LIFE AT CIP

INTERNATIONAL POTATO CENTER (CIP)

The Social Sciences at CIP

Report of the Third Social Science Planning Conference

Held at CIP - Lima, Peru September 7 - 10, 1987

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FOREWORD

This is the report of the thirty-second Planning Conference sponsored by the International Potato Center to review progress and develop recommendations for the Center's research. More than 300 individuals from 40 countries have participated in previous Planning Conferences.

This Planning Conference, the third concerned with the social sciences, assembled an authoritative, international group of 11 researchers and decision makers to examine how well CIP's needs are being met by the social science program and what changes should be considered to improve overall institutional performance. Three specific goals of the Planning Conference were:

- Review the past programs and plans of the social sciences
- Critically examine how effectively the social sciences are contributing to CIP's overall program
- Develop guidelines and recommendations for a five-year operational plan

Social scientists contribute to CIP's program by participating in the identification of client needs and opportunities, in the generation of technology, in the assessment of impact of new technologies and programs, and in strengthening social science research capacity in national and regional programs.

The Planning Conference papers and discussions covered a broad range of topics and issues that are important not only for CIP but for all institutions concerned with agricultural research and development. For this reason, we believe the proceedings will be of interest and use not only to potato scientists but to all those concerned with improving the effectiveness of research and development programs through the innovative use of the social sciences.

Peter Gregory
Director of Research

CONCLUSIONS AND RECOMMENDATIONS: THIRD SOCIAL SCIENCE PLANNING CONFERENCE

1. CONTEXT AND BACKGROUND

1. The six years since the last social science planning conference in 1981 have seen the creation of Thrust X for Research on Potatoes and Sweet Potatoes in Food Systems and a proliferation of demands on the social scientists at the International Potato Center (CIP).

2. The recent expansion of the center's mandate to include sweet potatoes as the second CIP commodity provides an historic opportunity for a rededication to well-focussed goals and strong interdisciplinary collaboration.

2. COMPARATIVE ADVANTAGE

3. During the past 12 years, CIP's social scientists have developed several areas of unique comparative advantage which should continue to form the foundation of future social science activity. These areas are related: (1) a creative combination of perspectives from economics and anthropology in the description and analysis of farmers' and consumers' behaviors and perceptions and; (2) the ability to utilize these insights in the process of technology generation through close collaborative work with natural scientists. Combined with the prestige, resources and networks which accrue to researchers in the GCIAR system, CIP's social scientists have made a unique contribution to the development of integrated social and natural agricultural research.

4. It is of particular concern to us that this comparative advantage continues to be the foundation of social science activity at CIP.

3. SOCIAL SCIENCE RESOURCES

5. The achievements of social scientists at CIP, working with their natural science colleagues, have been varied and are beginning to be well documented. We noted, however, during the conference, a tendency to focus more on successes involved in using these methods to design, evaluate and diffuse CIP technologies and less importance given to designing and diffusing methodologies for research between natural and social scientists in national programs.

6. We also noted that since the last planning conference there has been a proliferation of demands upon CIP's social scientists for a wide variety of important functions. This expansion of roles is a function of changes from both outside and inside CIP, including increased demands for information and analysis by CIP administration and donors and expansion of information technologies which have created new opportunities for global data collection and analysis. Furthermore, the addition of sweet potatoes as a new commodity in CIP makes much more urgent the need for CIP's social scientists to clearly focus their energies on those areas where they have unique comparative advantage and where their experience with methods in dealing with potato producers, consumers, and national scientists can be transferred to sweet potato research.

4. STRATEGIES AND PRIORITIES FOR SOCIAL SCIENCES RESEARCH

7. CIP's mandate and priorities and the comparative advantages of social scientists within the institution provides the framework for prioritizing social science research and research-related activities. The two areas that emerge from this context as meriting top priority are:

- Ex-ante assessment research.
- Development of research methodologies for strengthening farmers' and consumers' perspectives in National Agricultural Research Systems (NARS).

8. The strategy we recommend for fulfilling these priorities is based on the principle of making the most cost-effective use of scarce CIP social science staff resources. This has two dimensions:

- doing less where comparative advantage and benefits are lower;
- doing more where they are higher.

(a) Doing less: fending off and hiving off

9. During the past six years, three trends can be identified in demands and activities by CIP's social scientists:

- Special studies, for example on consumption, on seed programs, and on marketing, which are repeated in different countries and environments.
- Pressure for the early publication of results, sometimes at the cost of writing up and disseminating methodologies, as one special study follows another.
- Increasing attention to issues of policy.

Together these have contributed to a decline in time spent by CIP's social scientists working directly with farmers and national scientists.

10. At the same time, we note that the development of methodologies related to information technology should be an important part of CIP social science activity. However, once the initial information methodologies have been devised, their routinization, maintenance and updating should be transferred from the primary consideration of experienced social scientists.

11. We recommend that CIP social scientists be protected from such demands of information technology through the following:

- collaborating with CIP's Information Service Unit to devise mechanisms for responding to routine administrative and donor demands for information,
- completing methodological write-ups for special studies and putting any further special studies out to contract to developing country professionals,

- collaborating with the Information Service Unit to find a mechanism for maintaining the country reference files,

- involving international organizations and contractors with their own comparative advantages and data bases, such as ISNAR and others.

12. These measures will help protect and release CIP's social scientists to enable them to concentrate their activities where their comparative advantages and potential contributions are greater.

(b) New work and doing more

13. We recommend that the activities of CIP's social scientists be concentrated in the two recognized priority areas:

(i) Ex-ante interaction with the technical thrusts

14. CIP's social scientists should be involved with natural scientists in all the technical thrusts in discussion and analysis of priorities and their implications, bringing to bear the perspectives of poor farmers and consumers into the appraisal of potential impacts. The good track record of CIP in relations between social and natural scientists, and the diffusion of farmer and consumer perspectives among CIP natural scientists, give CIP an opportunity not only to improve the impact of its work, but also to develop methodologies for ex-ante interaction of value to other International Agricultural Research Centers and to NARS. Ex-ante research on farmer and consumer behavior and perspectives has to take place very early indeed in the evolution of technical research, before priorities have set, and is critically important as an urgent priority with sweet potato work potentially across all thrusts.

15. We recommend:

- a policy decision in CIP that social scientists should be involved and consulted by technical thrusts when they are considering new initiatives,

- rapid investigation by CIP's social scientists and others who can be quickly contracted to elicit and

present farmer and consumer perspectives on the sweet potato,

- immediate use of social science expertise in ex-ante analysis of all work proposed for sweet potatoes.

(ii) Developing and disseminating methods

16. Developing and disseminating methods and orientations is a much more cost-effective activity for CIP's social scientists than conducting substantive research per se. Much past activity has concentrated either on direct research or on the dissemination of production technology and principles. Direct research, and especially direct involvement with RPFs, is vital in the development of many methodologies but once developed, the priority is dissemination of the method rather than its use in the transfer of specific technologies.

17. We recommend:

- very high priority to direct field work by CIP's social scientists to develop new methodologies which involve farmers and consumers in three areas: identification of technical research needs and priorities, technology development and adaptation, and dissemination of indigenous and new technologies among countries and regions in the world,

- writing up, communicating and disseminating methodologies and approaches to NARS to be regarded as the end objective of field work and research

- methodologies to be developed under representative conditions to ensure their relevance for natural and social scientists in developing countries.

5. TRAINING

18. Given that few social scientists are in or available to national programs, alternative methodological approaches are needed to incorporate farmers' and consumers' perspectives into research approaches in the NARS. A crucial need is for natural scientists to become excited by the farmers' perspective. Training to achieve these objectives can be

organized in several ways. As CIP's social scientists have only a limited time to contribute, they may be best deployed in training trainers. Training inputs by natural scientists who have a social science and farmer perspective can make a strong contribution. In addition, social scientists can be sought from outside agricultural institutions.

19. In view of these objectives and considerations, we recommend:

- a shift of emphasis for CIP's social scientists from collaborative research as a training tool to more direct participation in training courses,

- development and dissemination of training methodologies which encourage and enable natural scientists to become excited by the farmers' perspective and by learning from and with farmers,

- exploration of the possibility of CIP social scientists finding and involving more national social scientists in CIP-related work, including conducting training-of-trainers courses so that participants could subsequently contribute to CIP's regional training courses,

- collaboration with other Internatioal Agricultural Research Centers (IARCs) in regional courses on farmers' and consumers' perspectives and on-farm research.

6. RESOURCES AND DEPLOYMENT

20. These priorities and strategies have implications for the number, disciplinary composition and location of social scientists at CIP. Fixed-core social science capacity can be enhanced by the use of special projects where priorities and strategies demand additional medium-term capabilities. A contract mode with both national and international scientists gives extra short-term capability. The use of both modes should be part of a considered implementation strategy.

21. We recommend that a more even balance in social science positions between anthropologists and economists be maintained to foster the creative interaction necessary for

exploring new methodologies. In addition we recommend, as did the second social science planning conference, that one and perhaps two of CIP's senior social scientists be regionally based and play an active role in existing NARS networks. Within the networks, NARS that are identified as potential models for the incorporating farmer and consumer perspective should be a focus for training and collaborative research activities by the regionally based social scientists. The network should be used to sensitize and build social science capacity across participating countries. Management will judge which regional networks justify early attention by senior CIP's social scientists and when capacity can be shifted to other regions. Complementarity and collaboration should be fostered with other International Agricultural Research Center's in building this capacity in NARS.

22. The emphasis placed on ex-ante impact assessment of new technical initiatives demands that a strong social science capacity also be retained in headquarters. Thrust X can be seen as a means for expanding CIP's capability in its two priority roles. Thrust X requires further attention in terms of planning and strategies and perhaps a separate planning conference is required. Research in Thrust X should develop and document new methods for NARS. The comparative analysis of potato and sweet potato food systems in Thrust X and the coordination of information gathering will enhance ex-ante technology assessment in Thrusts I-X.

REACTION OF CIP'S SOCIAL SCIENTISTS TO "CONCLUSIONS AND RECOMMENDATIONS: THIRD SOCIAL SCIENCE PLANNING CONFERENCE"[1]

1. GENERAL REACTION

We are very pleased and gratified by the Planning Conference panel's interest in, support for, and highly professional and critical review of the social science program. We believe the "Conclusions and Recommendations" provide a solid foundation for future social science research and training and CIP, and we have no major disagreements with the general guidelines. The purpose of this statemente is to record our general endorsement and interpretation of the "Conclusions and Recommendations" as the first step toward development of a post-conference plan of action.

2. SPECIFIC INTERPRETATIONS

The first three sections call for no specific reactions.

Under Section IV, "Strategies and Priorities for Social Science Research," we concur with the two areas identified as meriting top priority: "ex-ante assessment research (and) development of research methodologies for strengthening farmers' and consumers' perspectives in National Agricultural Research Systems (NARS)." We interpret "ex-ante assessment research" as the incorporation of producers' and consumers' perspectives into early phases of the research and development (R&D) process. This interpretation is broader than a conventional one, which is restricted to economic cost-benefit calculations that are done before initiatives are undertaken or after they are completed. The comparative advantage of social scientists in agricultural research systems is to work closely with natural scientists. Hence, assessment research should be conducted as an interdisciplinary activity which is part of the on-going R&D process, rather than as an adjunct to the mainstream R&D

process which is the responsibility of economists or of other social scientists working in isolation.

In the section on "Doing less," we interpret paragraphs 10 and 11 to mean that once needed data bases (e.g., the International Potato Reference Files and the Root Crop Data Base) and associated information technology have been developed, maintenance, updating and routine service functions (annual updating, standard reports, and providing information to CIP's and national scientists) should be transferred from experienced social scientists to junior staff, to CIP's Information Service Unit, to NARS, or to other institutions which have a comparative advantage in this area.

On the subject of "special studies," it would not be advisable, or, in fact possible, to put all future consumption studies, marketing studies, seed program evaluations, and impact studies out to contract with developing country professionals (paragraph 11). However, we agree with the principle that once needed pioneering studies have been completed, appropriate methodological frameworks should be documented and developing country professionals should be encouraged to conduct any further studies that may be justified. It should be recognized, however, that arranging for and backstopping contract research will require that CIP's experienced social scientists spend more time training, supervising, and handling administrative paperwork, at the expense of direct involvement in research.

Ideally, farmers' and consumers' perspectives should be incorporated as early as possible into the work of all the technical thrusts, both for potatoes and sweet potatoes (paragraphs 14 and 15). However, it should be recognized that for practical reasons, it would be impossible to do all the desired work before priorities have been set. Likewise, it would be undesirable to delay the setting of priorities until all of the suggested socioeconomic work was completed.

We intend to begin field studies on sweet potato production, marketing, and consumption immediately, and we hope to participate in the setting of priorities for technical sweet potato research through interaction with our natural science colleagues, both in CIP and NARS.

We have a broader interpretation of the end products of field work and research than the statemente in paragraph 17. We believe that our immediate clients, the NARS, need both methodologies and substative research findings. Most of CIP's "substantive" social science publications present

methodological lessons and serve as models for researchers in NARS as well as other International Agricultural Research Centers. Furthermore, in the absence of significant social science research in the NARS, the substantive research findings derived from the special studies have often become points of basic reference and documents. Widely circulated publications like the Potato Atlas, The Potato in the Human Diet, Potato Storage Systems in the Mantaro Valley Region of Peru, and the various marketing studies have provided a unique source of information on socioeconomic aspects of potato production and utilization. As such, they have facilitated the work of researchers in NARS and have inspired many to conduct studies along similar lines. In the future we intend to emphasize the writing up and dissemination of methods. However, for reasons outlined in the conclusions and recommendations of the 1981 social science planning conference, it would be a mistake to discourage publication of research findings.

In the area of training (paragraphs 18 and 19), we agree with the emphasis on training trainers and involving "sensitized" natural scientists in training activities. In this regard, we believe that high priority should be placed on training and sensitizing CIP's regional staff and professionals involved with bilateral potato projects.

Before special training programs and materials are developed, the goals, client needs, and alternative strategies for social science training should be carefully assessed. Many alternative strategies could be pursued, and there is a growing concern for different International Centers engaged in on-farm research and training to present consistent approaches and information to the NARS. For these reasons, we feel it is important to assess and build on the previous experiences of other centers, like CIAT an CIMMYT. Every effort should be made to ensure that our training materials and messages are consistent with those of other Center's.

In the section of resources and deployment (paragraph 20), it is unfortunate that no mention is made of the balance between junior and senior staff. Social science capacity can be enhanced not only through the use of specially funded positions and research contracts, but also through increasing the ratio of junior to senior staff at headquarters and more effective delegation of responsibility in both research and training. In this regard, novel contract arrangements and salary adjustments may be needed to ensure

the employment of national professionals with adequate training and experience.

We interpret the phrase "existing networks" in paragraph 21 to mean the collaborative country networks associated with CIP: PRECODEPA, PRACIPA, PROCIPA, PRAPAC, and SAPPRAD. While we agree with the principle of linking social science activities with existing networks, in some cases other country groupings may be more appropriate for social science research and training networks.

Concerning Thrust X (paragraph 22), we believe that a position paper outlining the mission, strategies, and workplan may be useful. However, a full-fledged Planning Conference is not justified at present.

NOTES

1. Prepared by the staff of CIP's Social Science Department.

SESSION I. CIP's Social Science Program

WELCOME, OPENING REMARKS AND OBJECTIVES

Richard L. Sawyer

Good morning. Welcome to this planning conference for the social sciences, an area which has become very important at CIP. The participants from CIP remain about the same as at the last planning conference, but the mix of social scientists from other institutions is different.

I think I can safely say, in the words of the new television star, Colonel Oliver North, that "to the best of my recollection," we have had more diversity of opinion on how we should use social scientists at CIP as a result of pressures from planning conferences and external reviews than with any of our other disciplines. This is because we have not followed the pattern of the older centers, and thus we have had more shifts in direction with social science activities than with other disciplines.

Change should be expected in all of our work since we are dealing with a changing world food situation. CIP, in fact, has recently had its mandate changed with the addition of a new commodity. Also, as research progresses, we expect to finish with some priorities and move on to others.

Let me briefly try to explain what your roles should be the next four days. First and foremost consider this institution and its responsibility to the developing world, the strategies which address that responsibility, and finally how social scientists should fit into the institutional approach. Please do not let your individual biases from past work and what you would like to see social scientists do because of your interest, influence how this institution should utilize the social scientist for best addressing our mandate.

The format for this planning conference differs somewhat from the one used in most previous conferences. We have reduced it from five to four days. More significantly, each of you will be expected to play several different roles during the week.

As participants, you are expected to listen to presentations, ask critical questions and synthesize and compare CIP's experiences with yours. I am very pleased that scientists who have had major responsibilities with several of the oldest CGIAR centers are present; their wealth of experience will be invaluable. Each center has its own personality, and that is probably as it should be. All of us have enough pressures from within the CGIAR system, trying to make us conform to a similar pattern and fit the same mold. Difference is the spice of life and without differences, how can we make comparisons? I suspect that the personalities of the Centers are caused more by the social sciences than by the Directors General!

As presenters of papers, you are to summarize your own work, its goals, methods, results, plans for the future and how these relate to the social sciences at CIP.

As discussants, you are expected to place the session's presentations in a broad institutional context and to raise relevant issues for discussion.

As members of working groups, you are to identify the three or four main issues or questions that arise from a session's papers and from the discussion. These issues and questions will provide the base for the discussion groups that meet on Wednesday afternoon and evening. Robert Werge, CIP's first anthropologist and a long-time friend, will serve as facilitator for the working and discussion groups.

The number of CIP social scientists whose work you will be helping plan is what we have right now. The ratio of social scientists to other disciplines will remain where it is. So if you are going to recommend additional activities, please also indicate what should be cut-out or reduced to make change possible. There will be some changes in personnel in the near future, but not in the number of social scientists.

The department-thrust organization at CIP is not subject to change. This warp and weft of the institution has been looked at closely by every external review, since it differs from other centers. CIP's board and management continue to feel the present organizational structure has major advantages that outweigh any limitations. CIP's board of trustees has insisted that we maintain our present structure. So while we welcome your comments, please do not waste time on trying to reorganize the institution.

Although I mentioned that core social scientist staff will remain at its present level for the foreseeable future, we have not taken advantage of special project-funded social scientists who were available in recent years. Following up on some of these special projects might have been more valuable to the institution than the activities which did not permit the follow up.

Presently, we are very crowded for space in all departments at CIP. But some modest construction over the next year will relieve the situation. Also, in my opinion, the greatest need for additional social science activities through special projects lies not here at headquarters, but with our regional teams. CIP now has nine international staff members in East Africa, and five core-funded staff in Southeast Asia. As we move core natural scientists to the regions, more and more we need regional and national social scientists to ensure that problems are correctly identified and that technology is adapted to farmers' conditions and adopted by them.

Once again, thank you all for coming. I shall try to participate in most of the sessions. For those of you who would like to discuss items of mutual interest with me, I maintain an open-door policy in my office, so just walk in.

REVIEW OF THE RECOMMENDATIONS OF THE 1981 PLANNING CONFERENCE AND 1983 EXTERNAL REVIEW

Peter Gregory

1. INTRODUCTION

At the September 1981 Planning Conference on Social Science research at CIP, recommendations were made in the areas of Lima-based research and training, research publications and training materials, resources and staff requirements, and organizational recognition. The Second Quinquennial External Review of CIP in February 1983 also made several recommendations related to the social sciences.

The purpose of this present paper is to summarize the recommendations from both the Planning Conference and the External Review, and the actions CIP has taken as a result.

2. THE 1981 PLANNING CONFERENCE

The Panel endorsed the high priority given to the development of social science capacity in regional and national programs, with the Social Science Department in Lima providing the essential backup. The Panel noted that social science capacity in the regions needed to be supported and promoted by well-qualified, experienced social science researchers who assist in efforts to strengthen social science capabilities in national programs.

The Panel highly commended the work of the Social Science Department, (Thrust X had not been created), especially for taking the lead in some interdisciplinary research projects. Although the Panel agreed in principle with the basic plan that had been developed by the Social Science Department, they were concerned with the multiple responsibilities of the Department in comparison with the resources available to meet those responsibilities. Thus,

the Panel suggested a concentration in priority areas and moves to acquire additional special project funding.

(a) Lima-based research and training

It was pointed out that the Social Science Department had two main responsibilities: (1) to undertake research to assist CIP in understanding the present position and future role of the potato (and now sweet potato) and to identify criteria in designing and selecting alternative technologies for priority countries and groups; and (2) provide the essential backup for regional and national research and training programs.

(i) Technology assessment

It was recommended that emphasis should be placed upon developing socioeconomic criteria for selecting alternative technologies in the context of their implications for resource-poor farmers and low-income consumers. Greater collaboration with breeders was encouraged.

Since the Planning Conference, several areas of technology assessment have been emphasized. In addition to work on true potato seed (TPS), there were studies on seed certification programs, diffused light storage, simple potato processing and integrated pest management (IPM).

The level of cooperation with breeders (e.g., in TPS work) has not yet been optimal.

The 1984 impact study of CIP, Potatoes for the Developing World was an important contribution in the area of technology assessment across many of CIP's activities.

(ii) Demand and consumption studies

The Committee endorsed an increasing emphasis on demand and consumption studies so as to: (1) develop basic information on actual and potential use of potatoes as a food for poor people; and (2) assist CIP policy makers in identifying potential priority countries and beneficiary groups within countries.

With respect to the development of basic information, studies on demand and consumption have been made in Peru,

Bhutan, Bangladesh, Thailand, Madagascar, Burundi, Rwanda and Zaire. Also a new edition of the Potato Atlas was published in 1985. This was a redesigned and expanded version of the original Atlas and Pocket Potato Atlas produced in 1978. It contains national and regional statistics on many aspects of potato agriculture. Information in the Atlas has been widely utilized.

While beneficiary groups in individual countries have been singled out, there is yet to be a formal global assessment of potential priority countries.

(iii) Comparative potato agriculture

The Committee encouraged continued work on agroecological zones and farming systems to: (1) improve the methodology; and (2) develop the application of these concepts in identifying potential regions for increased potato production. Vigorous work has been carried out in this area.

(b) Regional research and training

(i) General

The Panel was concerned about the limited amount of training of national social scientists in potato research, and encouraged development of interdisciplinary teams at the national level. They believed that whenever possible, CIP should promote three basic principles for strengthening national program social science capabilities, namely (1) integration of research with training; (2) participation of national social scientists in research activities; and (3) creation of opportunities for national social scientists to participate in the analysis of potatoes in an interdisciplinary framework.

Since the Planning Conference, social scientists have participated in courses on storage, IPM, TPS, general production, and on-farm research. Additionally, research and training have been combined in numerous studies of marketing and demand. Various students have completed their thesis research and people have been sent to the United States and Mexico for training.

(ii) Optimizing Potato Productivity (OPP)

The Panel supported the move towards phasing the Social Science Department out of primary responsibilities for OPP within CIP, and recommended that on-going social science input in this area should be continued on a collaborative basis.

The Panel also supported the transition from in-depth research in the Mantaro Valley to the application of on-farm methods in national programs. In addition, they also suggested that emphasis should be given to the early publication of the results of the Peruvian studies.

The Mantaro Valley project was successfully completed, and various publications on the Peruvian studies were produced. On-farm potato research has been extended to many countries, including Ecuador, Colombia, the Philippines and Pakistan. Nevertheless, institutionalization of on-farm research methods remains relatively weak in many countries.

(iii) Analysis of technology generation and diffusion processes

The Panel stated that the primary objective of this research should be to highlight institutional models for improving national research and production systems. They suggested that research in this area start with storage technology and proceed to other technologies as they became available.

Several impact studies have been carried out to document and analyze the generation and diffusion of technologies --primarily seed and storage-- in Sri Lanka, Tunisia, Korea and the Philippines.

(iv) TPS

The Panel strongly endorsed the research on TPS which would require a substantial effort in selected countries. It was thought that local analyses of the implications of TPS should assist in setting research priorities for potential target regions. Special attention was indicated on: (1) how the new system fitted within existing farming systems, particularly those of resource-poor farmers; and (2) institutional requirements for a new TPS supply system in contrast

with the existing seed systems. Considerable work has been done in these areas.

(v) Demand and consumption in the national context

The Panel endorsed cooperative work on demand for, and consumption of, potatoes in selected countries in the context of their national food and agriculture policies. As noted earlier, various case studies have been conducted in this area.

(c) Research publications and training materials

(i) Publications of research findings

The Panel placed high priority on the publication of research findings by CIP staff and CIP-stimulated research. They suggested that more emphasis be placed on writing for professional peer-reviewed journals both in developed and developing countries. There was also a continuing need for working papers and concise documents for national and international policy makers. They found that more extensive research monographs might be justified occasionally.

As can be seen from the department's publication list, publication of research findings has expanded dramatically in some areas since 1981 (e.g., storage and the farmer-back-to-farmer model). However, there is still a need for more publications in some other areas (e.g., seed programs and TPS).

(ii) Training materials

It was recommended that as part of the backup to the Regional Research and Training Program, research-oriented training materials should be prepared. Experiences of OPP and other research projects needed to be consolidated and processed into manuals and other training materials for teaching purposes. Various training documents have been completed and a manual is being prepared.

(d) Resource and staff requirements

(i) Social science materials

The Panel recommended facilitating improve access of CIP social scientists to a broader range of social science materials. They suggested an increase in library acquisitions, short-term study leaves and specific linkages to colleagues in other countries for this purpose.

Such recommendations have been implemented.

(ii) Short-term consultants

The Panel recommended the use of short-term consultants to complement the work of CIP social scientists. Recently, funds for this have been provided in several areas.

(iii) Special funds

The Panel endorsed the search for special funds to finance the placement of social scientists in the regions and in-service training of national social scientists through participation in cooperative research projects. This has been implemented in some cases, but greater use of special project funds can still be made.

(e) Organizational recognition

It was suggested that consideration be given to provide more specific organizational recognition to social science work. In response to this, Thrust X on "Potatoes in Developing Country Food Systems" was created in 1983.

3. THE SECOND QUINQUENNIAL REVIEW

The Report of the Second External Review, conducted in late 1982 and early 1983, characterized the social science program as lacking a strong central theme or organizing framework. The Department was faulted for having done little work on major policy issues and for limiting most of its interdisciplinary collaboration with biological scientists

to only two of CIP's then nine Thrusts. The Panel encouraged the Department to achieve a better-focused and more comprehensive research program that went beyond on-farm research to address broad policy issues and the orientation of the Center's overall research effort, and suggested that collaboration with IFPRI be sought when appropriate.

In the Panel's view, social science research was not sufficiently well-integrated into the formal research organization based on Thrusts.

The Panel expressed concern that the Department was relying heavily on post-doctoral fellowships that were about to terminate, and urged CIP to maintain the level of core funded staff allocated to the Department.

CIP responded quickly and positively to its External Review recommendations. Two post-doctoral positions were permanently assigned to the Social Science Department and, as noted earlier, a new Thrust was created. In its commentary on the External Review, TAC congratulated CIP for responding quickly in the social science area:

> "Although the center still debates some of the new suggestions, it has nevertheless already initiated the restructuring of research in this area and has added a new Thrust entitled "Potatoes in Developing Country Food Systems," to determine priority problems and client's needs in the production, marketing and utilization of the potato. TAC fully supports this wider framework for the social sciences at CIP."

(a) Development of storage and processing technology

The Panel urged that in processing research, alternative products and processes needed to be submitted to critical and realistic analyses of economic feasibility, and stated that these analyses should take into account the variable nature of supply and prices, set attractive margins for economic returns and demand high probabilities for success. This approach was not formally put into effect until recently, but some interesting data have now been generated for India and more cooperation with storage researchers is expected in other countries.

The Panel commended CIP on its well-integrated research on diffused light storage of seed potatoes and suggested that it continue to monitor further acceptance, modification and rejection of this technology. This has been done.

The Panel commended the continued input of the Social Science Department in a critical analysis of the place for, and economic feasibility of, consumer potato storage in the marketing chain and of the benefits of improved on-farm storage for consumption or sale. This issue has been addressed in several marketing case studies and a Technical Information Bulletin must be completed on this soon.

(b) Research networks

The Panel endorsed the development of a research network proposed by the Social Science Department and suggested that initially it might need to draw on social scientists who are not directly related to National Potato Programs.

The research network approach has been used in marketing and storage, and a food systems network is now becoming operational in South East Asia.

(c) Cropping patterns

The Panel urged that careful consideration be given to the way potatoes interact with other crops in farmers'production systems.

Some important work has been done on this, particularly in the context of a comparative study on potato farming systems.

4. CONCLUSIONS

We have seen that the recommendations of the 1981 Social Sciences Planning Conference and the 1983 Second Quinquennial External Review of CIP were carefully considered by the social scientists and in most cases the recommended actions were taken.

The goals of this present Planning Conference are to review the work done since those recommendations were made

and to plan optimal future research in the context of CIP's institutional priorities. I am optimistic that with the high level of social science-related experience and expertise present here, as well as our collective awareness of CIP's goals, this Planning Conference has the ingredients to be a resounding success.

THE SOCIAL SCIENCES AT CIP[1]

Douglas Horton

1. INTRODUCTION

It has been 16 years since the International Potato Center (CIP) was formally established, 15 years since funding through the Consultative Group on International Agricultural Research (CGIAR) commenced, and 14 years since an economist, Michael Twomey, was hired. Over the years, from its one-man staff, the social science program has expanded considerably and its orientation has broadened from economics to include anthropology, sociology, and other disciplines ranging from agronomy to nutrition.

This paper presents a history of the social sciences at CIP and the broad outlines of a plan for the next few years. The first section identifies a series of events that have influenced the course of the social science program. The second section presents an historical profile of the program in terms of its staffing and budget, institutional position, and major areas of work. The final section identifies four broad areas in which future work is needed and lists some issues for planning.

2. TURNING POINTS

CIP's social science activities have reflected several of the Center's basic attributes: its single-commodity focus (now broadening from potatoes to include sweet potatoes), its interdisciplinarity, its early and aggresive regionalization, its low-profile style of operations and the involvement of clients in program planning, implementation, and review (CIP, 1984). In addition to the overall framework provided by CIP, a number of events have influenced the

program in important ways. Among these, I would highlight the following:

- **1975** The first anthropologist joins CIP.
- **1976-77** CIP has its first External Review and Social Science Planning Conference.
- **1977** The Mantaro Valley Project begins.
- **1979** Comparative studies begin.
- **1981-83** CIP has its second Social Science Planning Conference and External Review (Thrust X created).
- **1984** CIP conducts an "Impact Study."
- **1985** The Department is moved to the Research Program and Thrust X is fortified.

(a) Anthropology takes root

When the Rockefeller Foundation created its post-doctoral fellowship program in the social sciences, CIP was the first International Agricultural Research Center to request and obtain a fellowship for an anthropologist. Robert Werge, who worked at CIP from 1975 to 1979 had several attributes that have had an enduring impact on the center. These include: his eagerness and ability to apply the tools of anthropology to solve practical problems; his keen interest in training; and his questionning, fiesty, yet good-humored way of working, which has come to be known around CIP as a style of "constructive conflict." Rob did some pioneering social science research on post-harvest technology (Werge 1977, 1979) and made significant contributions to training in that area. He also generated field information that influenced CIP's priorities for breeding and agronomy research (Rhoades, 1985).

After Werge's original two-year fellowship ended in 1977, the Rockefeller Foundation extended it for an additional year. In 1978, convinced of the value of anthropological work, CIP management created a permanent, core-funded position in that field.

(b) First External Review and Planning Conference

A second major turning point for the social sciences coincided with CIP's First External Review in 1976 and the Social Planning Conference in 1977. At that time, CIP's social scientists were part of the Regional Research and Training Program, which was in the process of establishing regional bases and contacts with governments, donors and scientific groups throughout the world. CIP's first "socio-economist," Michael Twomey, traveled so much that he once remarked, with tongue in cheek, that he was distinguished among the Center economists as the only one with an endowed chair on a Braniff airliner.

