduates from many of the agricultural universities around the world have been recognized, and the demand now is for more technicians rather than technologists. The essential need is for advisers who can pass on developments in a practical, scientific, but readily understandable way to farmers. United States authorities describe this very aptly as "hands-on" methodology. Perhaps we should examine more closely the concept of licensing extension workers to practice in specific subject areas; a subject matter specialist would have to

Shell International Chemical Co. Ltd., London.

undergo stringent tests to gain the license. We must endeavor to avoid teaching by rote and to introduce a better understanding of all aspects, especially the technical and practical. To achieve this, learning by doing is quite essential. The principle is that a person should teach only when he can actually perform what he will be teaching.

A good extension service calls for sufficient funding to ensure that field extension workers have satisfactory status, conditions of service, travel facilities, and general support. Conditions of service should encourage stability and detract from any tendency to consider the job as a stepping stone to a seemingly more important one. Extension workers need to be highly motivated and convinced of the importance of their work for farmers, with whom they must have very close rapport.

In practice, there are two major difficulties. First is the logistical problem of making contact with very large numbers of small farmers in order to provide advice on specialized subjects. Second is the shortfall, in many cases, in the provision of advice at a practical level to enable the farmer to select and use products or techniques in the most cost effective manner. Only when he has been instructed in the coordination of the many new technological advances available to him can the farmer create a viable farm business unit.

THE PRIVATE SECTOR

Against the background of demands for higher productivity we should look at the part played by the private sector. How are the business activities in industries ancillary to agriculture helping to upgrade production? What are their requirements involving agricultural education and training? Is there a demand for large numbers of qualified technologists?

For example, let us examine the subsector in which my company is involved, viz., the research, development, and production of agrochemicals, although many of the considerations would apply equally to any high technology research-based enterprise. The products are not commodities consumed in huge quantities. This is not a labor-intensive industry with numerous large manufacturing plants and a substantial demand for engineers. The technical materials are measured in grams per hectare rather than tons. Our basic research programs are carried out at a small number of specialized laboratories. Manufacture is carried out in a small number of specialized plants. At the other end of the chain, we need qualified people to develop and verify the suitability and efficacy of products under field conditions. Additionally, marketing and technical support are provided for distributors. Again, however, there is not a requirement for large numbers of highly qualified graduate technologists. To put the matter in perspective, the numbers of staff with formal agricultural qualifications working in Shell companies in four major Asian countries are as follows: Indonesia, 8; Malaysia, 12; Philippines, 27; and Thailand, 27.

Yet there is a very real need for farmers to be taught how to use the many new inputs emerging from research in agricultural engineering, crop and livestock production, biotechnology, and plant breeding. The dissemination of specific advice needed by farmers to use such inputs effectively is initially handled by the local supplier. More importantly, however, the official extension services provide advice on individual subjects and on the coordination of the various inputs. Field extension officers in regular contact with farmers can be by far the most effective means of introducing proven new developments.

Several examples

Over the past 30 years, a number of rural development projects have been established by Shell in many countries of the world, all with a strong training element. Perhaps, the best known is one started in the 1950s in a rural commune in Italy called Borgo a Mozzano. The late Eduardo Virone, a member of Shell Italia who was later to join the FAO as chief of the service for development organizations and institutions, evolved a plan designed to help the people of Borgo by training them in new approaches to agriculture. Similar schemes were launched in Venezuela, Nigeria, Thailand, Brunei, the Philippines, and in a number of other countries. With a few exceptions, these projects have been handed over to local authorities for continuation.

More recently, with the ultimate objective of providing advice for the large numbers of small farmers in developing countries and to add mobility to the Borgo concept, my unit evolved the idea of short in-country training courses for the trainers of agricultural extension workers. Known as "Train the Trainers," the first of these was held in Zambia in 1981. In order to maximize benefits, we planned for the courses to be held on a regional basis, so for this first one we had as participants agricultural extension officials from Zimbabwe, Zambia, Tanzania, Malawi, Kenya, and Uganda. By using the multiplier effect of training trainers, it is possible to assist many more farmers than would ever be feasible by direct contact. With a combination of classroom sessions, practical field tests, and group projects, our Train the Trainers courses introduce participants to a learning-by-doing approach, which has been extremely well received.

The courses are directed for us by a team of consultants from the Overseas Unit of the Wolverhampton Polytechnic in the United Kingdom. The tutors are led and coordinated by the head of Shell's Overseas Unit, who is assisted by a team of agriculturists experienced in teacher training and specialized in agricultural subjects relevant to developing countries. They have carried out many training assignments for various international agencies such as the World Bank and the Overseas Development Administration of the UK.

New teaching techniques are applied to practical subject areas that are important in the field. One of these has been farm management and another

the safe and effective use of agrochemicals. Field exercises are undertaken on such subjects as pest control, specific crop attacks, and field application of the pesticide. This format was used in the first course in Zambia, in the second held at Ciawi in Indonesia in 1982, and in the third in 1983 in Sri Lanka. The additional topic of farm water management was introduced for the fourth in the series, held in 1984 in Egypt and attended by extension workers and trainers from Egypt, Sudan, Jordan, and the Yemen Arab Republic. Two of the courses have been funded jointly by the Shell Grants Committee and a major aid agency—the European Development Fund (Zambia) and the Overseas Development Administration (Egypt). In a recently published review, the British Minister of Overseas Development underlined his policy to look for opportunities for cooperating with the private sector. He also emphasized the high priority given to training and to building up local skills.

The feedback that we have received from the participants in the courses has been extremely encouraging. They have seized the opportunity to include the various new methods of communication and training in their own programs on return to their work stations.

The effectiveness and impact of any of these methods at the farmer level is extremely difficult to evaluate, and we have yet to evolve a system whereby a more quantitative assessment can be made. Perhaps we should consider ways in which this assessment could be carried out in conjunction with local agricultural colleges.

International Agricultural Training Program

There is clear potential for cooperation with official training institutions, and another initiative that we are developing is known as the International Agricultural Training Program (IATP). In this, we are partners with the British Council, the UK Agricultural Training Board, Wolverhampton Polytechnic, and the City and Guilds of London Institute. A number of training packages are being designed for specific subjects in individual countries. Extension workers will be tested on their ability and proficiency in putting the training package over to the farmer. They will each have to gain a certificate of proficiency and thus, in a sense, will become licensed trainers in a particular area.

Royal Agricultural Society of England

A recent example of the combined role of the public and private sectors in agricultural education and training was provided by a symposium organized by the Royal Agricultural Society of England at Silsoe in June 1984. The objective was to examine the capabilities and resources available that could be mobilized to supplement the activities in agricultural extension by universities

and colleges around the world. A significant development emerging from the symposium has been the formulation of a Standing Committee on Education and Training for International Agricultural Development, the first intentions of which are to:

- stimulate and act as a forum for discussion and evaluation of the contribution that agricultural education and training can make to sustain success in international agricultural development, and
- encourage regular review of the capability of all British organizations involved in agricultural education and training to meet the needs of agricultural development overseas.

FUTURE COLLABORATION

In summary therefore, what can industry do? How can it help?

In those organizations such as my own, whose mainstream activity is not the provision of training per se, limited staff resources obviously preclude taking the lead role in any large-scale project. However, cooperation should be possible through the assignment of private sector technical experts to short-term advisory or evaluation work. Specific training in scientific techniques might be arranged with private sector laboratories and development centers.

Second, in connection with organizations engaged in the provision of educational services or supplies, an additional link will be provided through the Standing Committee for Education and Training for International Agricultural Development.

Third, it is hoped that the IATP will be developed further during 1985.

Fourth, for the field evaluation of projects such as the Shell Train the Trainers series, arrangements with relevant local agricultural colleges might be feasible.

Last and by no means least, we look to governments and to official training establishments for the provision of increasing numbers of extension workers who have received training in hands-on methodology and who can indeed practice what they preach. We hope to cooperate and advise on those subjects in which we have the necessary expertise.

Agricultural Education: Views of Indian Farmers

Swami Buddhananda

The Green Revolution in India gave promise of greatly improved yield and of higher incomes for the 70% of the population who earn a living from agriculture. But various constraints have kept the promise from being completely fulfilled. Agricultural education, research, and extension must work together to improve the quality and quantity of personnel at all levels from farmers to extension workers to scientists. Training must be made more need-based and problem-oriented. Universities should inculcate in their students love for humanity, affection for the poor, and a sense of dedication, sacrifice, fairness, justice, and ethics. Higher salaries should be given to agricultural graduates, and agricultural education should be made compulsory in classes 5 to 10.

Agriculture is the very backbone of the Indian economy. The largest employer in the country, agriculture is the source of livelihood of over 70% of the population. Yet it contributes only 44% to the national income. The failure of the secondary and tertiary sectors to develop sufficiently explains this overcrowding in agriculture. Indian agriculture supplies raw materials to its industries and plays a major role in its international trade by exporting products like tea, sugar, oilseeds, tobacco, and spices. The prosperity of agriculture thus determines the prosperity of the Indian economy.

Massive efforts of Indian agricultural scientists in the mid-1960s caused major breakthroughs in food production and altered the whole concept and process of farming in the country. The Mexican variety of dwarf wheat evolved by Borlaug opened the floodgates for this Green Revolution. Indian scientists working with the Indian Agricultural Research Institute have since developed dwarf wheat varieties that are more tasty and nutritious, as well as other varieties that are rust-resistant and adapted to both irrigated and dry areas. IR8, the high-yielding "miracle rice" developed by IRRI, is capable of giving 4-6 times more yield than traditional varieties. Indian scientists crossed IR8 with local varieties to make it more suitable to the environment and to make it disease-resistant. As a result of these efforts, India has gained self-

Secretary, Sri Ramkrishna Ashram, West Bengal, India.

sufficiency in foodgrains, which has led to large savings in foreign exchange. Concurrently, the state of helplessness of the Indian farmer, his confusion, and his apathy have disappeared like a bad dream; he has experienced a new awakening, full of purposiveness, confidence, and hope. The Green Revolution in India terminated the alienation between the agricultural scientist (the intellectual) and the farmer (mostly the illiterate laborer) and created a climate of confidence in India's growth potential.

The Indian farmer looks upon the agricultural scientist as his ally, friend, and benefactor. The farmer recognizes that the scientist acts as a guide and pathfinder in improving and modernizing agriculture. Furthermore, the Indian farmer has accepted agricultural education as one of the essential inputs in agricultural production.

CONSTRAINTS IN THE AGRICULTURAL SECTOR

Despite the advances of the Green Revolution, there are constraints on agriculture in India that pose challenges to the research, education, and extension systems. The soils in the Indo–Gangetic Plains are capable of yielding much more than they currently do. In Japan, the average size of landholding is 1.01 ha and in Egypt it is 1.59 ha as against the average size of 2.3 ha in India. Yet Japan and Egypt have successfully achieved very high yields. Production in India could reach much greater heights if production gaps could be removed by applying the scientific techniques adopted in agriculturally advanced countries. Imagine the benefits if India could grow rice at four times the present level to reach the level of production in Japan; if it could grow more than four times as much wheat to equal the yield obtained in Egypt; if it could grow more than four times the groundnut to match the yield of the US; and if it could grow more than six times the present level of maize to produce as much per hectare as Italy.

Technology and research needs

The conditions of agriculture vary from region to region in India with respect to many factors like water, soil, and land–man ratio. Thus no general recommendation is possible. The only durable solution to ago–climatic and socio–political variation lies in developing in each zone an agricultural university and a research station so that suitable technology and management practices appropriate to the specific conditions there can be devised.

In India, rice is the most important and extensively grown food crop, occupying nearly 37% of the total area under cereals. India has the largest area under rice in the world with, however, the lowest yield. West Bengal, having the second largest area under rice among the States in India, can legitimately lay claim to setting up another, better equipped rice research institute, prefer–

ably in the saline belt of the Sundarbans, to develop proper strains of seeds and techniques suited to local conditions. Control of algal weed in the waterlogged paddy fields in the Sundarbans would be one of the major research themes of the proposed rice research station.

Another principal reason for the unsatisfactory performance of agriculture is the grossly limited spread of new technology. Rice has even been called the "orphan of the Green Revolution," as the small and marginal farmers have not received benefits from the new technology. There has been overemphasis on big and costly multipurpose irrigation projects, the benefits of which remain largely localized. Cheaper minor irrigation schemes capable of having a more widespread effect have, unfortunately, been given low priority. In India the irrigated area is only 25% of the total arable land, whereas it is 52% in Sri Lanka and 100% in Egypt. The extension of irrigation facilities is most vital for the advancement of modern technology.

Our Ashram's Krishi Vigyan Kendra, financed by the Indian Council of Agricultural Research, has drawn up an integrated program of land shaping and water storage for the small and marginal Sundarban farmers. The project aims to raise $\frac{4}{5}$ of a plot of land by an average of 53 cm using the earth excavated from the other $\frac{1}{5}$. Raising the level of the low-lying land in this manner allows double cropping with the additional advantage of fish production in the excavated areas. The Government of West Bengal and the local farmers are patronizing this scheme.

Inputs and the nature of farming

Only limited mechanization is possible in labor-surplus India so as not to displace labor and cause unemployment. Mere facilities for innovation are not enough. It is equally necessary for the farmer who will make use of the new devices to be modern enough in his attitudes to seek and absorb the new methods. This points to the need for setting up an elaborate and effective extension service for creating awareness of farmer needs and for providing skill training to the farming community. Agriculture in India is predominantly of a subsistence type, caused by the low resource base of the majority of farmers. The average holding is very small, subdivided, and fragmented. The small and marginal farmers are too poor to buy even essential inputs such as improved seed, fertilizers, and insecticides, let alone more expensive equipment like tractors, harvesters, and sowing machines. Low per capita income, a poor production base, low food intake, the absence of a balanced diet, poor housing, and very poor living condtions—all these loudly announce appalling poverty and keep the farmers' efficiency at a low ebb.

Finally, a just and equitable land tenure system is an important prerequisite to increased agricultural production.

ROLE OF AGRICULTURAL EDUCATION, RESEARCH, AND EXTENSION

The agricultural universities, research stations, and extension network should critically study these conditions and constraints and devise appropriate actions to remedy them. The grim picture of stagnation and misery poses a great challenge to scientists and extension workers to bring about increased production to successfully fight hunger, poverty, and misery. The farmers have faith in the capacity of the scientific establishment and hope that new products will soon come out and benefit mankind.

A rupee invested in the intellectual improvement of human beings will bring a greater increase in national income than a rupee spent on railways, dams, or other tangible goods. Agricultural education is an investment in mankind as a factor in economic growth. The agricultural development of India depends upon the quality and quantity of the working personnel at all levels from the farmers to the field-level extension workers to the agricultural scientists and researchers. Agricultural education, research, and extension are the three essential services which a country and its government must provide under any circumstances for its agricultural development. Research breaks new ground by producing new ideas and new techniques. Extension assists the farmers in putting these research findings into practice. Higher education turns out trained personnel for agricultural development including research and extension. The three services constitute the framework through which government efforts, including international technical assistance, are channeled to the farming population. The three services are interrelated and, when put together, each tends to make the others more effective.

Higher education in agriculture

It is necessary to re-examine the whole question of the curriculum of agricultural universities. There is a need to revise the present system of higher education in agriculture to produce graduates better suited for the actual needs of the country. The scope and content of the conventional syllabi for the degree programs should be made need-based and problem-oriented. Practical aspects of crop production and animal husbandry, including the socioeconomic constraints spelled out above, should be adequately dealt with in the course of study after the students get a thorough exposure to the basic agricultural sciences.

Higher salaries, with wider avenues for promotion, should be paid to agriculture graduates. This would attract bright students to the profession and reduce the intake of mediocre ones.

Agriculture in the school curriculum

It is suggested that agriculture be introduced as a compulsory subject of study in the 10-class high schools throughout India from class 5 to class 10. As agriculture is the source of livelihood of 7 out of every 10 Indians, it is quite appropriate that each boy and girl have at least a rudimentary knowledge of the field. This would integrate the school with society, heighten the social status of farmers, familiarize the students with the realities of agricultural enterprises in their immediate environment, and make education truly meaningful for them. This would also be an advantage for the students who would subsequently enter the agriculture stream of the higher secondary course and those who would continue to university education in agriculture.

Extension and farmer training

Informal in-service training of farmers is important to agricultural planning. Unless the farmers are ready to accept and apply new devices and technology in their fields, progress in agriculture will remain mere idle thinking. Agricultural extension is an educational device and service for training and persuading farmers to accept improved practices. Research and extension are mutually complementary to each other. Some mechanism should be devised to bring research and extension together by taking the cue from Japan's successful experience.

Agricultural research

Research of both fundamental and applied nature, with emphasis on the latter aspect, is of supreme importance. While new research is necessary and should be given due importance, what is already known must be transmitted to the farmers in an acceptable form. Research is a continuing process, and each research station must be alert to the problems of the cultivators conveyed to it by the extension workers from the field. Highly qualified agricultural scientists having aptitude for research should man the research posts. The "ivory tower" attitude should be replaced by the "down to earth" approach to make research an effective instrument of change.

CONCLUSION

The purpose of having higher education in agriculture will be largely fulfilled when the agricultural graduates make their services indispensable to the farmers in the manner in which medical graduates have done. Unless the

universities succeed in giving a moral tone to education by inculcating in their alumni love for humanity, affection for the poor, and a sense of dedication. sacrifice, fairness. justice, and ethics, the best of agricultural education, like any other education, will be of little value.

Korean Farmers' Views of Education for Agriculture

J. H. Park

The Saemaul Movement of South Korea has made a great contribution in training farmers for improved methods of production to reduce growth gaps between the urban and rural sectors of the country. The training curriculum is shaped by the skills and technologies needed by farmers in specific production schemes as opposed to the scientific orientation of universities, experiment stations, and extension agencies. There is a disparity between the increasing number of farmers needing specific field instruction and the excess of agricultural graduates. Part of university resources should be reallocated for the education of these farmers. Three case studies of farmer training arc given.