The panel of the First External Review expressed concern that the focus of socioeconomic work had not been sufficiently clear and viewed CIP as "still wrestling with the problem of how best to utilize social scientists in its biologically oriented research and training programs." The Panel viewed the service tasks center management had assigned to the group as obstacles to the establishment of a well-focussed research program and concluded:

> "What is needed now is to concentrate on a few well-selected research projects in which concrete results can be produced in a reasonable time" (CGIAR, 1977: 56-59).

The panel of the First Social Science Planning Conference concurred with the External Review and recommended that for at least two years the service functions of the social science group be sharply curtailed in lieu of field research. The Panel endorsed the Social Science Unit's plan to begin a major program of field research in the Mantaro Valley of Peru's central highlands and recommended that these research activities become formally integrated into CIP's research thrusts[2] (CIP, 1977: 8).

(c) Mantaro Valley Project

Prior to the Planning Conference, CIP had submitted, and the Social Science Division of the International Development Research Centre (IDRC, Canada) had approved, a proposal to enable the Social Science Unit to undertake a program of on-farm research in the Mantaro Valley of Peru's central highlands. The three main objectives were to: (1) sensitize CIP and national-program scientists to the value

of on-farm research; (2) develop and field test procedures for on-farm research with potatoes; and (3) train national program personnel in the use of on-farm research techniques (Horton, 1986b).

The Mantaro Valley Project was implemented from 1977 to 1981 in collaboration with Peru's Ministry of Agriculture and with the International Center for Maize and Wheat Improvement (CIMMYT). Research focused on three major topics: (1) agroeconomic constraints to production; (2) post-harvest technology; and (3) seed production and distribution. Each of these was co-led by a social and a biological scientist: (1) D. Horton and P. Accatino (later R. Cortbaoui); (2) R. Werge (later R. Rhoades), R. Shaw, and R. Booth; and (3) A. Monares, and J. Bryan, respectively. Research methods ranged from casual observations and informal surveys to complex multiple-visit surveys and replicated experiments with factorial designs.

As the work moved along its programed schedule from literature review through informal survey, single- and multiple-visit surveys and on-farm trials, those of us involved gradually realized the danger of becoming so involved with research methods that the project's goals were forgotten. Moreover, while statistical and economic calculations provided useful information on the agronomic performance, costs, and benefits of different production and post-harvest technologies, they provided only partial, and sometimes misleading, guides for planning on-farm trials, deriving recommendations from experimental results, or predicting farmers' adoption of technologies. We learned that the pooled judgement of an agronomist, an anthropologist, an economist, and a farmer --each assessing a problem with the perspectives and tools of his or her profession-- were more useful than the judgement of a single professional using a single technique, no matter how sophisticated. Dialogue with farmers was found to be helpful in identifying problems, evaluating possible solutions, and in improving the design of survey instruments and experiments.

The initial Mantaro Valley work was based on a "transfer of technology" model which assumed that when farmers failed to adopt new practices it was mainly due to problems of extension, or technology-transfer. In this model, on-farm research was seen primarily as a mechanism to improve the flow of new technology from the experiment station to farmers. Its primary role was to "validate" new technologies and to establish recommendations for farmers. A major conclusion of the Mantaro Valley Project was that farmer

adoption was limited not so much by problems in the transfer process as by the inadequate design and adaptation of new technologies to meet farmers' needs.

Based on their storage research with farmers, Rhoades and Booth formulated an alternative model known as "farmer-back-to-farmer" which views on-farm research not as an intermediate step between research and extension but as a tool (or collection of tools) that can be put to good use at any point in the agricultural R&D process (Rhoades and Booth, 1982). The emphasis here is on identifying and solving farmers' problems rather than on demonstrating or recommending technologies to them. This new paradigm has had a profound impact on CIP's work both at headquarters and in the regional programs. The most immediate and pervasive impact was in the area of post-harvest technology, where Robert Rhoades has continued to work up to the present. The client-oriented perspective has also been embraced by scientists in other research areas, most notably in relation to seed programs, varieties and integrated pest management. On-farm research was promoted in regional and national programs through a project entitled "Optimizing Potato Productivity," aggressively implemented by the regional staff from 1978 to 1981 (CIP, 1980). In 1980, Roger Cortbaoui, an agronomist (previously CIP's regional representative in Tunisia) joined the Social Science Unit for a year to coordinate and support on-farm research in regional and national programs (Cortbaoui, 1981). The same year, another agronomist, Michael Potts, was posted with the Philippine National Potato Program to conduct a three-year program of on-farm research in the highlands of Luzon (Potts, 1983).[3] On-farm research is now a standard activity of regional scientists, and it is a cornerstone of several country programs.

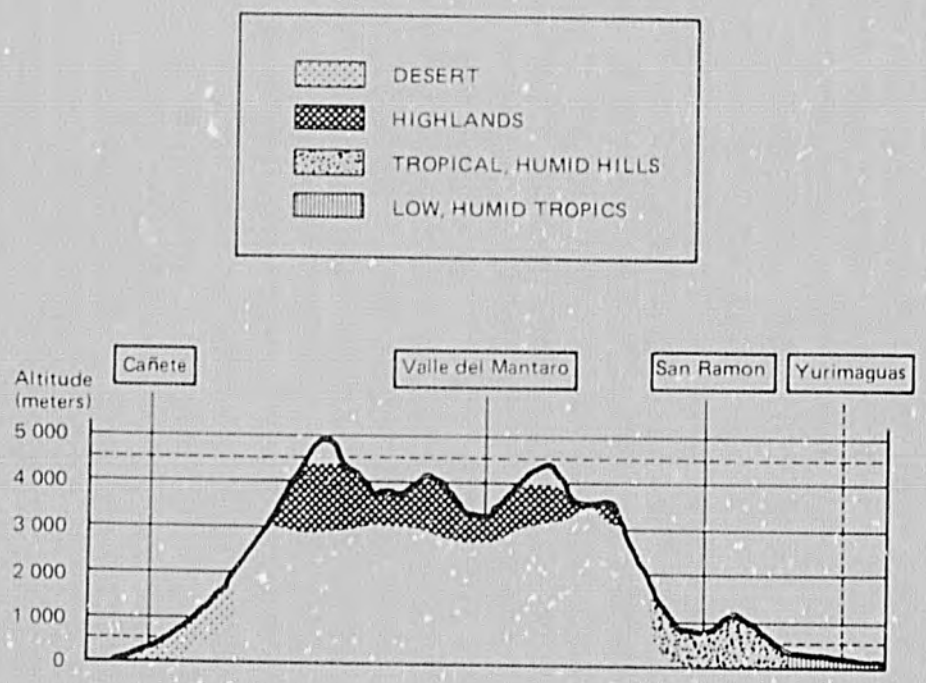
(d) Comparative studies

The Mantaro Valley Project's greatest strengths and weaknesses derived from its sharp focus on farm-level problems in a specific location. This focus allowed us to unravel many complex aspects of farmer decision-making and technological change. This focus, however, did not provide information on many important aspects of the food system, such as marketing, consumption and nutrition. The degree to which findings of a study in the Andean highlands could be generalized to other locations was also questionable.

Stimulated by the needs to answer broader questions and to extrapolate findings, we began a series of comparative

studies. In 1978 a graduate student from the University of Wisconsin, Gregory Scott, began his dissertation research on the economics of potato marketing in central Peru. Later published in English and Spanish (Scott, 1985a, 1985b), this work has served as a model for comparative case studies in Bhutan; Madagascar; Thailand; Bangladesh; Rwanda, Burundi and Zaire (Scott, 1983; Rasolo et al., 1987; Scott, 1987a, 1987b, 1987c). In 1979, observing that very few farmers in the Mantaro Valley had escaped being interviewed by CIP staff, Robert Rhoades began a comparative study of farming systems at CIP's other Peruvian research sites (Figure 1). This work later evolved into a global comparative study of potato agriculture and a set of International Potato Reference Files.

Figure 1. A cross section of the central Andes showing types of region, approximate elevation, and CIP research sites.



Source: Rhoades, R.E., Breaking New Ground: Agricultural Anthropology, (Lima: CIP, 1984) p. 15.

Anthropologist Susan Poats also joined CIP in 1979, to conduct a four-year comparative study of potato consumption patterns in developing countries. While formally based in Lima, the "potato lady" as she came to be known in many places, spent less than half her time in Peru. Consumption case studies included Rwanda, Guatemala, Bhutan, the Philippines, Indonesia, and Bangladesh (Poats, 1983; Woolfe, 1987).

(e) Second Planning Conference and External Review

The report of the Second Planning Conference (held in September 1981), commended the work of the Social Science Department, in particular for taking the lead in some interdisciplinary research projects, but expressed concern for the multiple responsibilities of the Social Science Department in comparison with the resources available to meet these responsibilities. The Panel suggested that research and backstopping of national programs should focus on the following topics:

- Technology assessment
- On-farm research
- Analysis of technology generation and diffusion processes
- Marketing, demand and consumption
- Comparative potato agriculture

"Technology assessment" was viewed as a means to "develop socioeconomic criteria for selecting alternative technologies in the context of their implications for resource-poor farmers and low income consumers." The group suggested focussing this activity on true potato seed technology, because of its priority at CIP at that time. The group supported a transition from in-depth research in the Mantaro Valley to the application of on-farm research methods in regional and national programs, and recommended integration of the "farmer-back-to-farmer" philosophy and the Optimizing Potato Productivity methodology. It recognized comparative marketing, demand, consumption and farming systems studies as well as the need to highlight institutional models for improving national R&D systems studies. The group noted the continuing need for training materials and CIP publications, but felt that more emphasis should be placed on writing for peer-reviewed professional journals (CIP, 1982: 17-19).

The report of the Second External Review, conducted in late 1982 and early 1983, viewed the Social Science Program as lacking a strong central theme or organizing framework (CGIAR, 1984: 38-41).

> "Specific projects seem to have been defined in response to research opportunities that were perceived as institutionally acceptable and useful rather than as a tightly defined and comprehensive research program" (p. 38).

The deparment was faulted for having done little work on major policy issues and for limiting most of its interdisciplinary collaboration with biological scientists to only two of CIP's nine thrusts. The Panel encouraged the department to achieve a better focussed and more comprehensive research program that went beyond on-farm research to address broad policy issues and the orientation of the center's overall research effort, and suggested that collaboration with IFPRI be sought where appropriate. In the panel's view, social science research was not sufficiently well integrated into the formal research organization, based on thrusts.

> "The Panel recommends that CIP study the creation of an appropriate administrative position, from a programing point of view, for research projects with strong social science components that do not fall within the present thrusts" (p. 41).

The panel expressed concern that the department was relying heavily on post-doctoral fellowships that were about to terminate, and urged CIP to maintain the present level of core-funded staff allocated to the department. It was noted that:

> "From an organizational point of view the department would probably benefit from belonging to Research (instead of Regional Research and Training) together with the rest of the research departments" (p. 38).

CIP responsed quickly and positively to the External Review's recommendations. Two post-doctoral positions were permanently assigned to the Social Science Department and a new Thrust was created. In its commentary on the External Review, TAC congratulated CIP for responding quickly in the social science area:

> "Although the Center still debates some of the new suggestions, it has nevertheless already initiated

a restructuring of its research in this area and has added a new Thrust entitled "Potatoes in Developing Country Food Systems," to determine priority problems and client needs in the production, marketing and utilization of potatoes. TAC fully supports this wider framework for the social sciences at CIP" (p. ix).

(f) CIP Impact Study

In 1983, as the CGIAR Secretariat prepared for a system-wide study of the impact of international agricultural research, CIP initiated its own study, completed by mid-1984 (CIP, 1984). I was called upon to coordinate the project, which was the first one to be formalized in the new Thrust X. Different sections of the study were drafted by taxonomists, breeders, pathologists, entomologists, nematologists, physiologists, seed specialists, research managers, policy makers, and communication experts, as well as by economists, sociologists, and anthropologists. Scientists and policy makers from developing countries were actively involved in preparing the study, which assessed impacts both on production and on institutional capacity. The institutional strategies used to achieve impact were highlighted.

Participation of the Department in the Impact Study helped legitimize social science research on broad policy issues. The following quotation is from the minutes of CIP's Program Committee Meeting, December 1984:

> "The Committee commends all CIP's staff, and especially the coordination provided by the Department of Social Sciences for the successful completion of the publication, "Potatoes for the Developing World - A Collaborative Experience."

The value of information provided by social scientists to correct erroneous assumptions and data in early drafts of a priorities paper for the CGIAR system (CGIAR, 1985) was also recognized:

> "The Program Committee was pleased with the information presented by the Department of Social Sciences to provide a more positive view of the potato's significance and importance among other major food crops. This information complements and improves that provided by other sources."

After this start in 1984, an increasing proportion of the Social Science Department's resources has been applied to research that generates information and guidelines for orienting CIP's programs and for assessing their effectiveness.

(g) Research emphasis

In 1985 the Social Science Department was shifted from Regional Research to the Research Program and greater emphasis was placed on strengthening Thrust X. The number of research projects and contracts has grown to cover the critical gaps in information on potato (and now sweet potato) production and use in the food systems of developing countries. These are outlined in Section 3 (see also Table A9).

3. PROGRAM RESOURCES, AREAS OF WORK AND RESULTS

(a) Human resources

Over time, the number of core-funded Ph.D.-level positions allocated to the Social Science Department has grown from one in 1973 to five at present. The research support staff, with bachelors and masters degrees, has grown from one position in 1974 to seven positions at present. The secretarial staff has increased from one in 1976 to three at present.

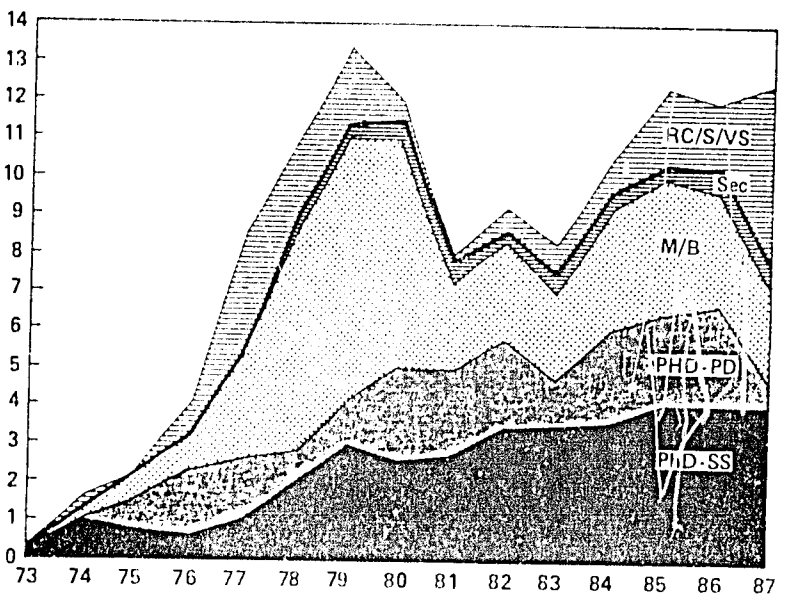
(b) Man-year equivalents

To expand our human resources beyond the permanent core-funded positions assigned to the department, we have used a number of mechanisms including special project funding, post-doctoral fellowships, research contracts, visiting scientists, and scholarships. We have also employed many people on short-term contracts. In total, over the last 14 years we have employed about 100 people in one capacity or another (Table A1). These individuals have provided about 65 man-years at the Ph.D. level, 90 man-years at the bachelors and masters levels, and 25 man-years at the secretarial and clerical level (Table 1). In addition to these employees, we have acquired about ten man-years of

man-year equivalents from research contracts, scholarships and visiting scientists.

Growth of the Ph.D.-level and secretarial staff has been rather steady, but junior research staff, research contracts, scholarships and visiting scientists have varied considerably over time (Figure 2). There was an especially notable buildup of junior staff during the Mantaro Valley Project and a decline as the project ended.

Figure 2. Human resources by position and degree (weighted man-years)*.



Abbreviations: RC = Research contract; S = Scholarchip; VS = Visiting scientist; Sec = Secretary; M = Masters degree; B = Bachelors degree; PD = Post-doctoral fellow (Ph.D.); SS = Senior scientist (Ph.D.).

*Weights: Senior scientist = 1; postdoctoral = 0.8; masters degree = 0.6; bachelors or professional degree = 0.4; secretarial or clerical = 0.2.

Source: This and the following figures are drawn from Annex Tables A1-A14.

The loss of post-doctoral positions that concerned the Second External Review panel took place in 1983, but was temporary. In 1987, the Department's Ph.D.-level staff declined rather sharply due to the departure of two post-doctoral fellows, one visiting scientist and a master-level assistant. This decline has been partially offset through research contracts and scholarships for these same four

external human resources through research contracts, 13 man-years through scholarships, and six from visiting scientists.

Table 1. Human resources 1973-87

	Man-years	
	Unweighted	Weighted
CIP staff		
Ph.D.s	64	58
Masters	27	15
Bachelors/professional	65	27
Secretarial	26	5
Sub-total	(182)	(105)
Others		
Research contracts	10	8
Scholarships	13	6
Visiting scientists	6	5
Sub-total	(29)	(19)
Total	211	124

In order to give a more realistic picture of social science research and training capacity, in the remainder of the paper the following weights are applied to different position and degree levels:

Senior scientists (Ph.D.)	1.0
Postdoctorals (Ph.D.)	0.8
Masters degrees	0.6
Bachelors degrees	0.4
Secretarial and clerical staff	0.2

In the special case of visiting scientists, who may spend part of their time on work of little direct relevance to CIP's program, an additional weight of 0.67 is applied.

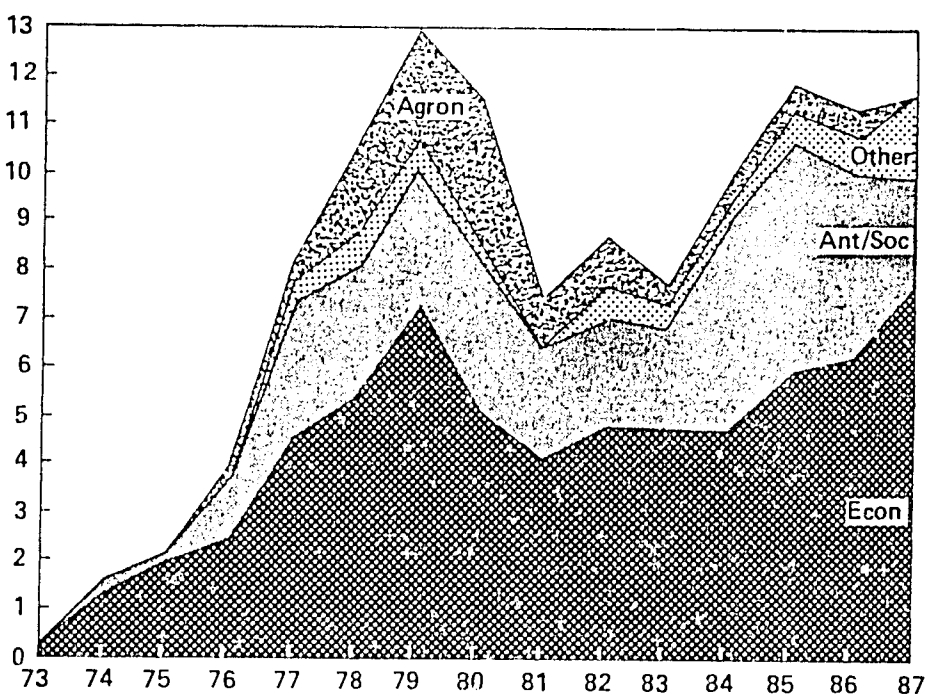
Using these weights, it can be seen that the Social Science Department has directly employed about 105 senior staff equivalent man-years and has obtained an additional 19

individuals. As discussed later, a sharp increase in staff funded by a special project is anticipated in 1988.

(c) Disciplinary mix

Over the entire period, about 55% of the staff resources has been in economics and 45% in other disciplines: mainly anthropology and sociology but also agronomy, nutrition, statistics, and geography (Figure 3). Economists provided less than half the department's total human resources during the Mantaro Valley Project when we made particularly intense use of anthropology, agronomy, and statistical skills. The number of anthropologists and sociologists reached its peak in 1985; since then it has declined while the number of economists has increased.

Figure 3. Research personnel by discipline (weighted man-years).



(d) Funding source

At times we had relied heavily on special projects and visiting scientists, but at present nearly all our staff positions, research contracts and scholarships are financed from the core budget (Figure 4). The ratio of core to special project funding has been considerably higher for economics than it has been for anthropology and sociology.

(e) Budget

The core budget allocated to the social sciences has increased rather steadily over the years, reaching a level of approximately US$ 500,000 in 1987. A notable feature is the relatively high travel budget (over US$ 40,000), which reflects CIP's global mandate, dynamic regional and national programs, and the fact that most social scientists have been based at headquarters rather than regional locations. We have acquired virtually no capital equipment through the core capital budget. Vehicles and computers, our two main capital items, have generally been acquired with special project funds or by reallocating small amounts of unspent funds from the core operating budget to the capital budget.

(f) Institutional position

Originally, social scientists were assigned to CIP's Regional Research and Training (RR&T) Program. In 1976, if I recall well, Robert Werge and I began calling ourselves the "Social Science Unit." No one objected, so we continued (Figure 5). In 1981, about the time of the Second Social Planning Conference, the Unit was converted into a full-fledged Department, still within the Regional Research and Training Program. As noted earlier, the Food Systems Research Thrust was created in 1983 in response to a recommendation of CIP's Second External Review. In 1985, the Social Science Department became part of the headquarters Research Program.

(g) Roles

As our institutional position and accomplishments evolved, so did our roles and activities. Originally, "socioeconomics" was perceived as a support unit within Regional Research and Training, to assist in training and

Figure 4. Human resources by funding source (weighted man-years).

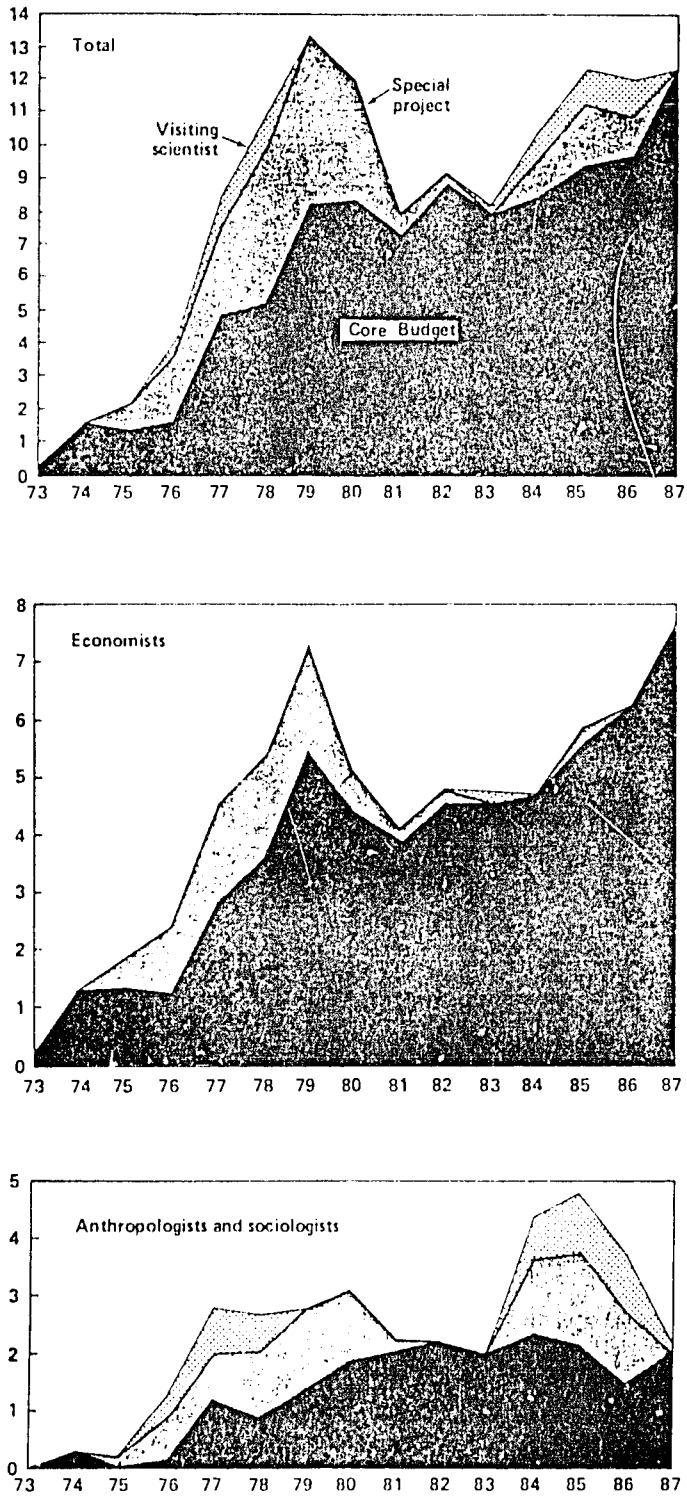
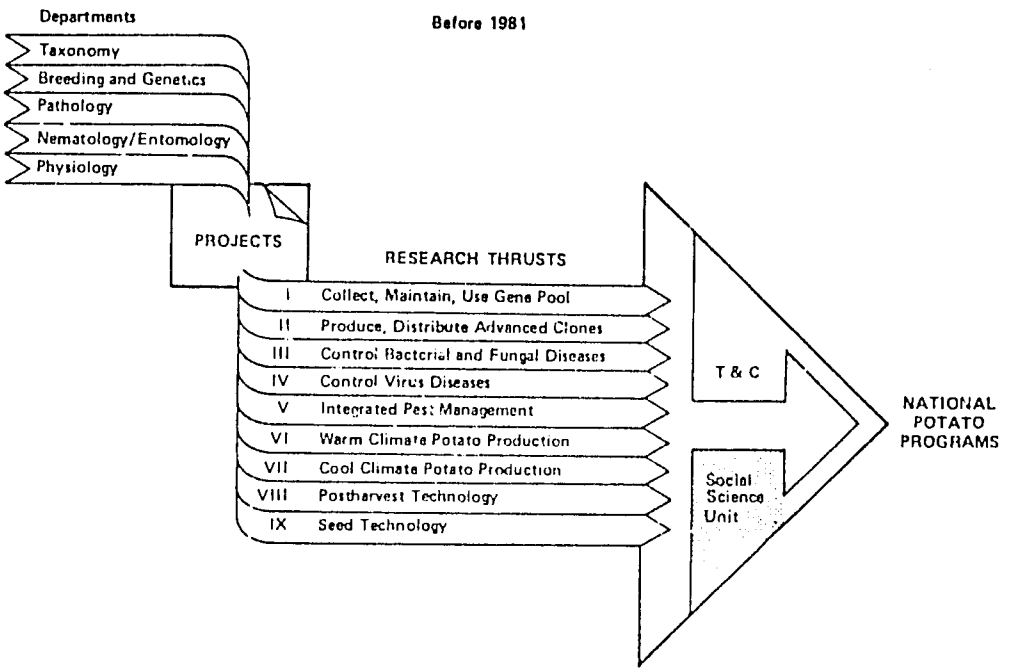
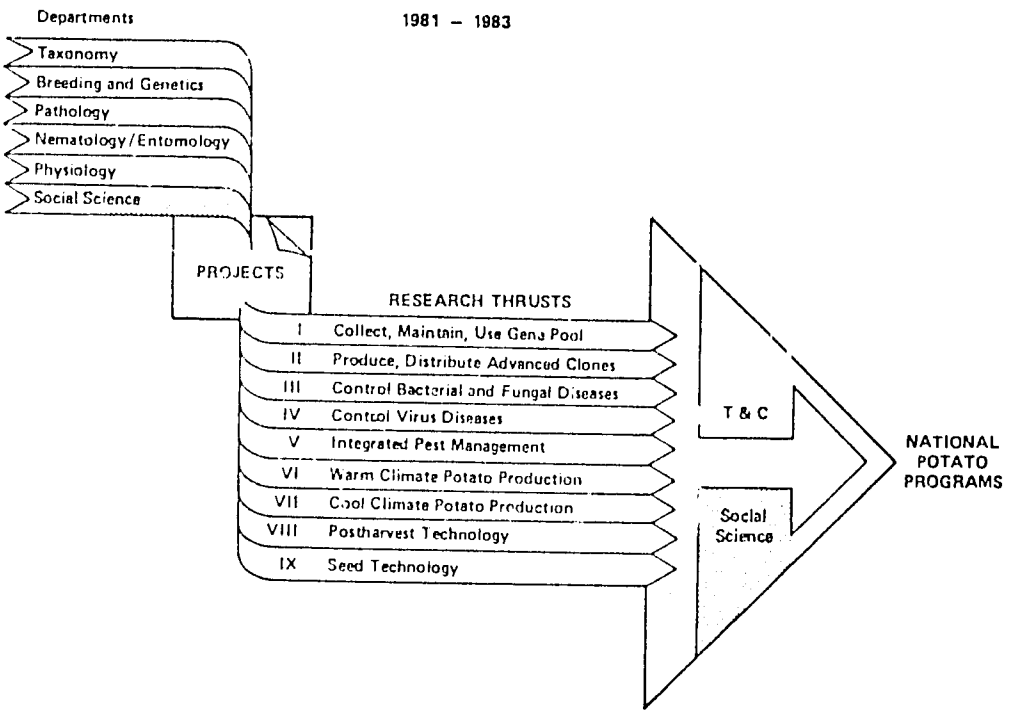


Figure 5. Position of the social sciences

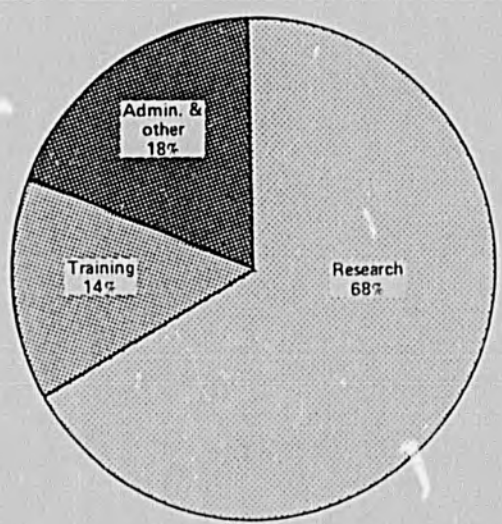




technology transfer, and with no research functions. Gradually this has changed. Within CIP, and within the social science group itself, we are now seen more as researchers rather than as trainers, or facilitators of technology transfer. This view was promoted by the first planning conference and became accepted as social scientists demonstrated the value of their research contributions. Furthermore, as the regional programs became established and matured, all members of RR&T became more research-oriented. Finally, the Department's shift from Regional Research to Research strengthened the trend toward a research focus.

At present, over 65% of the human resources of the department are allocated to research, just under 15% to training, and about 20% to administration and other tasks (Figure 6). Unfortunately, but perhaps inevitably, the people with the most research experience and ability spend the smallest proportion of their time actually doing research. Robert Rhoades and I estimate that in 1986 we spent only 35% and 45% of our time doing research, respectively (Table A8).

Figure 6. Allocation of time to research, training, administration and other activities.



Most of us spend a considerable amount of time traveling (Table 2). Originally, travel was primarily for training and backstopping CIP's regional programs. Increasingly, travel is used for collaborative research with national program scientists and for interacting with policy makers.

Table 2. Official travel of Peruvian-based social scientists (days)

	1983	1984	1985	1986	1987*
Peru	240	505	662	295	175
Other Latin America	47	100	63	73	146
Africa	64	14	66	29	--
Asia	51	125	56	69	139
USA + Canada	30	33	32	7	14
Europe	10	2	21	28	47
Total	442	779	900	501	521

* Estimated to August 31.

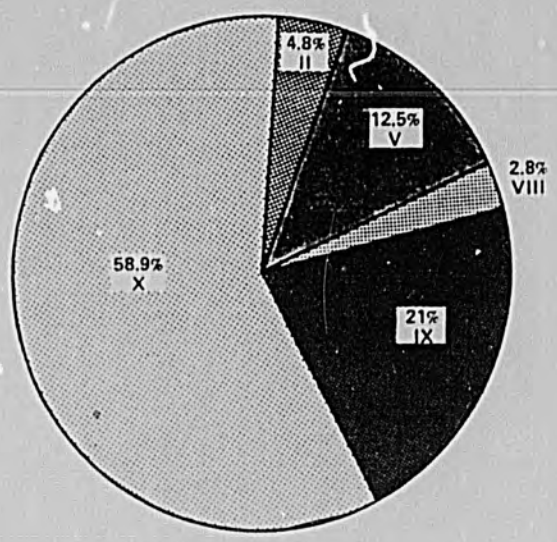
(h) Areas of work

CIP's organization and managerial philosophy encourage scientists to formulate research projects which are the basic units of research within the ten thrusts, defined as "coordinated sets of projects that integrate the contributions of different disciplines in addressing priority problems" (CGIAR, 1984). Most projects have a single leader and one or more cooperators. Co-leadership is less common.

Since 1973, social scientists have been leaders of more than 30 research projects, some of which have been extensions or reformulations of earlier projects (Table A9). In 1986, ten social scientists led 21 projects in five research thrusts: two in the breeding thrust, one in pest management, one in post-harvest technology, four in seed technology, and 13 in the food systems thrust (Table A12). Approximately 60% of our research time was allocated to the food systems thrust, 20% to the seed thrust, 12% to pest management, 5% to breeding and genetics, and just under 3% to the post harvest thrust (Figure 7).

These figures understate the involvement of social scientists in generation and diffusion of technologies, as well as the effort that goes into strengthening regional and national programs. For example, Peter Ewell led a Thrust X project on pest management, Gordon Prain led one on informal seed systems, and both Gregory Scott and Norio Yamamoto led Thrust X projects on potato processing. These project were assigned to Thrust X when the criteria for locating projects in different thrusts were unclear. Recently, based on the following criteria, they have been reassigned to technical thrust.

Figure 7. Allocation of time by Thrust 1986.



In general, Thrusts I-IX deal with technical aspects of crop improvement, such as selecting new varieties, seed production and distribution, pest management, and agronomic practices. Thrust X in contrast, focusses on people and institutions.

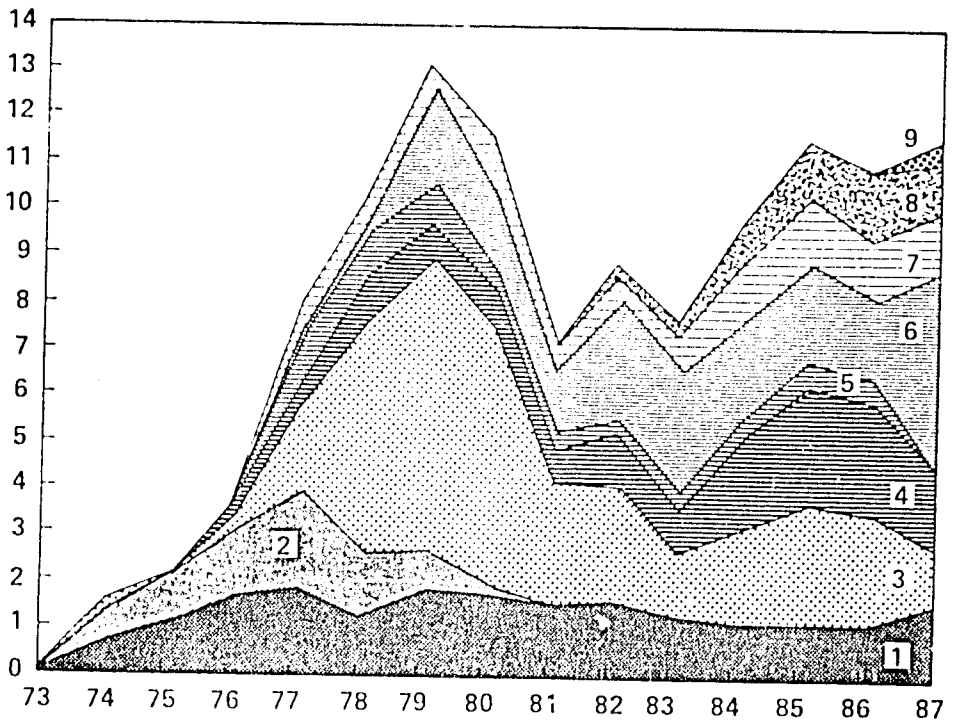
When social scientists work with biological scientists to generate, diffuse and assess the consequences of new technologies, their projects are located in Thrusts I-IX. When social and biological scientists work in Thrust X, their aim is to identify and solve more broadly defined client needs and priority problems in the production, marketing and utilization of potatoes and sweet potatoes.

Since many technological changes have strong institutional components, borderline cases exist. One example is Charles Crissman's study of seed programs. To the extent that it is focused on seed it belongs in Thrust IX. To the extent, however, that it focuses on programs it belongs in Thrust X.

To avoid focusing on administrative rather than substantive matters, I will portray the allocation of the Social Science Department's human resources to nine broad areas of work, irrespective of the thrust with which they were associated. These areas of work are listed below, more or less in the order in which they became important in the

social science program (Figure 8). Each area of work includes research, training and related activities designed to strengthen national program capacity:

Figure 8. Allocation of time by type of research.



1. Analysis of secondary information
2. Country studies
3. On-farm research emphasizing production technology
4. Post harvest technology
5. Seed systems and varieties
6. Marketing, demand, consumption and nutrition
7. Comparative farming systems
8. Impact studies
9. Constraints studies

From the outset, an important task has been the collection, analysis and synthesis of secondary information. Early work focused on collecting materials from developed countries and reviewing the FAO's statistical data. More recently, work has evolved toward the collection and synthesis of the rapidly growing literature on potatoes in developing countries. My sabbatical at IFPRI in 1984 and 1985 and much of Robert Rhoades' work with the International Potato Reference Files falls within this area. Synthesis, analysis and interpretation of the FAO data also continues to be a basic function of the department (Horton and Fano, 1985). In 1973 and 1974 roughly half the department's resources went into this area. Since 1975 between one and two man-years have been used for this purpose each year. In addition to the human resources allocated directly to this area, work in other areas such as marketing, nutrition and comparative farming systems has contributed to the stock of secondary information on socioeconomic aspects of potatoes and sweet potatoes that is now available at CIP.

In view of the scanty literature on potato production and use in developing countries, from 1974 to 1980 researchers were contracted to compile comprehensive studies on potato production, marketing and use in Bolivia, Chile, Ecuador, India, Kenya, and Rwanda. The country studies generated useful descriptive materials as well as several hypotheses that were later tested in field studies. A maximum of two man-years of professional time was allocated to this area in 1977, discontinued in 1980.

On-farm research in the Mantaro Valley began with a heavy emphasis on production constraints. This area expanded rapidly and employed more than five man-years of professional resources, each year from 1978 to 1980. Since then, between two and three man-years have been allocated to this area. Since 1984 the main concentration has been on seed technology and integrated pest management.

Post-harvest technology is one area in which a surprisingly small amount of human resources has generated high returns, both in terms of technology (diffused light seed storage) and methodology (Rhoades, 1985).

Inadequate seed systems are one of the principal constraints to potato production and use in developing countries (Monares, 1982). Seed tubers are the most costly input for most potato producers and more money is spent each year on seed programs than on any other aspect of potato improvement (Horton, 1987). In many cases, the seed problem

is more one of institutions than of technology per se. For this reason, from an early date we have allocated a significant amount of resources to work on seed systems. Since 1978, economist Anibal Monares has dedicated a major portion of his time to this area of work. From 1984 to 1986, anthropologist Gordon Prain was assigned on a full-time basis to a seed project in Peru. In 1986, economist Charles Crissman began a comparative study of seed projects in developing countries.

There is little literature on root crop marketing, consumption and nutritional value, and views on these topics are often based on heresay and anecdote rather than on research results. Given the generally negative view that many people have on the demand prospects and nutritional value of potatoes and sweet potatoes, we have invested a considerable amount of our human resources to this area. From 1979 to 1986 from one to three man-years have been allocated to this area each year. In 1987 the allocation increased sharply, primarily as a result of new research contracts and visiting scientists. Within this area, marketing research has been a continuous process. From 1979 to 1984, work was conducted on potato consumption and nutrition. Research on sweet potato consumption and nutritional value began in 1987.

The comparative study of potato farming systems in Peru begun in 1979 has taken on a significant international dimension. Between 1 and 1.5 man-years are allocated annually to this area. A major goal of Robert Rhoades' sabbatical this year is to generate reliable maps showing where potatoes are currently grown and the major parameters of their growing conditions, production systems and use. This work promises to be valuable for targeting future potato R&D programs.

Studies of the diffusion, adoption and impact of new technologies began in 1981. Over time, there has been a gradual shift in emphasis from ex-post studies of specific technologies to ex-ante or mid-program assessments aimed at identifying options for improving R&D programs. Since 1984, 1 to 1.5 man-years have been spent annually on this area of work.

Much of the work already covered aims in part to identify constraints to potato and sweet potato production and use. Until recently, however, no attempt was made to systematically obtain primary information on this topic. In 1986 an exercise began to survey national program leaders

and other knowledgeable individuals to obtain their views on the main constraints. Roughly one-half a man-year of professional time has gone into this area of work to date.

(i) Synthesis

The nine areas of work just discussed can be grouped under three broad headings:

- Identifying client needs and opportunities: analysis of secondary information, country studies, comparative farming systems, constraints studies, marketing, demand, consumption and nutrition.

- Generating and diffusing appropriate technology: on-farm research emphasizing production technology, post-harvest technology, seed systems and varieties.

- Assessing R&D programs: impact studies.

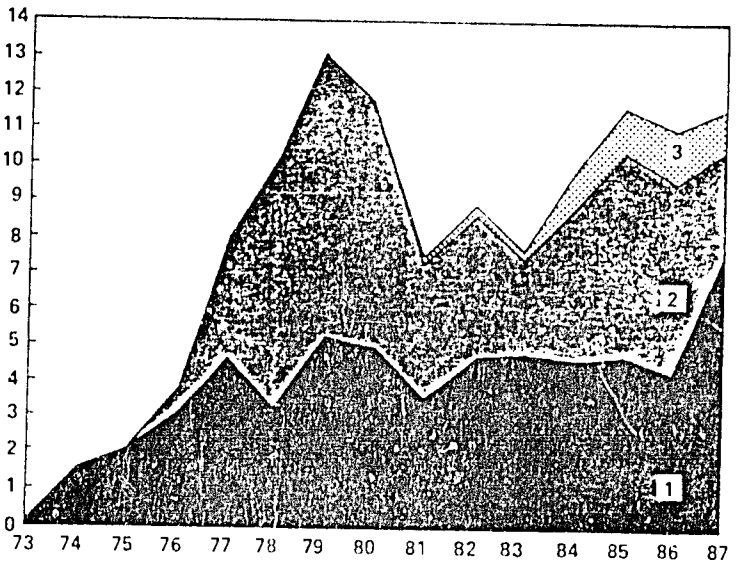
This year, nearly 65% of our human resources is being used for the identification of client needs and opportunities (Figure 9). Direct work in the generation and diffusion of appropriate technology is employing just over 25% of our resources, and assessing R&D programs is employing about 10%. This clearly represents a substantial shift in balance from earlier times, when the program was highly concentrated on farm-level studies related to specific technologies.

(j) Program outputs

It is difficult to measure the output of an R&D program. Nevertheless, a few indicators can be presented. Since 1977, the staff of the Social Science Department (including visiting scientists and students) has produced 12 theses (which CIP has bound and distributed free), 22 Working Papers and three Food Systems Studies, 32 Training Documents, 36 monographs or books, and 92 articles in books, conference proceedings and professional journals. Initially, most writing was for CIP publications, but increasingly it is for journals with wide international distribution, such as Agricultural Administration, Agricultural Systems, Human Organization, and World Development. CIP reprints articles, includes them in publication lists and makes them available free of charge to libraries and individuals in developing countries. In addition to English, many publications are available in Spanish and French. Books or

papers written by staff members have been published by Academic Press, Cambridge University Press and Westview Press. IDRC, FAO, Winrock and other international organizations have also distributed publications written by CIP social scientists.

Figure 9. Allocation of time to three broad research areas.



1. Identifying client needs and opportunities
2. Generating and diffusing appropriate technology
3. Assessing program strategies and results

An important work in process is a manual of food systems research methods, based on experiences accumulated during implementation of our major areas of work. We are also compiling a casebook of experiences with on-farm potato trials.

We have never attempted to measure our impact on the effectiveness of CIP itself or on national and regional programs. The demand, however, for social science research, publications, training and assistance of various sorts has increased dramatically in recent years. This demand, from CIP researchers as well as from national program scientists and policy-makers, is one indication that the work of the social science program is valued by its clients.

4. THE FUTURE

The most important task of this conference is to provide guidelines for the future. Given our mission and comparative advantages, what should be our priorities and strategies for the next three to five years?

(a) Mission statement

The major clients for our work are: potato and sweet potato researchers in developing countries; social scientists in developing countries engaged in research on potatoes and sweet potatoes; agricultural policymakers in developing countries who make decisions that influence potato and sweet potato production and use; CIP researchers and management; and researchers and policy-makers in developed countries who influence development programs involving potatoes and sweet potatoes.

The ultimate beneficiaries of our work are producers and consumers of potatoes and sweet potatoes in developing countries, particularly those at the lower end of income distribution.

Our mission is to contribute to increased food production and improved human welfare in developing countries through participation in CIP's programs at four levels: identifying client needs and priorities for agricultural R&D involving potatoes and sweet potatoes; generating and diffusing appropriate technology; assessing the performance of R&D programs and providing feedback to improve institutional strategies, and strengthening regional and national agricultural R&D systems.

We believe that accomplishment of our mission requires a strong participatory, client-centered research program that produces generalizable substantive results and appropriate methodologies that are communicated to a broad spectrum of researchers and decision-makers in both the developing and developed countries.

(b) Areas of future work

In keeping with our mission, the planning process should focus on four topics:

- Client needs and priorities
- Generating and diffusing appropriate technology
- Assessing R&D programs
- Strengthening regional and national programs

(c) Client needs and priorities

We now have a computerized data base with national estimates of potato and sweet potato production and use. Its management should become the responsibility of a junior-level scientist with adequate statistical training and computer skills. The major challenge for the future is to improve the FAO statistics and to integrate them with agro-ecological and socio-economic information coming from the International Potato Reference Files, constraints surveys and other relevant sources. An integrated data base is needed to pinpoint where, and understand how, potatoes and sweet potatoes are currently being grown and utilized. It would help target R&D programs, gauge the importance of the two crops for farmers and consumers in different regions, and anticipate the consequences of technological change for different socio-economic groups. This work will require a broad, interdisciplinary research framework combining anthropological, biological and economic perspectives.

As the computerized data base and mapping proceed, field studies are needed in representative areas to provide more in-depth information on potato and sweet potato production and use. This work must be done within the context of regional and national programs. It will require a strong anthropological input both for research design and for appropriate data-gathering methods.

The potato marketing case studies completed to date need to be analyzed in comparative perspective to extract major policy conclusions and methodological lessons. Future studies should be done by regional and national scientists with backstopping from CIP. The major future challenges in this area are to generate needed information on potato processing --both village-level and industrial-- and to move quickly into the more complex realm of marketing and demand analysis for sweet potatoes.

Jennifer Woolfe, author of The Potato in the Human Diet, has been contracted to write a companion volume on sweet potatoes. Research contracts may be useful for conducting some of the needed marketing and demand research for sweet potatoes. Marketing networks, like the one in the Andean region, can help strengthen national program capacity in this area.

(d) Generating and diffusing appropriate technology

In keeping with the recommendations of the last Planning Conference and External Review, we have reduced somewhat our work within the technical thrusts in favor of broader policy-oriented research. Over the next few years it may be appropriate to increase again our direct involvement in the technical thrusts. Since it is impossible to serve all thrusts simultaneously, a flexible approach is needed to address the changing needs of thrusts over time. Furthermore, most field research should be conducted by national and regional programs and not by headquarters staff. A special project (discussed in Session 5) should provide a useful mechanism for strengthening interdisciplinary fieldwork in Southeast Asia, with results feeding back to CIP headquarters. The basing of a postdoctoral anthropologist in Indonesia should also provide valuable social science input into a program to introduce potatoes to low- and mid-elevation areas.

(e) Assessing R&D programs

The impact studies and seed program evaluations will be pulled together for synthesis and comparative analysis in 1989. Future work should focus more on organizational strategies than on the impact of technologies per se. Hence, this work could benefit from the professional input of an organizational sociologist or management specialist. Linkages with ISNAR, INTERPAYS, and other groups may prove useful in this regard.

(f) Strengthening regional and national programs

In some areas such as marketing, research and support for national programs have been combined quite effectively through case studies, symposia and regional networks. In others, such as the impact studies, we have involved local social scientists to a lesser extent. This group needs to

explore alternative strategies for combining research and institution building in our major areas of work.

One way in which we plan to make an immediate and long-lasting impact is the completion of two volumes in process: (1) Manual of food systems research methods; and (2) Casebook of experiences with on-farm trials. These should be useful both for general production courses and for specialized training in client-centered R&D. They would also be valuable references for a broad range of social and biological scientists who are involved with interdisciplinary problem solving.

To make optimal use of these and other training materials, we feel that it would be valuable to have a full-time social science training coordinator at headquarters. The principal function of this person would be to organize appropriate training activities in Latin America, with special emphasis on the needs of our host country, Peru.

Filling the needs of other regions is more difficult. Ideally, we would have a core-funded social science position in each of CIP's regional programs. More realistically, we plan to build social science positions into proposals for regional and country-level projects and to encourage donor agencies to post postdoctoral fellows, associate experts and other young professionals with national or regional programs to work on potatoes and sweet potatoes. We are also considering the posting of senior staff away from headquarters to work directly with regional and national programs.

Strengthening regional and national program capacity is an area in which we are particularly interested in the innovative suggestions of the planning conference group.

(g) Some issues for the Planning Conference

The following list is not intended to be exhaustive, but to stimulate fruitful discussion:

- How adequately have we responded to the recommendations of the last Planning Conference and External Review?

- Is our mission statement appropriate for the needs of our clients?

- Are our projects and activities consistent with the mission statement?
- Are the resources at our disposal adequate?
- Is our disciplinary mix optimal?
- How best can the challenge of including a new crop (sweet potatoes) be met?
- How best can research be combined with institution building?

NOTES

1. In preparing this paper I have drawn liberally on the ideas and work of many fellow social scientists at CIP. I am particularly indebted to C. Crissman, G. Prain, R. Rhoades and G. Scott for comments on an earlier version.

2. A thrust is a coordinated set of research projects that integrates the contributions of different disciplines in addressing a priority problem.

3. Cortbaoui is currently CIP's regional representative for North Africa and the Middle East. Potts is a member of the Physiology Department outposted in Indonesia.

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Table A1. Social Science Department staff members 1973 - 1987

Name	Discipline	Funding source	Location	Type of contract	Proportion of each year on the job (1 = all year)														
					73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
1. CIP STAFF																			
Senior staff																			
Cortbaoui, R.	Agronomy	Core	Lima	P							0.42	0.58							
Horton, D.	Economics	Core	Lima	P				0.58	1	1	1	1	1	1	1	1	1	1	1
Monares, A.	Economics	Core	Lima	P						0.5	1	1	1	1	1	1	1	1	1
Rhoades, R.	Anthropology	Core	Lima	P									0.75	1	1	1	1	1	1
Scott, G.	Economics	Core	Lima	P												0.5	1	1	1
Twomey, M.	Economics	Core	Lima	P	0.17	1	0.75												
Werge, R.	Anthropology	Core	Lima	P						0.5	0.58								
Woolfe, J.	Nutrition	Core	Lima	FT *										0.84	1	0.18			
				Sub-total	0.17	1	0.75	0.58	1	2	3	2.58	2.75	3.84	4	3.68	4	4	4
Post doctorals																			
Crissman, C.	Economics	Core	Lima	PD														0.67	1
Ewell P.	Economics	Core	Lima	PD												0.92	1	1	
Haugerud, A.	Anthropology	SpecProj	Rwanda	PD											0.08	1	1	0.58	
Horton, D.	Economics	SpecProj	Lima	PD			0.67	0.42											
Monares, A.	Economics	SpecProj	Lima	PD				0.67	1	0.5									
Poats, S.	Anthropology	Core	Lima	PD							0.5	1	1	1	0.42				
Potts, M.	Agronomy	Core	Phil	PD							0.17	1	1	0.83					
Prain, G.	Anthropology	SpecProj	Huancayo	PD												0.58	1	1	
Rhoades, R.	Anthropology	SpecProj	Lima	PD							0.75	1	0.25						
Scott, G.	Economics	Core	Lima	PD									0.5	1	1	0.5			
Werge, R.	Anthropology	SpecProj	Lima	PD			0.25	1	1	0.5									
				Sub-total	0	0	0.92	2.09	2	1	1.42	3	2.75	2.83	1.5	3	3	3.25	1
Junior scientific staff, masters degrees																			
Achata, A.	Economics	Core	Lima	P													1	1	1
Alarcon, J.	Economics	Core	Lima	P						0.92	1	1	1	1	0.67				
Anosan M.	Economics	Core	Phil	FT															0.27
Fjeld, C.	Nutrition	Core	Lima	FT *												0.28			
Franco, E.	Economics	SpecProj	Lima	FT					0.58	1	1	1	0.42	0.27					
Giron, G.	Economics	Core	Lima	FT		0.5	1	0.5											
Quintanilla, L.	Economics	Core	Lima	P				0.33	1	1	1	1	0.58						
Schmidt, E.	Anthropology	Core	Lima	P												0.5	1	0.58	
Tomasini, L.	Agronomy	SpecProj	Huancayo	FT						1	1	1							
				Sub-total	0	0.5	1	0.83	1.58	3.92	4	4	2	1.27	0.67	0.78	2	1.58	1.27

Table A1 (continued)

Name	Discipline	Funding source	Location	Type of contract	Proportion of each year on the job (1 = all year)														
					73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
Junior scientific staff, bachelors and professiona degrees																			
Achata, A.	Agronomy	Core	Lima	P										1	1	1			
Apaza, J.	Economics	Core	Lima	FT							0.36	0.45				0.09			
Benavides, M.	Sociology	Core	Huancayo	FT						1									
Benavides, M.	Sociology	Core	Lima	FT				0.33	1		1	1	1	1	1	1			
Bidegaray, P.	Anthropology	Core	Lima	FT								0.73	0.27		0.42	1	0.67		
Bruno, E.	Sociology	SpecProj	Huancayo	FT						0.92	1								
Bruzzone, C.	Economics	Core	Lima	FT							0.45	0.09							
Collins, M.	Agr Econ	Core	Lima	FT														0.18	0.55
Egoavil, M.	Sociology	Core	Tarma	FT											0.27	0.27			
Eldredge, B.	Statistics	Core	Lima	P												0.17	1	0.25	
Fano, H.	Economics	Core	Lima	P					1	1	1	1	1	1	1	1	1	1	1
Gutierrez, C.	Economics	Core	Lima	FT											0.33	1	1	1	
Lau, W.	Economics	SpecProj	Huancayo	FT										0.27					
Miranda, C.	Economics	Core	Lima	FT											0.55				
Morales, C.	Economics	Core	Lima	FT												0.18			
Moreno, C.	Anim. Hust.	Core	Lima	P				0.42	1	1	1	0.5							
Moreno, F.	Biology	Core	Lima	FT *							0.84	1	0.42	1		0.18			
Perea, Jorge	Economics	SpecProj	Huancayo	FT							1	0.33							
Perea, Juan	Agronomy	SpecProj	Huancayo	FT						0.92	1	0.67		0.09					
Perez, E.	Statistics	Core	Lima	FT															1
Pulcan, N.	Economics	Core	Lima	P												0.42	1	1	1
Ramos, J.C.	Geography	Core	Lima	FT														0.83	0.58
Raymundo, M.	Agronomy	SpecProj	Huancayo	FT						0.92	1	0.67							
Recharte, J.	Anthropology	Core	Lima	FT								1							
Saco, L.	Economics	Core	Lima	FT						0.5	0.83								
Tardieu, F.	Agronomy	SpecProj	Huancayo	FT					0.58	1	1	1	0.42						
Ugarte, L.	Sociology	SpecProj	Huancayo	FT						0.92	1	1							
Uribe, F.	Agronomy	Core	Huancayo	FT					0.58	0.42						0.58	1	0.83	
Vilca, P.	Economics	Core	Lima	FT										0.45	0.09				
				Sub-total	0	0	0	0.75	4.16	8.6	11.42	9.44	3.11	4.81	4.66	6.89	5.67	5.09	4.13
Secretarial and clerical staff																			
Aguilar, E.	Secretary	Core	Lima	FT														0.09	
Altet, M.	Secretary	Core	Lima	P						0.25	1	1	1	1	1	1	1	1	1
Benavides, M.	Secretary	SpecProj	Lima	P						0.92	1	1							
Cruzado, G.	Data proc	Core	Lima	FT *											0.28	0.06			

Table A1 (continued)

Name	Discipline	Funding source	Location	Type of contract	Proportion of each year on the job (1 = all year)														
					73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
Secretarial and clerical staff (cont.)																			
Kalinowski, C.	Secretary	Core	Lima	P				0.67	1	0.58									
Lai, E.	Secretary	Core	Lima	FT														0.55	
Lozano, C.	Data proc	Core	Lima	FT *															0.58
Lozano, M.	Data proc	Core	Lima	FT *														0.75	0.58
Moner, B.	Secretary	Core	Lima	FT								0.09	0.09						
Ortigosa, M.	Secretary	Core	Lima	FT								0.09	0.18						
Otoya, I.	Secretary	Core	Lima	FT									0.09	0.18					
Rake, A.	Secretary	Core	Lima	FT											0.55				
Salinas, L.	Secretary	Core	Lima	P									1	1	1	1	1	1	1
Sulto, M.	Secretary	Core	Lima	FT															1
Villanueva, C.	Secretary	Core	Lima	FT														0.09	
				Sub-total	0	0	0	0.67	1	1.75	2	2.18	2.36	2.18	2.83	2.06	2	3.48	4.16
II. Research contracts																			
CEAS(PhD)	Economics	Core	UK	RC															
Ewell, P.(PhD)	Economics	Core	US	RC															0.36
Haugerud, A.(PhD)	Anthropology	Core	US	RC															0.18
IFPRI-Stone.(PhD)	Economics	Core	USA	RC															0.18
Lorenzi, G.(PhD)	Economics	SpecProj	Kenya	RC															0.09
Mayer, E.(PhD)	Anthropology	Core	Huancayo	RC						0.2	0.2								
Valderrama, M.(PhD)	Economics	Core	Ecuador	RC					0.5										
Woolte, J.(PhD)	Nutrition	Core	UK	RC					0.5										
Yamamoto, N.(PhD)	Anthropology	Core	Cusco	RC															1
CIUP(MS)	Economics	Core	Lima	RC															0.55
Durr, G.(MS)	Economics	SpecProj	Germany	RC															0.73
ESCAP(MS)	Economics	Core	Indon.	RC						1	1								
Fu, G.(MS)	Economics	Core	Chile	RC															0.36
IFPRI-Assist (MS)	Economics	Core	USA	RC					0.5										
Nunez, V. (MS)	Anthro	Core	Lima	RC *															0.36
Offenhauser,R.(MS)	Economics	Core	US	RC				0.25								0.5	1	0.56	0.17
Rechache, M (MS)	Economics	SpecProj	US	RC *															
Shea, R. (MS)	Anthro	Core	Huancayo	RC					0.5								0.92		
Srivastava,B.(MS)	Economics	Core	India	RC						0.5									
Benavides, M.(Proff)	Socio	Core	Lima	RC *															1
Shuman, R.(Secrt)	Secretary	SpecProj	US	RC **													0.92		
				Sub-total	0	0	0	0.25	2	1.7	1.2	0	0	0	0	0.5	2.84	0.56	4.98

Table A1 (continued)

Name	Discipline	Funding source	Location	Type of contract	Proportion of each year on the job (1 = all year)														
					73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
III. Scholarships, for work towards:																			
PhD degree																			
Bebbington, A.	Geography	Core	Lima	S														0.27	0.18
Durr, G.	Economics	SpecProj	Kenya	S				0.5	1										
Scott, G.	Economics	Core	Lima	S							1	1							
Master degree																			
Apaza, J.	Economics	Core	Lima	S									0.36	0.36	0.36				
Bekke, B.	Economics	Core	Colombia	S															0.55
Cordova, J.	Economics	Core	Lima	S							0.55								
DeCosse, P.	Economics	Core	Lima	S															0.36
Egoavil, M.	Sociology	Core	Lima	S		0.64													
Gutarra, R.	Entomology	Core	Huancayo	S													0.27	0.27	
Kabahisi, J.	Agronomy	Core	Rwanda	S													0.5	0.5	
Kiljn, T.	Economics	Core	Colombia	S															0.55
Lafosse, R.	Economics	Core	Lima	S										0.5	0.5				
O'Phelan, E.	Economics	Core	Lima	S										0.5	0.5				
Vargas, D.	Economics	Core	Lima	S							1								
Zuniga, E.	Entomology	Core	Huancayo	S													0.27	0.27	
				Sub-total	0	0.64	0	0.5	1	0	2.55	1	0.36	1.36	1.36	0	1.04	1.31	1.64
IV. Visiting scientists																			
Brush, S.(PhD)	Anthropology	VisSci	Huancayo	VS					0.33	0.67									
Carney, H.(BS)	Biology	VisSci	Huancayo	VS						0.64									
Eastman, C.(PhD)	Sociology	VisSci	Lima	VS				0.36	0.27										
Frerks, J.(BS)	Sociology	VisSci	Lima	VS					0.55										
Swindale, A.(MS)	Economics	VisSci	Lima	VS											0.36				
Yamamoto, N.(PhD)	Anthropology	VisSci	Lima	VS												0.75	1	1	0.25
					0	0	0	0.36	1.11	1.31	0	0	0	0	0.36	0.75	1	1	0.25
				Sub-total	0	0.64	0	1.11	4.15	3.01	3.75	1	0.36	1.36	1.72	1.25	4.88	2.87	6.87
				GRAND TOTAL	0.17	2.14	2.67	6.03	13.89	20.28	25.65	22.2	13.33	16.29	15.38	17.66	21.55	20.27	21.43

Notes: *=half time, **=1/4 time. Abbreviations: P = Permanent; FT = Fixed-term; PD = post-doctoral fellow; RC = Research contract; S = Scholarship; VS = Visiting scientist

Table A2. Human resources by position and degree (unweighted man-years)

Position/degree	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	Total
PhD - SS	0.2	1.0	0.8	0.6	1.0	2.0	3.0	2.6	2.8	3.4	3.5	3.6	4.0	4.0	4.0	36.3
PhD - PD	0.0	0.0	0.9	2.1	2.0	1.0	1.4	3.0	2.8	2.8	1.5	3.0	3.0	3.3	1.0	27.8
Master	0.0	0.5	1.0	0.8	1.6	3.9	4.0	4.0	2.0	1.3	0.7	0.6	2.0	1.6	1.3	25.3
Bachelor	0.0	0.0	0.0	0.8	4.2	8.6	11.1	8.9	2.9	4.3	4.7	6.9	5.7	5.1	4.1	67.2
Secretarial	0.0	0.0	0.0	0.7	1.0	1.8	2.0	2.2	2.4	2.2	2.7	2.0	2.0	3.1	3.6	25.6
Sub-total SSD	0.2	1.5	2.7	4.9	9.7	17.3	21.5	20.7	12.8	14.0	13.0	16.2	16.7	17.1	14.0	182.2
Research contract	0.0	0.0	0.0	0.3	2.0	1.7	1.2	0.0	0.0	0.0	0.0	0.3	1.2	0.3	4.4	11.3
Scholarships	0.0	0.6	0.0	0.5	1.0	0.0	2.6	1.0	0.4	1.4	1.4	0.0	1.0	1.3	1.6	12.8
Visiting scientist	0.0	0.0	0.0	0.4	1.2	1.3	0.0	0.0	0.0	0.0	0.4	0.8	1.0	1.0	0.3	6.2
Sub-total	0.0	0.6	0.0	1.1	4.2	3.0	3.8	1.0	0.4	1.4	1.7	1.0	3.2	2.6	6.3	30.2
Total	0.2	2.1	2.7	6.0	13.9	20.3	25.2	21.7	13.1	15.4	14.7	17.2	19.9	19.6	20.4	212.4

Note: SS=senior scientist; PD= postdoctoral.