Since the end of World War II, farmers in the newly independent Korea have shown deep interest in the education of their children, and the savings of farm households have been spent largely on such schooling. The principal reason has been pressure on the land. The size of family farms is so small that rural boys and girls have had to find jobs in non-farm sectors. In order to get a better job in the city, more education is needed. Generally speaking, rural parents have invested more in the schooling of the children who go out to the cities than in educating the children who remain on the farm.

The rapid growth of agricultural colleges and universities in the last four decades has offered opportunities for higher education for the outgoing farm boys and girls. In the early stage of university education, namely in the period 1945–1960, most students in agricultural colleges had a rural background, and a large proportion of graduates found jobs in agriculture-related fields, especially in teaching, extension, and research. Then the number of agricultural college graduates increased more rapidly than the job opportunities in the field, and only a small portion of graduates could find jobs that were directly related to rural development. Moreover, very few graduates returned to operate small size family farms.

The urban-industrial sectors of the economy developed rapidly in the period 1960–1984, and job opportunities in non-farm sectors increased more rapidly

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than those in the farm sector. Only a small fraction of college graduates in agriculture could get jobs in agriculture-related fields such as teaching, extension, research, agro-business, public administration, or agricultural cooperatives. Looking to the future, it is probable that the majority of agricultural college graduates will always be employed in jobs that are not directly related to agro-industry and rural development. Hence, education for agriculture in colleges and universities in Korea is facing the problem of excess supply.

On the other hand, the rapid urbanization-industrialization of the economy has brought about an increasing growth gap between the rural and urban sectors, and rural development has become an urgent matter. While rural people have invested so anxiously in the education of outgoing children, they have invested little in the education of farmers themselves. Thus, the lag in the stock of human capital in the rural sector became a bottleneck to rural development in the early 1970s.

RURAL DEVELOPMENT AND FARMER TRAINING

In order to reduce the growth gap, the government decided to allocate a larger amount of public funds to rural development. The Saemaul (New Village) Movement, launched in the early 1970s, was Korea's approach to integrated rural development. In order to accelerate rural development, however, it was realized that the active participation of farmers was an essential factor. There was an urgent need for the education of farmers to make them participative in integrated rural development.

The Saemaul Movement has thus had two components — Saemaul projects and Saemaul education. Saemaul projects are government-guided self-help programs to improve the living environment and infrastructure at the village level. Saemaul education has played a great part in making people participate in rural and national development. The aim of Saemaul education is to cultivate the work ethic of farmers — fostering diligence, self-reliance, and cooperation. The curriculum for Saemaul education is very different from the ordinary curriculum in a university. A one-week Saemaul training course includes disciplined dormitory life, presentation of successful case studies, group discussions, field trips, and a limited number of lectures by selected university professors. The highlights of Saemaul education are presented in the next section of this paper.

Due to the success of the Saemaul Movement, the growth gap between the rural and urban sectors has been significantly reduced. The modernization of traditional rural Korea has been accelerated greatly by farmers' participation in rural development. Above all, the commercial production of farmers has increased rapidly. Rice is the main crop for farm income, and a large propor-

tion of resources in agricultural research and extension have been allocated to increasing rice production. As a consequence the skills and technologies for increasing rice yields at the farm level have been extensively improved. In order to increase farm income continuously, however, rice farmers are facing a new challenge to allocate more resources to other crops and livestock. The yield of rice has already reached a high level, and the relative price of rice is also high due to the price support policy of the government.

The skills and technologies of rice farmers for commercial production of cash crops and livestock are at a low level. Because of increasing competition, rice farmers have to learn new skills and technologies in order to earn a profit. Therefore, rice farmers have become anxious for training in cash crops and livestock production. But agricultural extension workers at the farm level are often unable to meet the demands of farmers, because the skills and technologies needed are usually very specific. Neither are universities or experiment stations capable of meeting the demand. Agricultural colleges in the universities may have the experts and data, but they are not institutionalized to serve farmers. Research workers in agricultural experiment stations have relevant information, but their dissemination of new skills and technologies for cash crops and livestock production is not effective enough because of the shortage of qualified extension workers at the farm level, rigidities in the government budget system, etc.

Because of the inability of universities, experiment stations, and government extension programs to meet the rapidly changing needs of farmers, progressive farmers are increasingly willing to attend highly specialized workshops at their own expense. The College of Agricultural Cooperatives has conducted a series of product-specific workshops in recent years. The College, as a training center for the agricultural cooperative movement in Korea, does not have the experts and data to meet the specific needs of farmers; however, it has the necessary organizational network and facilities. Researchers, successful farmers, and specialists from public agencies are invited to address week-long workshops for about 60 farmers in such areas as cattle fattening, milk cow feeding, vegetable cultivation under vinyl paper, mushroom cultivation, and orchard management. The cost is paid largely by the participants but is partly subsidized by the agricultural cooperative in their locality. This has been found a very successful program. Highlights are presented in a subsequent section of this paper.

In the process of rural development, the agricultural cooperatives system has come to play an important role in supplying farm credit and new inputs, marketing farm products, mounting rural welfare programs, etc. The multipurpose unit agricultural cooperatives, which are organized at the sub-district level in rural areas, grew particularly rapidly in the 1970s. Presently, in each sub-district, a staff of around 20 provide about US$5 million worth of goods and services per year to about 1500 rural families. Thus, the unit agricultural

cooperative is becoming the foundation for the economic and social life of the rural people.

For sustained development of agricultural cooperatives at the grassroots level, however, there needs to be education of farmers for the cooperative movement. Again, this had to be undertaken outside the universities. In recent years, the National Agricultural Cooperatives Federation has established two training institutes to provide education for member farmers about agricultural cooperatives, and the training program is contributing significantly to inducing farmer participation in agricultural cooperatives. Highlights of cooperative education are presented in the last section of this paper.

Thus, in this paper three cases of farmer education that have been undertaken outside of agricultural colleges will be discussed, with the objective of identifying some of the limitations of education for agriculture in universities in serving the needs of farmers. As the semi-subsistence rural economy is transformed into a commercial economy, the farmers' demand for new skills and technologies increases beyond the capacity of existing facilities and manpower for farmer education. Education for agriculture in universities is facing an increasing disequilibrium. The farmers are hungry for education, while the universities are facing the problem of an excess supply of graduates. Thus an increasing amount of resources for agricultural education needs to be reallocated from the universities to the education of farmers.

SAEMAUL EDUCATION

In the 1960s, the most significant constraints upon rural development in Korea were the inadequacy of rural infrastructure and the lack of any mechanism to coordinate village efforts for the improvement of rural life. One problem was the conflict between traditional village infrastructure and the need to modernize. When goods were carried on human backs or by draft animals, villagers in rural areas did not feel any urgent need for wider and straighter access roads or for bigger bridges. When it came time to mechanize production, the village lanes were too narrow to permit a power tiller to be driven into an owner's yard, thus limiting the usefulness of multi-purpose tillers and discouraging farmers from buying them.

In the early stages of industrialization, only limited public funds were available for the improvement of the living environment in Korea's villages. Since farmers paid few taxes to the government before 1970, only limited local government revenues were available for the development of village infrastructure.

There were many problems which could be solved by the cooperative efforts of villagers. But inducing farmers to cooperate was not a simple task. The work ethic of villagers had to be built up, not by lectures or preaching but

by inducing their participation in self-help programs at the village level. This was the genesis of the Saemaul Movement.

Saemaul projects

In 1971, the government decided to dispose of surplus cement by distributing it in rural areas on the condition that it should not be divided individually but should be used for communal projects. The response was tremendous and included such projects as road development, bridge construction, housing improvement, facilitation of drinking water, public bath construction, and reinforcement of river banks — Saemaul projects.

Initially, the 35,000 villages were classified into three categories: basic villages, with low popular participation in previous self-help programs; self-helping villages, with some degree of popular participation; and self-standing villages, in which village participation was very high. Government assistance was at first given mainly to the self-helping and self-standing villages in order to stimulate the emergence of self-reliance in the basic villages. In 1973 about one-third of the villages were classified as basic, but by 1978 the basic villages had become only a negligible portion of the total, and nearly two-thirds were self-standing.

In light of the experiences and achievements of the Saemaul programs over the last decade, it is clear that the Movement has been remarkably successful. The living environments of the rural villages have been improved dramatically, the living standard of farm people has improved materially, and, above all, the work ethic of farmers is far stronger today than ever before.

Training village leaders

The training of village leaders has contributed greatly to inducing all villagers to participate in the Saemaul Movement. Among the many training institutions for the Movement, the Saemaul Leaders' Training Institute in Suwon is the best known for its unique programs and its effectiveness. In January 1972, 150 male village leaders (one from each county, recommended by local administrative offices) entered the Suwon Institute as its first trainees for a 2-week program. The sequence of events has been repeated many times since. After registration, uniforms, caps, and shoes are distributed. The 150 participants are divided into 10 teams, and each team stays in one room during the training period.

At 0600 h, all trainees line up in the compound and, after saluting the national flag and singing the national anthem, do exercises including running 2 km. After cleaning the dormitory rooms and personal hygiene, breakfast starts at 0700 h. Meals are served cafeteria style. Lining up quietly, good table manners, returning dirty dishes, etc. are regarded as part of the training.

Table 1. Adjustments in emphasis of the training schedule in Saemaul education.[a]

Subject	Period		
	1972	1973-1975	1975-979
Farm technology	***	*	
Agricultural cooperatives	**	*	none
Saemaul projects	***	**	*
Lectures to cultivate Saemaul spirit	***	***	***
Successful case studies	***	***	***
Group discussions	***	***	***

a*** = strong emphasis. ** = medium emphasis. * = less emphasis

At 0800 h all the trainees gather in the auditorium and sing; then a volunteer from among them tells of his experiences in the Saemaul programs of his village. From 0900 h to lunchtime, two lectures are given on such subjects as national security, economic development, family planning, and food and nutrition. No textbooks are used. Case histories of successful farmers cover the most important part of the curriculum.

The evenings are devoted to group discussions. On the second evening, the members of each team select a chairman and a reporter for the group discussions. They select one topic, and the group discussions continue on the topic throughout the training period.

The pattern changes in the curriculum of Saemaul education are shown in Table 1. More asterisks show greater emphasis. Strong emphasis has continuously been given to three subjects: lectures to cultivate the Saemaul spirit, successful case studies, and group discussions. The lectures on cultivation of the Saemaul spirit are offered under the following topics:

Rural problems and solutions
The independent spirit and economic development
Loving one's village and one's country
National ethics for nation-building
Spiritual foundation for agricultural modernization
Creation of a new history
Reawakening for nation-building
Leadership in nation-building
Spiritual revolution and the Saemaul Movement
International relations and national security
National unification strategies

Table 2. Distribution of 495 topics proposed by trainees for group discussions in 1972-1973.

Problem area	Frequency of proposals
Participation of villagers	125
Increase in farm income	79
Village leaders	76
Selection of Saemaul projects	70
Fund raising	70
Labor mobilization	27
Local government	34
Savings program and others	14
Total	495

The presentation of successful case studies has played an excellent role in explaining the Sacmaul Movement, not only to farmers but also to non-farm people in Korea. In the period 1972–1980, about 80 of these case studies were developed at the Suwon Institute. On the average, around 10-15 case studies are presented during a training session. Listening to the case studies, the trainees can learn how Saemaul projects are initiated; what kinds of difficulties are encountered; what the final results have been; how important the roles of Saemaul leaders are; what the difficulties of being a good leader are; etc.

Group discussions are another important factor in achieving the objectives of Saemaul education, contributing to mutual education and attitude changes of farmers. Also, the participants learn through group discussions about democratic decision-making processes, which has been a very important factor, for inducing villagers to join Sacmaul projects.

In 1972–1973, the number of topics raised for group discussion by trainees at the Saemaul Leaders' Training Institute was 495. Not all of the suggested topics could be selected for group discussion; on the average, one out of every five topics proposed was finally selected. The 495 topics are subclassified by the kinds of problem areas they represent and arc shown in Table 2.

Another important factor in Saemaul education is the dormitory life of the trainees. In fact, dormitory life is regarded as the most important part of Saemaul education. The trainers stay in the same dormitory with the trainees and demonstrate the Saemaul spirit by their actions in dormitory life. The trainees learn many things from this carefully arranged dormitory life.

The follow-up program is also an important factor in achieving the objectives of Saemaul education. Otherwise the Saemaul spirit of the trainees, which is cultivated during the training period, may not remain active after the training is over.

Saemaul education has played a vital role in the extension of the Saemaul Movement to urban–industrial sectors. In the early stage of Saemaul education (1972–1973), the farm leaders insisted that the local offilcials such as the township office chief, police chief, and the president of the agricultural cooperative should take the course in order to minimize the gap between farmers and local officials in the implementation of Saemaul projects. The request of the Sacmaul leaders was accepted by the government, and most of the responsible persons in various local offices at the county and township levels participated in Saemaul education in 1973–1974.

The local officials had a common complaint about planners in the central government, who, they said, ignored the wide variation in local conditions and failed to understand the urgency of decentralization of authority in the process of Sacmaul project implementation. As a result, a group of high ranking officials in the central government registered at the Saemaul Leaders' Training Institute in the early spring of 1974, an outcome that was not expected when Saemaul education was started. The responses of these officials to Saemaul education were positive; they said that it was a good opportunity to learn about the Saemaul Movement and about farm people, and also a valuable opportunity to reflect upon oneself as a public servant. Then the officials at the director level insisted that all the cabinet members take the same training with farmers in order to make the Saemaul Movement truly successful. Accordingly, the first group of cabinet members registered at Suwon in mid–summer of 1974. They had a 1–week training session with farm leaders. Since then professors, journalists, businessmen, artists, religious leaders, and others have taken part in the Saemaul education program. Consequently, Saemaul education has extended to all segments of Korean society.

PRODUCT-SPECIFIC WORKSHOPS

As the interests of farmers shift from rice production to new income patterns, agricultural extension workers are facing a new challenge. For example, there are many young farmers on rice farms who have started to feed milk cows and have a strong desire to attend, even at their own expense, a specialized short course to learn the answers to specific questions encountered on their farms. But rigidities in the government budget system do not allow a readjustment of the extension program to meet these needs.

The experience and data to answer the specific questions of young farmers can be found among advanced farmers, researchers in agricultural experiment stations, and some professors in universities. However, the expertise and data from these sources are not utilized effectively. Farmers do not have to learn about overall theories, and their needs for new skills are very specific, often going beyond the generalist knowledge of agricultural extension workers.

The College of Agricultural Cooperatives, which belongs to the National Association of Agricultural Cooperatives, provides dormitories, lecture rooms, transportation, and manpower to serve for training of farmers during vacation periods. The expertise and data come from agricultural experiment stations and universities, and from among advanced farmers. In 1983, the College established a new program of product-specific workshops for progressive farmers. The farmers pay only for the cost of invited experts, teaching materials, food, and other variable costs.

The first workshop topic was fattening of cattle. In the process of the rapid introduction of motor tillers, the feeding of draft cattle on rice farms was shifting to a fattening purpose, and the demand for relevant skills was very high among rice farmers. A 1-week course was planned for a class of 60 farmers. In the curriculum, emphasis was given to three areas: field trips, problem-oriented lectures, and group discussions. After registration, in order to explore the common problems of cattle feeding some slides were shown, and group discussions were arranged for the evening. On the next day, the participants went to a carefully arranged field trip, visiting a number of cattle fattening farms in the province where the College is located. It was found that the field trip was the most effective way of answering the questions of farmers; it lasted more than 12 hours because the participants asked so many questions.

The invited lectures were mainly on the problems of cattle diseases, feed mix, and construction of cattle barns. The lecturers were supplied from two principal sources: researchers from livestock experiment stations and advanced farmers in cattle feeding. It was apparent that university professors are less welcomed by the farmers than research workers from agricultural experiment stations. Generally speaking, university professors are not prepared to deal with the specific problems encountered by farmers; their content and lecture methods are aimed more at university students.

The workshop program was advertised one time only in the *Farmers Newspaper,* a weekly published by the National Association of Agricultural Cooperatives with around one half million farmer subscribers. Nevertheless, over 500 farmers from all over the country applied, and the College had to offer the same course repeatedly. The learning attitude of the farmers was so serious that lecture hours were extended from 0800 h to 2100 h and the group discussions had to be squeezed into the late evening between 2100 h and midnight. An applicant paid an equivalent of US $40 for the course, and an equivalent of US $30 was contributed by the local cooperative. The proceeds were used as indicated in Table 3. Fixed cost items such as dormitory facilities, lecture rooms, and manpower (about 10 staff members) to take care of the farmers for a week were contributed by the College.

The second workshop, concerning feeding of milk cows, was also publicized once in the *Farmers Newspaper,* and again several hundred farmers

Table 3. Cost breakdown of product-specific workshops.

Item	Share of the cost (%)
Honorarium for manuscript writing	12.7
Printing cost for a mimeographed textbook	19.3
Honorarium for invited lecturers	31.7
Food and accommodation	33.2
Field trip	7.0
Others	5.1
	100.0

applied. Three successful sessions were held. The cultivation of mushrooms was chosen as the subject of the third course. Again, the applicants were so numerous that four sessions were offered, with successful results. So far no farmers have complained about the fees they paid. The largest demand was for the growing of vegetables in vinyl paper houses; this course could be operated throughout the year if only the College facilities could accommodate it.