Table A3. Human resources by position and degree (weighted man-years)

Position/degree	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	Total
PhD - SS	0.2	1.0	0.8	0.6	1.0	2.0	3.0	2.6	2.8	3.4	3.5	3.6	4.0	4.0	4.0	36.3
PhD - PD	0.0	0.0	0.7	1.7	1.6	0.8	1.1	2.4	2.2	2.3	1.2	2.4	2.4	2.6	0.8	22.2
Master	0.0	0.3	0.6	0.5	0.9	2.4	2.4	2.4	1.2	0.8	0.4	0.4	1.2	0.9	0.8	15.2
Bachelor	0.0	0.0	0.0	0.3	1.7	3.4	4.4	3.6	1.2	1.7	1.9	2.8	2.3	2.0	1.7	26.9
Secretarial	0.0	0.0	0.0	0.1	0.2	0.4	0.4	0.4	0.5	0.4	0.5	0.4	0.4	0.6	0.7	5.1
Sub-Total SSD	0.2	1.3	2.1	3.2	5.4	8.9	11.4	11.4	7.8	8.6	7.5	9.5	10.3	10.2	7.9	105.7
Research Contract	0.0	0.0	0.0	0.2	1.6	1.1	0.8	0.0	0.0	0.0	0.0	0.2	0.6	0.2	3.5	8.1
Scholarship	0.0	0.3	0.0	0.3	0.6	0.0	1.2	0.6	0.1	0.5	0.5	0.0	0.4	0.6	0.7	5.9
Visiting Scientist	0.0	0.0	0.0	0.4	0.8	0.9	0.0	0.0	0.0	0.0	0.2	0.8	1.0	1.0	0.3	5.3
Sub-total	0.0	0.3	0.0	0.8	3.0	2.0	2.0	0.6	0.1	0.5	0.8	0.9	2.0	1.7	4.5	19.3
Total	0.2	1.6	2.1	4.0	8.4	11.0	13.4	12.0	7.9	9.2	8.3	10.4	12.3	11.9	12.4	125.0

Weights: Senior scientist=1; postdoctoral=0.8; masters degree=0.6; bachelors or professional degree=0.4; secretarial or clerical=0.2.

Table A4. Research personnel by discipline (weighted man-years)

Discipline	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	Total
Economics	0.2	1.3	1.9	2.4	4.5	5.4	7.3	5.1	4.1	4.8	4.8	4.7	5.9	6.2	7.7	66.2
Anthrop/Sociology	0.0	0.3	0.2	1.3	2.8	2.7	2.8	3.1	2.3	2.2	2.1	4.4	4.8	3.8	2.3	34.8
Other	0.0	0.0	0.0	0.2	0.4	0.7	0.6	0.4	0.1	0.6	0.5	0.3	0.6	0.8	1.7	6.9
Agronomy	0.0	0.0	0.0	0.0	0.5	1.9	2.4	2.9	1.0	1.1	0.4	0.6	0.6	0.5	0.0	11.9
Total	0.2	1.6	2.1	3.9	8.2	10.6	13.0	11.6	7.5	8.7	7.7	10.0	11.9	11.3	11.7	119.8

Table A5. Human resources by funding source (weighted man-years)

Funding source	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	Total
Core budget	0.2	1.6	1.4	1.7	4.8	5.2	8.2	8.3	7.3	8.8	8.0	8.4	9.4	9.7	12.1	95.0
Special project	0.0	0.0	0.7	2.0	2.8	4.9	5.2	3.7	0.6	0.3	0.1	1.3	1.9	1.3	0.0	24.7
Visiting scientist	0.0	0.0	0.0	0.4	0.8	0.9	0.0	0.0	0.0	0.0	0.2	0.8	1.0	1.0	0.3	5.3
Total	0.2	1.6	2.1	4.0	8.4	11.0	13.4	12.0	7.9	9.1	8.3	10.4	12.3	11.9	12.4	125.0

Table A6. Economists by funding source (weighted man-years)

Funding source	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	Total
Core budget	0.2	1.3	1.4	1.2	2.8	3.6	5.5	4.4	3.9	4.5	4.5	4.7	5.6	6.2	7.7	57.4
Special project	0.0	0.0	0.5	1.2	1.7	1.8	1.8	0.7	0.3	0.3	0.0	0.0	0.3	0.0	0.0	8.6
Visiting scientist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2
Total	0.2	1.3	1.9	2.4	4.5	5.4	7.3	5.1	4.1	4.8	4.8	4.7	5.9	6.2	7.7	66.2

Table A7. Anthropologists and sociologists by funding source (weighted man-years)

Funding source	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	Total
Core	0.0	0.3	0.0	0.1	1.2	0.9	1.4	1.9	2.1	2.2	2.0	2.4	2.2	1.5	2.0	20.1
Special project	0.0	0.0	0.2	0.8	0.8	1.1	1.4	1.2	0.2	0.0	0.1	1.3	1.6	1.3	0.0	9.9
Visiting scientist	0.0	0.0	0.0	0.4	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.8	1.0	1.0	0.3	4.9
Total	0.0	0.3	0.2	1.3	2.8	2.7	2.8	3.1	2.3	2.2	2.1	4.4	4.8	3.8	2.3	34.8

Table A8. Allocation of scientific staff time to research 1986

	Research	Training	Admin. & other	Total
Senior staff (PhD)				
Horton, D.	45	5	50	100
Monares, A.	70	20	10	100
Rhoades, R.	35	15	50	100
Scott, G.	60	25	15	100
Postdoctorals (PhD)				
Crissman, C.	95		5	100
Ewell, P.	75	15	10	100
Haugerud, A.	60	20	20	100
Prain, G.	75	20	5	100
Junior staff (Bachelors & Masters)				
Achata, A.	60	40	0	100
Collins, M.	80	0	20	100
Eldredge, B.	60	20	20	100
Fano, H.	85	10	5	100
Gutierrez, C.	90	10	0	100
Pulcan, N.	95	5	0	100
Ramos, J.C.	100	0	0	100
Schmidt, F.	90	5	5	100
Uribe, F.	70	30	0	100
Visiting scientists				
Yamamoto, N.	80	10	10	100

Table A9. Research projects led by social scientists: chronological list

LEADERS/Cooperators	Thrust	Title	Dates a/
1. M. TWOMEY G. Giron		Socioeconomic Program	1973
2. R. WERGE R. Shaw, D. Horton	VIII	Socioeconomic Project on Post-Harvest Utilization of the Potato	1976 (36)
3. D. HORTON E. Franco, A. Monares L. Quintanilla, R. Werge		Socioeconomic Analysis of Farm-Level Potato Production Constraints	1977
4. S. BRUSH Z. Human H. Carney		Traditional Classification and Seed Distribution Systems in Andean Agriculture	1977 (11)
5. P. ACCATINO, D. HORTON CIP RR Scientists/NPP scientists, K. Brown, W. Salhuana and others	VIII	Maximizing Potato Productivity in Developing Countries	1978
6. D. HORTON L. Quintanilla		Potential of the Potato in Developing Countries	1978 (24)
7. R. BOOTH, R. RHOADES CIP Regional and National Program Scientists	VIII	Storage for Developing Countries	1978 (60)
8. A. MONARES S. Wiersema J. Bryan	IX	Socioeconomic Aspects of Production and Utilization of Improved Potato Seed in Developing Countries:	1978 (36)
9. S. POATS H. Creed, J. Woolfe	VIII	Potato Consumption and Nutrition in Developing Countries	1979 (40)
10. S. POATS J. Woolfe and Library	VIII	Nutritional Value of Potatoes in the Human Diet	1979 (40)
11. R. RHOADES J. Recharte M. Benavides		Peruvian Potato Agriculture in Comparative Perspective	1979 (18)
12. D. HORTON A. Achata		World Trends in Potato Production and Use (extension of No. 6)	1980 (40)
13. A. MONARES D. Horton, P. Malagamba, S. Wiersema	IX	Socioeconomic Analysis of TPS Technologies and Systems	1981 (43)

Table A9 (Continued)

LEADERS/Cooperators	Thrust	Title	Dates
14. A. MONARES J. Bryan, D. Horton, S. Wiersema	IX	Socioeconomic Analysis of Tuber Seed Technologies and Systems (extension of No. 8)	1981 (42)
15. G. SCOTT R. Booth, R. Rhoades		Marketing and Demand for Potatoes in Developing Countries	1981 (36)
16. D. HORTON K. Brown, O. Page, J. Valle-Riestra R.L. Sawyer	X	CIP Impact Study	1983 (16)
17. R. RHOADES R. Booth, K.V. Raman, P. Bidegaray, M. Benavides, D. Horton	VIII	Socioeconomics of Potato Storage in Developing Countries (extension of No. 7)	1983 (24)
18. R. RHOADES M. Benavides, D. Horton P. Bidegaray	X	Potato Farming Systems (extension of No. 11)	1983 (24)
19. R. RHOADES P. Bidegaray, R. Booth D. Horton	X	Farmer Adoption of Potato Technologies	1983 (24)
20. P. EWELL K.V. Raman, D. Horton, A. Monares, F. Ezeta, H. Fano, M. Palacios, J. Alcazar	V	Socioeconomic Aspects of Insect Pest Management	1984 (36)
21. N. YAMAMOTO	VIII	Farm-level Potato Processing Technologies in the Andes	1984 (36)
22. N. YAMAMOTO	X	Andean Potato Farming Systems and Technological Change	1984 (36)
23. V. NIÑEZ	X	Household Gardens in Food Systems of Developing Countries	1984 (24)
24. G. FRAIN U. Scheidegger, F. Uribe, R. Rhoades	X	The Integration of Small Farmers in National Seed Programmes	1985 (17)

LEADERS/Cooperators	Thrust	Title	Dates
25. G. SCOTT R. Booth, R. Rhoades	X	Marketing and Demand for Potatoes in Developing Countries (extension of No. 15)	1986 (42)
26. D. HORTON N. Pulcan, R. Rhoades	X	Patterns and Trends of Root Crop Production (extension of No. 12)	1986 (48)
27. D. HORTON CIP & National scient.	X	Impact of New Tecnologies in Developing Countries	1986 (48)
28. R. RHOADES J. Bryan, G. Scott S. Wiersema	VIII	Socioeconomics of Post-Harvest Technology and Management (extension of No. 17)	1986 (24)
29. C. CRISSMAN R. Rhoades, D. Horton, G. Prain, J. Bryan, G. Scott, S. Wiersema, A. Monares	IX	Potato Seed Programs in Developing Countries	1986 (36)
30. J. BRYAN, C. CRISSMAN D. Horton	X	Survey of National Seed Programs	1986 (12)
31. D. HORTON, W. COLLINS, M. IWANAGA, H. MENDOZA CIP regional reps., national program leaders	X	Constraints to Potato and Sweet Potato Production and Use	1986 (36)
32. G. SCOTT S. Wiersema	VIII	Socioeconomics of Potato Processing	1987 (36)
33. G. SCOTT, F. EZETA, J. BUSTAMANTE, B. ARCALA, I. REYNOSO, A. COBIAN, R. PACHECO	X	Co-operative Program of Potato Marketing Research in the Andean Region	1987 (24)
34. K.V. RAMAN, H. FANO J. Alcazar, M. Palacios, J. Carhuamaca, E. Yabar, R. Aldona	V	Aspectos Socioeconómicos y Entomológicos de la Polilla de Papa en el Perú (formerly No. 20)	1987 (12)

a/ Date initiated (expected months of duration)

Table A10. Research contracts

Name	Institution/Country	Project	Year	Amount US$	Funding Source
A. Morales	Catholic University La Paz, Bolivia	Potato production and use in Bolivia	1974-75	3,000*	FF
R. Offenheiser	Cornell University Ithaca, USA	Bibliographic research	1976	2,500*	Core
M. Valderrama	Ecuador/Colombia	Potato production & use in Ecuador	1976-77	7,500*	FF
G. Fu	CENDERCO Santiago, Chile	Potato production and use in Chile	1976-77	7,500*	Core
E. Mayer	Catholic University Lima, Peru	Land use in the Mantaro Valley	1977	5,000*	Core
B.N. Srivastava	New Delhi, India	Potato production and use in India	1978	4,000*	Core
G. Lorenzi/ G. Durr	Technical University Berlin, West Germany	Potato production and use in Kenya and Rwanda	1978-80	43,000	GTZ
V. Niñez	Peru	Household gardens	1985-86	5,775	Core
N. Young	Centre for European Agricultural Studies Wye, UK	Potato seed programs in developed countries	1987	15,000	Core
N. Yamamoto	National Museum of Ethnology, Osaka, Japan	Andean potato farming system	1987	6,950	Core

Table A10 (Continued)

Name	Institution/Country	Project	Year	Amount US$	Funding Source
V. Niñez	U. of Arizona Tucson, USA	Edit volume on household gardens	1987	10,000	Core
A. Haugerud	U. of Georgia Athens, USA	Write up results of postdoctoral research	1987	5,000	Core
P. Ewell	Cornell University Ithaca, USA	Write up results of postdoctoral research	1987	5,000	Core
M. Benavides	Peru	Consumption of Andean food crops	1987	1,500	Core
R. Gomez	Pacific University Lima, Peru	Marketing of processed potato products in Lima, Peru	1987	15,378	Core
T. Bottema	ESCAP Bogor, Indonesia	Indonesia Demand and marketing of potatoes in Java, Indonesia	1987-88	7,000	Core
J. Woolfe	UK	Book: Sweet potato: an untapped Food Resource/Potential	1987-88	23,000	Core
B. Stone	IFPRI Wash.,DC,USA/China	White potato/sweet potato development in China	1987-88	25,000	Core
				US$	Source

* Estimate. FF = Ford Foundation.

Table A11. Visiting scientists

Name	Home Institution/Country	Degree	Project	Period	Year
C. Eastman	University of New Mexico Las Cruces, USA	Ph.D.	Sociological aspects of potato improvement	6 months	1976
J. Ferks	Agricultural University, Wageningen, Holland	M.S.	Potato processing in the Mantaro Valley, Peru	6 months	1977
S. Brush	College of William & Mary Williamsburg, USA	Ph.D.	Dynamics of Andean potato agriculture	6 months	1977/78
H. Carney	College of William & Mary	B.S.	Diversity, distribution and peasant selection of indigenous potato varieties in the Mantaro Valley: Peru	6 months	1977/78
A. Swindale	Fletcher School of Law and Diplomacy, Tufts University Medford, USA	B.A.	Role of women in Andean agriculture	3 months	1983
N. Yamamoto	National Museum of Ethnology Osaka, Japan	Ph.D.	Farm level potato processing technology in the Andes	2 1/2 yrs	1984/86

Table A12. Allocation of scientific man-years to research projects and Thrusts in 1986

Project title	Project leader	Unweighted B/Tec	Unweighted MS	Unweighted PD	Unweighted SS	Total weighted MY	Total weighted %
Thrust II							
Potato varieties: Kenya	Haugerud, A.	0.50		0.11		0.29	3.67
Potato varieties: Rwanda	Haugerud, A.			0.11		0.09	1.14
Sub-total		0.50		0.22		0.38	4.80
Thrust V							
Pest management	Ewell, P.	1.26		0.60		0.99	12.52
Thrust VIII							
Storage	Rhoades, R.		0.21		0.09	0.22	2.78
Thrust IX							
Seed program eval	Crissman, C.			0.64		0.51	6.45
True seed: Rwanda	Haugerud, A.			0.11		0.09	1.14
Econ of seed systems	Monares, A.		0.12		0.21	0.27	3.41
Econ of true seed	Monares, A.	0.03	0.48		0.49	0.79	9.99
Sub-total		0.03	0.60	0.75	0.70	1.66	20.99
Thrust X							
Pesticide use	Ewell, P.	0.17		0.15		0.19	2.40
Constraints	Horton, D.	0.09			0.05	0.09	1.14
Impact studies	Horton, D.	0.19			0.27	0.35	4.42
Patterns & trends	Horton, D.	1.32			0.14	0.57	7.21
Household gardens	Nunez, V.		0.25			0.15	1.90
Informal seed systems	Brain, G.	0.70		0.75		0.88	11.13
Farmer adoption	Rhoades, R.		0.48		0.09	0.38	4.80
Farming systems	Rhoades, R.	0.83	0.10		0.18	0.57	7.21
Andean marketing network	Scott, G.				0.18	0.18	2.28
Econ of processing	Scott, G.				0.06	0.06	0.76
Marketing and demand studies	Scott, G.	0.90			0.36	0.72	9.10
Andean farming systems	Yamamoto, N.				0.24	0.17	2.15
Andean processing tech	Yamamoto, N.				0.56	0.35	4.42
Sub-total		4.20	0.83	0.90	2.13	4.66	58.91
TOTAL		5.99	1.64	2.47	2.92	7.91	100.00

Table A13. Allocation of time to nine types of research

	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	Total
Secondary info	0.1	0.7	1.1	1.6	1.8	1.3	1.8	1.7	1.5	1.7	1.4	1.3	1.2	1.2	1.6	19.8
Country studies	0.1	0.7	1.1	1.4	2.1	1.4	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7
OFR - production tech	0.0	0.0	0.0	0.4	1.9	5.0	6.2	5.5	2.6	2.5	1.4	2.0	2.6	2.4	1.2	33.6
Pre - production	0.0	0.0	0.0	0.3	0.5	1.0	0.8	0.8	0.8	1.2	1.0	2.0	2.6	2.4	1.8	15.2
Post-harvest tech	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.4	0.3	0.3	0.3	0.3	0.5	0.4	0.0	5.2
Marketing, demand	0.0	0.3	0.0	0.1	0.2	0.4	2.0	1.6	1.5	2.6	2.6	2.1	2.1	1.7	4.2	21.3
Compar. farming systs.	0.0	0.0	0.0	0.0	0.5	0.3	0.5	1.3	0.6	0.5	0.8	1.3	1.3	1.3	1.2	9.4
Adoption, impact	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.9	1.2	1.5	1.1	5.4
Constraints	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.5
Total	0.2	1.6	2.1	3.7	7.9	10.2	13.1	11.7	7.5	8.8	7.7	9.8	11.5	11.0	11.6	118.2

Table A14. Allocation of time to three broad research areas

	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	Total
1. Identifying client needs and opportunities	0.2	1.6	2.1	3.1	4.6	3.3	5.2	4.9	3.6	4.7	4.8	4.6	4.7	4.3	7.4	58.8
2. Generating and diffusing appropriate technology	0.0	0.0	0.0	0.6	3.4	6.9	7.9	6.7	3.7	3.9	2.7	4.3	5.6	5.2	3.1	54.0
3. Assessing program strategies and results	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.9	1.2	1.5	1.1	5.4
Total	0.2	1.6	2.1	3.7	7.9	10.2	13.1	11.7	7.5	8.8	7.7	9.8	11.5	11.0	11.6	118.2

FOOD SYSTEMS RESEARCH

Robert Rhoades

1. INTRODUCTION

During the past few years, the concept of food systems has enjoyed increased attention from applied agricultural researchers, policy makers and academicians. This is due to a number of reasons. First, while increased production is still seen as the cornerstone of improving nutrition among the poor in developing countries, policy makers have also recognized that food must reach the neediest populations in affordable and nutritious forms. Often it is not enough to simply produce more food if distribution, marketing, and income levels still constrain the ability of the poor to procure food. Second, national governments are increasingly recognizing that food is embedded in global and national systems (involving agricultural policy, pricing, imports, research organizations, land tenure, and household issues) that can either facilitate or mitigate against effective technology development and transfer. In fact, lack of attention to forces and events occurring beyond the farm gate has been one of the main criticisms of Farming Systems Research (Biggs and Gibbon, 1986). Third, new perspectives on agricultural development have been brought to bear in recent years. Many non-traditional agricultural disciplines, such as geography, household sciences, nutrition, food technology, public management, and anthropology, have expertise valuable for analysis of important aspects in the food chain. The voices of these disciplines are now seen as a complement to the leading production sciences.

Food Systems is an integrated concept which nicely encompasses these new directions in agricultural research and development.[1] An indication of this wider understanding of agriculture is the decision to award in 1987 the first General Foods World Food Prize, the only such award of global scope and comparable magnitude. Although somewhat lengthy, I believe it is worth quoting the need underlying

the prize since it reflects the spirit of understanding the food system:

> "The quest for food has always dominated the lives of people around the world. Without a safe, wholesome and abundant supply of food, individuals -- and entire nations-- cannot achieve a satisfying quality of life. Indeed, they face the specter of malnutrition and starvation. Wars have been waged over food and even today, the economies of many countries hang in the balance, awaiting an ample harvest.
>
> It is no wonder that improvements in the food supply profoundly affect most nations. But, it is not enough merely to produce more food. The food also must be made available to every person in affordable, nutritious and appetizing forms.
>
> The concept of the "total food chain" lies at the heart of the General Foods World Food Prize, for each link in that chain plays a vital role. Every aspect of the production, processing, and distribution of food needs to be considered, including farming, the agricultural sciences, food science and technology, nutrition, and economics, technology transfer, governmental policies, transportation and distribution, and education."
>
> (General Foods, 1987)

Despite the increased focus on the food system and its corollary, the food chain, new questions are beginning to arise as the concept receives more official attention. Often, the notion of a food system is used as a rationale for research without a vigorous definition of precisely what is meant (United Nations University and IFPRI, 1986). Sometimes, it is used as a catchment term for research topics that do not fit into component production areas. Finally, it has not been made clear how the concept can be fruitfully applied in international and national programs dedicated to doing something about the food problem rather than simply intellectualizing those problems.

The purpose of this paper, therefore, is to explore the relevancy of the concept of food systems. I do not aim to convince you of the validity of the approach, but rather to provide a background which will (one hopes) allow us to discuss its relative strengths and weaknesses within the

context of this planning conference.[2] To accomplish this, I will present four questions and one request:

- What is meant by the term "Food System" and how has it been approached in the development literature?

- How is the concept applicable and relevant to basic and applied international agricultural research, especially technical research oriented toward national programs and small farmers?

- Who are the clients of such a food systems research strategy?

- What are examples of how the food systems perspective might be applied to improve production-utilization systems, including international, national, and household levels?

- Finally, I want to solicit the opinions of my colleagues at this planning conference, both biological and social scientists, and from the distinguished invited guests, as to their views on the concept of food systems and what future directions should it take, given CIP's resources and mandate.

2. FOOD SYSTEMS: THE LITERATURE AND THE CONCEPT

The concept of food systems is not new. Most discussions about what constitutes a food system have occurred within universities, with two important exceptions where governments have adopted formal food systems policy frameworks. Agricultural economists, in particular, have looked upon the concept to elucidate the importance of agricultural policy, especially government price policy. Peter Timmer (1986) and his colleagues at Michigan State University (Timmer et al., 1983) have used food system as a key concept to trace the impacts of government policy on consumption and production. They essentially argue that production does not occur in a sociopolitical vacuum and that government policy can have significant impacts at the farm level, a fact often overlooked in technology improvement programs. James Shaffer (1973; see also Riley and Staatz, 1981), another Michigan State agricultural economist, developed a framework for food systems organization and performance, with application to the U.S. food system. Among the variables included were:

environment, behavior of individuals and organizations, firms, households, government, and the market. Faced with the difficult task of defining the U.S. food system (which receives inputs from many corners of the globe), he developed the concept of a systems model which provided a simplified description of that part of the world that has a greater degree of interdependence with production, distribution, and use of food.

Nutritionists, food technologists, and consumption specialists have also looked to the food systems concept to highlight the importance of quality and quantity of available food to different segments of society, including the poor. This work was pioneered at the University of Sussex in the U.K. and summarized in a book edited by Arnold Pacey and Philip Payne (1985). In this work, they define the food system as being comprised of production, distribution, consumption and biological utilization. The emphasis is on food availability to the consuming household and ultimately on nutrition and health of the individual.

Even political scientists have focused on food systems to understand better food insecurity and its impact on developing countries. Raymond Hopkins (1986), for example, sees three systems levels: international, national and household. He also sees three phases cross-cutting these: production, marketing and consumption. He argues that positive action can be taken at all levels to help reduce food insecurity. At the international level, for example, more funds for basic research on new cropping technologies, at the national level appropriate price orientation can enable domestic production to expand and become more reliable, and at the household level better use of improved technologies to raise yields.

The concept of the food system has fortunately not remained within the ivory towers of academia. Through sheer necessity, farmers and their families have always had to organize their own production strategies along food systems thinking. Similarly, national programs have had to look at the linkages between production, marketing, utilization and consumption. The end concern is generally food availability, not compartmentalized thinking about only one link of the chain. Mexico, for example, under President Lopez Portillo initiated in 1979 its sistema alimentario Mexicano (Mexican Food System, SAM) in an effort to stimulate production and reach consumers. China, under Deng elected a similar approach. The Chinese and Mexican efforts aimed to strike a balance between favoring both producers and consumers. In

many cases, policy is disarticulated from the actual food system so that one is favored to the detriment of the other.

In most discussions of the food systems approach, little effort has been spent on trying to define precisely what is a food system. It is normally argued that the definition and extent of the food system depends on the interests of the researcher. Whether one focuses on the micro-level or the macro-level depends on the objectives of the research. A food system can be defined as specifically as a household or as locally as an Andean valley, or as broadly as the world system. Furthermore, it is not always necessary to offer a compete definition of the "system" but rather to use the idea of interrelatedness as a starting framework within which to elaborate certain problem areas (e.g., consumption, marketing, utilization, trends) and highlight key relationships and processes. This procedure is much the same as that used in most of science, even the biological branch.

In most literature on food systems, however, food is seen as playing a number of roles: nutritional, symbolic and cultural, economic and national well-being (security). Also prevalent is the concept of the food chain and interdependence between different activities (production, marketing, consumption, etc.) that make up a population's food system. Finally, it is argued that macro forces, such as import substitution and price policy, can have important consequences on farm-level production. A basic tenant of food systems thinking is that food, unlike other human needs such as water and oxygen, must be produced by purposeful human activity. After it is produced, food must ultimately reach consumers, and those who consume it must have the resources to obtain food from, in many cases, middlemen. All this adds up to a food system which is a fragile, interrelated activity. Policy, demographics, knowledge. Land tenure, technology, and international monetary policy all have an influence in determining the "performance" of the system.

3. RELEVANCY FOR A COMMODITY CENTER OR NATIONAL COMMODITY PROGRAM

While it is clear that the food systems concept has great heuristic validity for international and national food analysis, the same cannot be automatically said for an international center such as CIP or a national commodity program. From the more clearly focused commodity viewpoint,

the food systems concept may seem overly ambitious, dealing with too many factors, and leading into areas which are beyond the mandates of the center or national program. Other approaches, such as cropping systems and farming systems, have a production focus and therefore may appear to be more manageable. Even in farming system research, however, a tendency developed to broaden the systems studied which, in turn, led to the collection of unwieldy volumes of data (Chambers and Jiggins, 1986; Farrington and Martin, 1987) In fact, to be viable, the food systems strategy will have to prove that it has clearly focussed, comparative and useful advantage not dealt with elsewhere in a research organization, and that it is cost effective.

To discuss comparative advantages, we should first step back to look at the general objectives of agricultural research and development. If we accept that the primary objective is improvement not only of the technical base, but also of developing country research institutions and capabilities to ensure proper availability of food to all consumers, then we are obligated to place research in a broader framework, or at least keep an eye on those broader forces. Also, with scarce resources, researchers are constantly asking themselves if their priorities are the correct ones. Information for establishing those priorities can come from many sources, including the biological sciences, but also from the human sciences that focus on events closer to the consumer, such as distribution and marketing. Another concern is related to building institutional and organizational structures for ensuring long-term sustainability of investments in agricultural development programs and projects.

Given that food systems research is a new framework for many of us, it may be advisable to make explicit a few relevant assumptions of such an approach: (1) no technological component, including a specific crop, is an island in itself; (2) improvements at one technological stage can have an impact on the next stage, and often the stages are linked in time through markets, stores, or formal and informal farmers' organizations; (3) research priorities to improve the overall food system can be adjusted to answer the weak points in the chain (and gaps in our knowledge) by being aware of the interrelatedness of the food production-utilization process; (4) forces beyond the farm gate, such as agricultural imports or pricing policy, have an impact on farm production in such a way as to negate or enhance technological improvements.

Within these broad assumptions, specific types of research activities can be defined which should be of value to an international organization:

- Researching the global view of the mandate crop(s) within food systems: (1) How, where, and in what seasons is the crop produced? (2) Who produces, markets, processes, and utilizes the crop? (3) What are the biological and socioeconomic constraints and opportunities? (4) What nutritional or economic role does the crop(s) play? and (5) Where is the potential for expansion or intensification?

- Researching how farmers perceive and use new technologies generated by agricultural scientists and how farmers and scientists can be brought closer together in an interactive method of research;

- Researching how distribution, marketing, and exchange occurs and how this is important for commodity mandated centers such as CIP or national programs;

- Researching how food is made available and to whom, and how it is consumed, particularly at the household level;

- Researching nutritional outcomes of different production strategies, for households and nations;

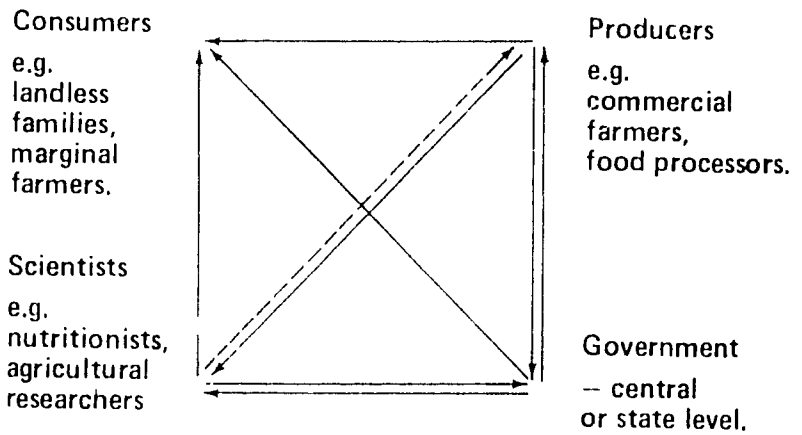
- Researching the ability of agricultural organizations in developing countries to manage and sustain a technological improvement; and

- Researching the "impact" or consequences of technological change and the influence of policy on crop improvement efforts.