LEADERSHIP TRAINING FOR AGRICULTURAL COOPERATIVES

The active participation of villagers in integrated rural development has contributed greatly to the growth of agricultural Cooperative activities at the grassroots level. 'This can be seen in the rapid growth in business volume of the unit agricultural cooperatives as shown in Table 4. There are around 1,500 sub–district administrative units in Korea, each with its unit agricultural cooperative. The number of permanent staff for a typical unit cooperative increased from 6 persons in 1972 to 19 in 1983. As the deposits of farmers increased, they became free from private money lenders. Because of the network of agricultural cooperatives, even farmers in remote areas are able to purchase farm inputs and consumer goods of reliable quality at reasonable prices. As farmers produce increasingly for the market, the roles of the agricultural cooperatives in marketing and price stability of farm products are increasing. Also, unit agricultural cooperatives are serving as the insurance company for rural people. In recent years, the cooperatives have undertaken special loan programs for the education and medical care of farm families. Thus, the multipurpose agricultural cooperative at the primary level has become a regional center for the economic and social life of the rural people in a sub–district.

Table 4. Growth of business turnover of 1500 unit agricultural cooperatives in Korea.

Year	Deposits	Loans	Supply of farm inputs and consumer goods	Marketing of farm products	Insurance	Warehousing transportation	Total business turnover	Number of staff per cooperative
	(US$ x 10^3)							
1972[a]	17	17	31	23	-	2	90	6.0
1973[a]	41	37	75	85	110	4	352	9.2
1974	81	60	135	164	147	6	593	12.3
1975	120	68	232	242	182	10	854	13.1
1976	211	114	325	309	226	17	1,202	14.3
1977	398	257	418	383	309	25	1,790	16.0
1978	603	305	505	377	462	33	2,485	16.9
1979	827	933	626	489	608	40	3,523	17.0
1980	905	1,184	618	468	610	34	3,819	18.0
1981	1,174	1,668	746	474	541	40	4,643	19.0
1982	1,361	1,921	626	401	507	45	4,861	19.0
1983	-	-	-	-	-	-	5,611	19.0

[a] 1974 prices.

Table 5. A study team of 10 persons from a unit cooperative

Type of leader	Sex	Number of persons
President of unit cooperative	Male	1
Chief staff of unit cooperative	Male	1
Women's association	Female	2
Farmers' study circle	Male	2
Better farming group	Male	2
Youth organization	Male	2

But farmers' understanding of the roles of agricultural cooperatives has not kept pace with this growth in business volume. Hence, in the 1980s the need for farmer education about cooperatives become apparent. While education for agriculture in the universities includes the basic principles of cooperatives, the dissemination of these principles to the farm level has not been effective. The National Agricultural Cooperatives Federation has thus established the Institute of Farmer Education for Agricultural Cooperatives in two local areas. Each institute has the capacity for 200 trainees to stay in dormitories. A 1-week training course is offered for leaders of the unit agricultural cooperatives, the objective of which is to make member farmers participate more actively in the cooperative. Ten persons are chosen from a cooperative as specified in Table 5. Twenty such groups receive training at one time.

On the first morning, the participants register at the Institute. The training schedules for the week are similar to those of the Saemaul leaders training; however, the content of the curriculum is focussed on the roles of agricultural cooperatives as community centers for rural people.

The response of farmers to this leadership training has been very good, especially among young persons and rural women who have not yet paid much attention to the roles of cooperatives in their community. The expenses for the leadership training are paid largely by the respective unit agricultural cooperatives and partly by the central organization of agricultural cooperatives. It is fairly certain that the leadership training of farmers for the agricultural cooperative movement will contribute significantly to the human capital development of farmers in Korea.

Agriculture Graduates and Agricultural Education in the Coming Decade

D.L. Umali

The agriculture graduate of tomorrow should possess respect towards his or her culture and traditional values, practical knowledge of field problems, a sense of equity and social justice, and selectivity in approach compatible with contemporary social, cultural, ecological, and economic conditions. The new breed of agriculture graduate will impose new demands on agricultural universities that will entail appropriate practical work, broad based education, moral education and socially useful action, vocationalization and ruralization of education, democratization of admission requirements, and preparation of students to serve and not to be served. Curricula should be modified to emphasize small farm technology.

This paper is an attempt to peer into the future–often a risky task. But, as the old saying goes, he who will not look forward will be condemned to lag behind. And we have to take an interest in the future if for no other reason than that we will spend the rest of our lives there.

I have no crystal ball. The probable realities of the next decade or so that I shall sketch out are derived from a series of thoughtful studies. These studies show that our world, by then, is likely to be short of fuel, water, land, and other resources. It will be more crowded, probably hungrier and more destitute, drenched in acid rain, ecologically brittle, short of jobs, armed to its nuclear teeth — and badly in need of understanding itself.

Demographers at the Mexico Conference on Population in August 1984 said we are witnessing "the greatest urban mass migration in human history." By the turn of the century, this will likely be still in progress. Mega–cities will alter the landscape. There could be 45 cities, maybe more, with populations of over five million, compared to 6 such cities in 1950. This urban sprawl will continue to bury, in concrete, the farmlands that now ring the cities, eroding environmental standards as well as the capacity to produce food and fuelwood.

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In Asia and the Pacific, fragmentation of arable land will continue; per capita availability of land could shrink from 0.23 ha in 1975 to only 0.15 ha by the year 2000. Acute fuelwood scarcities already affect 31 million people in the region, but we are currently planting only 10% of the fuelwood needed. And we are clear-cutting forests equivalent to the size of Korea yearly.

All is not bleak, however. Over the last three decades, world agriculture, under the impact of scientific breakthroughs spread by modern communication media, has made unprecedented advances. Agricultural output doubled the rate of earlier periods. This surge is partly due to the application of science to crop production. It has resulted in the developing world's greatly enhanced capacity to produce food. High yielding varieties, greater control of pests, expansion of hectarage, and other factors have contributed to this growth. Institutes like IRRI have played an honored role in this dramatic record.

But alongside this historically unprecedented achievement stands the cruel paradox of the world's food problem: Never has our world produced more food than it does today, yet millions of people continue to be short of food.

TECHNOLOGY AND THE SMALL FARMER

The obvious lesson is: Technology that increases crop productivity is simply not enough. The totality of farming systems must be improved to make the farmer and his whole family economically viable.

Technological innovation is essential and exciting; but it can also be seductive. It panders to our all-too-human desire for panaceas. An innovation is too often wished into a "miracle" answer. This has been true not only of rice but also of *Leucaena leucocephala* (ipil-ipil) and the "energy tree," *Piposporium revisirum* (hanga).

Technological innovations operate in a complex matrix of economic, social, political, and cultural forces. Single factor solutions invariably backfire. Worse, technology, when divorced from structural reforms, can lead to further exploitation of small farmers and other equally vulnerable groups. It is against this mixed record that we consider some of the lessons the Green Revolution has taught us.

In the 1950s and 1960s, much of our optimism stemmed from the Green Revolution. The new varieties of wheat and rice demonstrated the cutting edge of applied science, which Chandler documented for rice in *An Adventure in Applied Science—A History of IRRI* (1). The new varieties were superb in converting fertilizer into foodgrains. They broke yield records on irrigated. farms with good soil, adequate fertilizers, and pesticides. They bought us time in the race between food and population. Asia's overall lead in food production, compared to the disastrous situation that prevails in Africa today, is due in large measure to this new technology.

But, almost unnoticed, the new seeds also reinforced an implicit belief that unlocking technical problems would automatically resolve mounting problems of hunger and poverty. That belief has been throughly debunked as festered with problems. In the Philippines, for example, despite the gains due to the new seeds, more than two million pre-school children are malnourished; about 43% of Filipino families live in absolute poverty. Looking back, we find that the new varieties did little to help small farmers. Nor were they of much help to those who tilled hilly, arid, or swampy areas with poor, leached soils, scared by drought or submerged by floods. Yet, these are areas tilled by the men and women who constitute the overwhelming majority in this region. They were bypassed as Green Revolution benefits gravitated toward the better-off farmers in the endowed areas.

The small farmer's income comes mainly from working long hours. If there is anyone who fully understands the scriptural injunction—"By the sweat of your brow, you will eat your bread"—it is the small farmer. Yet malnourishment saps his very capacity to work, which, in turn, aggravates the very poverty that breeds it. Thus, we have what the Malaysian Prime Minister once observed: the grim paradox of hungry people who till the land and feed the well-nourished.

In view of this, we urgently need to vest commanding priority in work in the rainfed areas in our research agenda for the balance of the 1980s. IRRI and the University of the Philippines at Los Baños have given commendable emphasis to this task.

A second Green Revolution is urgently needed, this time for the small farmers and those in poorer regions. It should involve development of new breeds of biologically more efficient plants that can do well on poor soils and in hostile climates; that need less energy, fertilizer, insecticide, and fungicide because of their built-in resistance to pests and diseases. The second Green Revolution must build on a truism demonstrated time and again over the last three decades: Expensive technology produces expensive goods, including higher priced food. This is particularly true when western-style, highly energy-intensive growing methods are used. There is no such thing as a free lunch. Someone has to foot the bill for fertilizers, pesticides, and energy.

A second Green Revolution would not occur in a vacuum. It would be in a context where the poorest, especially the landless and small farmers, find that the assistance they need to break out of their desperate predicament is dwindling due to runaway military expenditures, inflation, and corruption. The "magic of the market place," in such a setting, usually works only for those who have the muscle. A devil-take-the-hindmost attitude can develop. The private sector will not take up essential programs with high social costs such as agrarian reform. The disorganized and voiceless poor are likely to find themselves, once again, on the shorter end.

These are the realities of our time confronting our agricultural graduates.

THE NEW BREED OF GRADUATES

No responsible government will accept life sentences to hunger and poverty for its citizens. Therefore, governments will have to act decisively if current trends are to be altered. And the parameters for such work, which future agricultural education graduates will face, are summed up concisely in FAO's study *Agriculture Towards 2000* (2), which states:

"First : Future generations will face the same basic issue of how to grow and distribute enough food and agricultural products. The 21st century must inherit a food and agricultural system which is much more productive and equitable than it is now;

Second: Foundations for securing the enormous increase in output, needed in the first half of the 21st century and assuring equitable distribution, must therefore be laid in what is left of this century;

Third : Requirements of generations yet unborn for productive land, unpolluted water and a rich complexity of species must be respected; and

Fourth: The food and agricultural problems that will confront us in the 1980s and 1990s can be solved—if there is the political will to do so.''

To help translate these broad general objectives into action will require well trained people in addition to technical and institutional reforms. What kind of graduates should agricultural institutions produce? What kind of agricultural institutions must we have?

These questions cut into the heart of a basic problem of many Third World countries. Their poverty is not of natural endowments, though some are not as fortunate as others; but rather it is their inability or failure to develop their human resources — the most crucial component of development. Hence, their priority task must be to build up human capital.

Given the crucial role agriculture plays in the thrust towards modernization, relevant agricultural education is indispensable. Agricultural education systems are therefore not only called upon to train teachers, research workers, and field agents, but they must bring forth leaders able to innovate and translate findings into practical action, motivate farmers, advise governments, and understand the relation of agriculture to the rest of the economy, mindful that human beings, with values of their own, are involved in the whole process.

Whether an agriculture graduate is from the North or the South, there are no differences in the essential attributes. Dr. Karl E. Gardner, Associate Dean of the College of Agriculture at the University of Illinois, cites some as a willingness to keep on learning; a concept of the ethics of work; ability to communicate; technological competence; common sense. But the desperate poverty that traps many farmers in developing countries imposes, I believe,

special demands on the agriculture graduates from the South as well as those who train in the North. Among these are:

- A scrupulously nurtured respect towards one's own national culture and traditional values. Open to scientific innovations from abroad, the graduate avoids a "scorched earth" approach towards indigenous agricultural practices, values, and institutions, aware that development will occur only when it is rooted in the cultural soil of the country.
- A proven capacity to go beyond academic parameters to practical action in the field. In semiliterate societies, effective practical work has the capacity to strip down communication barriers. The agriculture graduate, or any graduate for that matter, must learn to live in two worlds—the world of books and the world of life.
- More importantly, a sense of equity and social justice. In agrarian societies, the agriculture graduate has more occasion than others to exercise "the preferential option for the poor." His education should equip him to see beyond narrow technical concerns to the more fundamental issues of structural reform and social justice. The graduate must not only "see" but feel. It has been aptly observed that "no amount of knowledge in the head can make up for a lack of feeling in the heart."

Does this carry the overtones of Paolo Freire or Leonardo Boff of Latin America? Yes. But it also reflects what Asian agrarian leaders like Mahatma Gandhi and Ramon Magsaysay taught: Social justice makes for good economics. Such an outlook is built on the basic truth that to know and not to act is not to know.

Development of agriculture is only a part, after all, of the process of liberating people from paralyzing traditions, from exploitative systems, from want, and from fear. It therefore begins with the liberation of man's enthusiasm, creativity, and energy, as reflected in a person's involvement in the development process, his participation in shaping and implementing decisions that affect his life. Development is not simply modernization. Unfortunately, in the minds of some Third World elites, it is synonymous with westernization. The Japanese experience, wherein technical innovations of the West were assimilated into their cultural matrix and traditions, contains some useful lessons.

It is critical that the agriculture graduate be selective in his or her approaches. There is enough accumulated experience to show that one can become brutally impoverished even when traditional indicators of economic growth look rosy. Everyone agrees that, at the very minimum, development means the eradication of absolute poverty and hunger—the provision of basic human needs such as shelter and clothing. But in addition to these material provisions, people also need the freedom to organize, to speak up and be heard, to participate meaningfully in economic and social decisions that affect

their lives. Pope Paul VI summed it up very concisely in a phrase reminiscent of the "broad sunlit uplands" that Churchill spoke of in 1939. Development, the late Pontiff said, should enable man to rise to more humane standards of living.

Going beyond the usual economic criteria, the agriculture graduate has to be especially aware that development interacts with nature. Policies that disregard the natural world, its complexity, and its sensitivity are corrosive. They deplete resources. Ecosystems collapse and species disappear. Consider, for example, our genetic stocks. These are irreplaceable; yet we are losing at least one species daily. This appalling statistic is a telling indicator of our stewardship of the planet.

The need for this new breed of graduate raises a parallel question: What reforms should be instituted by agricultural universities to increase their ability to produce such graduates?

MANDATES FOR THE UNIVERSITIES

There has been a sharp increase in the number of agricultural colleges and universities in the last two decades. That many possess inadequate physical facilities is well known. But the most searing criticism is that far too many of them are locked into sterile academic exercises, quite unrelated to the seething issues of agriculture rendered stagnant by social injustice. Many are located in urban areas and have few provisions for students to learn the practical side of agriculture. Thus, they become like faculties of science, with indoor laboratories. Lack of research facilities and overloaded staff are often noted.

Universities will have to put more emphasis on strengthening and broadening students' foundations so that graduates may adapt to a wider range of jobs and professional demands. Productive labor needs to be combined with instruction. Some worry that student participation in productive labor erodes the quality of teaching. Experience, however, proves that as long as time spent in study and labor is properly apportioned and integrated, labor usually reinforces the performance of both teachers and students. Through labor students learn good habits, a sense of organization, discipline, and the spirit of hard work.

The prevailing climate of permissiveness of our society has oftentimes eroded the values and decorum of our generation. In fact, many present-day economic and social problems are rooted in lack of discipline, in corruption, in civil disobedience, and in moral decadence. It is about time that the entire educational system, not only the higher institutions, promoted moral education and socially useful actions.

It is tragic but true that even today there are agricultural institutions whose curricula remain basically those taken over from colonial powers. They

provide students with few of the skills needed for community improvement in the rural areas. Worse, they often alienate young people from their own culture, cram their heads with urban dreams, and give them only the ambition to head for the cities.

We are saddled with the education of hierarchial societies, with their pronounced inequalities of power and income. Unconsciously, this produces elites to run those societies. In practice, even where equality of opportunity is encouraged, it tends to favor the children of the elite. This is a pity because education is a proven stimulus to the socioeconomic development of rural areas. For this reason, there is a growing trend in regional agricultural colleges towards vocationalization and ruralization of education, which aims to prepare students to take up innovative roles in their own villages. Students' ambitions are channelled away from urbanized career terms into a vision of self-fulfillment in the service of their communities. Thus, they help create work opportunities where they live instead of seeking them in already severely strained cities.

It is an uphill battle. Poverty in villages often combines with sluggish, insensitive policies from capitals that suck talented youngsters away from the very sites where they are needed. Yet, the ideal remains valid: The agriculture of the 1990s needs graduates who step forward to serve and not to be served.

Today, we need to make our education more closely geared to each country's identified development needs. This implies encouraging creativity and adaptability rather than rote learning, and it requires relating learning to the real lives of the students.

The festering issues of social justice too long denied are bound to come to a head in the 1990s. Most of us, I think, do not fully grasp the social forces building up behind those antiseptic rows of statistics on rural poverty. It is with a sense of sadness that I say that our children will inherit the legacy of the failed and faltering reforms of our generation.

Educational reforms are, of course, required. Curricula have to be revised, books rewritten, teachers retrained. But these tasks must be seen in the context of a larger issue: How can we reorient social systems so that the poor are not hungry and the rich are not oppressive? Education is a part of a social system. While it often has shortcomings peculiar to itself, many of them are reinforced by the faults of the overall social system.

As in generations past, what we need now are more visionaries in education who will hack out new paths in agricultural education. It is not an easy task. People like to tread familiar ground. The unfamiliar scares them. But we have a duty to try. Our fading generation of agriculture graduates owes it to the youngsters who are coming into the immensely troubled world we will leave them.

REFERENCES CITED

1. Chandler, R.F. 1982. An adventure in applied science: a history of the International Rice Research Institute. Int. Rice Res. Inst., Los Baños, Philippines. 233 p.
2. FAO (Food and Agriculture Organization of the UN). 1981. Agriculture: toward 2000. Rome. 134 p.

Special Needs of Women in Agricultural Education

M. Shah

Women are often relegated to lower status, more labor intensive, and often physically harder work than men. New technologies are invariably taken up by men, even when these are introduced for tasks that are traditionally those of women. Male biases in the career structures of society stem partly from the agricultural universities' focus on women as homemakers. The need for training and assistance to develop alternative income-generating activities for women who are being displaced by mechanization is underscored. There is a need to educate women in all agricultural fields in addition to home science.

It was probably a woman who first picked up seeds from wild growing wheat and barley, which led to the "Dawn of Agriculture" 7000 years ago somewhere in Southwestern Asia. People learned this skill and thus became producers of food instead of hunters and gatherers. This revolutionary change from hunting to farming laid the foundations of civilization, for it was only afterwards that the first human settlements appeared near perennial springs that made it possible to raise crops and breed domestic animals as population increased.

ROLE OF WOMEN IN AGRICULTURE

From the Neolithic period onwards agriculture has developed gradually and steadily to its present highly mechanized state. During all the intermediate stages women have played a key role in its development. Women's work provides a substantial portion of household cash income in rural Asia, particularly in the poorest households. Women in rural areas work for longer hours than men in both domestic tasks and agricultural production because they frequently have the responsibility for both household subsistence needs and looking after the children. Today, an overwhelming majority of women carry out numerous agricultural operations with men — seed selection, manuring, weeding, sowing behind the plough, hoeing, harvesting, threshing, storage, preparation of produce for marketing, etc. In fact, in India, once the

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fields are ploughed (by men) and the crops sown, all the remaining field operations until harvesting are carried out solely by women, allowing the male family members to go out of the village for other manual work. Women play a major role in rice cultivation, especially post–harvest processing and marketing, although their sphere of work varies in different cultures. Feeding and milking cattle and keeping poultry are jobs in which women in India predominate. In addition to participation in physical work, women help in decision-making with regard to farm practices and operations. Much of the success of farming depends on how well the family makes certain decisions. Women are more involved than men in choosing what technologies should be adopted and what inputs should be purchased and in the management of hired labor. Women's participation in farm management in a number of Asian countries is increasing with the migration of men to urban areas.

Any technology that can increase rural women's productivity so that they can earn more and work less would be beneficial not only to the women but to the welfare of rural families. The important questions are: Will the technology lead to greater production in less, time? If so, will the technology increase women's earning opportunities or be responsible for displacing them from their current tasks? As a matter of fact, care will have to be taken that the increased production is generated through gains in labor productivity, holding the productivity of other factors constant. In addition, the social environment and technology transfer programs must be such that they are accessible to women. It must be remembered that in India more than 90% of women workers are agricultural laborers who are engaged as unskilled workers, and their problems vary from place to place depending upon the prevailing social and economic factors. But it is generally true that most farm women, being uneducated, are exploited due to their ignorance. Moreover, there is an important distinction between the needs of women working in small farm households and those of women in landless rural households: Their access to resource-earning opportunities and their ability to gain from new technologies differ greatly. The issues relating to labor use and productivity will more significantly affect landless women who seek wage employment. Issues of access to new technology will more readily concern women in small farm households who are involved in farm management.

The agricultural education of women and the learning of new technologies will vary from country to country and among different environments within a given country. A technology which is new in one country may already be widely used in another.

The rice technology introduced in the mid–1960s increased the earning opportunites of rural women in India, and double cropping increased both the demand for women laborers and the incomes of women in small farm households. However, studies have shown that extension programs and credit facilities do not often reach women and lead rather to male dominance in tasks

that were previously performed by women. Women and children do not benefit in spite of an increase in family income. In Northern India, the Green Revolution brought about through the introduction of improved varieties, increased use of fertilizer, and controlled irrigation led to more concentration of land ownership, massive dispossession of smallholders, proliferation of landless workers, rural unemployment, and increased inequality among different sections of the people and among rural women. Technological developments tilted the balance in favor of big farmers over the rural masses. This in turn generated a process of underdevelopment of women, who suffered a two-pronged attack — first, exclusion from new technology and economic exploitation, wherein they were denied productive roles, and second, victimization within the family by a perpetually patriarchal system.

Parenthetically, it has often been noticed that appropriate technology, when developed for special work, often leads to men replacing women, e.g., cooking in big hotels is now done mostly by men throughout the world.

From the analysis of these problems it should be obvious that women have to be trained specifically to upgrade their skills, and at the same time society has to give due status as well as recognition to the role they play as workers.

COMPONENTS OF AGRICULTURAL EDUCATION AND TECHNOLOGY

Agricultural education is expected to contribute to the progress of agricultural and rural development by training scientists, technicians, and skilled workers. Agricultural education for women must operate along both formal and informal channels, as follows:

1. *Vocational training.* There is an urgent need to open opportunities for the technical and vocational education and training of women in the skills and professions in which they are engaged in order to enable them to contribute their full share to the development of the home and the country.
2. *Employment opportunities.* Rural women must find their livelihood in the rural areas to which they belong because the employment situation of women in cities is not encouraging. Self-employment capacity must be generated by creating small-scale industries in the rural areas, keeping in view the natural resources available locally. Remunerative jobs for women can be provided in the fields of health, education, and social services, but it should be ensured that jobs that could be efficiently handled by women are not taken by men. There should be equity of pay for the same type of job done by men and women.
3. *Basic amenities.* Improvement in housing; opening of health centers, creches, and boarding schools; better sanitation; provision of drinking water; and meeting the minimum nutritional requirements of small children would all certainly help rural women to perform their traditional

role as mothers, i.e., to take care of young ones and the family, and would create more time for their fruitful participation in agricultural production.

4. *Development of appropriate technology.* Application of simple technology in the life of rural women can go a long way towards improving their productivity and economic status and can give them time to participate in their education and in other developmental activities. Women should be given training in recently developed technologics in the following occupations, which would provide them extra income during lean periods: kitchen gardening, horticulture, poultry, animal husbandry, seed storage, preservation and treatment of seeds, treatment of plants, and processing of milk to prepare cheese, ghee, and other milk products. Such training would help farm women add to their income as well as increase production of vegetables, fruits, and milk, which are essential components of the daily diet. Other areas where agricultural education and technology could be useful are:
   a. *Home management.* Since rural women spend most of their time in household work, their training in care and maintenance of household tools, utensils, electric appliances; etc. and in planning the house for sanitation, disposal of wastes, and control of household pests would be useful for better living, budgeting, and saving.
   b. *Nutrition.* Training for improvement of the knowledge and skills of farm women in nutrition — low-cost nutritive recipes, methods of cooking to preserve nutrients, and balanced diet during pregnancy, lactation, infancy, and other phases of life — would certainly improve family life.
   c. *Child cure.* Although priority is currently being given to child welfare, due in part to the influence of the International Year of the Child in 1979, little attention has been paid to training mothers to take care of children, especially during their early years. Some steps are now being taken in this direction under the Integrated Child Development Services (ICDS), which aims at providing a package of supplementary nutrition, immunization, prenatal and postnatal care of mothers, and health check-ups for children below six years of age so that every child has a reasonable opportunity for survival and for developing into a useful member of society.
   d. *Other fields* where training of women could be useful are sericulture, tailoring, garment making, weaving, knitting, social forestry, handloom and crafts like pottery, use of agrowaste and biomass for production of energy (gobar gas plants), post-harvest technology, and the use of biofertilizers and renewable sources of energy including sunlight.
5. *Extension education and technology transfer.* There is need to train a cadre of women extension workers to help create scientific awareness among

women and to help women prepare developmental projects for the community and participate in various educational programs.

6. *Effective personnel policies.* There is an urgent need to formulate personnel policies aimed at increased employment of women in research, teaching, and extension and at legal protection for farm women during pregnancy and maternity leave such as being allowed to have part-time or full-time employment during these periods. Sensitization of the scientific community and of extension workers to the problems of women involved in agriculture is also essential.
7. *Coordination and collaboration of all agencies.* All agencies and persons involved in the development of agriculture — the center, states or provinces, public servants, scientists in agricultural universities, Department of Agriculture staff, students, administrators, and social workers — should make an integrated effort to uplift the socioeconomic conditions of women.
8. *Women's participation in decision-making.* Involvement of women in decision-making processes at higher levels and opportunities for their placement should be encouraged during the planning and implementation of programs for rural women.
9. *Special cells.* To look after the problems of women involved in agriculture, special cells should be created in the concerned ministries so that follow-up action can be efficiently taken.
10. *Role of media.* Programs should be designed that will raise the status of women in society. Programs such as family planning should be given a proper place in television, films, and other media so that rural people can appreciate their necessity. Population control is one of the most important factors which can help solve the problem of hunger and malnutrition in developing countries.
11. *General education.* Since agricultural extension methods are mainly verbal, and since retention of oral messages is minimal, farmers find it difficult to use new techniques at the time of need. If illiteracy among rural women were wiped out, information could be imparted in a format which could be comprehended by them and recalled when needed.

AGRICULTURAL EDUCATION OF WOMEN IN INDIA

There appears to be a healthy trend in the enrollment of women in higher education for agriculture in India. Now women are enrolled in almost all faculties of agriculture and veterinary science. From about 1% in the early 1970s the enrollment of women has gone up to about 4% (Table 1).

Yet, if we compare these data with figures from other subjects, the enrollment of women in agriculture and veterinary science is the lowest. At the research level fewer than 250 women scientists are working in the agricultural

Table 1. Enrollment in agriculture and veterinary science in India.

School year	Agriculture			Veterinary science		
		Women			Women	
	Total	no.	%	Total	no.	%
1971-72	25,971	274	1.1	6,086	59	1.0
1972-73	25,882	NA[a]	NA	5,954	NA	NA
1973-74	26,520	233	0.8	6,334	50	0.8
1974-75	25,293	272	0.9	6,736	80	1.2
1975-76	30,160	432	1.4	6,377	91	1.4
1976-77	31,660	NA	NA	6,700	NA	NA
1979-80	39,962	1,101	2.8	7,435	202	2.7
1980-81	39,231	1,311	3.3	7,648	249	3.3
1981-82	39,318	1,390	3.5	8,173	352	4.3
1982-83	40,139	1,517	3.8	8,732	268	3.1

[a] NA = not available.

universities out of a total of 10,000 agricultural scientists in India. These figures clearly indicate the lack of participation of women in agricultural education. Yet, to be able to ensure more complete involvement of women in agriculture, it is essential for farm women to be made aware of the latest agricultural technologies and to be trained in them. One of the most effective ways of doing this would be by strengthening the links between the teaching, research, and extension activities of agricultural colleges and farm women by enrolling more girls in agriculture courses.

If there were more girls enrolled in agricultural engineering courses, we would probably be in a better position to understand the drudgery of agricultural operations and to design implements more suited for women. A simple device such as a sickle can be made thoughtfully to suit the grip of a woman's hands. Similarly, adjustments in implements for sowing, weeding, transplanting, threshing, winnowing, parboiling, husking, milling, and shelling could be designed to suit the needs of women. Rapport with farm women could be established more easily if there were women extension workers in the agricultural universities.

At present, Indian agricultural universities consider women more as homemakers than as workers and decision-makers, and the extension programs for them are directed more through the home science colleges. Yet it is equally important to educate women in the modern aspects of agriculture relating to areas such as pesticides, herbicides, plant diseases, high-yielding varieties, and fertilizers. Since women are performing all these different agricultural activities, it is important to get feedback from them on the new technologies which are being used. For getting the feedback, it is again important to have women

agricultural scientists and extension workers as suitable links because there is still hesitation among farm women in communicating with men. A beginning has been made, and several training programs are being conducted for women by the trainers training centers of the Krishi Vigyana Kendras; however, these programs have to be stepped up.

There is a need to train women in agricultural marketing and to make them aware of credit facilities, processing, grading, and quality control. They must be taught to compare prices offered by purchasers and must have complete marketing information. The concept of cooperative enterprise has to be developed with women as the nodal point. There are several success stories, especially concerning the women of Gujarat.

It is very important to educate women in the fields of livestock management, veterinary science, animal husbandry, dairying, and poultry farming, where women are traditionally already involved to a great extent. Training women in the preparation of modern balanced feed for poultry and farm animals, their breeding and health control, and fodder cultivation will lead to increased productivity. This same concept also applies to fisheries and aquaculture.

In India, several programs have been initiated to train women in modern agricultural technologies and income generation from agriculture-based occupations. Utilization of agricultural residues such as rice husks and other cellulosic residues such as bagasse and coconut pith can also lead to various sources of income. Cultivation of mushrooms, utilization of non-edible oil seeds, and cultivation of aromatic and medicinal plants offer several avenues for income generation. With training in modern processes of leather tanning, beekeeping, lac collection, aquaculture, etc. there is immense scope for improving the economic status of women. In all these areas, when programs are initiated it is vital to assess their impact and get continuous feedback so that necessary corrections can be made in future programs, which will hopefully hold more promise for our womenfolk.

In conclusion, if the problems of women involved in agriculture are fully appreciated and if sincere efforts are made to solve them, these efforts will certainly contribute to the well-being of rural society and the nation as a whole. But this requires political commitment of the highest order rather than mere policy framing.

Follow-up: An Essential Element in Training Agricultural Workers

C. Siri

Learning needs are not static and cannot therefore be solved in a single training course. However, this fact has not been recognized in most training institutions because training has been traditionally a one–way, one–time event that assumes all knowledge on one side and ignorance on the other side. Further, systematic communication is not usually maintained with former trainees. To counter thee problems, CIP has developed what it calls a permanent training system based on an assessment of work–related learning needs, the development of appropriate courses and individual training activities, follow–up assessment, and follow–up communication.

The International Potato Center (CIP) is making efforts to respond to the training needs of Third World potato workers. These efforts are the result of a wider concept of training that involves continuous assessment of achievements and needs plus communication with national researchers, extensionists, and educators from those counties where CIP works to improve potato production.

TRAINING OBJECTIVES AND PROBLEMS

Training is an important element of technology transfer. Often it is the first step in a much longer process. Success in reaching training objectives can be seen only when those who receive training apply what they have learned and when changes can be observed in practices and production. Training is not solely an event where learners sit around a table or even perform practical activities. After a learning experience, such as a course, researchers and extensionists continue to need new information and skills to use and improve what they have learned and to address problems encountered in their work. Training for agricultural development should be a continuous, dynamic process, and training structures and strategies must be designed to meet this challenge of constant change.

CIP's research efforts are directed at solving key potato production problems and expanding production in the Third World. In line with these

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strategies, training priorities are set to link new technologies with the requirements of national potato workers. CIP's training goal is to respond to their needs so that they can perform their work better, i.e., conduct basic and applied research to answer existing agricultural problems and to improve potato production.

Two important problems lie in the path of achieving these objectives. First, training has traditionally been a one-way, one-time event that assumes all knowledge on one side and complete ignorance on the other. Most human and financial resources available for training are used from the perspective that learning needs are resolved once and for all through a course or other instructional event. Second, systematic communication is not usually maintained with former trainees. Trainees return home with a set of skills that should be adapted to local conditions; however, problems often emerge that create new learning needs. If these needs arc not addressed, the newly acquired knowledge or skills may not be put to use. The raining may thus not have any effect in the real world.

CIP TRAINING SYSTEM

In trying to solve these problems, CIP has designed a training system based on two principles:

- All CIP staff members are committed to training.
- Dissemination of information and skills through training is a permanent process.

Several groups of people play a part in CIPs training program. The training and communications staff is only one element. At CIP headquarters in Lima, Peru, scientists commit a large part of their time to training activities, and the administration provides logistical support. A key role is played by CIP's outposted scientists in seven areas of the developing world. Their responsibility is to support the development of national programs through research and training. National programs are the most important group in the transfer process. They select and adapt technology and, more importantly, interact with potato producers; they know their countries' needs and have a comparative advantage in causing changes in production practices.

Although CIP's network permits interaction with numerous national programs, objective knowledge is lacking concerning what *all* former trainees are doing, what present needs they have, and what additional support may be provided to them. Recognizing this weakness, CIP has begun developing and institutionalizing a continuous training system.

Permanent training system

The system proposed is a "permanent training system." Training is seen as a process that starts with an assessment of work-related learning needs done by

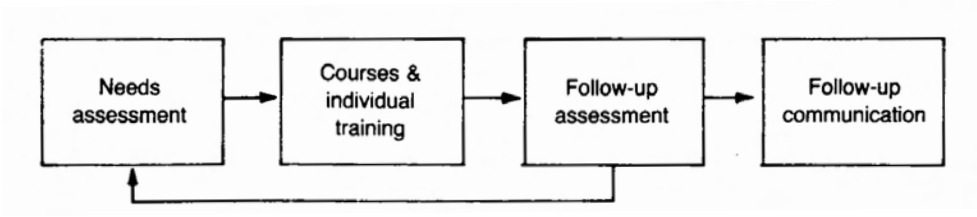

Fig. 1. CIP training system.

the regional staff (Fig. 1). Needs determine the training required; courses and other instructional activities are not isolated, but integrated into a continuous transfer process. When a person finishes a course the training is not complete. Follow–up assessment *and* communication become essential to determine what other support may be needed.

In the past 2 years, CIP's Department of Training and Communications has developed a follow–up process that provides us with better information on the performance of former trainees and lets us address their needs on a *continuing* basis. Follow–up has two basic components: First, follow–up has an assessment component — an identification of former trainees' achievements and needs. Second, it involves a communication component — exchanging information and providing support as needed. This aspect has been managed primarily through the network of regional research and training scientists and will be reinforced by other follow–up support.

Follow-up assessment

CIP's first follow–up experience was in 1981. An attempt was made to determine the degree to which storage training participants had been able to apply or adapt the storage technologies they had learned. Although the resultant report was positive and indicated areas for future work, the follow–up was not a continuing process.

In 1982, a pilot questionnaire involving on–site interviews was developed in collaboration with staff of the National Agrarian University (UNA) in Lima. Early that year UNA had organized a CIP production course within a UNDP project. The objective of this follow–up was to detect the effect of the course on participants' work. The study indicated that many participants had initiated projects applying technology learned in the course. But former trainees stated that they needed additional information and support to improve their research and to solve problems arising from their specific working conditions.