4. CLIENTS OF FOOD SYSTEMS RESEARCH

In researching a topic as complex as a food system, it is an illusion to think that a consensus can be reached among the many participants as to a single, appropriate direction for agricultural research and development. Focused research, however, can help clients make informed decisions. Thus the food systems researcher engages in

dialogue and interacts with each group to explore the likely relevance of scientific findings for them. Pacey and Payne (1985:202) have outlined below what they believe to be the main actors in the food system:



The bold lines indicate the well-established interaction existing between scientists and government by virtue of the employment of agricultural scientists in government posts. Also, often the interaction between producers and government is strong due to extension, cooperatives, pressure groups and farmers'organizations. According to Pacey's diagram, however, consumers are rarely in a position to have their points of view made known. CIP has already made excellent strides in correcting this neglect by recognizing that consumers of all classes should participate policy and research. Otherwise, without the consumer (and the consumer is the ultimate client) our research and recommendations can be mistargeted. A good example of the importance of understanding consumers comes from Bangladesh. Recently at an international conference, I came under criticism as a CIP scientist for supporting research of only rich farmers (the false assumption being that only rich farmers produce potatoes in Bangladesh). I was best able to counter the argument through CIP's research on Bangladesh consumers. Susan Poats' research revealed the crucial nutritional role for the "poorest of the poor" during the harvest periods when food supplies are low. Poor people are allowed to keep potatoes from their harvest work and also to glean the fields. When prices drop rapidly due to gluts, poor people within the immediate areas are able to capitalize on the prices and therefore consume more. Eliminating support for larger farmers may not necessarily lead to greater availability of

food for the poorer consumer. This illustrates, I believe, why we have to be careful in isolating specific events from the full food chain and drawing sweeping conclusions.

For an international center such as CIP, I would be inclined to list the following clients:

(i) Farmers and other clients (traders, processors, home gardeners)

The point of articulation with this set of clients is obviously the national program, but researchers need not give up face-to-face contact since it is at the field level where new research directions emerge.

(ii) National program personnel (especially those in the non-production sciences).

In addition to supporting component research, a food systems framework offers a possibility for peer group development among developing country researchers normally on the margins of production programs. Although such disciplines are not singularly represented in large numbers; taken together, the disciplines (e.g. economics, sociology, anthropology, nutrition, geography, household sciences, marketing specialists, and even public administration) have an important voice. In the developing world, there are large numbers of such dedicated individuals who have been overlooked to date because they do not fall within the production sciences.

(iii) Biological scientists and interdisciplinary research in teams and other thrusts

All food systems projects should cross-cut other technical thrusts. Consumer needs, for example, can feedback into breeding programs, marketing research into post-harvest, and agro-ecological studies into warm climate production.

(iv) Planners, policymakers, and administrators

Projects that deal with trends, patterns, information bases, constraints, etc. can provide use information to

policymakers and planners for establishing priorities and allocating resources.

While this long list of clients may again seem too ambitious, the wide range of clients reflects the complexity of the food system and helps keep research projects relevant and in context. Also, I believe that these four clients are the same for all CIP scientists, not just those working on food systems research.

5. EXAMPLES OF THE APPLICATION OF FOOD SYSTEMS RESEARCH

In this section, some examples where a food systems perspective can have a positive application will be discussed. The methods of a food systems approach have not yet been fully developed, but some of the general features are already in place (Holtzman, 1986). Depending on the issue at hand, a researcher may wish to start research from the perspective of consumers, traders, or input supply agents and work toward other clients. This more flexible orientation makes the food system approach different from farming system research which must, by definition, begin with the farmer. This means we need methods for understanding the various actors in the food chain. Considerable progress has already been made at CIP within the Social Science Department through the work of Poats on consumption, Scott on marketing, Wolfe and Poats on nutrition, Prain, Monares, and Crissman on seed systems, Yamamoto on processing, Ewell on pest management, household food production by Ninez, and Horton on trends, patterns and assessment of impact. Closely related projects are found in Post Harvest Management and Technology (VIII), Seed Technology (IX), Pest Management (V) and Warm Tropics Potato Production (VI). I believe much of this work is already having an impact at various levels of food systems. The work of Horton on trends and patterns has affected the thinking of the World Bank and the FAO on the importance and production magnitude of the roots and tubers. Although rarely thought of in this way, both the World Bank and the FAO are key elements in many national food systems.

In the future, I believe that the food systems perspective may in addition prove particularly relevant in the following areas:

(a) Rapid introduction of potato or sweet potato into new regions

A good example comes from Peru, where potatoes have been cultivated in the highlands for centuries. In recent years, however, the potato has been making inroads into the warmer high jungle or ceja de selva (ca. 1,800 m.a.s.l.) due largely to better adapted varieties (Bebbington, 1987). In Oxampampa, for example, potato production increased from a few kitchen gardens in 1980 to an estimated 600 hectares in 1984. Although extension services were poor, input supplies highly restricted, farmers inexperienced, and markets uncertain, the lure of high profits and easy credit brought farmers to overexpand their production. In 1984, however, the climate was favorable to late blight (rancha) and unfavorable for an early harvest. As fungal problems increased, the banks responded optimistically by lending more and more credit for pesticides. Simultaneously, prices at the farm-gate fell 30 per cent, leaving farmers in the end with production costs that totalled 175% of the price. Farmers were "burned" and most completely gave up on potatoes while the few who remained cut back their production to earlier levels. The potato is not a popular crop in Oxapampa today (Bebbington, 1987).

This case shows the interrelatedness of the food system in which potato farmers were embedded. Although it is presumptious to argue that in this case a food systems perspective could have averted the disaster, it seems logical that attention to understanding the food system and predicting markets, prices and levels of experience could have tempered the enthusiasm of the banks and the potato fever of the farmers. National programs, particularly in Asia, are making tremendous progress in introducting the potato into new areas with both cool and warm climates (Midmore and Rhoades, 1987). Programs are only successful if they are sustained.

(b) Household perspective on technology generation and use

Another area where food systems might be of value is in farm-level research. With few exceptions, on-farm research has remained focused on "the farmer," in isolation from the farm household where agricultural decisions are made. As a result, women, members of the household other than the male head, and many food production and utilization activities and institutions have been ignored or relegated to a minor position in research. Emphasis has been on field production

as opposed to pre- or post-production activities in which all household members play important roles. This perspective opens the way for research on hitherto neglected areas such as technology development in home gardens, small scale food enterprises in the home and the household as an important marketing unit (CIP, 1987).

(c) Research on the policy environment

This topic, with its sensitive ramifications, is one that an international center cannot enter into directly, particularly at the national level (see, however, De Walt 1987). Agricultural policy and its effects on traditional subsistence crops such as potatoes and sweet potatoes can be "like an 800 pound gorilla at a cocktail party that everyone pretends is not there." If national programs ignore policy implications, then technological improvements can fail or be misplaced. At the request of national programs, CIP economists, nutritionists, and anthropologists can provide relevant training or research backstopping. One area of particular interest is import policy, which in many countries is undermining a drive toward self-sufficiency, particularly roots and tubers. The experiences of Egypt, Peru and Kenya where there is heavy reliance on grain imports, has had negative effects on root and tuber production. In New Guinea, for example, the sweet potato) --historically a staple and even religious object-- is being neglected in many areas due to subsidized rice imports. In such circumstances attempting to promote or even improve root and tuber production could prove to be frustrating. While there may be little that international scientists can or should do about national policies, we need to be aware of their operation for allocation of our own resources and efforts. Promoting consumer stores, for example, in countries which have a long history of laws and regulations against holding potatoes for speculation can be self-defeating.

Numerous other examples of useful food systems research could be mentioned. The point to be stressed is that food systems research is meant to complement component research, and certainly is not meant to be competitive. The practical and economic payoff of such an approach will have to be measured, although some cost-benefit analysis of similar approaches at the World Bank has been undertaken (Cernea, 1987).

6. THE FUTURE

Our understanding of agriculture in developing countries is constantly improving and evolving. The important role of component production research is an established reality. CIP's research is organized around ten thrusts, nine of which are concerned primarily with the technical aspects of improving potato and sweet potato research in developing countries. I believe CIP (which is well known for its pioneering approaches) is to be congratulated for taking an additional step ahead by formalizing a "food systems research" Thrust X which, in part, takes up where component research leaves off and helps us understand specific phases in the complete food production-utilization cycle. The perspective also helps advance the important perspectives of other participants (e.g., consumers, middlemen, processors, managers) in the food chain. To a great degree, therefore, this perspective cross-cuts the other thrusts and is meant to be supportive of the technical goals of the center.

The food systems concept needs additional debate and refinement, and particularly further evidence of its practicality. Our understanding of the cyclical link between production, distribution, consumption, and biological utilization is still in its infancy. Like all new ideas, food systems needs to mature. This planning conference is the first opportunity we have had since the thrust was established in 1983 to discuss critically the food systems approach with outside observers. Although this planning conference has broader goals than just consideration of food systems research, I hope you can give some time to a critique which gives us strong direction.

NOTES

1. In addition to these developments, the United Nations University has funded a series of projects on food systems in developing countries. Cornell University Press has launched a new development series on Food Systems and Agrarian Change. Michigan State University has a special fellowship program for outstanding individuals from developing countries who are concerned with food systems issues.

2. Unfortunately, since I wrote this paper in the United States I have not had the opportunity to receive comments

from my CIP colleagues. Therefore, all errors and incorrect interpretations are mine.

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THE ROLE OF THE SOCIAL SCIENCES IN MEETING FARMER AND NATIONAL PROGRAM NEEDS

Primo Accatino

1. INTRODUCTION

In the last week of June, just before departing for a five-week-long trip, I was asked by D. Horton to make a presentation to this Social Science Planning Conference. I was hesitant to accept, partly because my time was already committed to travel and other tasks, but also and probably more important, I felt uneasy about writing and speaking on a subject which is not my discipline and where the human factor is the focal point. I also felt, however, that I was facing a challenge, as well as an opportunity to offer my thoughts and ideas on how the social sciences at CIP could further develop their contribution to major clients --such as researchers and policy makers in national programs-- and to the ultimate beneficiaries: consumers and limited-resource farmers in the developing world. Thus, I decided to accept the request to speak on "The Role of the Social Sciences in Meeting Farmer and National Program Needs".

An agronomist and a breeder by training, I have always approached my work with the understanding that farmers and consumers are the ultimate beneficiaries of agricultural research. This was, of course, a reason for problems with my activities as a potato scientist, and later as head of the National Potato Program in Chile in the 1960s. Work was conducted at the experimental stations where the challenge was to get highest yields with highest inputs. Any relationship with farmers was called "regional trials" and these were conducted on farms with enough land and supplies for the standard ten to 12 treatment plots of 20 m^2 with four replications. The farmers and we were very pleased with the high yields obtained. Occasionally, these farmers would adopt a new variety or technology that would raise production, allowing them to earn more money.

The success of technology transfer was attributed to the regional trials and to a twice-a-year farmer's day at the experimental station. Social scientists were non-existent, and we never considered them as possible members of our team. At that time, the agro-economists were concerned with farm management, agricultural policies, marketing and demand studies. We published the results of our work with farmers and were proud of our research and technology transfer program, which clearly showed the benefits of linear evaluation and transfer process "from research down to the farmers." It was clear in our minds that we knew the farmers' conditions, for which we designed the appropriate technology, evaluating it on their farms, and leaving it up to them to adapt it. Of course, business-like and educated farmers profited from these activities.

The resource-poor farmers, the small farmers and the subsistence farmers, however, did not profit from these efforts. The expectation was that they would catch up and adopt improved technologies and varieties following the lead of advanced, large-scale and resourceful farmers. As scientists of the national program familiar with this situation, we could do nothing about it due to lack of transportation (small farmers are always removed from main roads) and travel funds. Thus, we were balancing our frustrations of not reaching the ultimate beneficiary with the high yield results and compliments from the large-scale farmers and the Institute's management. The national program was releasing new varieties and generating new, high-yielding technologies that looked excellent in our publications and technical bulletins. This was a small, happy world of self-justification. Why bother, we asked? You are probably wondering what I am driving at; very simple: the majority of national programs in Latin America, Africa and Asia, are currently experiencing what I did in Chile.

Coming back to my story: In the mid-1960s, a maize improvement project was initiated in Chile with external funding and technical assistance. The major goals were the dissemination of hybrid maize and of agronomic practices for higher yields. I witnessed the development and success of this project, and in four years hybrid maize was found in the country's major production areas; there were even farmers with world yield records. The increase in national production and the farmers' high yields were key factors for the development of two large and important agri-businesses: the chicken and pork production industries. What were the major factors contributing to this success?

- Excellent high-yielding genetic material, appropriate agronomic practices and seed availability for the user.

- Dedicated agronomists, breeders and economists working as an interdisciplinary team with a workplan for adaptive research in farmer's fields.

- Transportation and operational funds for field supplies and manpower to fully meet the needs of the program.

- Credit from agricultural banks for farmers using the hybrid seed.

- Adequate market demand from the agri-businesses for hybrid maize. This demand mushroomed in a few months in response to the ample less-expensive source of food for chicken and pork, resulting in substantial increases for these two commodities in the consumer market. The greatest beneficiaries were low-income consumers who then had chicken and pork at prices that previously they could not afford.

Although this may all seem obvious, if we have:

- The necessary financial resources;

- A team of dedicated scientists and technical staff;

- An appropriate philosophy and methodology to work with farmers;

- Technology and genetic material that meet farmers conditions and needs;

- Credit for the farmers; and

- Markets for the product.

Then a successful program that meets the farmers' and national program needs is created. This, in my opinion, was the case in the hybrid maize project. There was one important problem, however: low-resource farmers and small and subsistence farmers were not included in this program, and consequently, the majority of farmers did not profit from agricultural development.

2. CIP SOCIAL SCIENCES MEETING FARMER AND NATIONAL PROGRAM NEEDS

What do these personal experiences have to do with the social sciences at CIP? I believe that at CIP we have been very fortunate to have the involvement of social scientists in the research program both at headquarters and in the regional program. Their major concern from the start has been the low-resource and subsistence farmers, whom comprise the majority of growers in the developing world and to whom CIP addresses its research and technology transfer activities. Their research results and contributions to development are well known, and have been published in CIP and international publications.

Social scientists at CIP have consistently approached their research from an interdisciplinary team approach, and through hard and sometimes misunderstood work they have been the key constructors of three major concepts guiding the generation and transfer of CIP technology to national programs and farmers:

- The farmer-back-to-farmer model, based on the philosophy that research must be farmer-oriented --beginning and ending with farmers.

- On-farm research, a flexible set of procedures and methodologies for testing and adapting technologies.

- The food-system approach, which places research within its broadest framework, from seed development to consumption.

These three concepts have evolved within the Social Sciences Department as part of its strategy to help low-resource farmers improve productivity and to provide national programs with methods and knowledge to better orient their resources and priorities for research and development. In accomplishing these tasks, the social scientists have carried out relevant research in:

- Identifying farmer and national program needs through:

  - Comprehensive country studies of potato production, marketing, and use;

  - Studies on consumption and nutrition; and

- Studies on production constraints.

- Social scientists have also carried out relevant research in the generation and diffusion of appropriate technology in areas such as:

  - On-farm research in production technology;
  - Post-harvest technology; and
  - Seed systems and varieties.

The methodology and knowledge generated by the Social Science Department has been rapidly adopted by CIP regional scientists, in collaboration with their national counterparts. Specifically, I should mention that on-farm research is now an integral part of collaborative research in most of the developing countries where CIP regional scientists are currently working. The farmer-back-to-farmer approach is successfully used by the SAPPRAD network in Southeast Asia for the introduction and development of the potato in warm mid- and low-elevation areas.

When analyzed in a comparative perspective we expect that the studies on marketing and demand, already proving to be beneficial in the case countries, will benefit other developing countries. In relation to this point I should also mention the expectations we have for the outcome of the marketing and demand studies that have begun in the five countries of the PRACIPA network.

My intention here has been mainly to highlight social sciences research that contributes to collaboration with national programs in research and technology transfer. If I go back to my introduction, where I mentioned my experiences, I could say that thanks to the involvement and team approach of social scientists, we are demonstrating that low-resource farmer needs can be met and national programs assisted in orienting their research and priorities to serve their large community of small farmers. These efforts are also demonstrating that development in food production can be achieved when the appropriate philosopy and methodology is implemented in an interdisciplinary approach. Thus, increases in productivity with low resource-farmers can take place without necessarily depending upon large amounts of external funding: increase in national food production is thus not only the domain of high-resource larger farmers.

There is still room for improvement with regard to social science involvement in CIP research. CIP's major comparative advantage in potato and sweet potato research

lies in the development of superior genetic material resistant and adaptable to the diverse environments of developing countries. From this material, national programs can select commercial varieties or parental material for their breeding programs. The involvement of the social scientists in breeding and evaluation of genetic material has so far been minimal. It has proved, however, to be very useful, for instance, in understanding the role of potato varieties in central African cropping systems. The knowledge gained needs to be used in CIP's breeding program so that the genetic material generated at CIP can meet farmers' needs within their cropping systems, and to determine its perspective in terms of food availability and marketing. The involvement of social scientists in assessing farmers' needs in terms of new potato cultivars and in the selection and evaluation of superior material is an interdisciplinary activity that needs urgent implementation. This is especially true when we refer to the African countries, and in the development of the potato in warm-climate cropping systems. In this respect, the activities of the social scientists should also involve the development of alternative seed systems, that is, the use of tuber seed vs. true potato seed.

Training, crucial to meeting national program needs, is an area that needs to be given higher priority by the social sciences. Although training in on-farm research was emphasized for a couple of years in the 1980s, there has been no formal training program to diffuse the philosophy, methodology and knowledge developed.

It is crucial for potato and sweet potato research and development in national programs that social science training be conducted, both through courses and individually as with other disciplines at CIP.

With the implementation of the social sciences project on potato and sweet potatoes in Asia, there will be close links with the national programs of Thailand, the Philippines, Sri Lanka, Papua New Guinea, and Indonesia. These countries already collaborate through the SAPPRAD network. A resident social scientist will coordinate the collaborative research between national programs and CIP. This project is considering a major effort in social science training and it is expected that national potato and sweet potato programs will, from then on, include interdisciplinary teams of biological and social scientists. This will be a major step in improving agricultural research and development in the region. I should add that CIP is also looking

for a social scientist in Indonesia to work closely with our regional physiologist; they will study the adaptation of the potato to warm climates and its role in cropping systems. Thus, it is timely to initiate studies on the role of the sweet potato in Indonesian agriculture and food systems. I envision a definite strengthening in Asia of the role of the social sciences in meeting farmer and national program needs.

I believe we have to move in a similar direction in Africa. The progress made by the social scientist based in Rwanda and Burundi from 1984-86 in understanding local agriculture and its technology provides very valuable information for true potato seed research and in breeding programs in terms of evaluating the role of the potato in existing cropping systems. Thus, to improve the technology generation and transfer process in East and Central Africa, it would be a priority to have a social scientist join the regional team currently formed by an agronomist, a breeder, a seed specialist and a post-harvest specialist. This interdisciplinary team could then approach the overall research needs of the national programs and farmers of the region. Another region where I believe a social scientist is needed is in West Africa, which will become operative in early 1988, with headquarters in Cameroon. Understanding the role of potato and sweet potato and the generation and transfer of appropriate technology for their improvement, needs the joint efforts of the biological and social scientists. Thus, we have an opportunity in our collaborative role in West Africa to start meeting national program and farmer needs from a social science perspective.

These regional social scientist positions in East and West Africa could be implemented through special project funding. For the last three years, a social scientist in CIP country special projects has been included where research and technology transfer consider the overall development of a priority activity such as seed production or the improvement of all aspects of production. Such projects are already under way in Peru and we expect to start in Indonesia and Bolivia in 1988.

I hope I have been able to give some insight into the role of the social sciences in meeting farmer and national program needs. I believe that its involvement and contribution is finally breaking down the barriers that have until now prevented low-resource small farmers and subsistence farmers from profiting from agricultural research and development.

CIP'S SOCIAL SCIENCE PROGRAM IN THE CONTEXT OF THE CGIAR: IS THERE A CIP MODEL?

Michael Collinson

1. INTRODUCTION

With a 25 year history of social science involvement, agricultural research establishments continue to suffer from indigestion. In many of the International Agricultural Research Centers (IARCs), interdisciplinary links with the social sciences remain tenous, and in most national systems working closely with the small farmer, the social sciences are still scrambling for a foothold.

Consultative Group (CG) policy has absorbed the evidence of low adoption of traditional research output among resource-poor farmers. The social and economic circumstances of the client, including the compromises on technical optima important for the operation of a multi-enterprise farm, dominate the choice of technology. Broadly speaking, CG policy on social sciences in the IARCs has three emphases:

- Adaptive research using a farming systems perspective (FSAR) is highly location-specific and is the responsibility of national research systems. IARCs are responsible for raising national awareness of FSAR and building FSAR capacity in national systems; by developing appropriate methodology, training material and by training.

- Social science tracks the impact of IARC technology, adapted and diffused by national systems and influenced by national policy frameworks, on CGIAR target groups: resource poor farmers and poor consumers. It ensures feedback of national priorities, identified through FSAR and policy research in the national system, into IARC program planning.

- Through policy research and advice, the International Food Policy Research Institute (IFPRI), the

International Service for National Agricultural Research (ISNAR) and IARC social cientists raise awareness of the policy role and institutional framework in mobilizing new technologies to improve agricultural productivity.

These emphases highlight the fact that IARC and national programs are complementary but distinct components of the same global research system. Similarly, the roles of the social sciences are complementary, but also different in the IARCs and national systems. The roles that the social sciences play, or should play in the national systems, must be the basis for IARC training programs to build national capacity. IARC interests should not distort national capacity building efforts if the global system as a whole is to function effectively.

There are gray areas in both technology development and policy. I will spell out my ideas on two of the most important:

(a) The organization of FSAR in national agricultural research systems

This area is under study by ISNAR, whose report is likely to compare commodity teams doing both traditional station research and FSAR, and regionally based specialist FSAR teams drawing technology from, and feeding researchable problems to specialist commodity teams. Below are five points in favor of regional-based FSAR teams:

- They solve the commodity/regional interface problem.
- They allow prioritization on the basis of farmer, not commodity problems, i.e., across commodities, maximizing adoption possibilities and guiding research managers into allocating resources to specialist commodity teams which reflects farmers' needs.
- They focus extension messages onto the parts of the local farming system of most interest to farmers -- the foundation of strong extension morale.
- They put farmers' resources to work at points in the system where they are most profitably employed.

- They allow FSAR capacity to be built up more easily. (Young social scientists are eaten alive by "old" technical specialists in established commodity teams).

Without dwelling on the commodity option, the image of six commodity/FSAR teams with experiments on the same small farm, each identifying exclusive and no doubt mutually incompatible solutions for the farmer, carries my prejudices to their extremes.

(b) National agricultural research systems and policy research

Experience tells me that national systems in Ministries of Agriculture or as parastatals, are policy takers and not policy makers. I believe, because of technology's central role in agricultural development, that this could change and that the best way for it to change is through a micro-policy perspective. Regionally-based FSAR teams, as part of the ex-ante evaluation of potential solutions to farmers problems will, as a matter or course, investigate the local policy environment. They create a grassroots information flow for regional and national decisions on changes needed to mobilize promising technologies. LDC agriculture has long suffered from policy making at the national level, distorting the local production environment. A grassroots information flow allows a balance of local farmers and national interests in policy decisions. The increasing political recognition that technological change in small farmer agriculture drives development, gives grassroots information reflecting local interests the opportunity to play a powerful role.

At the national level, umbrella policies for agricultural development necessarily provide a common denominator for parallel and coordinated programs in a whole set of executing agencies, including agricultural research. Such agencies are essentially national policy takers. To overly involve agricultural research social scientists at this national level ignores their comparative advantages in working closely with biological scientist. In addition, opportunity for them to contribute to a major breakthrough in policy formulation processes by providing a bottom up flow of local information to planners and decision makers is hereby passed up. Indicators of the repercussions to be

weighed in technology choice and policy formulation emanating from IFPRI and other institutes researching development, and ranging from price distortion to changing the balance of gender roles in farming, are way ahead of the game. Such adjustments require fine tuning and knowledge of local circumstances thus far rarely available to national technology development and policy making processes. A focus by IARC social scientists on micro-policy process within the FSAR context will help to eventually operationalize a wide range of developmental concerns. "How to do it" needs priority over "what needs doing" to get the development ship back onto a more even keel. At both technology and policy levels in general, much more attention is needed to the research process.

The two previous CIP planning conferences have brought a transparency to the history of the social sciences at CIP which recommends them as a device which could benefit other international centers. After a gestation period, CIP management learned to use social scientists to considerable effect. The Social Science Department contributes to the formulation of center priorities and strategy through market and consumer studies and comparative analyses of potato food systems. It then collaborates with technical scientists, within chosen thrust priorities, from farmer-back-to-farmer in technology transfer and adaptation. While I cannot let CIP get away with "farmer-back-to-farmer", "OPP" or "Food Systems Research" as original models, I feel the use of social scientists in the formulation and implementation of both research and geographical priorities is a CIP strength, reinforced by a practical, non-academic approach with many of the methods attractive to national systems. Its success is evidenced by the strong motivation among CIP social scientists and mutual respect between social and technical scientists at the center and in national systems.

I think a clear strategy has contributed to the success of the use of the social sciences at CIP, and has itself been helped by characteristics of potato production in LDCs.

- A new crop in many areas, potatoes are closely bounded by agro-climatic limits. Target groups are often self-identifying.

- Strong and identifiable consumer preferences allow a clear definition of desirable product character.

Clear definitions of production areas, product type and markets are not as obvious in many other commodities.

Within this CGIAR and Collinson context, I turn to some issues centered on the CIP social science program.

2. COMPARATIVE STUDIES

It seems that comparative studies of potato production would benefit from a more explicit strategy. Within the wider CIP objective of developing potatoes as an LDC crop, the study of the historical forces which have brought potatoes to the front in new growing areas could produce guidelines for identifying potential new areas for potatoes. My feeling is that subsistence producers under land pressure will increasingly turn to potatoes as a food crop; potatoes offer very high calories per hectare per month and the short growing season gives the small farmer the flexibility to manage human and climatic exigencies.

One comparative approach involves looking at areas at different points along a population density gradient which have in the past developed potatoes as a major crop. This could capture the historical sequence of changes in cropping patterns and in farmer potato management practices to accommodate an increasing population within each of these areas. It could help identify areas about to come under similar land pressures and evaluate the possibilities for similar patterns of change.

3. FEEDBACK TO BREEDERS

The question of social science input into breeding strategies was raised as a challenge at the last planning conference. Clearly, breeding strategies cannot cope with every foible exhibited by smallholders. One approach is to identify and incorporate generic characteristics important to lots of smallholders. Six important general characteristics can be identified as important for smallholder maize in eastern and southern Africa:

- Volume/value of green biomass and/or stover for livestock feed.

- Hardness in the kernel to reduce losses in maize stored at home for consumption.

- Plant architecture best suited for intercropping usually with low growing, leguminous plants.

- Varieties with a short growing season to give farmers flexibility in managing household grain supplies in the face of climatic and human contingencies. (Early plant, early harvest for early food, avoid threat of late season drought. Late plant, get a crop despite late start to rains or shortage of draft power).

- Varieties tolerant of a range of soil temperatures to reduce time of planting effect for farmers with low power resources.

- Because of wide differences in plant architecture, variety trials done over a range of densities show different varietal rankings. Ideally, varieties should be compared at their own optimal densities. (This last point is on method not substance but is important in a range of smallholder situations. Optimal densities range over 40-90,000 plants per ha depending on plant type and water stress).

Are similar generalizations across several locales feasible for potatoes? The wider the generalization possible the more practical the trait becomes as a target for the breeders.

4. POLICY WORK BY SOCIAL SCIENTISTS

The Technical Advisory Committee (TAC) has called for more policy research. The comparative advantage of social scientists in agricultural research remains their close links with biologists. A shift into macro-policy at the national level does not exploit this comparative advantage; rather, it threatens to reisolate social scientists in national systems. Three types of policy seem to me to exploit the social biological science link, giving IARCs their comparative advantage:

- Market studies to help technical research priority setting.

- Ex-ante and ex-post impact assessment in planning and evaluating technology development.

- Micro-policy work out of FSAR, bringing farmer- and technology-based information from local situations to allow better macro-policy decisions.

CIP is already quite involved in the first area as well as with ex-post impact assessments. I plead the case for stronger efforts on ex-ante impact assessment. An effective, uncluttered system based on ex-ante methodology needs to be sorted out for the sake of national systems and priority planning within the centers themselves. Ex-ante impact assessment should occupy an important niche in any farmer-back-to-farmer approach and the results need to be written up and disseminated. Having been based in Nairobi for some years, next door to CIP's Region III office, I noted a lag in the declared CIP policy of moving social science capacity out to the regions where it can be developed in the field with national programs. As I have elaborated earlier, micro-policy is an easy area to extend into from on farm research, indeed it grows naturally out of it. CIP documentation of FSAR in the Mantaro Valley, in the Philippines, in Rwanda and Burundi demonstrates that the micro-policy aspects are already very strong. I would urge that they be incorporated into an explicit strategy linking local specific technology development with planners and policy makers. I believe a bottom up information flow on the implications of local technology choice for policy decisions will be a valuable development for the LDCs.

5. NATIONAL RESEARCH SYSTEMS AND FSAR

My fourth and final comment is a critical one, based on the idea presented earlier that FSAR organized in regional teams with a farmer, not a commodity orientation, best meets the needs of national systems. It raises a set of questions on the aims and orientation of CIP's FSAR, farmer-back-to-farmer or OPP programs in the regions.

CIP's country programs are aimed at technology transfer and the build up of national research capacity. Lessons from the Mantaro Valley and elsewhere have encouraged CIP to transfer a technological principle and harness local means for its adaptation. Yet, is this not a top down orientation and if so, isn't 'we know what is good for you' being built into national capacity for adaptive research? Are CIP's country programs as a means for selling its products compatible with the need to build a national capacity with the

skills to choose which of CIP's products are useful for the country's farmers? I believe the orientation and organizational implications for FSAR are different for each of these objectives, which should be seen as alternatives. My feeling is that a sales ethic dominates CIP's country programs, and as a result, CIP may be building national skills and influencing national research organization in the wrong direction.

As hinted at earlier, commodity-centered FSAR has many shortcomings in exploiting the potential of a systems approach. I end these comments with two points amplifying the case for rethinking whether potato technology transfer is compatible with building national capacity in FSAR.

- Working alongside national scientists is an excellent training, but is very low geared and severely limits country coverage with a given staff complement. It is even more expensive if it moves very limited national capacity in the wrong direction.

- The best way to train national systems in appropriate FSAR is by a coordinated inter-center effort in each major region. Such an effort:

  - Spreads the load both in preparing unified training materials and in teaching more widely, and allows a more cost effective application of centers limited resources.

  - Reduces confusion caused in national systems when several centers are simultaneously involved in FSAR initiatives which differ in objective and therefore in approach and organization.

  - Allows the national system interests to orchestrate what is taught.

Does 'singleness of purpose' raise blinkers which inhibit CIP's participation in this kind of collaboration?

SESSION II. Identifying Client Needs and Opportunities Through Global Studies

ROOT CROP DATA BASE

Douglas Horton, Norma Puican, and Robert Rhoades

1. INTRODUCTION

CIP has a global mandate, and hence, a need for information on production and utilization of potatoes and sweet potatoes around the world. This paper outlines how we have attempted to meet this need through the establishment of a Root Crop Data Base (RCDB) with national level statistics, the present status of this work, and our plans for the future. Operating a statistical data base of this type is generally seen as a rather mundane, repetitive task, and is seldom considered to involve "research" in its own right. Nevertheless, as with CIP's germplasm bank, operating the RCDB has been a highly dynamic activity. As computers and information technology have improved, the scale and nature of the data base have changed dramaticlly over time. During the establishment and primary manipulation of the RCDB, several research hypotheses have been generated and tested. The data base has also been a valuable resource for other research projects, both at CIP and in other institutions. Other researchers have obtained access to an up-to-date, comprehensive set of national-level statistics on root crop production and use, and we have obtained valuable feedback on the quality, interpretation, and presentation of the data.

The RCDB is the foundation and principal resource of the Thrust X project, "Patterns and trends in root crop production and use," which has the following objectives:

- Establish a computerized bank of national-level statistics on production and use of cassava, cocoyams, potatoes, sweet potatoes, and yams. Data, provided by the FAO Basic Data Unit will be updated annually.

- Provide potato and sweet potato statistics at the request of CIP scientists and other interested parties.

- Provide feedback to FAO on alternative estimates on potato and sweet potato production and use.