The follow–up questionnaire that is now being used was designed in 1983 and was based on these experiences and a careful analysis of CIP's training objectives. The questionnaire was first tried out in seven countries of Africa, Asia, and Latin America (Bangladesh, Chile, Colombia, India, Kenya, the

Philippines, and Rwanda). This tryout was essential to perfect evaluation procedures and redefine indicators of success. The indicators were sought with reference to CIP's main training objectives. Of special interest were problems or situations limiting a former trainee's ability to implement the objectives, i.e., to do research, train others, or communicate with farmers. The questionnaire provides information on the following:

- background of the respondents,
- extent to which former trainees have initiated research in topics related to their training,
- participants' efforts to change farmer practices where CIP-originated information or technology is involved,
- participants' training of others in topics learned in CIP courses, and
- trainees' contact with CIP in the past and what is needed in the future.

We are pleased that this questionnaire has also been used by other International Agricultural Research Centers (IARCs) such as the International Institute of Tropical Agriculture and the International Center for Tropical Agriculture in the evaluation of UNDP-funded courses. CIP is presently managing this joint evaluation project. Furthermore, some national program staff involved in the evaluation undertaken by the IARCs' Technical Advisory Committee have adapted the questionnaire for different case studies.

Preliminary findings

During the past year, CIP mailed the questionnaire to over 1400 former trainees. An analysis of the results is in progress. Preliminary findings indicate that follow-up is essential for trainees to be able to implement what they have learned. Some examples are:

- Of the 557 persons responding to the questionnaire, 333 (60%) responded that they had done research related to their training. The problems reported, in order from most frequent to least frequent, were:
  - insufficient budget;
  - deficiency of laboratory, field, or greenhouse equipment;
  - researchers/assistants required additional training;
  - lack of information about related research;
  - lack of support within the institution;
  - logistical/organization problems; and
  - problems in managing the technology.
- Although the number of former trainees maintaining contact with CIP after their training was high (345 or 62%), there was still a large number who responded that they had never written to, nor received letters from CIP staff after their training (193 or 35%). Although 286 (51%) former trainees had been visited at their work by headquarters or regional staff, 253 (46%) had not been visited.

- A larger number (127 or 23%) of former trainees reported that they were unaware of available CIP publications. Other problems indicated were high cost of publications (66 or 12%), obtaining foreign currency (49 or 9%), and requests that were not answered (46 or 8%). Of the total sample, 264 (47%) indicated that they did not have problems in obtaining CIP publications.

Continuous follow-up assessment

This assessment is not intended to be a one-shot event. In the future, we envision a continuous follow-up assessment that will be a dynamic and interactive process to permit constant updating of country situations and communication needs. A simplified instrument is under development that can be used by any CIP regional or headquarters staff and by national program staff. This instrument will guide them in obtaining and validating information on the achievements and needs of former trainees. Until now, we have relied extensively on CIP staff traveling in Third World countries to ensure the return of questionnaires. The new, simplified questionnaire that can be used as an interview schedule will strengthen this essential two-way communication.

Follow-up communication

The other essential element of follow-up is the communication component, which ensures that information derived from assessment reaches those who need to take action. Presently, feedback about an individual's needs is channeled to CIP's regional, headquarters, and training staff. General findings pointing to where action is needed will be reported later. Ultimately, feedback of periodic information to decision-makers about the achievements and, more importantly, the needs of national programs is being sought — not just manpower development needs but requirements in the broader context of agricultural development, i. e., for institution building, program development, and resources management. Technology transfer will be effective only when the needs are recognized and action is taken to respond to those needs.

Finally, national program staff will have access to the follow-up system for future planning. We envision that this communication will have far-reaching implications, since the national programs' potential for impact will be strengthened by their involvement in the system. National programs will benefit from the most important component of this follow-up process — feedback to former trainees.

Follow-up activities will diversify post-instructional support to trainees. We foresee that the following will be considered:

- recycling of persons into courses,
- personal contact with former trainees such as letters and personal visits,

- publications and communications such as the *CIP circular,*
- training materials such as technical information bulletins and visuals, and
- an information system that enables national potato workers to conduct research.

Institutionalizing follow-up

Adjustments in training structures and policies are required to make follow-up a systematic activity. A training program considering follow-up as a permanent element must optimize its use of available human, technical, and financial resources, which are needed to implement this new concept of training. Some of the elements that must be considered are as follows:

- Follow-up costs have to be integrated into budgets.
- Training strategies have to use personnel and resources more efficiently.
- Libraries must serve as available resources for developing country scientists.
- Scientists have to maintain links with national researchers.
- CIP's regional network will be involved in systematic follow-up activities.

CONCLUSIONS

CIP is trying to respond to potato workers' needs. Follow-up is an essential element in training, as former trainees face constantly changing situations that require additional training and support. This can be provided only by combining assessment and communication.

This effort means that potato workers will have access to a permanent training system where they can find answers to their principal learning needs. The training system developed by CIP views training as a continuous process that starts from an on-site needs assessment, continues with direct teaching events, and remains active through a continuous follow-up of individuals' needs.

The planning of agricultural education should integrate follow-up as a permanent exercise. Training systems should be dedicated to permanent assessment and communication with national scientists and extensionists. Traditional training activities should be seen as part of a global process of diffusion of information and skills. This type of training system will help solve the main learning needs of persons working in agricultural production and research in developing countries.

Systems of Agricultural Extension

G.H. Axinn

Extension systems, fall into two groups: the delivery system, wherein information needed by farmers resides in an organization whose purpose is to deliver it to them; and the acquisition system, wherein farmers reach out beyond their villages to get information. For the extension system to be successful, it should be controlled by the target group, which can even influence the agenda of agricultural research and national policy. Extension efforts have often failed because of conflict of objectives and agendas between field-officers and supervisors; the influence of foreign sources of technology; conflict between agricultural policy and extension goals; incompatibility of technology with the needs of farmers; lack of support systems; inability of extension workers to relate to the needs of rural people; lack of technical experience in extension workers; and lack of discipline and seriousness among extension personnel.

The systems of agricultural extension are many. Every nation state has at least one; many have more than one. Swanson and Rassi (10) show over 290,000 men and women working throughout the world in agricultural extension, of whom more than two thirds are in Asia and the Pacific. The scope of the effort is enormous. It includes indigenous learning systems, which are everywhere and carry the main burden of agricultural education for many rural people. It also includes exogenous learning systems, sometimes with massive bureaucracies, that have been introduced relatively recently and are struggling with difficult problems of size, management, personnel, program development, and implementation. But the potential of the effort is significant, and the significance of agricultural extension must always be one of its major tests: What difference does it make? Are rural people better off or worse off because there is agricultural extension? Is the world better fed or more hungry because there is agricultural extension? Does it make any difference at all whether or not the world has agricultural extension education systems?

This paper will briefly review some examples of both success and failure of extension, then turn to an analysis of the types of extension systems, and finally discuss some current issues.

FAO Representative in Nepal.

CRITERIA FOR SUCCESS

One criterion that is often used as a measure of success for agricultural extension is that of production. If the farmers produce more, extension may receive the credit, at least in part. Effective extension work in Pakistan two decades ago certainly contributed to the rapid spread of Mexi-Pak wheat, closely followed by the new short-stemmed rice varieties from IRRI. And on both sides of the Punjab where new technology fit, where inputs were made available in a timely fashion, and where prices of the surpluses that farmers could now sell were high enough to make production profitable, production certainly increased. Even more dramatic stories can be told of the specialized agricultural extension organizations that work with rubber in Malaysia or tobacco in Bangladesh. In both cases, a relatively small, well-staffed extension group, under the same management as those who supplied the inputs and purchased the outputs from farmers, was able to demonstrate significant success in a short time. Bangladesh went from being a tobacco importer, with almost no local production, to being an exporter in just a few years.

In addition, there are many examples of small-scale local efforts at agricultural extension that have been highly successful. The Small Farmers Development Projects in Nepal are typical of others throughout this part of the world where a very limited but skillful, committed, disciplined agricultural extension staff has worked closely with small groups of local people who have gone beyond merely increasing production; in some cases they have contributed significantly to the improvement of conditions among the rural people of their areas. Other examples may be found in the Hill Areas Education Program and in Khit Phen in Thailand, in the thousands of brigades in rural communes in China (particularly since they introduced the "Responsibility System"), in the village groups of the Saemaul Undong in Korea, in small rural bank branches with successful farm credit programs in the Philippines, and in the Ghandi Grams of India. These are all living examples that small is beautiful, even in agricultural extension (2).

But there are also examples of agricultural extension efforts that have not been so successful, although "success'' may depend on the evaluation criteria. Sometimes production does not increase. In some cases, yield even goes down, and then extension receives a share of the blame. One way out is to suggest that productivity is in the hands of larger powers—if the monsoon fails, if the floods come, or if insects plague in uncontrollable numbers, what can the extension officers do?

If targets are set by the central government and are not in the interests of the local people, why blame the extension officer when farmers do not adopt a particular practice? If the technology fits large farms but is simply not feasible

for small farmers, how can the extension staff achieve equity goals or serve small farmers?

The failures often involve a large staff of field officers who are controlled and supported by the central government and who suffer from the conflicting agendas of their superior officers at the district or regional level and of local rural people (5). And, unfortunately, the front line agricultural extension officers tend to be poorly paid, poorly trained, and younger than their target farm family decision-makers, having very little in common with those farm families and not having much impact upon them. If the extension officer is given neither house nor office, he or she may have to find a wealthy rural family to provide a room in exchange for either teaching the children their school lessons or providing special extension and other agricultural services for the owner. When the goals of the landlord are different from those of the agricultural extension administrators, the field officer has a serious problem (7).

Sometimes the failures result from excessive influence of foreign sources "trying" to assist by bringing in agricultural technology from some other part of the world. Large tractors fail on small farms; submersible electric water pumps for irrigation fail where electricity and diesel fuel are unavailable. And new varieties that require mineral fertilizer and irrigation water fail where the former is too expensive or the latter not there when required.

Some characteristics of success are external to the extension organization, while others are internal characteristics of the organization itself. The first group includes policy matters, while the other tends to involve strategic considerations (6). On the external side, there is sometimes a convergence of agricultural policy and extension goals. Sometimes there is not. For example, if national price policy makes it profitable for farmers to produce the crop that extension is recommending, the chances of extension achieving its goal are great. However, if national price policy discourages farmers from adopting that crop, extension may fail, no matter how many demonstrations are done or how well radio programs are coordinated with farmer discussion groups or how well other extension teaching techniques are executed. This conflict between policy and extension is well illustrated by Roling in a recent article (9) wherein he states, "There is persistent evidence that agricultural extension in the developing world is not reaching the poorer farmers and that extension and other agencies tend to focus instead on the better-off farmers who probably represent not more than 20% of the total." He goes on to explain, "The objective is often not so much the welfare of the farmers as it is the creation of a surplus for national development, which has often been equated with urban elite development. In the short run, such a policy is much easier to implement with a few larger farmers than with thousands of small ones."

Another external consideration may be the technology itself, which has been a serious problem in Asia and Africa. The successful agricultural technologies of Europe and North America have tended to feature large-scale, capital intensive innovations that fit in situations with a surplus of land, a shortage of labor, and plenty of capital. Unfortunately, attempts have sometimes been made to transfer those technologies to places where there is a shortage of land, a surplus of labor, and very little capital. In those situations, the technology transfer has tended to fail (4).

Sometimes extension programs have called for introduction of a technology where the required inputs simply were not available. An extension officer is doomed to failure if he or she must try to convince farm families to use an insecticide, for example, when no insecticide is available either at the local bazaar or market or even at the nearest major market town. And on the other side, when the marketing and distribution system is not there to buy from farmers a product that extension officers are encouraging, failure is predictable. Attempts to encourage hill farmers in the Himalayas to grow apples were frustrated by the cost of transportation to the nearest markets, which was greater than the market value of the apples.

Some internal constraints on extension systems relate to personnel management and some to program. Personnel problems include selection, training, and the reward system. It has been very difficult for most extension systems to employ staff whose social distance from their clientele groups is small enough so that they can communicate effectively. Usually, young workers from urban families find it difficult to understand farm families. Sending male agricultural officers to explain agricultural practices in situations where most of the farmers are women is a similar phenomenon, often found where certain crops or livestock are the traditional province of women. Until more women are trained for extension work, this problem is not likely to be overcome.

And then there is the matter of training. If the new recruit into an agricultural extension organization has never lived or worked on a farm, as is most often the case, it takes a great deal of hands-on experience and practical training before he or she is likely to appreciate what is really going on in agriculture. And even then, the trainee may lack commitment and enthusiasm for field extension work. Most training for such personnel tends to be too short, too theoretical, and much too centered on lectures and books.

At this point, I must mention the training program at IRRI. Since its beginning, it has been an outstanding world example. Trainers at IRRI have insisted that all trainees actually get into the fields themselves—actually transplant rice with their own hands or plant seed or harvest grain. Whether a training program lasts 1 week or several months, a hands-on dimension is always part of it. This in itself has been a powerful force among agricultural extension officers throughout Asia in helping them successfully spread the improved germplasm developed by their research colleagues. Whether the

impact of the training program or the new germplasm has been more significant would be hard to prove, but agricultural training at IRRI should be an example to teachers everywhere whose goal is to prepare new agricultural extension officers.

And finally, with respect to personnel, the reward systems have been a problem. Vigorous, dedicated, competent young men and women are not likely to stay in remote rural locations doing extension work unless there are more rewards and fewer disincentives for such work. Their families will not let them stay, and the pressure to move on to a different career, or into the headquarters city, is usually too great for them to withstand.

On the program side, there are similar constraints. If the same program is offered for the whole country, it is not likely to fit in many locations. If the program is controlled locally, it is more likely to be relevant but may not please political leaders at the center. A great extension target that is achieved but not relevant to the local situation must be considered a failure. And any extension program that is not implementable is not going to be a success.

But beyond the techniques that enable extension—the choice of appropriate communication channels, attractive treatments for relevant messages, and timing to enhance impact—the need for internal discipline among field personnel, their supervisors, and the technical specialists who provide substance to their programs is paramount. This internal discipline can be seen in the vigor with which staff approach their work. It can be seen in the extent to which extension workers are physically present on the farms, listening to farm men and women. It can be seen in the hours they work. It can be seen in the rewards received—or not received—by those who stay in the field and work where the farmers are, compared with the rewards for those who gravitate to the central administration. That discipline and seriousness—more than any other criterion—is an indicator of success in agricultural extension education.

TYPES OF SYSTEMS

Although there are many different types of agricultural extension education systems, I find it useful to divide them into two basic categories. One category may be called the agricultural extension *delivery system;* the other category is termed the agricultural extension *acquisition system.* Most countries have examples of both types (3).

The main idea of a delivery system type of agricultural extension organization is that there is a body of information that farmers need. The extension system either has this information or can get it, and its purpose is to deliver the information to the farmers. Besides information, there may be other inputs such as fertilizer, seed, or credit. Government agricultural extension systems in India, Pakistan, Bangladesh, and Thailand are examples of delivery systems. They are almost always a part of the Ministry of Agriculture. Staff at all levels

are government officers. Program targets, goals, and objectives tend to be fixed by the government; strategies, tactics, and other aspects of implementation are decided centrally.

Acquisition systems in agricultural extension are very different. Here the main idea is that groups of farmers, organized one way or another, reach out beyond their villages and acquire whatever information they need. These are usually smaller organizations, like farmers' associations, small farmers' groups, or village level cooperatives. Indonesia has experimented with several different types. In some countries like Malaysia and Nepal, these groups are found operating alongside the Ministry of Agriculture extension system. At their best, the communes and brigades of China are acquisition systems. Staff of acquisition systems are employed by the local organizations, sometimes enjoying cost-sharing arrangements with larger government units or other outside sponsors. Program targets, goals, and objectives are fixed by members of the groups themselves; and strategies, tactics, and other aspects of implementation are different from one village to the next and from region to region within a country.

Among the delivery systems, some-deal with all aspects of agriculture, including livestock, fisheries, and forestry, while others are more specialized. The rubber extension group in Malaysia and the tobacco organization in Bangladesh are examples of single crop agricultural extension delivery systems. Others deal with multiple crops and livestock, but tend to take them one commodity at a time. There are now increasing efforts at agricultural extension dealing with the whole farming system, but these tend to be small, experimental, and widely scattered, sometimes combining research and extension activities. And there is also a considerable amount of agricultural extension "delivered" by even more generalized rural development agencies, often in integrated rural development projects, and usually associated with a Ministry of Local Development or Community Affairs.

The acquisition systems are generally concerned-with a broader range of agricultural subjects, shifting their focus from time to time as village problems change or as new needs arise. The World Conference on Agrarian Reform and Rural Development (WCARRD), organized by FAO in Rome in 1979, suggested the clear advantage of the acquisition systems. The analysis of country experiences in the implementation of the WCARRD Program of Action, published by FAO (8), concludes that "an increasing number of countries are showing interest and are trying the participatory approach in extension as a way of reaching large numbers of small farmers more effectively . . . ." That report also points out that "an increasing number of countries are specifying small farmers and, in a few cases, including women as the main target clientele of the extension activities. "

Current patterns of agricultural extension also include variations in who controls the system—governments,commodity groups, or rural people (or-

ganized in various ways)—and variations in intended beneficiaries—consumers, producers, industry, or even broader national interests. There are also different patterns in the level of discipline, or seriousness, which separate one agricultural extension system from another, or sometimes just one section of a national system from other sections. But rather than go on with differences in pattern, I will turn to some of the issues that I believe are most relevant, as well as most illuminating with respect to effectiveness in diffusing new agricultural technology and to applicability to small farms in "developing" countries.

CURRENT ISSUES

Five main issues surround agricultural extension: interests, expectations, control, practicality, and gender.

Interests

A major issue that is beginning to emerge as critical is that of whose interests are served by the agricultural extension system. The main conflict is between the urban consumer and the rural producer. It is in the urban consumer's interest for farmers to produce a surplus. It is in the rural farm family's interest to consume more. Most extension systems are dominated by the political policy of "cheap food in the cities." The alternative interest of improved quality of life for rural people is always part of the rhetoric but not as well evidenced by programs, personnel, or the operating doctrine of the extension system. Problems arise when central targets are set with a production orientation but without price policies to match.

Over the years, Japan has overcome these problems by keeping the domestic price of rice paid to farmers high enough to encourage production. Production oriented agricultural extension programs have a much greater chance of success when those who produce more are sufficiently rewarded that they may also consume more.

Another example of the issue of whose interests are served relates to differences between large commercial farms and small self-sufficient farms. In spite of the aspirations of some scientists involved in agricultural research, most technologies are not scale-neutral, and most productivity enhancing technology developed by the international agricultural research community assumes the type of farming system that purchases its inputs from off the farm and sells its outputs to commercial marketing channels. However, most small farming systems, particularly in Asia, produce their own inputs and consume their own outputs; they are not completely self-sufficient, but highly so. Furthermore, the large farms tend to specialize in one or only a few crops, or in certain classes of livestock. Small farms tend to have mixed crop and

livestock systems, with many different cereal grains, farm animals, fruits, and vegetables. With technology generated to meet the needs and solve the problems of large-scale commercial agriculture, it has been very difficult for agricultural extension systems to have much impact on small, mixed, basically self-sufficient farming systems.

Expectations

A second issue revolves around unrealistic expectations for agricultural extension. It is unrealistic to expect extension to be able to convince farmers to add mineral fertilizer, for example, when the price of fertilizer, compared to the price of the crop, is such that the farmers who follow the recommendation lose by doing so. If a technological innovation is not supported by appropriate price policy, agricultural extension cannot convince farmers to accept the innovation.

A second example of unrealistic expectations appears when the new technology simply does not fit the type of farming system or the agro-ecological-economic environment. Attempts to introduce artificial insemination in dairy cattle face this problem where communication and transportation infrastructure do not facilitate this technology.

A third unrealistic expectation is that extension officers can somehow bring about an increase in production without appropriate technology being generated or made available to them. Where they have nothing practical and useful to offer to farm families, their work is not likely to result in increased production.

A fourth example is found where a national agricultural research system responds to rewards from outside the country—somehow from the international agricultural research system—instead of to the needs of rural people in its own country. Then, if the research system attempts to pressure agricultural extension to promote its findings (or "borrowings"), extension is likely to fail. This happens when short-stemmed cereal varieties are introduced in regions with very high populations of ruminants. Since the farmer must have straw for fodder, the extension effort invariably fails. Agricultural extension is often blamed when such unrealistic expectations result in farmers' refusal to adopt new technologies.

Control

Another vital issue is that of control of agricultural extension. My own operational definition of control is to ask local agricultural extension officers who pays their salary and who decides how much increase they get and how often they get it. If they answer that it is the central government or a body like the national rubber board, then they are part of a delivery system. If they

answer that the members of their cooperative or the farm families of their district decide these matters, then they belong to an acquisition system. If the answer is somewhere in between, then the organization is somewhere in between.

Where agricultural extension education is not controlled by the farm families it is expected to serve, it is likely to have an inappropriate program, with targets that do not fit the situation and with implementation means that fail. And where agricultural extension is not controlled by its clientele, the personnel are likely to be poorly paid, poorly trained, poorly managed, and consequently not very effective.

A short-term solution to this symptom has been the Extension Training and Visit system. It does bring discipline to the system, and under certain conditions it has increased effectiveness. But it fades without appropriate control, as neither program nor staff are likely to maintain effectiveness if control is centralized. It becomes plagued by the conflicting agendas of professional agriculturalists and of farmers—and with control in the hands of the professionals, neither programs nor personnel tend to be responsive to the needs and interests of farmers.

The long-term solution, in my view, is control in the hands of the target groups, the farming families themselves. When they organize their own acquisition systems, the program is likely to fit their needs and interests. When national groupings of acquisition systems are organized to reflect these needs and interests, they can exert influence on the agenda of agricultural research as well as on national policy.

Practicality

A fourth issue, found throughout all levels of agricultural education, may be labeled the issue of practical versus literary. Too often the graduates of agricultural institutions have little practical training or experience. They have memorized the textbooks and have only a literary understanding of farming. At the local level, they are of little help to farmers. At the regional level, if they are training agricultural extension officers, they are disfunctional.

An excellent example of the use of practical approaches in agricultural education is found at IRRI. It is one of the world's outstanding examples of the victory of the practical over the literary in agricultural education.

Gender

The final issue is that of women in agriculture and food systems. Visibly evident throughout Asia, but also true in other parts of the world, there is a serious anomaly in agricultural extension: While most of the farmers are women, most of the extension personnel are men. Some facts from Nepal are

illustrative of similar phenomena in many other countries. In Nepal, rural women's total work burden is extremely high at an average of 10.8 hours per day compared to 7.5 hours per day for men. Rural Nepalese women not only spend more time, but also generate more income than men to contribute to the total household economy. Women are primarily responsible for the farm enterprise both in terms of labor contribution (9.9 hours per day versus 5.9 hours per day for men) and management decisions. The evidence for this, documented in the last decade, is compelling (1). Yet extension concentrates on the husbands of these farmers, with little effort directed at either women farmers or whole farming families.

There are gender-sensitive issues in the selection of future extension personnel, in the training of agriculturalists, and in the agenda of agricultural research. The opportunity for significant improvements in the effectiveness of agricultural extension education may hinge on the ability of the systems to respond appropriately to the challenging reality of women in agriculture. Personally, I do not believe that separate projects designed for rural women are going to solve the problem. What is more desirable is a dimension of focus and concern for women and families in every aspect of extension. With this focus, whether an extension system is working on rice production, dairy cattle, or aquaculture, it can be more effective. A much higher proportion of extension field workers should be women, who could contact farming women directly.

This issue is not going to be resolved quickly. It is a long-term matter, involving changes in attitudes of people like us. This calls for changes in procedures for admission to the schools and colleges of agriculture, as well as changes in recruitment practices of agricultural extension organizations. But changes in this area offer great promise to increase the relevance and effectiveness of agricultural extension organizations in most of the world.

REFERENCES CITED

1. Acharya, M., and L. Benett. 1981. The rural women of Nepal: an aggregate analysis and summary of 8 village studies. *In* The status of women in Nepal, Volume II, Part 9, Centre for Economic Development and Administration, Tribhuvan University, Kathmandu, Nepal.
2. Axinn, G.H. 1978. New strategies for rural development. Rural Life Associates, Kathmandu, Nepal.
3. Axinn, G.H., and N.W. Axinn. 1976. Non-formal education and rural development. Program of Studies in Non-formal Education, Supplementary Paper No. 7. Michigan State University, East Lansing, Michigan.
4. Axinn, G.H., and S.S. Thorat. 1972. Modernizing world agriculture: a comparative study of extension systems. Praeger Publishers, Inc., New York and Oxford, and IBH, New Delhi.
5. Axinn, N.W. 1981. Mediating conflicting agendas in the development

process. Proceedings of the Conference on Responding to the Needs of Rural Women. South-East Consortium for International Development. Kentucky State University, Frankfort, Kentucky.

6. Axinn, N.W., and G.H. Axinn. 1984. Energy and food relationships in developing countries. Pages 121-146 *in* C.W. Hall and D. Pimental, eds. Food and energy relationships. Academic Press, Inc.
7. Chambers, R. 1980. Rural poverty unperceived: problems and remedies. World Bank Staff Working Paper No. 400. The World Bank, Washington, D.C., U.S.A.
8. El Ghonemy, M. R., ed. 1984. How development strategies benefit the rural poor. WCARRD Follow-up Program, Food and Agriculture Organization of the United Nations, Rome.
9. Roling, N. 1984. Appropriate opportunities as well as appropriate technology. CERES, FAO Review on Agriculture and Development No. 97, 17 (1): 15-19.
10. Swanson, B.E., and J. Rassi. 1981. International directory on national extension systems. University of Illinois at Urbana-Champaign.

Patterns and Trends in Information Dissemination

J.F. Evans

Reliance on information is increasing among persons involved in agriculture, and delivery of appropriate information to end users challenges agricultural communications systems. Closer coordination is needed among research and extension organizations, agricultural universities, and the mass media. IARCs must link up with national systems in the exchange of information. The professional agricultural communicator, who possesses education and experience in both agriculture and communications, provides specialized resources and services for use at all levels and for all functions in an organization. Short courses, workshops, specialized training, and in–country, degree–based academic programs can build up the stock of agricultural communicators.

Within agriculture we are seeing many important developments such as:

- ever growing worldwide pressure for increased production of food;
- more agricultural research being carried out at the international, national, and local levels;
- more multidisciplinary activity;
- more international connections and dimensions; and
- increased diversity of agricultural information users and their needs.

By its nature, agriculture requires information that is often localized and short–lived. As research activities increase, they generate not only new subject matter but also new categories of information users, plus needs for new information systems and new levels of message treatment and presentation.

The field of agricultural communications is being affected not only by these forces within agriculture, but also by another set of forces growing out of the dynamics of communications technology. My purpose here is not to describe and evaluate new communications technologies, but simply to emphasize that they help account for important trends in agricultural information. Then I will summarize some needs, concerns, and opportunities for the future.

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SOME MAJOR TRENDS

If we put together these two major sets of forces involving agriculture and communications technologies, we find a dizzying array of activity in all parts of the world, e.g., the use of side-band high frequency equipment for delivering rural health programs, computer-based agricultural information banks, in-field uses of videotapes, rural satellite networks, local market information systems, hand-held electronic learning aids for literacy instruction, audio-casettes, solar-powered radios for use in isolated rural areas, slow-scan pictures by telephone, microfiche for storage of agricultural information, and many others. Applications of new technologies seem to be getting most attention, but I prefer to put them into a broader context because some other important trends seem apparent. At the risk of oversimplifying, the following discussion will center on four broad areas: the growth of information, the value of information, information management, and the scope of services.

Growth of information

Those who are involved in any aspect of agriculture, in any nation—as producers, researchers, policy makers, marketers, educators, or others—are confronted with the potential for receiving far more information than they can absorb, and many are becoming worried. Some observers refer to the growth of information as an information explosion, while others prefer to describe it as an ignorance explosion. I recently estimated that if I were interested in reading one month's new entries in only one of the international agricultural data bases, AGRICOLA (Agricultural On-Line Access System of the U.S. National Agricultural Library), I would need to set aside about 200 years, reading 365 days a year. If I set my sights on reading all of the materials currently in the AGRICOLA system, I would face about 24 centuries of reading. The AGRICOLA collection now contains about two million documents. Yet it is only one of many collections, each of which is growing. For instance, a recent analysis of literature in my own academic field, agricultural communications, revealed an annual growth rate of about 14% (12).

Value of information

Agriculturists are becoming more aware of the economic value of information. A relatively new field of research—described as the economics of information—is providing evidence about the rate of return to investments in agricultural research and extension. Other research studies are showing how individual producers earn greater profits when they have greater access to information.

Information management

A third trend (emerging from the first two) is that of greater emphasis on information management at all levels in agriculture. Herbert Buntrock, in summarizing with VIth World Congress of the International Association of Agricultural Librarians and Documentalists, noted the "still increasing importance of intermediaries between information systems and users, due to the still growing complexity of modern information technology (9)." In a similar observation, Drilon emphasized that the role of the third party (that is, the channels of information and the change agents) is made imperative by the very distance between the scientists and the users of scientific information (4).

Signs of searching for better agricultural information management are abundant. We can note, for example, widespread efforts to strengthen extension programs, to establish information units within research and extension organizations, to provide more programs of communications training, and to seek better connections among researchers, extension personnel, clientele, media organizations, policy makers, and others. Part of the search is the vigorous experimentation with new communications technologies mentioned earlier. Similarly, we observe that the International Agricultural Research Centers (IARCs) are becoming more actively interested in the dissemination and utilization of their research findings. Agricultural colleges and universities are seeking ways to fit more effectively into their nations' programs for agricultural and rural development. Dynamic changes are occurring in agricultural libraries. One observer (1) puts it this way:

> It is no longer the general opinion that management of scientific and technical indexes is merely an honorable, useful activity deserving encouragement even if it is in fact neutral, indifferent, and almost ridiculous work to be regarded with kind condescension by scientists and scornful deference by politicians. Today, information is considered to be a key to power, political power, which explains why it now interests statesmen.

The same writer adds that "in most developing countries, there is now an official body whose role is to organize agricultural documentation at home and defend national interests abroad. Scientific and technical information in agriculture has in fact become another way of playing a part in world affairs (1)." As a result of these and other developments, we have seen widespread efforts to reconceive agricultural libraries, to change them from passive collections to aggressive information services.

Efforts throughout the world to improve school systems and programs of formal education for agriculture provide another example of the general trend that I am describing.

I have suggested that a trend toward greater emphasis on information management can be accounted for, in part, by the growth in supply of agricultural information and by increasing recognition of the political and economic value of information. However, policy makers have other reasons for giving more attention and higher priority to information management, in particular the problems and failures that they observe in many programs of rural development. They see organizational blockages that squeeze the flows of information to a trickle. They see well-intended recommendations that seem ignored, rejected, or misapplied by those to whom they are offered. They see costly projects that yield poor results.

On that note, I will move to a fourth major trend, from my point of view the one most central to human resource development in agriculture.

Scope of services

Signs suggest that agricultural and rural development activities are showing a more enlightened view of communicating than in earlier years. Experiences around the world are teaching us that communication is more than information systems, programs, and services. All too slowly, we are learning an urgent lesson—that agricultural and rural development is more than merely channeling research findings and other information to various audiences.

Sources of information for development are often urban-oriented, and channels of mass communication are often not easily accessible to rural people. Messages are often frivolous, irrelevant, and even negative for rural development. Development-related innovations are often inadequate and poorly adapted, and rural audiences are not as passive and inert as once assumed. Individual receivers of communications are parts of complex social systems that influence decisions. The environment for development communications sometimes features restrictive social structures, poor policies, and inept or poorly coordinated development activities that may stifle promising efforts.

Colin Fraser (5) of the Food and Agriculture Organization has stated that "rural development programs, if they are going to succeed, must be cooperative ventures between rural people and the development agency or the authorities. And there must be a full and constant change of information, from the first plans to the day the development agency can phase itself out." Fraser further noted that the concept of two-way flows of information began to be generally accepted 10-15 years ago. "But what has happened? Unfortunately, not enough (5)." I share his point of view and sometimes wonder if notions such as two-way flows, participation, and listening are doomed in the organizational context of rural development. Even after decades of being warned about the fallacies of a "hypodermic needle" model of communicating, many in agriculture seem intent on trying to inject information into would-be users. They seem driven to talk more than (and before) they listen.

Evidence of progress

But let us turn now from shortcomings of the past to evidence of progress for the future. I am encouraged by some signs of change at the national and local levels. Several recent activities may illustrate my point.

- Communication research in India has compared farmers' perceptions of the importance of various kinds of agricultural information with those of village level workers and block level personnel (10).
- A teacher training project in Nepal has developed a feedback system whereby letters from teachers are aired on a regular radio broadcast called "Teacher's Corner," which has become a valuable way for teachers to share questions, suggestions, criticisms, and materials (7).
- Videotape technologies are being used in ways that involve farmers as teachers.
- The Development Support Communication approach used by the United Nations Development Program helps assure that messages, methods, timing, and other communications decisions are based upon analyses of audiences, information systems, resources, subject matter, and other aspects of each situation.
- The recent use in rural development of so-called advertising approaches (described also as social marketing) is often based upon analysis of market research. For instance, a technique of focus group interviews helped guide the message planning for a breast-feeding campaign in Indonesia. Pretesting of messages is common practice in such approaches. Periodic tracking studies help assess changes in awareness, attitudes, intentions, and practice. An effort in Mexico for the social marketing of contraceptives involved a three-phase market research program that included communications analysis not only of intended consumers but also of retailers, who would be important to the success of the program (11).
- The Training and Visit System of extension in Thailand is using farmer surveys, pretests of communications materials among intended users, and two-way communications in order to determine whether the problems identified by extension staff are perceived as real problems by farmers (6).
- Community broadcasting activities such as those conducted in the Philippines help rural people take part more fully in development efforts.
- Citizens' Advice Bureaus in Britain "operate on the basis that their clients are information seekers and this perspective is reflected in the service they provide (10)."

These approaches may be among the most important trends in the human aspects of agricultural and rural development today. They provide feedback for better communications decisions. They can help local people participate

more fully in development. They can help development organizations achieve better results more efficiently. And they reflect a more enlightened view of communication.

NEEDS, CONCERNS, AND OPPORTUNITIES

I will now turn to the needs, concerns, and opportunities for improving communications related to human resource development in agriculture. I use a broader, more challenging notion of communicating than merely disseminating information. Also, my comments are directed toward the goal of helping several categories of persons learn, grow, and improve their lives—particularly farmers and their families, residents of rural communities, and researchers, extension workers, communications staff members, and others within development organizations.

Choice of information

Troubling case reports from various countries suggest that producers often receive information and advice that are not useful to them. Whereas the volume of research information is growing steadily, we face a considerable challenge in assuring that the information used in a given situation is appropriate, sound, and relevant. Part of the challenge can be directed to researchers and research organizations. However, part can be directed to those who, on a day-to-day basis, select agricultural information from the available storehouse and help channel it to farmers and local communities. Surveys and other tools for audience research can help avoid problems if the decision-makers will use those tools.

Support systems

A related challenge is illustrated by experiences of family planning programs. The Development Training and Communication Planning group of UNDP found that basic health services such as supplies of contraceptives were often "dreadfully weak" and not only disrupted their communications program but also created frustration and even resentment toward government programs in general (15). Obviously, even the most beautiful posters, compelling messages, or sophisticated satellite delivery systems cannot overcome a weak or missing support system, whether it involves health services, farm supplies, market outlets, or other supplies and services upon which success depends.