- Prepare four CIP periodicals: Potato Atlas, Sweet Potato Atlas, Potato Statistics, and Sweet Potato Statistics. These will be modelled on the earlier Potato Atlas (1985) and World Potato Facts (1982). The first two periodicals will be issued every five years, the last two will be issued annually.

- Issue in collaboration with AVRDC, CIAT, IITA, and Winrock International a Root Crop Atlas (first edition 1988).

The intended clients of this research project are numerous: CIP scientists and management, who frequently need up-to-date estimates of potato and sweet potato production and use; national program researchers and decisions makers, who often want to compare and contrast their own situation with that of other countries; and a broad clientele of academics, researchers, donors, policy-makers, and private businesses who need occasional access to comprehensive, authoritative figures on root crop production and use.

2. METHODS

The methods used for assembling, maintaining and exploiting the RCDB have changed dramatically over time. When the senior author joined CIP in 1975, one of the first things he did was to obtain all the FAO Production Yearbooks available at the National Agrarian University and neighboring experimental station and have an assistant tabulate, by hand, production estimates for all countries between 1961-74. Later, we added some economic and demographic variables from a World Bank source and began to look at how total and per capita potato production were related to income level and how they were changing over time. This work culminated in the publication of the first Potato Atlas (CIP, 1978b). In terms of methodology, it is interesting to note that the first Atlas was based entirely on published information and was assembled entirely by hand. Due to problems in the print shop, it was typed from scratch three times before it was finally printed.

Since that time we have improved methods by employing more consistent, unpublished FAO data and by computerizing

data processing and text preparation. The 1985 edition of the Potato Atlas was produced and printed with an Apple IIe computer. A major stumbling block was that we still had to key in all the data manually from the FAO printouts and from World Bank publications.

In 1986 a major "breakthrough" was achieved when the FAO provided us with production, area and yield data on floppy diskettes, eliminating the extremely tedious process of data entry and checking. By performing all our work on IBM-AT computers, we now have access to a range of powerful, user-friendly software for data processing and text preparation.

3. RESULTS

A computerized data base has been established with the FAO Basic Data Unit's most current estimates for all countries of the world. The RCDB includes estimates of population, GNP per capita, index numbers of total agricultural production, and production, area, yield, exports, and imports of cassava, cocoyams, potatoes, sweet potatoes, yams, and other (non-specified) root crops for each year 1961-85. Food balance sheet estimates (sources and uses) for the same list of root crops are included for 1963 and 1984. Average farm-gate prices for the same crops are included for 1981.

The most tangible, direct outputs of the RCDB are the two editions of the Potato Atlas (CIP, 1978b; Horton and Fano, 1985), the Pocket Potato Atlas (CIP, 1978a), World Potato Facts (CIP, 1982), and the Root Crop Atlas (Horton, forthcoming). Figures presented in these publications or derived from the RCDB have been presented in a number of other publications (CIP, 1984; 1987; Horton 1987; Scott, 1987). They are also used in special project proposals and in program reviews.

In the mid-1970s, when this work began, people generally assumed that the income elasticity of demand for potatoes was low or negative and that economic growth in poor countries would cause a decline in per capita potato consumption. Our earliest work cast doubt on the validity of this assumption, since potato consumption was observed to increase rapidly in a number of developing countries --more rapidly than consumption of most other foods. Later analysis highlighted the influence of supply factors, prices and

changes in dietary patterns and potato consumption (Horton, 1987; Poats, 1983; Woolfe, 1987). As a result of this work, the scientific and policy-making community has gradually recognized that potatoes are rapidly becoming an important food crop in many developing countries and that the potato's importance is likely to increase in the future.

The RCDB is now providing useful background information for setting sweet potato R&D priorities. Nearly all sweet potatoes are produced and consumed in developing countries (Table 1). Since sweet potatoes are unimportant in most developed countries, there is a relatively small research base to build on. Utilization estimates are poor. It is generally believed that in most places sweet potatoes are consumed fresh. In China, however, most are processed or are fed to livestock. Since 1960, sweet potato production has fallen in the industrial nations (primarily Japan and the USA). Production has been rather erratic in most developing areas, except in Africa where it has increased rather steadily. Unfortunately, there has been little socioeconomic research on sweet potato production and use and on the causes behind the observed trends.

Table 1. World sweet potato production, area, yield, and production per capita for 1983-85 and percent change in these variables from 1961-63 to 1983-85

	Average 1983-85				Percent change 1961-63 to 1983-85			
Region	Area (000 ha)	Yields (t/ha)	Prdn (000 t)	Prdn/ capita (kg)	Area	Yield	Prdn	Prdn/ capita
World	7,998	14.3	114,185	24	-33	70	13	-25
Africa	1,094	5.6	6,100	11	69	5	78	-3
Asia	6,413	16.3	104,603	38	-41	89	-44	-51
Europe	10	11.1	108	0	-44	1	-44	-51
Oceania	116	4.8	560	23	35	12	52	3
North/Central America	213	6.8	1,442	4	11	-1	10	-23
South America	153	9.0	1,371	5	-32	-7	-37	-63
All developing countries	7,867	14.2	111,979	32	-32	76	20	-27
All developed countries	131	16.8	2,206	2	-70	-2	-70	-76

Source: CIP Root Crop Data Base. Based on unpublished estimates provided by FAO Basic Data Unit.

Careful studies are needed to determine the relative importance of three broad types of problems: production constraints, marketing problems and limited demand. For this reason, the work on national-level production and use statistics needs to be complemented with other sources of information, from the leaders of national sweet potato research programs, where they exist, and also from producers, market agents and consumers of sweet potatoes.

One final result of the RCDB is the improvement in the FAO's estimates of root crop production and use. Through interaction with regional and national scientists, we have obtained some country estimates of production and use that differ sharply from the FAO's. When this information has been provided to the FAO, the Basic Data Unit, has taken into account in future updates. In this sense, CIP is providing a communication link between FAO and national programs which gradually improves the quality of information in the FAO's Food Production Yearbooks and Food Balance Sheets.

4. PLANS

Now that a computerized data base has been established and its value recognized, certain things need to be done to streamline its operation and expand its use.

First, a formal arrangement needs to be established with the FAO so that we obtain needed information annually on diskettes that can be used directly on our IBM computers, eliminating the need for manual data entry and checking.

Second, responsibility for operating the RCDB should be delegated to a locally-hired professional whose formal training, interests and career goals coincide with the tasks that need to be done. This means a person with excellent statistical training, organizational skills and an interest in computerized data base systems. To date a senior scientist has supervised this project directly and the day-to-day work has been done by locally hired assistants with no previous computer experience and no career interest in this type of work.

Third, the annual Potato Statistics and Sweet Potato Statistics should be routine outputs of the RCDB under the responsibility of the same junior level staff member.

...

Fourth, the Atlases, published every five years, should be developed by one or more senior staff members in collaboration with the responsible junior staff member, and should contain analytical essays that highlight and interpret important patterns and trends in root crop production and use.

Fifth, more emphasis should be placed on systematically gathering local estimates of production and use, interpreting discrepancies between these and the FAO figures, and forwarding relevant information to the FAO. In this way we can improve their, and hence our own, data base.

Finally, with the maturing of the geographical mapping and constraints projects, to be reported on later in this session, we now have the opportunity to break down the national-level figures in the RCDB and to estimate the number of potatoes and sweet potatoes produced in different agro-ecological zones and farming systems. This is the greatest challenge and offers the greatest potential benefits for CIP and national programs.

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THE REFERENCE FILE METHOD: AN ECLECTIC APPROACH FOR IMPROVING AGRO-ECOLOGICAL AND CROP DATA OF DEVELOPING COUNTRIES

Robert Rhoades

1. INTRODUCTION

Virtually everyone who uses agricultural statistics on tropical developing countries in the tropics agrees that they are woefully inadequate for dealing with important policy and planning decisions. Beyond the feeling of "inadequacy," however, there seems to be little room for agreement on the severity of the problem or what can be done to improve the state of the arts. Development specialists who rely heavily on national and international statistics collected (or estimated) by international bodies, such as the FAO, tend to be apologists for the data, arguing "it is the best we have." Others, particularly those who work intimately at the local level, are more skeptical and openly critical of the "apologists" and even go as far as to argue "no data is better than false data," for it might force us into false decisions that can have harmful consequences for the Third World poor (Hill, 1984). To compound matters, neither the critics nor the apologists seem to have many solutions for improving agricultural data so that they accurately reflect on the ground conditions. Apologists do little more than argue that proper statistical analysis using computers can help overcome biases while critics likewise argue there is no substitute for closer attention at the moment of data collection. Accomplishing either of these at the national or local level, however, is immensely difficult.

Innovations in space and satellite technology may within a decade revolutionize the ability of man to access the agricultural production and productivity of the earth. Already various forms of remote sensing, satellite imagery, and Landsat and Spot (the recently launched French satellite with a resolution of 10 m) can pick up many crop distributions and herd counts with details at the local level which we never dreamed were possible before. These techniques combined with aerial photography are giving agricultural scientists new tools with which to cross-check any estimates provided by surveys at the local level. In fact, within a

few years, instead of deriving estimates from national governments, those agencies controlling satellites will be informing national governments what their hectare or livestock counts are. It is no exaggeration to state that we are on the frontiers of a knowledge revolution about the actual agricultural production of the earth.

Despite this tremendous potential, however, a few problems still have to be worked out. Unfortunately, complex ecologies, intercropping, mixed cropping, cloud cover, etc., still prevent us from a clear understanding of the ground-level situation. Also, while these space technologies may give us accurate information on distribution and incidence of many crops, it cannot tell us much about the socio-economics or specific constraints surrounding the crops.

The purpose of this paper is to suggest an approach which complements both the traditional approaches and the space technologies. The method proposed in this paper is called the Reference File Method and is meant to pull together a number of low cost techniques which can give us a very accurate understanding of many topics of Third World agriculture. I will use the potato as an example and the development of the International Potato Reference Files to show how this new approach is viable and cost effective. To develop my argument, I will (1) discuss the background to this method, (2) show how it has been applied to the potato, (3) show how the data has been collected and computerized and related to base maps; and (4) illustrate the uses of such data. Although the method is not new, and is very simple and low cost it has never been used by agricultural development agencies.

2. BACKGROUND TO THE REFERENCE FILE METHOD

Potatoes and sweet potatoes are good examples to illustrate problems with both the traditional approaches and the space technologies. Unlike the grains, the roots and tubers are not grown in large homogenous fields on flat lands, but in mountainous areas or mixed cropped and therefore more difficult to capture in images from the air. The roots and tubers do not enter into international trade and are less likely to be reflected in national production statistics. Horton (1986:456) notes: "Production and yield estimates for roots and tubers, vegetables, and other crops which are grown in remote areas and consumed on the farm or traded

locally tend to be poorer than estimates for cereals, oilseeds, sugar, and other crops which are traded on international markets." One solution to this problem is to develop an eclectic approach wherein international level information (such as that developed by the FAO or from satellites) is combined with information properly collected at the local level. It is through checks and cross-checks at various levels that we will be able to gain a semblance of truth about crop patterns in the tropical, developing world. A major barrier, however, is how do we get proper information at the national and regional level? Polly Hill, a British social anthropologist, has some caustic words on the use and abuse of local statistics:

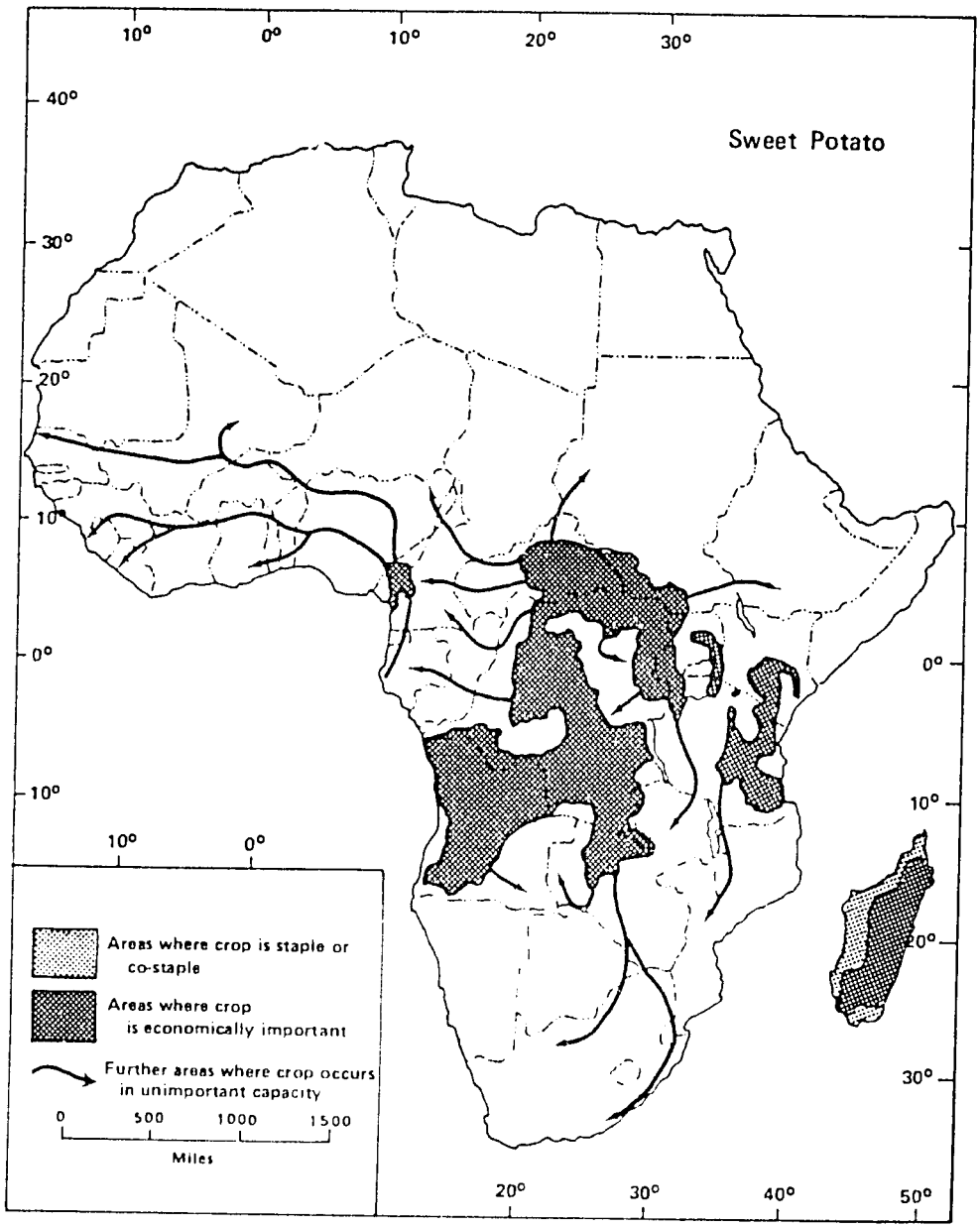
> "As we all know (and as well all always forget), the quality of the final presentation mainly depends on the reliability of the statistical material obtained from respondents in the field, not on the methods of processing it. I refer to this basic information as material, not as data, as I am sure that the widespread use of the misleading word datum, itself partly accounts for the falsity of prevailing ideologies, suggesting, as it does that the basic statistics are a kind of pure substance with an inherent (given) validity.... whereas the fact of the matter is that in tropical conditions it can only be "extracted" by resorting to many convolutions, blandishments and deceits, including guesswork...At later states the material emanating from the field is commonly fudged, cooked and manipulated by various people at higher levels, the main purpose being to ensure that the trends will be found convincing by those at still higher levels."
>
> (Hill, 1984:492)

Hill then goes on to offer suggestions: (1) we should continually be cautious about statistics, even those collected from surveys in villages; (2) the FAO should be more explicit about how they make "estimates;" (3) produce fewer statistics with higher quality; (4) special grades of statisticians should be created emphasizing exactly how the information is obtained at ground level and; (5) surveys need to recognize diversity of agrarian systems and farmer's classifications. Unfortunately, by the time that Hill's recommendations are accepted (if ever), years of important decision making will have already passed. Without demeaning her positive suggestions, we need to look for more immediate options. I am suggesting in this paper that the Reference

File Method is one such approach with immediate applicability.

The Reference File Method has its origins in the Human Area Relations Files (and the World Ethnographic Atlas) developed at Yale University in the 1950s and '60s by anthropologist George Peter Murdock. Murdock's aim in establishing his Human Area Relations Files was to classify the world's human societies and to systematically organize specific information about technology, social patterns, economics, language, and food production, among other categories. Murdock generated an enormous amount of systematic information, especially on agriculture in tropical countries. He soon fell from grace in academic anthropology, however, since no one could find a use for the data, and Murdock himself did not utilize it to generate new anthropological theory. A story is told wherein the Yale faculty comes to see Murdock off at the airport after his retirement. As he climbed the steps to his airplane someone caustically yelled: "George, for God's sake don't forget to take those useless files with you."

Murdock was ahead of his times. For Africa alone --now a continent of great concern to agricultural scientists-- he collected detailed data on the incidence and distribution of cultivated plants from over 2,000 ethnographic sources. The best information was on subsistence crops, such as the roots and tubers (Murdock, 1960). From these data, Murdock developed original maps for crops such as banana, date palm, finger millet and even sweet potato. Eleven of these maps were published in The Geographical Review (October, 1960), among which was a sweet potato map. In the conclusion to this paper, Murdock argues that a wealth of information exists in published and unpublished reports of anthropologists and other agricultural fieldworkers who had the advantage of working locally and who were therefore knowledgeable of local conditions. He also recognized that government statistics are a completely independent source of information on the same facts, capable of being mapped in a similar fashion. Murdock (1960:540) concludes "Would the comparison of maps from these two sources show a degree of correspondence reassuring to the practitioners of the several disciplines concerned, or would it reveal discrepancies of such an order as to raise fundamental problems in their reconciliation"?



Map developed by George Peter Murdock using an early anthropological reference file method, 1960.

3. THE INTERNATIONAL POTATO REFERENCE FILES: A NEW APPLICATION OF MURDOCK'S METHOD

When I came to work for CIP in 1979, I was struck by the paucity of crop distribution maps for the potato in developing countries and the lack of systematic information on a country-by-country basis. The outreach program had made admirable steps with their country profiles --two page reports that gave basic statistics and, in particular, information on potato programs and contact persons for some of the countries where contact had been made by the regional staff. Douglas Horton had already published his first issue of the Potato Atlas based on FAO statistics. It seemed to me at the time that the use of Murdock's method would be the next logical step in fleshing out the details needed at the local and national levels. As a result, the following first steps were taken: (1) an international country file was established; (2) materials in the CIP library and other Lima sources were carefully examined and only directly relevant potato materials were collected; (3) a search was made at the University of Arizona library in the United States for additional material; (4) interviews were conducted with visiting potato scientists at CIP and in the regions; and (5) information gained from country reports presented at CIP courses and especially the international potato course in the Netherlands were incorporated. As this information was processed, it was then condensed into specific country reports according to the following categories:

- History and Production Trends
- Zones of Production and Climate
- Production
  - seasons
  - seed sources
  - varieties
  - land preparation
  - planting
  - cultivation
  - fertilization
  - irrigation
  - socioeconomics
  - other aspects
- Post-Production
  - harvesting
  - storage/processing
  - distribution
  - preparation and consumption
- Disease and Pest Problems

- Program Development
- Additional Information

An estimated 3,000 documents have been reviewed and information from over 2,000 documents has been placed in the country files of 123 countries. Care has been taken to practice economy and streamlining in accepting the information that finally makes it into the country files and ultimately into the reference books, representing a point in time of a constantly evolving product. Only "facts" are included, not recommendations. Also, initial contradictions in information are included and resolved with additional information. Information coming from individuals with long-term experience near potato production zones was looked upon as an excellent source.

4. MAPPING BASED ON THE REFERENCE FILES

The next major step is to produce useful production maps from the data in the files. This has proven to be an enormous and difficult task, but not an insurmountable one. During the past year, I have been building the reference file books and attempting to map the potato production zones country-by-country along with other overlays such as agro-ecological zones, topography, climate, etc., country-by-country.

Development of the maps has involved a number of decisions and forms of research that often seemed to lie beyond my expertise as an anthropologist. We had several problems of mapping scale and projections, developing proper coordinate systems, changing national and provincial borders, gaps in information, and uncertainties about precise locations. It also became evident that the mapping of 130 countries, the separate regions and continents, and the world would be extremely expensive. I decided that computerized mapping would, in the long term, be the only economic route for CIP or national programs.

Computerized thematic mapping is a new and developing technology that still contains many "bugs." In 1986, for example, I visited three top universities in the United States to find the best facilities for my sabbatical. Only one of those universities had committed itself to using cartographic mapping that could relate to a VAX. Once at

that university, however, I found that the cartography was being done on Hewlett Packard and that the software we planned to use would be costly as well as incompatible with the Social Science Department's IBM. Fortunately, three months after my sabbatical began, an IBM compatible thematic mapping software was released. This software continues to change and has many problems, but it is relatively inexpensive and suits our needs.

With this software in hand we are able to generate digitized base maps, further digitize them to our needs, and create any number of overlays. The maps are organized by latitude and longitude (or other coordinate systems). For each production zone in a country, dot maps can be produced automatically by the program when hectarage and tons are added. There are many other uses: if latitude and longitude are known, distribution of germplasm or location of trials can be plotted. Soils, precipitation, temperature regimes, and even disease patterns can be mapped. Of course, as I have learned the hard way, all of this is easier said than done. Once the problems of this new technology are overcome, however, it will give us a powerful, fast, and relatively inexpensive information tool.

5. USES OF THE REFERENCE FILE METHOD AND THE MAPPING PROJECT

(a) Method applicable to other crops and mandates

The International Potato Files will constitute the most complete information organized country-by-country, of any major food crop. It can tell us country-by-country who grows the crops, in what regions, how they are grown, what the problems are and where they lie, and what other regions have similar climate and geography.

The method can be applied to any crop or livestock enterprise at the international or national level. Not only could the International Rice Research Institute (IRRI) have such a file on rice, for example, but Thailand (at low cost) could have a similar file for rice at the national level. A newly established center such as the International Centre for Integrated Mountain Development (ICIMOD) in Nepal could, for example, establish the International Mountain Reference Files organized around countries or ranges. A similar file has already been started at CIP for sweet potato. The data

in such files could be constantly checked against the FAO and other production estimates and therefore are a complement to the root and tuber research headed by Horton. Even if the method is not yet ready for national programs, every international center could easily have such files on its mandated crops or agro-climatic zones. Specialized files, such as those established for potato marketing or seed programs, is another use of the reference method.

(b) Wider uses of base maps

The base maps on political boundaries, major topographical features, cities and provinces which we are digitazing can be used by any of the other centers or by national programs. All they will need to do is add information on their crop and any special information required.

(c) Suited to agro-ecological zoning needs

The mapping work and the data base fit well with one of the objectives of agroecological zoning work recently defined at a CGIAR meeting in Rome (Report on Inter-Center Workshop Agricultural environments: Characterization, Classification and Mapping, 1986). Agroecological information is used in the Centers to devise or define the conditions of locations in which they propose to conduct research, and in which the products of research are intended to be used; to interpret or explain variations in yield (seen often as interactions between genotypes and environments), particularly in their work in international trials and nurseries; to identify areas to which their products might be extrapolated; to define the environments in which accessions of genetic resources are found, and to explain parts of the reasons why research products are sometimes less acceptable to producers than the centers hope. The reference files and thematic mapping program will also fit the requirements proposed for management of databases of geographical information:

- Contain latitude and longitude (also altitude)
- Relational capabilites
- Be easily updated
- Be user friendly

- Be efficient in cost and user's time
- Include internal documentation of variables and data

(d) Serve as a baseline for future reference

Details in both the reference files and the maps will provide us with a benchmark with which to measure future developments. It can show us in what areas the crop is expanding or diminishing and what kind of progress is being made.

(e) Compatible with future space-satellite technologies

The reference file and particularly the digitized maps will invaluable for matching with Landsat, Spot or satellite imagery. It should soon be possible to match the satellite images and impose them on the digitized maps and get an accurate reading of cropping incidence. There will surely be major problems in defining political boundaries on the satellite images, but through various methods of scaling this should be resolvable.

(f) Use by national programs

Although the research technology discussed in this paper may at first glance seem high powered and beyond national programs, I do not think we are many years away from seeing even the poorest countries able to establish such reference files and mapping projects. All that is needed is an IBM XT (or other low cost brand and software package) and a graphics printer. Within two years, I expect all countries and regions to be fully digitized with a number of useful overlays. These files can be made available to national programs at low cost.

In conclusion, I believe that this final point --use by national programs-- may be the area with the highest payoffs. Instead of being dependent on expatriate agencies for information, they will be able to map their own environments, target their research, and build valuable data bases for planning and policy ends. It will also mean that the data will be collected and analyzed locally and will therefore be closer to reality.

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CONSTRAINTS TO PRODUCTION AND UTILIZATION OF POTATOES AND SWEET POTATOES

Douglas Horton, Wanda Collins, Masaru Iwanaga
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1. INTRODUCTION

From the outset, the International Potato Center (CIP), has maintained close links with potato researchers in developing countries through the regional programs, and national program leaders have participated in program planning and review. Early guidelines for CIP's research were drawn from an international symposium "Prospects for the Potato in the Developing World" (French, 1972). Since then, 31 planning conferences have been held to review progress and establish guidelines for future work in specific areas. Until recently, however there has been no systematic data gathering and analysis of constraints to production and use of potatoes and sweet potatoes.

The need for more systematic information on constraints is mentioned at several points in the report of CIP's second External Review (CGIAR, 1984). In relation to the social sciences, the External Review recommended that CIP promote mechanisms to enhance the integration of social science research with other disciplines; particularly, "to define production and consumption constraints to help guide biological research." (p. 41). In its commentary on the review, the Technical Advisory Committee commented:

> "At several places in the quinquennial review report, the panel recommends that CIP should obtain more systematic information on disease and pest incidence and crop losses in order to determine the balance in its research efforts. However, TAC is of the view that CIP's current strategy of using assessments from three sources --its regional staff in collaboration with national scientists, its planning conferences and senior consultants-- is adequate and appropriate at this

stage, but may need strengthening in the future." (p.xi)

In 1986, a project was initiated in Thrust X to gather information from knowledgeable individuals throughout the developing world on constraints to production and use of potatoes and sweet potatoes. The objectives are to:

- Obtain systematic information on constraints to production and use of potatoes and sweet potatoes in the major production zones of each country.

- Analyze this information so as to identify the principal types of production zones, socioeconomic environments, and the associated constraints to production and use.

The potential users of the project's results include: CIP scientists and managers who need to know the distribution and severity of constraints in different areas; national program leaders who can use the results in their own decision making and can benefit from comparisons with other countries; and donors who need to know the relative importance of different problems in order to set priorities for international agricultural R&D programs.

2. METHODS

On the basis of a review of literature and discussions with CIP scientists, two questionnaires were prepared in late 1986: one for potatoes, the other for sweet potatoes. Originally the two questionnaires were quite different, reflecting the ideas proposed by different scientists. Later, it was realized that the same major types of constraints were valid for both crops, and a conscious attempt was made to standardize the two questionnaire forms. In this way, we combined the best ideas from each and laid the groundwork for comparative analysis of results.

The questionnaires were tested by regional staff members during CIP's Annual Meeting, December 1986. This exercise provided useful feedback on questions and the weighing scale and generated preliminary data on constraints to production and use of potatoes in 60 countries and sweet potatoes in 25 countries.

On the basis of this feedback and of further discussion with CIP scientists, we expanded and refined the questionnaires, translated them into Spanish and French, and mailed them to knowledgeable individuals in developing countries. To date, 73 questionnaires on potatoes and 35 on sweet potatoes have been mailed out. Responses for 19 potato questionnaires and for 14 sweet potato questionnaires have been received.

The questionnaires have three sections:

- Introduction. This brief section requests information on the respondent's discipline or specialization and his or her best estimate of the country's total area and production of potatoes (sweet potatoes).

- Major production regions. This sections requests information on the characteristics of up to four production regions, including name, location, approximate elevation, market prices for seed and consumer potatoes (sweet potatoes), planting and harvest dates, estimated production, area, yield, use of irrigation, and use of the harvest.

- Evaluation of constraints. The third and most lengthy section requests information on constraints in three major phases of the production use cycle: pre-planting, field production, and post-harvest.

The constraints section of the potato questionnaire has 71 questions that examine potential constraints related to varieties, planting material, viruses, nematodes, insects and mites, environmental problems, seed storage, storage of consumer potatoes, marketing, and demand.

The constraints section of the sweet potato questionnaire contains only 46 questions. This may reflect that sweet potatoes are subject to fewer constraints or that scientists have identified fewer. Our working hypothesis is that the latter is closer to the truth than the former.

For each of the questions on constraints, respondents are asked to use the following scale:

0 = The constraint is not important
1 = It is present, but is of little practical importance
2 = It is a somewhat important constraint

3 = It is a very important constraint
Blank = The answer is not known

We are just now beginning to process the survey returns. As they come in, we are entering results on Lotus worksheets on an IBM AT computer. We plan to keep a running tab of the mean scores and standard deviations for individual questions, as well as for the 12 major problem areas under which they are grouped. Later, as the number of responses increases from different parts of the world, we plan to analyze results by type of production zone and farm type.

3. RESULTS

Since the questionnaires have recently been mailed out, only a few preliminary results can be presented at this time, using sweet potatoes as an example. Simplified versions of the sweet potato questionnaire were filled out by participants of the First Planning Conference on Exploration, Maintenance and Utilization of Sweet Potato Genetic Resources, held in Lima in February 1987 and by participants of the International Sweet Potato Workshop-Symposium held in the Philippines in May 1987. A complete version was filled out in June by participants of a Latin American workshop on sweet potatoes held in Lima.

Two problems areas were commonly identified: insects (particularly weevil) and marketing problems. Interestingly, these two areas, particularly marketing, are receiving very little research attention in the countries concerned. In several cases, participants requested CIP's assistance to conduct farm-level studies of constraints to production and utilization of sweet potatoes, with special emphasis on marketing.

4. PLANS

In the remainder of 1987 and in 1988 survey follow-up will continue, to ensure as large and representative a data base as possible. As completed returns arrive and are processed, an attempt will be made to fill important gaps in

the information through follow-up correspondence from different geographical regions, work will begin to identify major agro-ecological zones and farm types. Write up of survey results will be in late 1988 and 1989.

Field studies in representative areas are essential to complement the global mail-out surveys, which are in a sense opinion polls of informed individuals. Farm-, market-, and consumer-level surveys should begin in 1988 and continue throughout the planning period. Their main purpose would be to incorporate users' perspectives into the research process at an early stage. The surveys should be carried out by national researchers with backstopping from CIP. Ideally this work would be coordinated by a CIP team composed of an agronomist and a social scientist, both with substantial field experience. This team would face three major challenges: to design an adequate inter-disciplinary framework for assessing constraints to production and use from the user's perspective, to identify field methods that are appropriate for each country's situation and provide the essential data for comparative analysis, and to make suitable arrangements for local researchers to take part in the needed studies. Assembling the needed team and providing adequate support for the in-country work will require special project funding.

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POTATO MARKETING AND DEMAND IN DEVELOPING COUNTRIES

Gregory Scott

1. INTRODUCTION

The last quarter century has witnessed a spectacular increase in potato production in many developing countries (Horton, 1981). This trend, accompanied by the increased capacity for the development and diffusion of improved production technology, raises a key question: if developing countries produce more potatoes, where will these potatoes be marketed? The purpose of this paper is to present some common implications of the research on potato marketing and demand carried out by the International Potato Center (CIP) in collaboration with national potato programs in Latin America, Africa, South Asia and the Far East during the last six years. The paper first briefly describes the origins of marketing research at CIP, the objectives of these studies and the methods employed. It then reviews the salient findings to date as well as the implications for national programs and for CIP.[1] Future plans are also outlined before emphasizing in the conclusion that marketing and demand issues have become an area of growing importance for potato and sweet potato development.

2. THE ORIGINS OF MARKETING AND DEMAND RESEARCH AT CIP

"It is unwise to launch a potato production program unless we simultaneously conduct marketing research and develop market solutions for any production increases".

The International Potato Center: First Regional Workshop on Potato Seed Production and marketing 24-31 October, 1976, Nairobi.

CIP has long recognized the importance of marketing issues to the future of the potato in developing countries. Thus, in late 1978, an in-depth analysis of the marketing system in the Mantaro Valley was initiated (Scott, 1981) in response to a recommendation of the first Social Science Planning Conference (SSPC/CIP, 1977: 12). Research on marketing was undertaken in Chile (Fu, 1979: 81-92), Ecuador (Valderrama and Luzuriaga, 1980: 95-99) and Kenya (Durr and Lorenzl, 1980: 85-113), as part of larger studies of potato production and utilization. However, as requests from national potato programs for assistance in the field of marketing continued to be received, the Center initiated in July, 1981 a research project devoted to this particular area.[2] The research objectives of this project are as follows:

- Identify types of marketing and demand patterns for potatoes in developing countries;
- Analyze how potato marketing and demand may affect or be affected by the adoption of new production and post-harvest technology; and
- Document and analyze potato marketing programs, projects and policies in a comparative perspective.

In order to achieve these objectives, the Department initiated: (1) a series of case studies on potato marketing and demand; (2) a continuous search for available literature; and (3) an on-going program of support for researchers in developing countries working in this field. The remainder of this paper is devoted to reporting the findings of the case studies and literature search; support for researchers is discussed elsewhere (Scott, 1987c).

3. MARKETING CASE STUDIES: METHODS, FINDINGS AND IMPLICATIONS

(a) Methods

Since the last Social Science Planning Conference, case studies on potato marketing and demand have been carried out in Bhutan, Peru, Thailand, Burundi-Rwanda-Zaire, Bangladesh, and Madagascar (Scott, 1983, 1985, 1986, 1987a, 1987b, and Rasolo et al., 1987). The broad geographic distribution, variations in the importance of potato production (Table 1)

and the diverse topics examined in these studies (Table 2) comprised one part of the overall methodology intended to generate findings that would be of widespread usefulness.

Table 1. Potato production and population in selected countries

Country	Production 1983/85 (000 t)	Population (millions)	% rural
Bhutan	26.7	1	96
Peru	1,417.7	18	32
Burundi	36.7	5	98
Rwanda	272.3	6	95
Zaire	40.3	30	61
Thailand	8.0	50	82
Bangladesh	1,116.7	98	82
Madagascar	260.3	10	79

Source: Production: FAO Production Yearbook 1985; Population: World Development Report 1986.

Table 2. Potato marketing case studies

Country	Key issue
Bhutan	Seed and table potato marketing
Peru	Consumption and demand in Lima
Burundi, Rwanda, Zaire	Producer-consumer price differentials
Thailand	Markets for Thai potatoes
Bangladesh	Seasonal price/supply problem
Madagascar	Feasibility industrial processing

Source: Scott 1983, 1985, 1987a, 1987b; Rasolo *et al.*, 1987.

These studies also employed a common analytical framework. Each study analyzes potato marketing and demand in the context of the existing food system for that commodity (Table 3). In other words, potato marketing and demand is considered first in terms of the given country's overall development goals. The studies thereby highlight the importance of policy objectives and the potential of potatoes to help achieve these goals. Subsequent analysis of potato production and consumption sets the stage for an analysis of potato marketing itself.

By including production and consumption, these studies acknowledge that potato marketing is as much a product of these activities as it is an influence upon them. The interdependence of sets of activities within the system is therefore emphasized. At the same time, by reviewing all aspects of the potato trade, a comprehensive analysis of available information on potato marketing is presented, policy recommendations put forward and an agenda for future research outlined.

An in-depth search of the literature and a review of available secondary data were standard procedures for each of the studies. These practices were adopted as much to obtain information as to identify institutions that could provide such data to future researchers. Data gathering techniques also included: informal interviews with policy makers, administrators and potato marketing participants; and, participant observation of all phases of the food system, but with proportionally more time devoted to marketing. Considerable time was also spent talking with biological scientists, both in the country itself and at CIP-Lima, about potatoes and potato marketing. This exchange of ideas was particularly useful both to appreciate their perspectives on the problem and address their concerns in the final reports.

Data analysis for these studies consisted essentially of basic, descriptive statistics. Time, resources and available information preempted the use of more elaborate procedures. It is envisioned, however, that future quantitative research might use the data sets collected for these studies.[3]

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Source: Scott 1987a.

(b) Findings

Although the process of comparative analysis of the various case studies has really just begun, the following observations have emerged thus far.

(i) Marketing research scarce

Relatively few studies of potato marketing exist in most developing countries. Instead, research on commodity marketing has focused on export crops or on food imports. Alternatively, prices, margins and the internal distribution of cereal crops has also received attention. Potato research has tended to focus mainly on agronomy, physiology, and pathology; or, in the case of socio-economics, on aspects related to production. Marketing has received less attention partly because only minor quantities of potatoes are imported or exported in most countries. In addition, potatoes generally have not been the subject of government-sponsored schemes to support prices, control trade, etc., as often has been the case with cereal crops.

A corollary to this finding is that existing studies are to be found in the so-called "gray literature." In other words, results of potato marketing research are in publications that receive limited distribution, particularly at the international level. As a result, research on potato marketing has been further discouraged by the absence of a readily available body of knowledge on the topic.

The important consequences of this particular result are: (1) national potato programs frequently have limited information about marketing problems; (2) priority areas for marketing improvements are not always clear; and (3) the probable impact of government interventions are not readily apparent.

(ii) Many markets for potatoes

Given the adaptability of the potato to diverse growing conditions, its attractiveness to different types of producers (semi-subsistence, commercial, household gardens) and its flexibility in terms of final use (seed, table, processed), a variety of markets exist for this food commodity in the developing world (see, e.g., Fletschner, 1971: 88; Scott, 1983: 31). Thus, rather than the simplistic distinction between seed and table potato marketing, there are

numerous markets for table potatoes (fresh, stored, export/local), seed potatoes (imported, basic, certified, ordinary) and processed potato products (traditional, simple, industrial). Hence, for example, what one might consider to be a fairly straightforward problem: marketing channels for potatoes in Rwanda, really involves a complicated set of physical flows and a diverse group of marketing participants (Figure 1).

Nearly all potato marketing research has focused on issues related to the domestic market for table potatoes.[4] Research on seed potato marketing --particularly the distribution of locally multiplied, improved quality seed-- is limited, and that on processed potato products more meager still. Moreover, rather than strictly potato marketing studies, information about potato marketing is included in studies on production or consumption. The distribution of results by topic is also highly uneven across countries, e.g., some countries have more findings on marketing channels and participants, others on prices and margins.

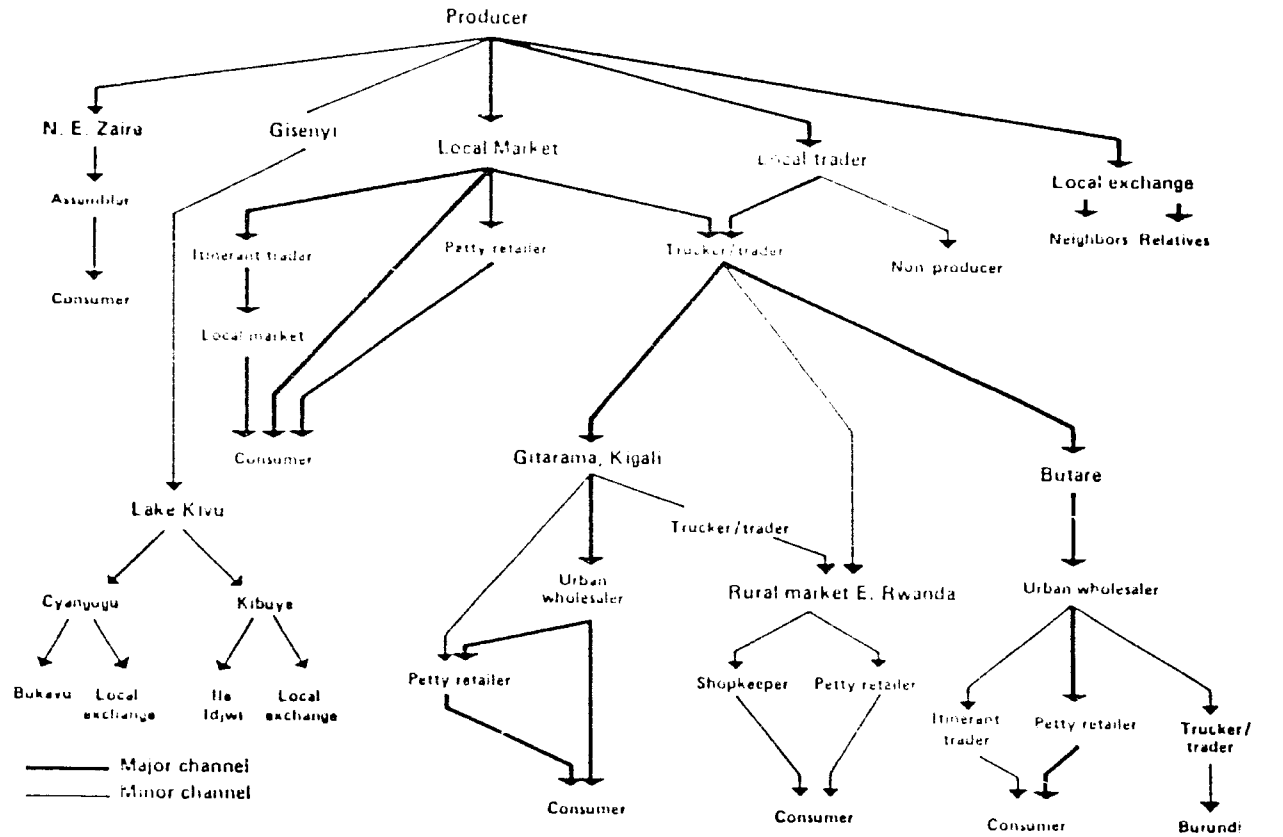
(iii) Small vs. large producers differ

The most fundamental characteristic of potato marketing at the farm-level is the distinction between the marketing patterns and practices of small vs. large growers.[5] The vast majority of all potato producers world-wide are small farmers. These growers typically produce a large percentage of their potatoes for on-farm consumption. They nevertheless depend on potato sales as a important source of cash income. These growers sell potatoes in small lots of 500 kg or less per sale, in local fairs and markets either to rural assemblers or directly to consumers.

Large growers participate in potato marketing in quite a different fashion. They typically sell most, if not nearly all, of the potatoes that they produce. They tend to sell their potatoes right out of the field to urban buyers or directly to major wholesale markets. They sell in much larger quantities per sale, from several hundred kilos to several tons, and given their more prolonged presence in the market, are frequently better informed about current developments through their well-established commercial contacts.

Two important implications of this small farmer-large farmer dichotomy are as follows. Firstly, policy makers -- particularly in sub-Saharan Africa -- tend to overlook the importance of potatoes as a subsistence crop to help meet

Figure 1. Rwanda: Principal marketing channels for potatoes.



Source: Scott 1986.

the rural demand for food. Since some potatoes are sold, it is often inferred that potatoes are primarily a cash crop that require the necessary emphasis on marketing to better serve grower clients. Secondly, there is little consideration of appropriate marketing initiatives by type of farmer. Rather, there is a tendency to assume that all growers would benefit equally by the same measures, for example, to increase competition in urban markets or to purchase potatoes at designated, rural collection points.

(iv) Post-production vs. post-harvest technology

There has been a tendency in developing countries to equate marketing technology with post-harvest technology and this in turn with storage and processing. In fact, marketing involves an extended sequence of post-production operations --harvesting, grading, handling, transporting-- in addition to storage and processing. This observation raises two important points about the development and diffusion of marketing technology.

First, the gamut of post-production operations is sufficiently large and the ways in which they are integrated into the food system sufficiently varied that there is considerable work to be done to identify potentially transferable practices from one type of farmer to another. In other words, if the identification of producer practices and their transfer in the case of potato production (e.g., tissue culture in Vietnam) has proved useful, the same would appear to hold true for post-production practices as well, and perhaps even more so. Generally speaking they have been less studied.[6] As production increases and more and more potatoes are sold, the potential of endogenous innovation would appear to be considerable indeed.

Second, little "up-stream" research has been done at CIP on the potential returns to technological innovation at the different levels of the marketing chain or involving different types of post-production activities.[7]

(v) Costs and risks rarely appreciated

This perception partly reflects the lack of research on this topic (thus, there is little information on the essential functions that traders perform) and a confusion about basic marketing concepts.[8] Many marketing studies also use accounting procedures for economic analysis. In this sense,

they only take note of actual costs and make no provision for opportunity costs. As the vast majority of potato traders operate personal or family-operated businesses, opportunity costs (e.g., family labor, capital) form an important component of their costs. Furthermore, policy makers often view potato marketing from a strictly business point of view, i.e., they overlook the technical aspects of the trade, including such things as differences between varieties, and being able to distinguish good quality tubers vs. those that are disease-infested.

While there is a widespread appreciation of the risks assumed by potato producers' in developing countries, the same cannot be said with regard to the risks assumed by potato traders. These risks include those associated with changes in supply and demand conditions for a perishable commodity or those resulting from abrupt changes in government policy as affects prices for potatoes, marketing operations and foreign trade.

One consequence of this lack of appreciation for costs and risks has been the unsuccessful and costly direct public intervention in potato marketing (Scott 1983: 56-57; 1985: 36-37). Another has been the willingess to underwrite private ventures with public funds in spite of their dubious economic viability (Scott 1987b: 121).

(vi) Retail marketing margins the highest

A breakdown of marketing margins received by potato traders around the world found that retailers frequently receive the largest percentage share of the price paid by consumers: Peru 20% (Scott, 1985: 104-105), Burundi 29% (Scott, 1986: 37) and Thailand 40% (Scott, 1987a: 40-47). [3] These results reflect the small volumes and high risks associated with this type of trade, although the extent to which these margins represent high profits or costs remains unclear. In light of the proliferation of rural markets -- as agriculture becomes more commercially-oriented world-wide -- and the explosive growth of urban areas this particular activity would appear likely to become more important in the future.

Previous research has emphasized the importance of reducing the price of potatoes so as to make them more affordable to consumers in developing countries with limited food budgets (Horton, 1981). As retail marketing margins are highest, national programs' efforts intended to make

potatoes more affordable have the highest potential pay-off at the retail level.

(vii) Few demand studies

If little research has been conducted on potato marketing, even less has been conducted on the demand for potatoes in developing countries. Several reasons are given for this void in the literature. National household budget surveys frequently do not include potatoes as a separate crop; rather they are mixed together with other roots and tubers (Horton, 1986). Therefore, analysis of the demand for potatoes based on actual income and consumption data is often simply not possible because the data are not available. Alternatively, some countries have only recently begun to collect information on potato prices (Bhutan). Others have these statistics but keep them only for a certain period of time (Burundi, Thailand). Finally, the magnitude of the upsurge in potato production and consumption in many developing countries has been overlooked by researchers and policy makers; hence, they often have not consulted available information to evaluate changing demand patterns for potatoes.

(viii) Income elasticities positive

Several erroneous interpretations about the demand for potatoes have emerged as a result of limited research on this topic. Firstly, there has been a tendency to assume that a single income elasticity for all root and tuber crops --frequently near zero (see, e.g., IFPRI, 1977: 114)-- is a reasonable estimate. Available evidence suggests that such diverse food commodities as cassava and potatoes frequently have quite different roles in the diet and therefore merit separate treatment (Horton, 1986). Moreover, where income elasticities were measured using actual consumption data for potatoes, these nearly always were positive (see Scott, 1985: 123-124, 172; Scott, 1987b: 77-78).

Secondly, there has been a consistent pattern of underestimating the demand for potatoes --especially among low-income consumers. Small, resource-poor producers in the highlands of Burundi, Rwanda and Zaire as well as in the central plateau of Madagascar, eat most of the potatoes they produce. Population pressure and seasonal production patterns for other food crops make potatoes an ideal supplement to the diet in Burundi (Ndimira and Christensen, 1983: 124)

and Madagascar (Rasolo et. al., 1987: 22) and a seasonal staple amongst peasant households in Rwanda (Poats, 1981) and Zaire (Scott, 1986: 126-129). Per capita potato consumption in rural Bangladesh increased by 200% between 1975-76 and 1981-82 (Ahmad and Hassan, 1983). Contrary to popular opinion, potato consumption increased slightly in Lima during the last decade and remains highest amongst low-income households (Scott, 1985: 109-112). The findings for Bangladesh and Peru in particular are consistent with the estimates by Pitt (1983) and Apaza (1983) that showed income elasticities of 1.66 (Bangladesh) and between 0.7 and 0.2 (Peru).

(ix) Lower prices induce greater consumption

In several countries studied, the relationship between potato prices and potato consumption has not been clearly understood. In Peru, for example, higher prices for potatoes were allegedly responsible for the decline in potato consumption in Lima during the last two decades. In fact, real prices --the current retail price per kilo deflated by the consumer price index-- were lower in December 1979 than in January 1960, and this contributed to the slight rise in per capita consumption during the 1970s (Scott, 1985: 114-115). Lower prices for potatoes also helped to induce greater potato consumption in Bangladesh between 1972 and 1984 (Scott, 1987b: 103-104). Similar trends have been observed for Colombia and India (Horton, 1987: 83:87).

Potatoes still remain an expensive, luxury vegetable in many parts of the developing world e.g., Burundi (Scott, 1986: 38), Zaire (Ibid.: 145). In most of these countries, consumers like the taste of potatoes but simply cannot afford them given their meager food budgets. Lower prices, therefore, could induce greater consumption. While some research has been done to estimate the impact of lower prices on potato consumption, this topic is an area that merits closer attention in the future.

(c) Implications

Two sets of implications emerge from the marketing and demand research done to date: one for national programs and one for CIP.

(i) National programs

The most obvious implication for national programs concerns the location-and time- specific nature of these studies. One study cannot possibly address all marketing problems for all time. Efforts should be made to try and institutionalize this type of research so as to address marketing issues where and when they present themselves. One impact of the case studies in Bhutan and Peru has been the willingness of the national potato program leaders to recruit additional personnel to do this type of work.

Another implication is getting potatoes and potato marketing issues into the regular decision-making process. In many countries this translates into seeing that potatoes are in the national development plan and that marketing strategies and resources to implement them are considered as well. Most countries consider only production targets and policy measures such as farm credit. Still, in the case of the Madagascar, questions about potato marketing prompted policy makers to include potatoes in the new five-year plan. More pragmatically, the marketing study for Bhutan prompted a diversification of improved varieties made available to growers so as to facilitate capturing the market for red-skinned tubers. It also led to a decision to reduce the subsidy on imported rice so as to promote domestic consumption of potatoes.

A third implication of these studies concerns prime topics for future research. National programs have their most direct contact with (1) producers and production-related technical personnel (e.g., biological scientists, extension agents); and (2) administrators and policy-makers within the Ministry of Agriculture. Well-focussed research to develop procedures to help growers improve their post-production practices and to keep administrators and policy makers better informed about potato marketing developments is certainly called for. For example, the horizontal transfer (i.e., among growers) of more effective selling practices would appear to have considerable potential.[10]

(ii) CIP

CIP is the only institution of this kind in the Third World that devotes resources specifically to addressing potato marketing problems in different developing countries. Furthermore, CIP's comparative advantage is the collaboration between biological and social scientists in devising

ways to solve these problems. CIP should be prepared to continue addressing clients needs in this area as long as it works with national programs to promote increased potato production and utilization.

CIP can assist developing countries solve potato marketing problems in three ways. Firstly, CIP can provide potato varieties, processes to make new potato products and information about improved marketing practices. Secondly, CIP can offer information about research methods and/or operational experiences in potato marketing in other developing countries. This service can be provided through Center documents or studies done elsewhere but available from the CIP library. Finally, CIP can provide national programs with on-the-job training (e.g., through collaborative case studies), backstopping (via correspondence, follow-up visits) or courses that include marketing as a subject matter.

4. FUTURE PLANS

Requests for CIP support in addressing marketing problems are not likely to decline in the future. On the contrary, the growing influence of market forces on potato production and consumption in the developing world suggests that there will be increasing pressure on national programs to provide their clients with assistance in this area as well as in traditional, production-related activities.

CIP's role in this field will be two-fold. Firstly, it will assist researchers associated with national potato programs to carry out these studies themselves (see, e.g., PRACIPA, 1986).[11] This assistance will consist of: (1) the exchange of ideas and publications; (2) project development; and (3) project implementation through on-the-job training involving CIP social scientists and the researchers in a given country. This type of assistance will also include promoting greater cross-fertilization of ideas between the researchers themselves, for example, in courses and workshops, (see, e.g., Scott and Costello, 1985). Secondly, it will also entail the preparation and distribution of several publications. One would be a monograph that provides a synthesis of research results from case studies already completed. Another would be a simple bibliography of publications on potato marketing. Several operationally-oriented

pieces on the implications of the findings for producers and policy makers also would be useful (see, e.g., Scott and Gutierrez 1987; Scott and Ezeta 1987).

CIP social scientists have done much less work in the area of price analysis/forecasting and on the marketing of processed potato products. In the first instance, national potato program leaders are frequently called upon to provide basic outlook information to government officials, growers' associations and interested traders. Based on my field work over the last six years, much of this information tends to be presented in simple, static form, i.e., this is the situation now. As time-series data on prices, volumes, and production have become more extensive in many developing countries, it would be useful to try and develop simple models for analyzing the evolution of these phenomena provide outlook information to farmers' representatives, national potato program personnel and policy makers. This type of research should combine work on potatoes as well as sweet potatoes and although it will be collaborative in nature, will require considerable input from CIP social scientists.

Over the last several years, scientists from a number of developing countries have done research at home or have received training at CIP-Lima on simple potato processing. Only recently, however, has technology reached the stage where it was ready for evaluation "out of the laboratory." Still, as potato production expands around the world, it is anticipated that national programs will explore ever more actively the possible alternative uses for potatoes and sweet potatoes. Some work on the socio-economics of the market for processed potato products has already begun in Colombia, India, Madagascar, Peru, and Thailand. Diagnostic studies on existing marketing patterns, prices and policies as regards processed potato products can be contracted out. More research on the costs and returns for different types of processes and products will be needed in the future. This will require greater involvement of CIP social scientists.

5. CONCLUSIONS

Marketing and demand issues have assumed increasing importance for future production and utilization of potatoes

and sweet potatoes in developing countries. CIP has anticipated this development by incorporating marketing research in its program of activities some time ago.

Marketing and demand case studies carried out in Latin America, Africa and Asia during the last six years have highlighted the scarcity of previous research, the complexity of the problems to be analyzed and the potential for improvements through well focused efforts by national programs supported by CIP. Specific examples cited included the horizontal transfer of improved post-production practices at the farm-level, measures to reduce retail marketing margins and initiatives to strengthen the capabilities of national programs to collect, analyze and disseminate market information.

Future plans in the marketing and demand area cover three broad fronts. The first involves the preparation and distribution of publications and training documents. The second entails promoting research by social scientists in developing countries on marketing topics, e.g., through on-the-job training and regional workshops. The third calls for new research activities by CIP social scientists in the areas of price analysis/forecasting and the market for processed potato products and sweet potatoes.

Implementation of these activities will require consultation between CIP-staff concerning the availability of core-funds to support contract research, the search for special project funding and the delegation of additional responsibility for backstopping national programs to junior level staff.

NOTES

1. Training aspects and implications of these studies are discussed in Scott (1987c).

2. The second Social Science Planning Conference (SSPC/CIP 1981: 19) endorsed work on the demand/consumption of potatoes in selected countries in the context of their respective national food and agriculture policies.

3. A graduate student from the United States is now using Peruvian data to develop a demand/forcasting model for potato prices in Lima's wholesale market (see De Cosse 1986).

4. A series of studies has examined the flow of potato exports to the Gulf States and the Middle East (see, e.g., PSI, 1985; Winter, n.d.).

5. The following escription of small vs. large farmer marketing patterns applies to producers in the highlands of Peru (Scott, 1985: 44-50), in Bhutan (Scott, 1983: 32-33), and in Rwanda (Scott, 1986: 74). A similar small vs. large farmer dichotomy is reported by Shwedel (1977: 95-105) for Costa Rica, by Valderrama and Luzuriaga (1980: 96-97) for Ecuador, by Fletscher (1971: 100-104) for Chile, and by Diwakar and Muralidharan (1981) for India.

6. Rhoades et. al. (1987) have done work along these lines on storage in Peru; Yamamoto (1987) has studied simple potato processing in Peru and Bolivia.

7. This point was also raised by Ruttan in the previous Social Science Planning Conference (SSPC/CIP 1981:30).

8. For example, a marketing margin is often thought to be equivalent to a profit margin. The former is a measure of the difference between buying and selling price per kg as a percentage of the retail price per kg; the latter refers to total net income as a percentage of total sales.

9. This finding is generally consistent with the results of other research on the marketing of root and tuber crops (FAO 1985).

10. Another prime area for marketing research is retail trade. This topic is being studied now in Thailand partly as a result of the marketing case study that identified the retail marketing margin in Bangkok as a major contributor to high consumer prices for potatoes.

11. Only under unusual circumstances could I foresee CIP social scientists carrying out extensive field work in developing countries on this specific topic as was done in the past.

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TARGETING R&D: HOW WELL ARE CIP'S AND NATIONAL PROGRAMS' BEING MET?

Enrique Mayer

The International Potato Center's mandate can be considered an accomplishment when improved potato production is achieved in farmers' fields, when nutritious products flow from these fields to consumers, and when the income levels of producers are raised. CIP's offer of improved technology needs to flow from CIP and reach the farmers worldwide. In addition, CIP scientists (biological, technical and social) need information about farmers, consumers and marketing links in order to accomplish their tasks.

When the system was set up, the country program was a crucial component, linked with CIP for the two-way flow of information. When I was asked to comment on the ways in which links between CIP and the national programs could be improved, and the ways in which national programs could be strengthened through this linkage, I had considerable difficulty in conceptualizing this linkage as it exists in the real world. Ideally, each country has a Ministry of Agriculture, each ministry has a research and extension service, and within this structure space for potato and sweet potato can be found through which to establish two way flows for mutual benefit, and ultimately, for the benefit of farmers and consumers.

We all know, however, that this linkage is weak and difficult. These are all third world countries with enormous financial difficulties, manpower shortages, lack of facilities, and social conditions that make the farmer-technician link particularly difficult and complex. National Programs respond slowly, they are subject to political pressures that militate against successful collaboration, they are inherently unstable, slow, and fraught with complex currents and countercurrents that make collaboration and work with them incredibly difficult. This is the weak link in the chain.

One the other hand, mandates to work with national programs will have to be respected. National programs have legal authority that obligates CIP to work through them. Of

course, in many situations national programs exist that are models of collaboration and effectiveness. It seems to me, however, that wishful thinking often does take place, and the hope and faith that national programs will improve so that collaboration between them and CIP can work successfully becomes part of the style of work. How long can we live on faith alone? What happens when accomplishments gained over a couple of years deteriorate with a change of government and the departure of the person with whom CIP had been successfully collaborating? The point of these brief observations is that changes and instabilities are beyond the control of CIP and can only in very few instances be helped through intervention by CIP staff.

Are there alternatives which can improve the country-CIP link? National (State) programs may only be one of the few intermediary organizations that provide links between farmers and CIP. Depending on the activity, one can think of several alternatives. I list some of them:

- Other national institutions such as universities, research organizations, and consulting groups. Some are state owned and managed, others may be private, regionally based, or supported through charity organizations such as Oxfam.

- There are many locally funded and also internationally supported non-government organization's whose aims and working methods might be more directly suited to CIP's needs.

- There may be individuals whose life long work and knowledge are absolutely crucial to CIP's work. (A botanist, for example, who has studied and collected for decades in a country). Given institutional instabilities, these individuals must often move from one institution to another --frequently they have to work on non-important things just to earn a salary -- and their contribution is dissipated.

- There are, increasingly, many grassroots organizations: associations, federations of cooperatives, federations of peasants, and church groups which also have development projects.

I would argue that CIP often can work more effectively with some of these alterantive organizations or individuals than by restricrting itself to official state-level national programs. Finding out who these organizations are, how they

work, in what ways they can help, on what level collaboration is going to be established, and through what mechanisms, does take time, effort, diplomacy and administrative skill. But it may pay off.

Why choose this alternative path? It seems that one often gets carried away by images and diagrams. We tend to think that the national programs cover the whole country, diffuse technology through extension nationwide, and thus the impact is widely spread. Consider, however, that potatoes grow in restricted regions of these countries in specific agro-climatic zones. Thus, for example, might it not make sense to concentrate efforts on the provincial (or regional organizations) where the potato is actually grown?

The particular emphasis inherent to CIP's farmer-back-to-farmer model implies that long-lasting relationships need to be established between farmers and their technical support staff. It also implies a rapid and efficient communications channel to upper levels. Are government agricultural agencies the only ones who can do this? In Peru, for example, (the country I know best) there are now many regional based NGOs who work with grassroots organizations. In many cases, their program includes agricultural development schemes. They are often dedicated to improving potato production (through supervised credit, farm trials, extension services, etc.). Funded in part by external agencies, they are better equipped, have trained personnel, and these people --by belonging to an organization that has stated goals to help local people-- may have the better attitudes required for farmer-oriented research and extension work. It seems to me too, that success in adoption requires technical people to continuously interact with farmers over a long period of time. This is so because not only does technology require local adaptation and fine tuning, or diffusion takes time that could be effectively helped along; or not even because there may be unforseen consequences to the introduction of the technology that further require national or even CIP participation. But ultimately, the reason is to establish firmly that the only real style of work for an effective link between centers of technological innovation and farmers is that they be effectively connected to solve each other's problems. These links exist in the developed world, and that is why it is so effective.

Another point that argues in favor of bypassing national organizations is innovation itself. We all know that innovation generates resistance to change. We are by now

convinced that it is not the farmer who is resistant to change. But the national organizations, the government institutions and the national programs have a great deal of difficulty in changing their attitudes and styles of work. I can predict that they will be the last ones to adopt successful changes --and not the first ones. Non-government organizations and grassroots organizations, on the other hand, are so structured that they more readily adopt innovative schemes, experiment, monitor their failures and successes and modify the way they act according to their successes. In part because they are small and do not need to overcome institutional inertia, in part because they define themselves as groups searching for alternative development models, and most often, because they insist (whether true or not) that client participation in decision making is the cornerstone of their philosophy. They are small groups competiting with the national systems, and thus more open to change and innovation. They are also financially strapped, and thus would welcome help from CIP.

Throughout the planning conference, it was stressed that the particular advantage of the CIP model is its direct link between biological scientists and the farmer. This link is facilitated through social science work (research, collaboration, sensitizing, training, etc.). It seems to me that often the character and nature of national programs (which have other functions and are necessary for other things) make this link difficult to establish and even more difficult to sustain over time. Non-government organizations and grassroots organizations may provide the better link for CIP.

Along with technology itself, the CIP model of social science participation needs to diffuse from CIP. How can this be done given the current staffing and financial constraints? I would like to argue that often this transfer work with local groups will prove more effective in establishing a foothold in one or two regions in a country. Once it works, then the late adopter organizations (such as the national programs and national policy makers) will take note and have no difficulty in accepting and adopting the model to their national needs. Bypassing the national programs in certain ways and for certain specific needs may be an effective way to gain a beachhead in a country. It has the advantage of being a "bottom-up" rather than a "top-down" model. Working with local organizations may move CIP a little closer to the farmer and a little further away from the national program.