Linkages

The agricultural enterprises within developing nations desperately need improved linkages for the two-way flow of information between research and

extension organizations, within research organizations, and within extension organizations. In many countries the agricultural colleges and universitites are out of the main flow of agricultural research and extension. How can they fit more productively into efforts for development? How can the IARCs and the national research organizations work out divisions of labor for disseminating research findings? For example, to what extent should the IARCs carry out programs to disseminate information directly to farmers? Where in-country extension services lack strength, should IARCs find other ways to channel research information to end users? National programs should play the crucial role in extending research information to various end user audiences. How can the Center be linked effectively with research and extension systems in cooperating countries? And within specific countries, how can the extension relate more effectively to mass media institutions such as broadcasting systems and publishers (either government or commercial)?

Information units

Extension services and other organizations interested in improving the flow of information must become more serious about their systems for providing communications support to researchers, subject matter specialists, extension program specialists, field workers, and others. I am referring especially to in-house information units that provide technical support such as writing, editing, printing, photography, graphic arts, broadcast services, audiovisual production, and library and information services. Strong information units can multiply the impact of every person in an organization — from researchers to field workers, from technicians to administrators — by helping provide educational materials and a wide range of other resources.

In many countries, information units are understaffed, underfunded and underappreciated. Sizes of staff vary greatly from organization to organization and country to country. A 1980 international study of national extension systems revealed that among 62 systems that reported having agricultural information units, the sizes of those units ranged from 1 to 167 staff members. The mean size was about 14 staff members while the median was 5 (14). The study also showed a mean ratio of 1 agricultural information staff member to 139 extension workers in the total system. These staffing levels for communications support of extension are widely believed to be lower than optimum.

As far as budgets are concerned, a 1982 study by Gowdar (8) revealed that some agricultural development organizations are investing relatively little in communications support. His results showed that 151 agricultural research and education organizations in 9 Asian countries were allocating only 1-3% of their organizational budgets to information services. Similarly, a 1979 study by Barghouti (2) showed that the IARCs were investing about 3% of their operating budgets in information services. Within Pakistan, only 0.28% of the

total budget spent on agriculture in 1980 was being allocated to the information services. With the Extension Wing, the staffing ratio was about 1 information worker to more than 150 other technical extension workers. Aggressive gains in agricultural development will require levels of funding higher than these.

Staffing and funding are only two of many angles from which one can examine the extent to which agricultural organizations are getting the communications support they need. There are several other related, troublesome trends in both developed and developing countries. One is a tendency to invest more eagerly in hardware than in personnel and programs for communicating. The price tag for hardware-madness seems exorbitant in both types of country. Another troublesome trend involves the functions assigned to communications units. Commonly, information staff personnel are called into projects at the end of the decision-making process. They are asked, for instance, to edit a manuscript and print a publication—without the opportunity to help identify and analyze the intended audience, the communications situation, the educational objectives, the alternative forms that this information might take, the appropriateness of the content, timing factors, and so on. Administrators of organizations should expect their communications units to provide not only output (in the form of educational materials) but also input (in the form of audience data, media analyses, and other kinds of information to guide communications decisions). Such an approach would greatly change the staffing, organization, and functions of communications units and would also greatly improve the educational effort of organizations that use it.

Apart from failing to take full advantage of communications units, organizations should be alert to the dangers of using such units inappropriately. Some organizations use their communications staffs more as publicity tools than as resources to support programs of public information and education.

Agricultural communicators

Efforts to improve communications support capabilities within organizations must also address questions about developing human resources. Many countries now recognize that there has been a serious missing link in the agricultural knowledge sharing process: professional men and women who have education and experience in the twin disciplines of agriculture and communications. Such agricultural communications professionals can serve leaders of development organizations by identifying and analyzing communications problems; monitoring relations with other organizations; operating information systems for communications within the organization and between the organization and other bodies; establishing and maintaining good relations with media institutions; helping report to policy makers about the programs, progress, and needs of their organization; and so on. They can serve researchers by gathering

feedback from the field, preparing research proposals for funding, reporting findings of research studies, and so on. They can serve extension personnel by planning communications programs, producing references and instructional materials, disseminating information by mass media, teaching communications skills to extension personnel, and so on. In short, the professional agricultural communicator provides specialized communications resources and services for use at all levels and for all functions of an organization.

The problem is that qualified agricultural communicators are in extremely short supply. At a 1982 Asian regional workshop on communications for rural development, the lack of qualified communicators emerged as a dominant problem in disseminating agricultural research and carrying out rural development programs. Research institutions were seen as weak in delivering results to their intended clientele primarily because of lack of qualified communications personnel in the organizations and lack of communications management ability (3).

How can we build the missing link? Efforts to provide more and better qualified professional agricultural communicators can proceed along several lines of activity. The existing approach of providing short courses, workshops, and other kinds of specialized training for communications staff members can be expanded and intensified. They can also study abroad in degree and non-degree programs. Experience in the development of other academic disciplines, though, suggests that the most promising long-range possibility lies in developing in-country, degree-based academic programs that specifically combine the partner disciplines of communications and agriculture. Such programs permit the systematic integration of studies in agriculture and communications rather than the piecemeal efforts that often characterize short-term, non-formal teaching approaches. They can help professionalize the individual more effectively than the usual short-term approaches. They encourage the use of communications approaches that are uniquely adapted to conditions and opportunities in the learner's country. They minimize language barriers that place heavy burdens upon students who are involved in study programs abroad. They are less expensive than foreign study programs. They enhance the long-term professional growth of the individual by providing valuable academic credentials, putting the individual into the educational mainstream, and providing a solid platform for career advancement. And they generate sustained study and research that can build a stronger knowledge base for effective communications in agriculture.

For these reasons, the University of Illinois recently established an International Program for Agricultural Communications Education. Through it, we work with partner universities that wish to analyze the educational needs in their countries and develop courses and curricula in this general discipline. We have worked in various ways with universities in Indonesia, the Philippines, Pakistan, and the Caribbean. One of those institutions, the Institut Pertanian

Bogor in Indonesia, is now teaching its first course work and admitting its first degree candidates.

I feel confident about the long-range soundness of this concept of developing qualified professional agricultural communicators through in-country degree programs. It also happens to be an important new way in which agricultural colleges and universities can become stronger partners in development. Academic programs in agricultural communications add nicely to courses and curricula in related disciplines such as extension education, rural sociology, journalism, and broadcasting.

Data bases

Agricultural libraries and related information services pose special challenges and opportunities. As agricultural libraries get more administrative attention, they become more susceptible to what has been described as politicized documentation. Patterns of growth in agricultural data bases have prompted expressions of concern about concentration of documentation in the large English language data sources in the Northern Hemisphere. Also, as more agricultural data bases emerge throughout the world, will they interrelate through networking arrangements? What are the incentives to do so (or not to do so)? How can they create such linkages?

We also note here some needs for human resource development. Many persons who work as professional agricultural librarians/information specialists have little or no education in library and information science. In some countries or regions of the world there are no schools offering programs relevant to modern information science. Most of the existing training programs organized by the larger agricultural information systems are run independently and are not integrated (13).

Application of technology

Certainly, the emerging communications technologies offer promising potential to help improve information for agriculture, and I am among those who encourage efforts to experiment with those technologies and apply them in appropriate ways. At the same time, I urge caution about how we use them and what we expect of them. Mere application of communications technologies does little for agricultural and rural development. The trail of develop ment programs is littered with failures in which high hopes rested on the use of new communications technologies. We see some promising information systems come into place but languish because of inept usage, poor content flowing through them, and other (human) problems. Technology cannot replace understanding, sensitivity, sound communications planning, and participation.

We also should be aware that, whereas communications technologies are neutral in themselves, their effects are not. When they are used in ways that lead to centralization of economic, political, and social power they stand in the way of true cultural development. My main suggestion in this regard is to be sure that usage of new communications technologies is guided by careful, audience-oriented analysis.

Voices in development

The potential for using communications research tools to get more feedback from the intended beneficiaries of development is great. Administrators of programs for development need to get more serious about the importance of feedback and participation. Tools such as baseline studies, media analyses, pretesting, and tracking studies are at hand, ready to be applied. The growing awareness of the importance of participation is well-founded, but we need to define participation and mobilization more clearly than we have so far. Participation can range broadly from conferring only with those who agree with us or using captive, figurehead advisory groups to giving clientele a strong financial and political voice. A development organization can easily claim that it is involving clientele, even when the involvement is on a token level. Real progress in development, however, awaits those organizations that give clientele and others in the system more than token voices. Those involved in agricultural and rural development must keep their eyes on the question: development for whom? Unfortunately, the benefits of development do not get spread evenly across a society or among groups. I am encouraged by current priorities given to development for those who have little economic and political power. Their voices must be heard where development-related decisions are made.

REFERENCES CITED

1. Aries, P., 1975. Evolution of agricultural information services in the world: general trends and the present situation. Quarterly Bulletin of the International Association of Agricultural Librarians and Documentalists 20 (3/4): 105-110.
2. Barghouti, S.M. 1971. The role of mass media and personal channels in agricultural development in Jordan. Doctoral dissertation, University of Wisconsin, Madison, 126 p.
3. Bueno, P.B., and A.S. Frio, eds. 1982. Proceedings of the Regional Workshop on Development Support Communication for Rural Develop ment, Southeast Asian Regional Center for Graduate Study and Research in Agriculture, Los Baños, Philippines. 115 p.
4. Drilon, Jose D., Jr., 1981. Mass media's role in disseminating agricultural

research results. Pages 17–21 *in* Papers on Communication. Communicators for Agricultural and Rural Development, Philippines.
5. Fraser, Colin, 1981. Promoting people's participation. Agricultural Information Development Bulletin 3 (4): 17–19.
6. French, James H., 1984. Linking farmers with research. Agricultural Information Bulletin 6 (2): 2-4.
7. Goodman, K., Rajaram Shrestha, Rameswor Shrestha, S. Sharma, and P. Chitraker, 1984. Letters from teachers: a report on the feedback from participants in the radio–based teacher training project in Nepal. Pages 44–53 *in* V.A. Sigman, ed. Development communications in the Third World. International Agriculture Publications General Series Number 2, University of Illinois, Urbana.
8. Gowdar, S. 1982. Information service functions and training needs of agricultural research and educational organizations in Asia. Doctoral dissertation, University of the Philippines at Los Baños. 171 p.
9. International Association of Agricultural Librarians and Documentalists. 1981. Agricultural information to hasten development. Proceedings of the VIth World Congress. Agricultural Libraries Association of the Philippines and the Agricultural Information Bank for Asia, Los Baños, Philip pines.
10. Laflin, M. 1983. Information and farmers' needs. Agricultural Information Development Bulletin 5 (1):2–4.
11. Macorra, L. de la. 1980. The social marketing of contraceptives in Mexico. Development Communication Report 31:3–4.
12. Prabha, C., and J.F. Evans, 1982. The literature of agricultural communication. Agricultural Communicators in Education Quarterly 65 (4): 15–31.
13. Ronchi Martinelli, M.T. 1983. Education and training for the agricultural information professions. Quarterly Bulletin of the International Association of Agricultural Librarians and Documentalists 28 (3): 126–151.
14. Swanson, B.E., and J. Rassi, 1981. International directory of national extension systems. Bureau of Educational Research, College of Education, University of Illinois at Urbana–Champaign, Illinois.
15. Woods, J.L. 1982. Time for a new approach to population communication. RB: # 394, Development Training and Communication Planning, UNDP Asia and Pacific Program, Bangkok, Thailand.

Computers in Education: The Revolution

D.R. Minnick

Computer aided instruction and computer managed instruction can assist the learning process. Four major areas where computer technology can be applied are tutorial drill, response situation, simulation, and problem solving. Computers can also be utilized to evaluate the instructional process and handle the management aspects of training. Computers will become integral tools in Third World education and decision-making. There are three basic challenges associated with computers in training: counselling and human dynamics training for educators, training materials that are learner directed and enhance independence in learning, and training human resources to adapt computer materials.

A myriad of concepts relate to this subject material, concepts that are anchored in relatively new buzz words and acronyms like cutting edge, educational technology, micro millenium, simulation modeling, whole brain and Skinnerian learning, andragogy, CAI, CMI, AI, CRT, and CPU (7, 9). Not only are computers a viable technology in the educational process, but it is imperative that we as decision-makers in this process prepare ourselves to contend with this new technology.

THE HUMAN TIME LINE

To develop the topic of computers in education, let us first turn our attention to Deevey's concept of revolutions or the human time line (4). When the human animal entered the world, the cultural revolution was born. Man was originally a hunter/gatherer. Then he discovered fire. Pair bonding and banding were established. There evolved a division of labor and a language to transfer the information of man's rudimentary technology.

In about 8000 BC, the agricultural revolution occurred, and man ceased to be a hunter/gatherer; he established a stationary food base by domesticating plants and animals, and he manipulated water to irrigate this food base. He created agricultural tools and traveled to other lands, resulting in an exchange of Old World and New World crops. Simultaneous with this agricultural revolution, mankind was evolving on other paths, one of which involved

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paper and eventually print material, that hastened the diffusion of information.

Around 1650, the scientific/industrial revolution occurred; man discovered the microscope, harnessed water power, built the internal combustion engine, discovered immunization, and invented the telephone, the typewriter, the calculator, the television, and, in accelerated fashion, a host of items.

Deevey's time line, conceived and published in 1960, quits with the scientific/industrial revolution. But another revolution has occurred that has been called the information revolution, the communication revolution, or the micro revolution. This revolution emerged from the scientific/industrial revolution and started to gain impetus in the 1960s. However, that impetus took on logarithmic proportions with the advent of the microcomputer in 1975 and the floppy disk in 1978 (5). This micro revolution is producing a time warp that is and will go on altering human behavior in an unprecedented fashion.

Spatially, this revolution is making our world smaller because of the rapidity and ease with which information can be transported and shared in the world community. The implications for human information processing, labor markets, mechanization, transportation, education, and every conceivable aspect of our present behavior patterns are evident.

COMPUTERS NOW AND IN THE FUTURE

The hue and cry from many nations is, how do we catch up? It is my contention that we, in institutes and schools of agriculture, cannot be content to hold back in this revolution. We must find ways to amalgamate the components of all the revolutions. We have a responsibility that entails holding fast to the tenets of agriculture while simultaneously embracing new advances in agricultural and educational technology as well as those of the information revolution.

The end result of this responsibility is the development of human resources that can *adapt* and have the prospect of making informed decisions about future technological changes. We require human resources that can explore the information of all revolutions and grow independently, of their own volition, after they have terminated their structured training—a continuous independent learning process called andragogy.

The computer is one tool that may assist us in this process. Its inroads into agriculture are already evident in areas of statistical computations and in the crunching, manipulation, and management of data banks for decision-making associated with plant breeding, marketing, weather prediction, crop production, etc. The MSTAT program of Michigan State University, AGNET of the University of Nebraska, and the FAIRS program of the University of Florida are examples (10). The computer is being used in modeling to simulate

dependent and independent variables to allow predictive capabilities in decision-making in an array of agricultural disciplines.

In extension, FAO estimates that in 20 years the world extension force will increase 4½ times to 1.25 million (1). We must find new ways not only to train but also to update this force for technological change (5). Computers will be an integral part of this process, for this ubiquitous machine is now gaining momentum in instruction (computer aided instruction or CAI) and data management associated with instructional evaluation (computer managed instruction or CMI).

The four major areas where computers are assisting in the learning process are in the realm of autotutorial instruction and involve tutorial drill, response situation, simulation, and problem solving. For CMI, the computer assists in evaluating instructional processes and in managing the administrative aspects of training (2).

Some may be skeptical that this computer technology will endure, thinking that it will instead go the way of the TV methodology that entered American and many Asian colleges in the 1960s. Especially doubted may be its applicability to Asian training facilities. But I contend that this educational methodology is different in many respects. First, computer methodology is anchored in valid concepts in educational psychology (7, 8). It is based on Skinnerian learning principles that have come to be called programmed instruction — the presentation of educational materials in small steps in organized and sequential measures that are self-paced, provide immediate feedback, and possess inherent rewards (3).

In addition, there are related events already in process in both developed and developing nations:

- Most technological advances are associated with the activity of a rabid fringe for about 10 years before the technology goes to its demise or is accepted. In developed nations, the rabid fringe concerning microcomputers and CAI is being supplanted by the entry of giant, conservative multinational corporations like IBM and McGraw-Hill into both the hardware and software markets.
- There is a dramatic intensity of computer activity in western school systems such as the implementation of required computer curricula, the development of computer departments, and the training and updating of academic professionals in computer disciplines (2).
- This activity is associated with the proliferation of CAI software at all levels of use for school and home consumption.
- The most frequently cited reason for a personal computer purchase for the American family home is that it gives the children an edge in their schooling.

In developing countries, we see:

- international computer corporations setting up representative offices and complete marketing outlets,
- a Japanese consortium investing in basic communication and hi-tech electronic research,
- imitations of brand name computers that may eventually provide a decent computer at a decent price,
- the proliferation of private computer schools in Asian cities to handle the demand for computer training along with the establishment of computer facilities and centers in Asian universities, and
- most important, a communication priority that has literally invaded the Asian sphere in the last decade.

A few examples will suffice to underscore the seriousness of this last point.

- Rural electrification in the Philippines advanced from 73,000 homes to over 1 million in 10 years. Recently the first light bulb was lit in an Ifugao hut on the rice terraces. Video will surely follow.
- An enthusiastic letter from a high school student in the Himalayas of Bhutan talks about the intrusion of video into the pastoral community and school life.
- One can buy western cassette tapes in rural Malaysian markets.
- An antenna poking out of a nipa hut is no longer an anomaly.
- The priority given in Asia to the quality and duration of education of children is no different from that of the American family.

Revolutions take time, and the changes that accompany them — that change our lives — are insidious; they happen by degrees. We hardly notice. A car carburator changes, an automatic pilot is perfected, a bullet train is instituted, a satellite gets pumped into the air, a dish gets planted in the ground, and the sound changes in the cash register as it rings up our bill. Our conversation changes as we adapt and incorporate the new buzz words into our vocabulary. If we look and listen, we find a revolution that surrounds us and is affecting our lives. It will change our lives even more dramatically in the future.

We now have for the first time in the history of mankind a machine rather than a human with which we, the human animal, can hold a dialogue. Better yet, we can carry it around with us, and it never complains of being hungry or even of where we eat. It is a machine companion. Recently, it has been made to talk to us in a human-like voice. This machine can already play music and will soon be able to sing to us and understand our voices. It will have the capacity to translate between languages.

With the change of a small disk or bubble, it will be able to provide us with almost instantaneous feedback to our questions, even those pertaining to agriculture. It will assist us even in problem solving as artificial intelligence comes on-line. It will be much like the hand-held calculators on which we

have come to depend for our mathematical decision-making. It will be our mental mentor extraordinaire; to many it already is.

The implications of this scenario for the human animal are awesome, not only in redefining the learning process, information accesibility, and pedagogy but even more so for determining our future social interactions.

CONCLUSION

The challenges of embracing this information revolution are formidable. We live in an era of increased longevity that affords us the opportunity to experience, in an unprecedented fashion, the interaction between accelerated technological and social change.

There are three basic areas in which we must make preparations. The first is psychological in origin. In the realm of psychology (6), there are two schools of thought and research referred to as the naturalist and humanist schools. Much of our educational technology has been advanced through the naturalist school and we, as scientists by training, embrace this school. One challenge is thus to train our educators and extension people also in the precepts of the humanist school, in counseling, and in the human dynamics of the learning process. We must extend our training to the affective or attitudinal domain as well as the technical because this revolution is defining a new role for the teacher.

The second area is to develop an independence in the learning process so that students and all people can be taught to cope with the deluge of information that is being disseminated in a world full of technological discoveries. The teacher of tomorrow will be an information counselor to guide students through software programs. Extension agents will also need both humanistic and independent andragogical training to be able to interrelate technology with social impact.

The third challenge is to train human resources not only to create but to adapt relevant computer information to their respective disciplines and cultures. We also need to train technicians to repair and service computer hardware.

These and other challenges associated with this micro revolution afford mankind an opportunity to use this technology to forge a better world.

REFERENCES CITED

1. Anderson, C. 1984. Agricultural education: definitions and implications of international development. NACTA 28(2):34–37.
2. College of Agriculture, Univ. of Florida, 1981. Computers in teaching. Committee Report, Gainesville, Florida. 91 p.

3. Commission on Undergraduate Education in the Biological Sciences (CUEBS). 1971. The use of modules in college biology teaching. J.G. Creager and D.L. Murray, eds. Washington, D.C. 173 p.
4. Deevey, E.S., Jr. 1960. The human population. Scientific American 203(3):194–204.
5. Extension Committee on Organization and Policy. 1982. The computer management power for modern agriculture. Coop. Ext. Ser., Purdue University, W. Lafayette, Indiana. 19 p.
6. Lowe, C.M. 1976. Value orientations in counseling and psychotherapy. Carroll Press, Cranston, Rhode Island. 305 p.
7. Novak, J.D. 1977. A theory of education. Cornell University Press, Ithaca, New York. 295 p.
8. Novak, J.D. 1980. Learning theory applied to the biology classroom. American Biology Teacher 42(5):280-295.
9. Springer, S.P., and G. Deutsch. 1981. Left brain, right brain. W.H. Freeman and Co., San Francisco. 243 p.
10. Waldren, R.P. 1983. AGNET as a teaching tool. NACTA 27(3)38-39.

Overcoming Language Barriers: Autotutorial Modules and Copublication

T. R. Hargrove, W. H. Smith, and V. Cabanilla

Autotutorial modules, which are composed of slide–tape presentations, are useful in that they permit students to proceed at their own pace; select those subjects in which they are weakest and concentrate on them; repeat instructional material as often as necessary; select their own time for study; and study in private. Copublication, on the other hand, is a cooperative endeavor whereby the original publisher of a book or document grants permission to a second publisher to translate, publish, and disseminate that publication in another language. Copublication efforts can come in the form of procedural help or physical/mechanical help by sharing printing negatives, sharing color separations, sharing black and white illustrations, or contract printing.

The language problem is a major barrier to the dissemination of information on improved technology in the Third World. It is difficult for an international research institute, a national research organization or any agency to publish in any other than its working language.

From 2500 to 5000 languages — many of which are broken into local dialects — are spoken worldwide. Although English is generally acknowledged as an international language and is considered as the language of science, only 380 million of the world's 4.3 billion inhabitants speak it as their native language. That means that materials published in English automatically bypass 90% of the world's people. Consequently, the results of the hundreds of millions of dollars invested in international agricultural research are generally available only to the top–level research community and government planners. These people comprise the English–speaking segment of most non–English speaking countries.

These figures illustrate the enormity of making any information product available in different languages. Our concern is even broader — the use of autotutorial modular instruction and copublication to transfer agricultural technology across language boundaries.

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AUTOTUTORIAL MODULES

First, let us define autotutorial teaching. In the sense that autotutorial means self-teaching, it is a concept that educators should certainly find repugnant. Even an autotutorial module has been generated by a teacher with a student in mind. And because there is no interaction between student and teacher, there is even greater emphasis on the logical, systematic presentation of concepts than in face-to-face instruction. Autotutorial modules are really a way of packaging instructional materials in a form other than in the traditional lecturer-student classroom situation. Autotutorial modules appeared on the educational scene in the early to mid-1960s. S. N. Postelhwait of Purdue University is credited with developing modular instruction (1), which has been characterized as probably the most widely used instructional innovation on college campuses since 16 mm educational films (2). Modules are often in the form of slide-tape presentations that permit students to:

- proceed at their own pace,
- select those subjects in which they are weakest and concentrate on them,
- repeat instructional material as many times as they believe necessary,
- select their own time for study, and
- study in private.

Autotutorial modules provide direct-experience activities for students to integrate into the learning process, and they ensure that all students receive the same message.

In 1976, IRRI began to produce a 43-module series on rice production training. The number of modules later rose to 52, and by the time the project was completed in 1983 there were 64 modules in the series. Since the beginning, some of these modules have been used in other IRRI nondegree training courses besides that on rice production.

English is the working language of IRRI and of many other international research agencies. The more than 3700 trainees who have completed short-term nondegree training courses at IRRI in the last 25 years were all taught in English. However, their English language skills varied greatly.

Since introducing the rice production training modules into the nondegree courses at IRRI, we have found that many of our trainees use the modules to improve their English skills. Navarro et a1 (1) listed the modules as a vehicle for improving English language skill as one of seven benefits of the autotutorial series. Apparently, listening to a tape and following along with the text in a booklet helps our trainees improve their English language skill.

In preliminary investigations conducted by D. R. Minnick at the University of Florida, a record was kept of the number of times a student checked out a module and the total time spent. Students with foreign names — presumably

that means names other than of Anglo-Saxon origin — checked out training modules 3.2 times compared to 1.3 times for other students, and they spent three times as long with the modules. It is reasonable to conclude that those students were non-native English speakers and had to spend more time with the modules to master the material, and Dr. Minnick is unwilling to conclude that they used the modules to improve their English language skill; but it certainly was an option.

COPUBLICATION

What do we mean by copublication? At a copublication workshop held at IRRI in November 1983, participants agreed that copublication is the communication, in different languages, of any useful information to different audiences via all communication media. The group, finding this definition wanting, further determined that "all communication media" meant the printed word, audiovisuals, films, video, radio, and television.

For our purpose, we prefer to define copublication as a cooperative endeavor whereby the original publisher of a book or document grants a second publisher permission to translate, publish, and disseminate that publication in another language. The second publisher may adapt the information to make it more useful for the recipients of the translated material. Note that we make no distinction among commercial publishers, universities, academic presses, national programs, or international development agencies or institutions.

Copublication is not new. Translation of information products has been going on for centuries. One of the first and better known formal copublishing ventures was sponsored by the Franklin Book Programs, a United States nonprofit organization that operated from 1952 until 1979 to make English language books available in languages that more people could read. The program had three distinguishing features vital to any copublishing program (3). First, local publishers decided which books suggested by the Franklin Book Programs they would translate and publish. This saved the program from being branded as cultural imperialism. Second, local publishers used their own translators, who often were leaders in intellectual and public life — cabinet ministers, university presidents, top-flight journalists, and leading poets, scientists, and engineers. The third hallmark of the Franklin Book Program was the adaptation of the content of some works to the cultural themes of the language into which they were translated.

If we accept that copublication equals translation, and that the practice is well established, then what relevance does a copublication discussion have to overcoming language barriers? The answer is the way the original publisher designs the publication to facilitate its translation and dissemination.

Original publishers' standard approach has been to produce information products in their own languages. If other publishers wanted to translate the work, they initiated the translation. In their original decision to publish, the first publishers were not concerned about translation.

Copublication involves a different approach. Original publishers plan on the possibility of the work being translated and actively seek copublishing arrangements with secondary publishers. Original publishers design their publications so that a second publisher can translate and redistribute them with the least effort and expense. Copublication, then, is a sharing concept used by the original publisher.

How does copublication involve the original publisher more actively in the translation, printing, and distribution process of the second publisher? There are really two steps: physical/mechanical help and procedural help.

Physical/mechanical help

Physical/mechanical help is aimed toward assisting the copublisher with the production process. This can be as straightforward as simply sharing printing negatives to actively assisting in the printing of the translated work.

Sharing printing negatives. At first glance, sharing printing negatives with a second publisher may not seem to fit into a copublication discussion in which the emphasis is on overcoming language barriers. Obviously, sharing printing negatives means that the original work is published in the same language by a different publisher, and no language barrier is crossed.

Often, however, the barrier to disseminating technological information is not one of language but of economics. Many countries such as India, which have a tradition of English as an academic language, can use books written in English. Even though IRRI books are inexpensive compared to those published in Europe and North America, they are still too expensive to be sold widely in developing countries. In this case, by using original printing negatives a second publisher can economically reproduce English language books because the typesetting and layout costs are absorbed by the original publisher. Sharing printing negatives of a translated work reduces costs of translated editions. For example, it would make little sense for several agencies to translate and copublish materials locally in the same language when one edition could serve several regions - a Bengali edition of a book could serve both Bangladesh and West Bengal, India, and a Spanish edition could work for both Ecuador and Honduras.

Sharing color separations. Color printing is often too expensive for Third World publishers. The original publisher can help the second publisher by making color separations available. Or, as IRRI has done with one of its

widely copublished works, *Field Problems of Tropical Rice,* the original publisher can arrange for enough color pages of a copublished work to be printed so that many publishers can be served by the same press run.

For example, Field Problems has recently been revised. In its first edition, the book was translated and copublished in 10 languages. When the book was revised, interested copublishers were given galley proofs so they could translate the book even before the revised English language edition was printed.

The text and color photos of *Field Problems* are always on facing pages. No text is printed on pages with color photos. The color plates are all on the same printing flats. Copublishers translate the English text, typeset it to the same line and column length, then submit the translated text to IRRI. IRRI forwards the text to the printer, granting permission to use IRRI's color plates to print the non-English edition. The copublisher pays only for the printing.

This procedure saves the copublisher money because IRRI absorbed the major cost of color printing — the color plates — when the English edition was printed. Non-English editions can be printed almost as cheaply as reprinting in English.

Shaving black and white illustrations. Sharing black and white prints is another mechanical way in which an original publisher can help a copublisher. The IRRI publication, *A Farmer's Primer on Growing Rice,* is designed to help progressive rice farmers and technicians understand why and how improved rice varieties and farm technology increase production. It is highly illustrated and contains a minimum of text. After the English edition of *A Farmer's Primer* was printed, we blocked off the English text and printed reproducible copies of the illustrations. These are given to copublishers, who translate the text, paste the typeset copy of the translated text on the illustrations, and then print their local language editions.

Contract Printing. Contract printing is another way in which the original publisher can assist the copublisher. In some cases, that is the only way the copublisher can obtain printing.

Using the example of the copublication of *Field Problems,* we are presently working out an arrangement to provide 38,000 printed sets of the color illustrations of *Field Problems* to a national agency. The agency will translate the book and print the text pages in that country. Then it will bind the locally-printed text pages together with the color pages printed in the Philippines.

Almost all of the 30 translations of *A Farmer's Primer* were printed by the local copublisher. In a few cases, the copublishers translated the text, pasted it on the illustrations, and then sent the pages to IRRI. We, in turn, arranged for printing.

This help with printing is a logistical one. In all cases, the copublishers have paid for the printing and shipment of books, either through their own budgets or with grants from donors.

Procedural help

Procedural help to copublishers pertains to policies, the granting of rights, copyright protection, etc. To carry out a successful copublication program, the original publisher must begin to approach the publishing process in some nontraditional ways. Some procedural questions a publisher must consider are listed below.

- Should the original publisher charge royalties or payments for copublished editions of its materials? IRRI does not.
- Should the original publisher grant exclusive rights to a copublisher? IRRI retains the right to authorize multiple editions of copublished material. We do this to ensure that non-English editions are widely and continuously available. If a copublisher fails to make the copublished editions available, then we have the option of granting another copublisher the right to publish a non-English edition.
- Should preference be given in the selection of a copublisher? IRRI gives first preference to national agricultural improvement programs and other International Agricultural Research Centers.
- Should the original publisher help promote the copublished edition? IRRI assists copublishers in promoting non-English editions through announcements in the *International Rice Research Newsletter*.
- How deeply should the original publisher become involved in helping the copublisher to issue a non-English edition? Much depends upon the resources of the original publisher. At IRRI we will arrange for printing of the non-English edition if the copublisher asks. That may not be an option for some other publishers.

There are other procedural questions to answer, but these illustrate the kinds of questions that arise.

IRRI'S COPUBLICATION EXPERIENCE

As of 15 March 1985, at least 118 non-English editions of 19 IRRI books had been or were in the process of being translated into 39 languages in 18 countries (Table 1). *A Farmer's Primer* had been copublished in 25 languages, and the 1st edition of *Field Problems* had been published in 10 languages (Table 2). At least 688,600 non-English copies of 29 copublished editions of 17 IRRI books have been printed since 1973 (Table 3). Another 14 editions of *A Farmer's Primer* are in preparation. The revised edition of *Field Problems* released in August 1983 has been published in 7 languages and is being translated into another 21 languages. Both of these books were designed for copublication, and they account for about 90% of the 688,600 copies published in non-English editions. Thirty-seven translated editions of 16 IRRI books that were

Table 1. Languages in which 19 IRRI books had been or were being copublished as of 15 March 1985.

Languages	Books (no.) Copublished	In press
Arabic		2
Bahasa Indonesia	3	2
Bahasa Malaysia	1	-
Bengali	3	0
Bicol	-	2
Burmese	2	1
Cebuano	1	1
Chinese	16	2
Farsi	1	2
French	2	1
Gujarati	2	2
Gujarati and Hindi	1	-
Hiligaynon	1	-
Hindi	2	1
Ilocano	1	1
Japanese	1	2
Kannada	1	1
Korean	1	-
Maguindanao	-	1
Malagasy	-	2
Malayalam	-	2
Marathi	-	1
More	-	1
Nepali	2	1
Oriya	1	1
Pampango	-	1
Portuguese	-	2
Punjabi	-	2
Singhalese	-	2
Spanish	9	2
Swahili	1	1
Tagalog	3	
Tamil	2	1
Telegu	2	2
Thai	3	1
Urdu	3	1
Vietnamese	5	1
Warai	2	-
Wolof	-	1
	72	46

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Despite the enthusiasm of many agencies for rice materials in local languages, we really know little about the effectiveness of translated materials. IRRI and Araneta University are cooperating in a PhD research project to compare knowledge transfer of *A Farmer's Primer* and a poster on natural enemies of rice insect pests in Cebuano (a Philippine local language) and English. We will interview two groups of 40 technicians each to test their knowledge of the content of the two publications. Then one group will be given the materials in English and the other group will receive Cebuano editions. The Ministry of Agriculture and Food has instructed all of the technicians to study the materials. Two months after the pre-test we will conduct the post-test. The group that receives the English language materials will be interviewed in English, and their questionnaires will be in English. The group that receives the Cebuano language materials will be interviewed in Cebuano, and their questionnaires will be in Cebuano. We hope this study will give us some clues as to how our materials are working and how we can improve them.

CONCLUSION

Language differences that block effective communication in agriculture are a world tragedy. Ineffective communication is the greatest single barrier to agricultural and rural development. Even more than differences in natural and human resources or in education and research capabilities, language differences limit the spread of our most altruistic ideals and the use of our most basic technologies.

Although the examples here have dealt primarily with the translation of English materials, they pertain to other languages as well. A bulletin published by a fishery scientist in Thailand may be equally valuable to a colleague in Malaysia — but the language barrier prevents its use.

In his closing remarks at the November 1983 workshop on Copublication: Strategies for Multilanguage Publication in Agriculture, Dr. M. S. Swaminathan, Director General of IRRI, stressed that copublication is a means to an end, not an end in itself. Copublication, he said, is the means by which we see to it that language is not a barrier in communicating information between and among countries.

It has been demonstrated that copublication and autotutorial modules can help us overcome the language barrier in our efforts to spread the benefits of new agricultural technology to end users. It remains for us to intensify our efforts, rethink our traditional approaches to publishing, and try to be as innovative as the scientists whose work we are disseminating.

REFERENCES CITED

1. Navarro, E.L., C.C. Quijano, V.M. Macalinga, and H.H. Hagerman. 1982. A-T modules: adding dimension to rice production training. Philippine Journal of Crop Science 6(1 & 2): 39-43.
2. Novak, J. 1977. A theory of education. Cornell University Press. Ithaca, N.Y.
3. Smith, D.C., Jr. 1983. The Franklin Book Programs. Journal of the Library of Congress. Summer 1983: 255–266.

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