There is also the transfer of more intangible assets such as the mystique of the approach and the philosophy of work. As a cultural anthropologist, I find this a fascinating problem. Can one bypass the person-to-person contact and still transmit the ephemeral mystiqe? Can you teach attitudes through manuals? Or, is the only way to learn it by example and doing it? If there are local organizations and non-government organizations that are willing to try this, is this not the effective way to missionize the approach?

As a final comment, I need to contextualize the argument. In order to state the idea as forcefully as possible, I have painted it starkly in black and white. The real world is not like that. Situations vary from country to country, from region to region. There are very good National Programs in many parts of the world. There will be many situations where there is no option but to work with national programs; and in the real world, there will be a need to establish a multiplicity of situations and networks. To a large extent, CIP is probably already doing this. My question though, is whether this approach --to work in regions with local organizations and grassroots as well as NGOs-- as a deliberate option (where appropriate) might not pay off.

In conclusion, National Programs is too big a category. NARS are too often ineffective and too rigid. Within the country one should look at a wide range of institutions and programs to find strategies that effectively suit the needs of CIP and farmers. A study of the options and possibilities might be useful. Country profiles could include lists and descriptions of NGOs and local organizations suitable to work with.

A special contribution of CIP's social scientists to the development process involving social scientists working on technology development and transfer is a unique "technological (in the social engineering sense) innovation" that should spread from CIP to local organizations. NGOs and local organizations are more likely to be early adopters of this technology than the government's national organizations.

This, however, does not preclude the need for CIP to continue to work with NARS. Strategic thinking about how these two aims could be solved simultaneously is necessary, but beyond the scope of the few comments expressed here.

SESSION III. Generating and Diffusing Appropriate Technology Through Client-Oriented R&D

CIP'S PHILOSOPHY ON FARMER PARTICIPATORY RESEARCH

Robert Rhoades

Farmer Participatory Research is a term increasingly used in agricultural research and development circles. The stress on farmer participation has arisen from a realization that earlier approaches to on-farm research (e.g. farm management, farming systems research) recognized the importance of farmers, but was not able to effectively incorporate farmers' skills, knowledge and experimental practices into the research process.

Since the late 1970s, the International Potato Center (CIP) has stressed the importance of farmer participation in the research process. This philosophy, known at CIP as the "farmer-back-to-farmer" model, grew out of a series of unique experiences within and without the organization.

First, CIP's inherent organizational structure is based on the participatory philosophy. It is a small organization for an international center and is structured along research lines (Thrusts) that are intensely interdisciplinary. There is no opportunity to drift far from the goals of the center, and with the assignment of social scientists to the thrusts, little opportunity to drift too far from the farmers' perspective. Social scientists serving on the Board of Trustees (e.g., sociologist Gelia Castillo) have given higher credence to the farmer participatory model (which can be applied to other clients such as consumers or traders).

Second, CIP's first on-farm experience took place in the central Andes (Mantaro Valley). In much of Peru, where communities are self-governed outside researchers must first obtain permission and have the research agenda approved by community assembly. This implies, therefore, that research must address the needs of the client first, and the researchers' needs second. Thus, the direct participation of the farmers was required to address their needs.

The papers related directly to CIP's work in this session illustrate methods and approaches of farmer participatory research. We feel, however, that we are only now gaining an understanding of this approach. Advances in methods are expected from CIP in the near future.

POTATO PROCESSING: LEARNING FROM A TRADITIONAL ANDEAN SYSTEM

Norio Yamamoto

1. INTRODUCTION

It is well-known that Andean people have processed potatoes for centuries, yet this area has been very little studied by agricultural scientists because most people think that Andean potato processing technologies are old fashioned and of little use for the future. Furthermore, Andean potato processing techniques are thought to be of little use for other regions due to the particular Andean environment required for processing. Potato processing techniques, however, are still of vital importance for rural households living in the high mountainous regions of the Andes (Yamamoto, 1976). Many potatoes in the central Andes of Peru and Bolivia are processed without any fuel into several dehydrated products (Mamani, 1978). The most common one is known as chuño, which can be preserved for a long time without any spoilage. Chuño is shrunken, concentrated, small in size and light in weight, and these dehydrated potatoes are easily transported and sold in the market.

According to my observations based on several years of fieldwork, Andean small potato farmers are concentrated mainly in isolated and high mountainous regions. These farmers are struggling with the problem of procurement of cooking fuel and food processing due to the isolated topography and harsh ecological conditions as well as lack of transportation and scarcity of resources.

Not only in the Andes but also in the Himalayas, intensification of land use associated with the problem of fuelwood removal has had many dramatic consequences, such as deforestation, erosion, floods, landslides, etc., (Eckholm, 1975). For this reason, Andean potato processing techniques that need little fuel should be studied in order that improved technologies in high mountainous regions such as the Andes and the Himalayas can be developed.

2. METHODOLOGY

The objectives and methods of this study are as follows. First, to document Andean potato processing techniques. In order to do this, fieldwork was carried out in parts of Peru's coast and highlands, the Bolivian highlands, and northern Argentina. Early chronicles, written soon after the Spanish conquest of the Andes in the 16th century, were also examined. Second, to study the applicability of Andean potato processing technologies to other regions. To do this, the agro-ecological conditions as well as the materials needed for the processing were analyzed. Third, to identify useful processing technologies for small farmers in general and poor farmers living in isolated mountainous areas in particular. In order to identify useful technologies for small farmers, other similar technologies in different ecological regions were considered for their applicability.

3. RESULTS

Why is Andean potato processing technology neglected by agricultural scientists? Prejudice is an important reason. Since the manufacture and consumption of chuño is associated with poor and traditional peasants living in cold high areas, chuño is considered by most city dwellers to be a low prestige, or "Indian" food (Werge, 1979:234).

This prejudice is reflected in the early chronicles written soon after the Spanish conquest of the Andes. Table 1 shows the numbers of different agricultural products mentioned by 13 early Spanish chroniclers (Masuda, 1984). Logically, the Spanish took great interest in maize and a maize product --chicha beer-- because they were grain eaters themselves. Their interest in potatoes and chuño, however, was surprisingly low. Eight of 13 chroniclers studied did not mention chuño even once, and the total number of times chuño was mentioned is only ten --extremely low in contrast to the 203 times chicha beer was mentioned. Some chroniclers also mentioned that potatoes were a poor Indian food with low prestige. If the chroniclers considered potatoes to be low in prestige, how much lower chuño must have been!

In any case, the Andean potato processing techniques described by these chroniclers are the same or nearly the

same as the techniques used today. In other words, potato processing in the Andes has changed very little since Inca times. I would like to add that I believe Andean potato processing techniques should not be neglected but improved.

Table 1. Number of times chroniclers mentioned different agricultural products in the 16th and 17th centuries*

	Number of authors	Total number of times mentioned
Maize	13	385
Chicha beer	13	203
Coca	13	201
Chili pepper	10	56
Potato	9	53
Chuño	5	10
Quinua	7	11
Manioc	5	7

* After Masuda (1984)

Before discussing potato processing technologies, let us take a general look at ecological conditions in the central Andes where Andean potato processing profits from several features of the tropical high mountain climate. In tropical alpine regions, there is little seasonal fluctuation in temperatures but great daily fluctuations. Seasonal cycles of rainfall, however, are substantially greater in high areas than in mid-altitude zones (Rhoades and Thompson, 1975). This type of climate is not common, but is found in the high Andes, an area known as the puna in central Peru and northern Bolivia (Troll, 1968).

Table 2 shows a list of potato products in Peru and Bolivia: lojota, kachu-chuño, chuño, moraya, mosqo-chuño, toqosh, chuno, papa seca, and almidón de papa.

The best-known dehydrated potato product is called chuño, found in markets from central Peru to northern Argentina. The elaboration of chuño is confined to the high areas of Peru and Bolivia. In June or July, the driest

months with the greatest daily temperature fluctuation, potatoes are spread evenly on the ground for several days. The natural alternations of freezing temperatures at night and thawing during the day, process the potatoes. When they have been thoroughly frozen and thawed, they become so soft and juicy that water can be squeezed from the tubers even by hand. They are then gathered in small piles and trampled under foot to slough off the skin and squeeze out residual water. After being trampled, the potatoes are placed in a field and sun-dried for several days.

Table 2. Processed potato products in the Central Andes

Product name	Potato varieties used	Necessary processing days	Is product stored?
Lojota	Mainly bitter	1-2 days	No
Kachu-chuño	Small	1-2 days	No
Chuño	Small and intermediate	2 weeks	Yes
Tunta	Mainly bitter	1 month	Yes
Muraya	Damaged	1 month	Yes
Mosqo chuño	All types	3 months	Yes
Toqosh	Mainly bitter	2 weeks - 1 year	Both
Chuno	Non-bitter	1 month	Yes
Papa seca	Non-bitter	2-3 days	Yes
Almidón de papa	Non-bitter	1-3 days	Yes

According to use, varieties and region, some abbreviated procedures as well as more complicated forms of chuño processing are also used. Aymara-speaking people, for example, refer to frozen-soaked dehydrated potato as tunta. Processing of this product is similar to that of chuño, except the additional procedure that tubers are soaked. That is to say, after being frozen and thawed thoroughly, the potatoes are gathered and taken to a stream to be soaked in cold, running water. Since bitter potatoes are used mainly for this processing, the main purpose of soaking is to reduce the bitter taste by leaching out the glycoalkaloids. As the tubers dry, they form a crust, giving this type of chuño its particular white color. Thus, this product is called white chuño or chuño blanco in Spanish, in contrast to the black chuño or chuño negro mentioned above.

A variation of chuño called muraya by the Aymaras, is a fermented freeze-dried potato. Its process is similar to that of tunta, with the exception that the tubers are fermented. Since damaged potatoes are favored for this processing, this technique serves not only for storage but also for the recovery of spoiled potatoes.

All the processing techniques mentioned above are common in southern Peru and Bolivia. But other processed products such as toqosh, almidón de papa, and papa seca are found in northern and central Peru.

Toqosh is processed by fermenting the tubers in stagnated water without prior freezing for periods ranging from two weeks up to one year. While fermenting, the potatoes are covered with straw and stones are placed on top to press them. The potatoes are then taken out of the water after a long period of fermentation. Although the odor of fresh toqosh is quite strong and distinctive, it is usually eaten boiled without sun-drying.

Almidón de papa is potato starch. Household starch is made by grinding potatoes into a pulp, leaving the pulp to soak in water for a number of days in large jars. The starch settles to the bottom of the jars. The water is changed frequently and the starch is then filtered through a cotton cloth and left to dry in the sun.

A final product made from potato is papa seca, quite different from those described above. Papa seca is made by boiling, peeling and drying the tubers. In contrast to chuño, papa seca is consumed mainly on the coast in a special or festive dish called carapulcra. Hence, there is a regular market demand for papa seca.

Figure 1 illustrates briefly all the potato processing techniques observed in the central Andes. In this figure, we find two different groups of processing --those with and those without boiling. They also can be classified into the following two groups: one requiring boiling and another using freezing and/or soaking processes. In other words, the processing patterns associated with papa seca and the others are completely distinct (Yamamoto, 1982). All those products processed by soaking and/or freezing may be considered variations of chuño. While it is often said that chuño is simply freeze-dried potato, its variations consist of several products processed without freezing or drying. Thus, Andean people have developed chuño processing into a great variety of techniques adapted to different ecological

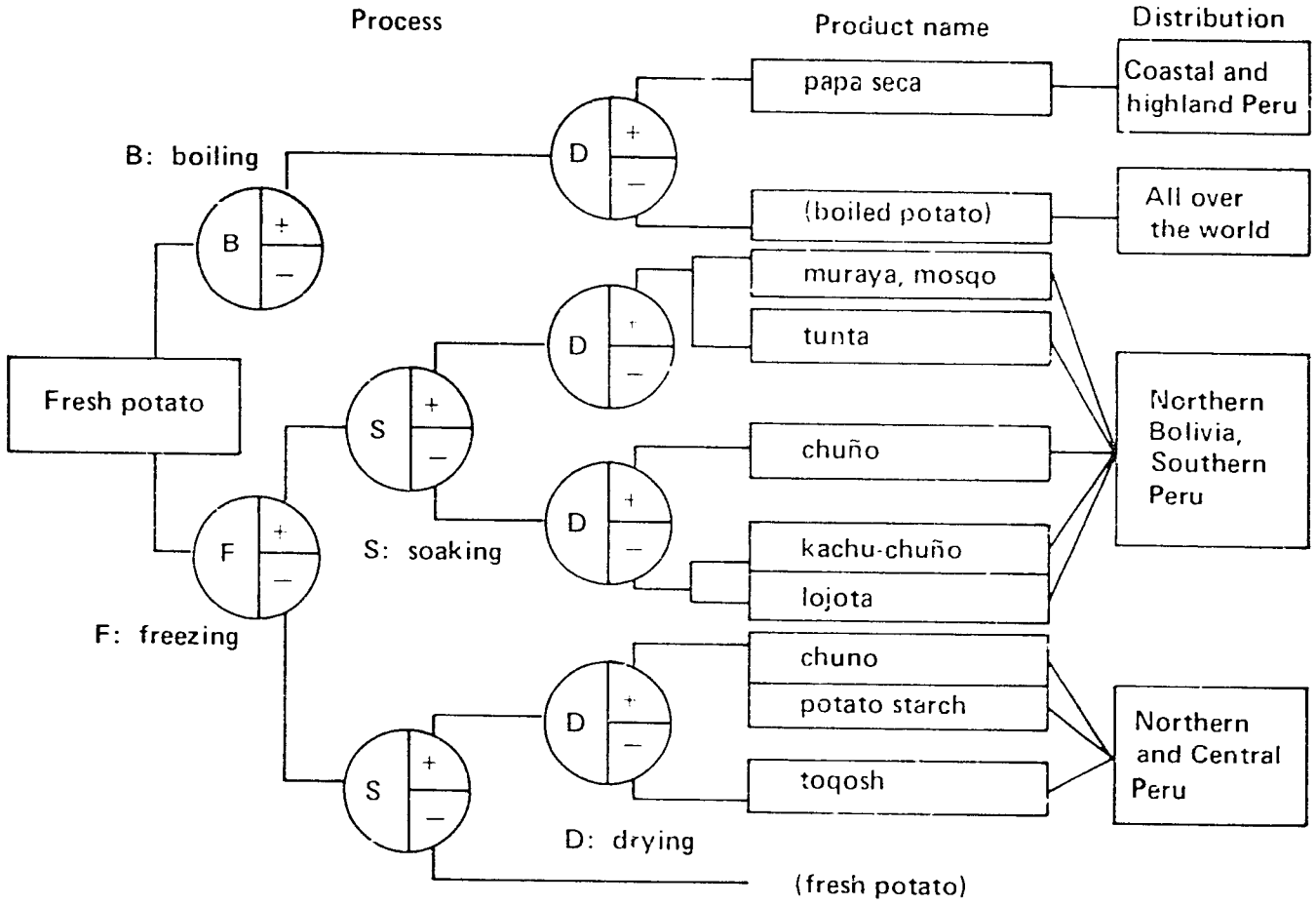

Figure 1. Variations of potato processing in the central Andes

conditions. Most of them are found in the highlands, but toqosh is also made on the coast.

Although no production data related to chuño and its variations are available, the origin of the papa seca sold in the Lima wholesale market is shown in Figure 2. This indicates that most papa seca is produced on the coast and in northern Peru. Furthermore, papa seca is very rare in the southern highlands of Peru and almost unknown in Bolivia. I am sure that the distribution and production pattern of papa seca reflects demand as well as transportation and availability of fuel. Among the productions mentioned above, city dwellers prize only papa seca. Yet, the nutritional value of chuño and tunta is not inferior to that of papa seca (Table 3). In addition, chuño and tunta are more easily stored than papa seca due to their lower water content (Marin, 1973; Ravines, 1980).

Table 3. Nutritional composition of potato, chuño, tunta and papa seca (%)*

Constituent	Potato	Chuño	Tunta	Papa seca
Water	78.8	10.0	10.0	15.6
Ash	1.1	0.7	0.8	3.7
Proteins	2.2	8.4	1.8	7.2
Carbohydrates	17.8	76.5	87.8	70.8
Fat	0.1	0.4	0.2	0.9

* After Marin, L. 1973 and Ravines 1980.

4. JAPANESE PROCESSING TECHNIQUES

Finally, I would like to examine the applicability of these Andean potato processing techniques for other regions. Here I will only present some similar potato processing techniques developed in Japan.

Japan is a mountainous country. More than 70% of its land is covered with steep slopes which until recently have caused difficulty in transportation. For this reason, storage and processing have been important survival strategies. Japan, however, is located at a relatively high latitude.

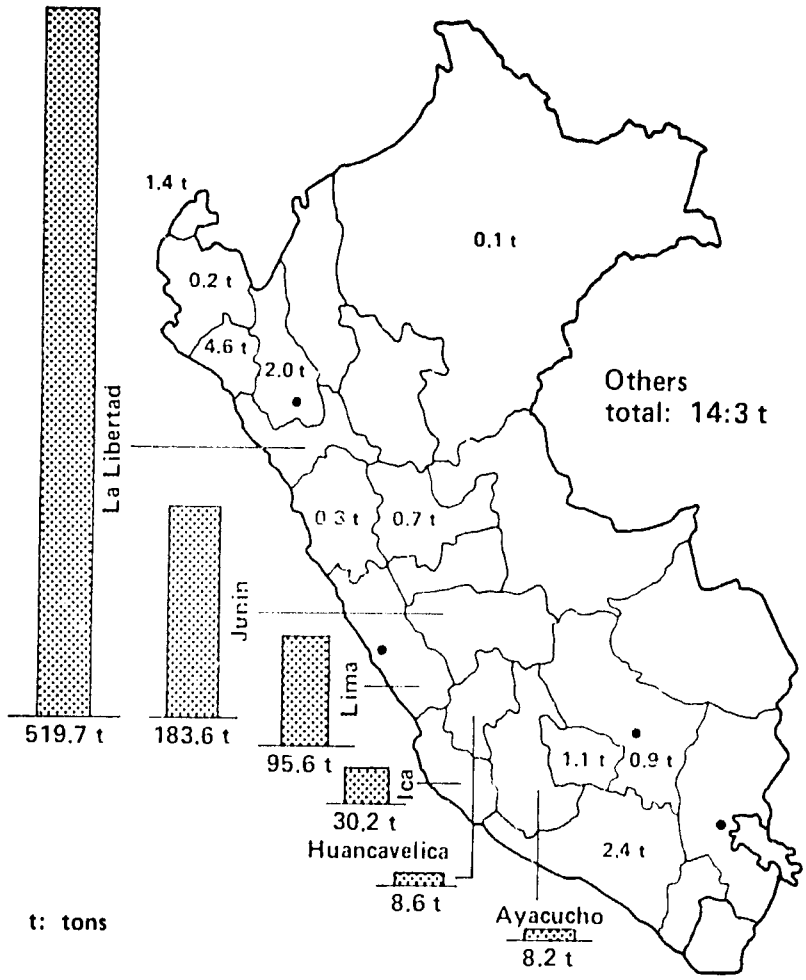

Figure 2. Origin of papa seca sold in Lima wholesale market (after Benavides and Horton, 1979).

In contrast to the low latitude countries, there are clear distinctions between the four seasons in Japan. Using such marked seasonal changes, in contrast to the great diurnal changes in the tropical mountains, farmers have developed several potato processing techniques, some of which are similar to Andean ones.

Figure 3 is a distribution map of processing techniques similar to chuño and toqosh. Northern parts of Japan, like Hokkaido, are considerably colder than the southern part, Kyushu. As a result, potato products like chuño are produced in northern Japan and products like toqosh are produced in the south. In Japan, not only potatoes but other root crops, vegetables and beans are processed into fermented foods for storage. Like toqosh, fermented foods in Japan have a distinctive, strong odor, especially to foreigners. But in Japan these foods are eaten fresh, not boiled. The processing of Japanese chuño is basically the same as that of Andean chuño with the exception that the potato is frozen in the cold of winter and thawed in spring.

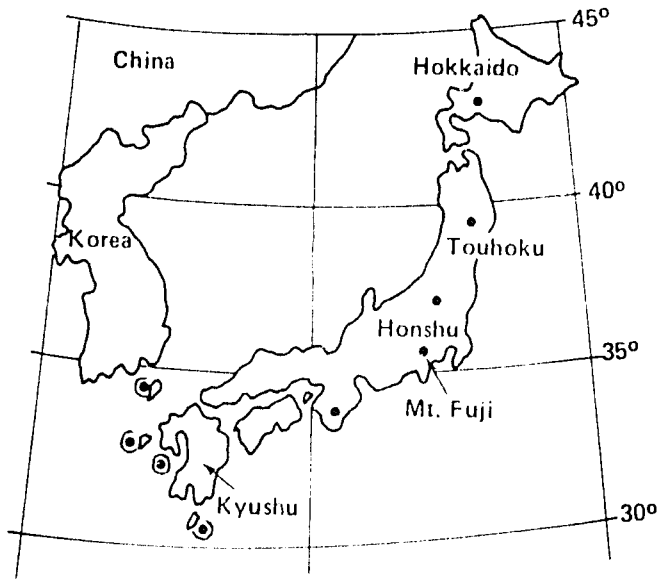

Figure 3. Distribution of processing techniques similar to chuño (●) and toqosh (⊙) in Japan.

In addition, some simple instruments and machines that use no fuel have been developed to improve processing techniques in Japan. Figure 4 illustrates a box used for holding freezing potatoes over the long winter until springtime. Figure 5 is a Japanese press used to squeeze water out of potatoes (Kaneko, 1940). Figure 6 is a potato cutter developed originally for sweet potatoes by small farmers 50 years ago.

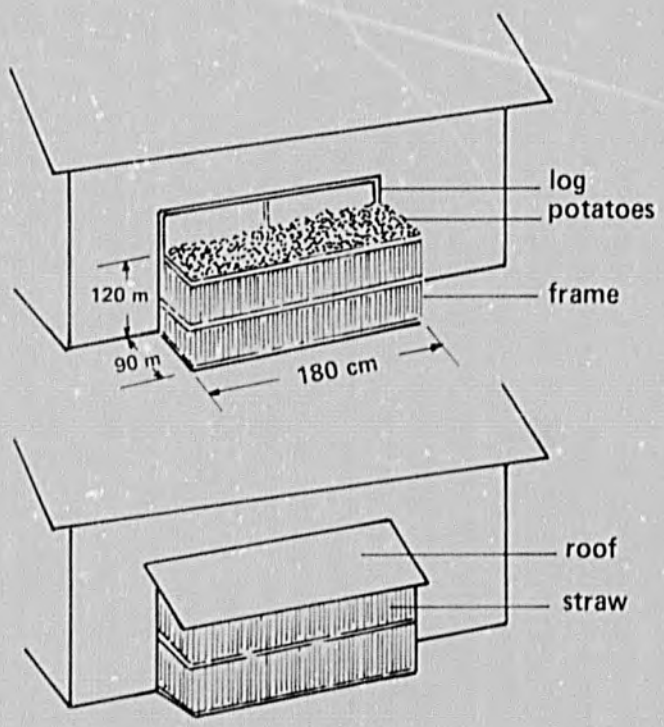

Figure 4. Japanese box for freezing potatoes (after Kaneko, 1943)

These techniques, as well as the instruments, are disappearing rapidly due to electrification as well as great change in farmers' life styles. The point I would like to stress here, however, is that similar potato processing techniques in the Andes and in Japan show a possible applicability of Andean techniques for other regions that reaches beyond ecological limitations and perhaps beyond prejudice. At the same time, some technologies developed in other countries may be used to improve Andean techniques.

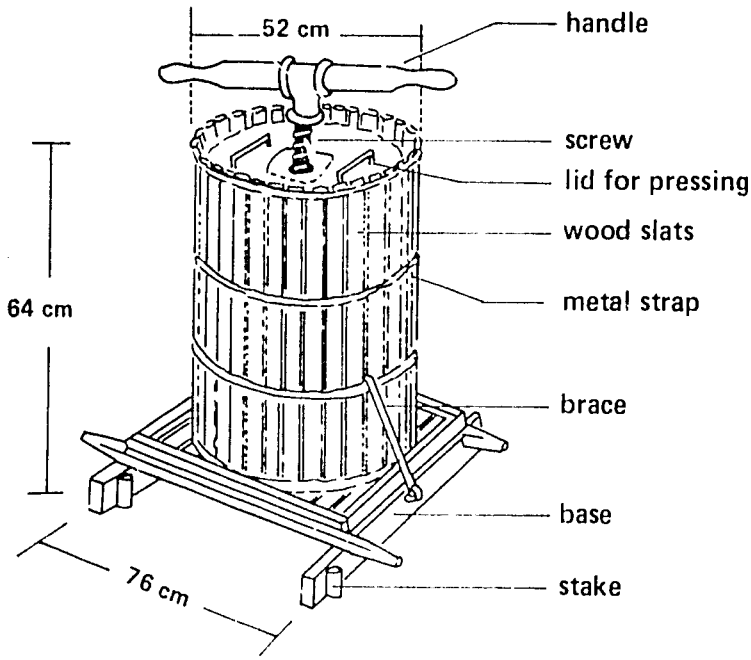

Figure 5. Japanese potato press
(after Kaneko, 1943)

5. PLANS FOR THE FUTURE

Potato scientists have a great interest in the potato varieties domesticated in the Andes, but most scientists are indifferent to the variations in potato processing techniques developed by Andean farmers. In other words, the Andean potato processing techniques are ignored and they are neither improved nor applied to other regions. At the same time, improved potato processing techniques developed by farmers outside the Andes must exist, techniques which could be useful in improving Andean processing. Unfortunately, we are not certain, because potato processing techniques have not been studied in other areas. In my opinion, we should not ignore farmers' knowledge, but try to understand their indigenous techniques and experience in order to improve potato agriculture, particularly that of poor farmers living in isolated areas.

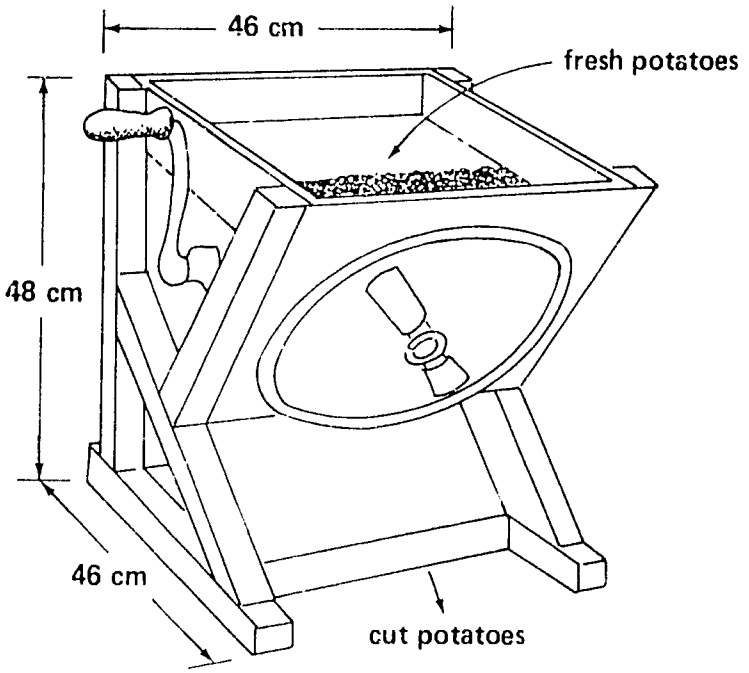

Figure 6. Japanese potato cutter cap. 300 kg/h

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DESIGN OF A CLIENT-ORIENTED TECHNOLOGY: THE CASE OF TRUE POTATO SEED

Aníbal Monares and Patricio Malagamba

1. INTRODUCTION

Economic analysis has been frequently used in the final stages of the process of technology generation and transfer to identify factors that contribute to its more rapid and effective diffusion among farmers. In these later stages of the generation process, however, it is not usually possible to introduce any significant change in the design of such technology. For practical purposes it is assumed that the package of recommendations is extended to farmers and the probabilities of adoption will improve if potential users with certain favorable characteristics are found. The economic analysis stresses, then, the need of identifying potential clients and the factors affecting the efficiency of the transfer process.

Few studies have attempted to incorporate economic analysis at an early stage of the generation process of a new technology (Anderson and Hardaker 1979; Pachico and Janssen, 1982; Arcia and Sanders, 1979; Sanders and Dias de Hollanda, 1979). Several reasons seem to explain the limited contribution of the economic analysis in this stage.

First, social scientists from developing countries often face difficulties participating in multidisciplinary research teams. Difficulties appear to increase as the research becomes more basic in nature; i.e., problems are greater the wider the gap between the technology at the present stage of development and what would be needed for a widespread utilization by farmers. A second factor is the lack of clear and viable conceptual models on the generation and transfer of technologies that make possible the formation of multidisciplinary research teams under the usual institutional limitations in developing countries.

Can social scientists help to improve the design of technologies in their early phases of development?

The main objective of this paper is to illustrate one of the ways by which social scientists can contribute at an early phase of the technology development process, modifying its design in order to adjust it to the needs and circumstances of specific clients. This is the case of the use of true potato seed (TPS), an innovative propagation method suggested as an alternative to the traditional seed tuber system.

In the last decade, CIP and other agricultural research institutions have investigated the feasibility of TPS use by small farmers in warm areas and with low purchasing capacity for growing potatoes. The main advantages of this technology are: (1) it reduces the cost of production per unit of land and per unit of output; (2) it minimizes problems associated with tuber-transmitted diseases; (3) it reduces the need for specialized storage facilities and eliminates the usually high storage losses; (4) it diminishes seed transport losses and costs; and (5) it helps small farmers to be less dependent on complex and often inefficient seed certification schemes (Monares et al, 1983).

CIP's multidisciplinary research project on TPS has been carried out within the scope of Thrust IX: Seed Technology. Other members of the research team are Adolfo Achata, agricultural economist and Fausto Buitrón and Donald Berrios, agronomists. Research has focused on two specific objectives: (1) to identify the key elements of TPS technology that influence the economic performance and acceptability at the farmer level; and, (2) identify agroeconomic conditions under which different methods of using TPS would have greatest potential for farmer adoption.

2. RESEARCH STRATEGY

The most distinctive characteristic of TPS technology is its capacity for reducing total and average production costs. This capacity is primarily influenced by two factors: (1) the cost of seed tubers replaced by TPS; and (2) the additional cost of labor and of other inputs required for using TPS (Monares, 1984). Based on these

considerations, the following general hypothesis was formulated: the potential cost savings derived from the use of TPS will be greater in areas where the cost of seed tubers is a large proportion of the total production cost for the crop and minimal additional inputs are required for using TPS. Accordingly our on-farm research strategy was based on the following guidelines: (1) select areas where soil and climatic conditions do not limit potato cultivation during the growing season; (2) select areas and/or seasons where seed tubers are either expensive or of poor quality; (3) utilize TPS progenies with acceptable yield and tolerance to sub-optimal cultural practices and with resistance to local diseases; and, (4) select cooperating farmers among those with small land holdings and with experience in growing labor intensive crops.

Field research was carried out mainly in Peru under diverse farming conditions, using a combination of research methods such as farm surveys, on-farm trials, field observations, etc., (Moscardi and Winkelmann, 1979; Ashby, 1986). Farm surveys were used to find out how well various forms of using TPS could fit in specific farming systems and to elicit farmers' reaction to the technology being tested. The major objective of on-farm trials was to appraise the gap between the technology's present stage of development and what would be needed for farmer adoption.

One of the greatest advantages of TPS is the flexibility offered by the different systems for its use, permitting adaptations to various climates and farming conditions. Through on-farm research, the different possible technical methods of using TPS --transplanting seedlings to the field, production of seed tubers in seed beds, direct sowing to the fields, etc.— were followed closely to assess possible associations between the adoption of a particular method with specific farming systems or other socioeconomic factors. In turn, a need was seen to determine what biological or technical requirements these agroecological and socioeconomic factors placed on the technology and which needed further consideration in the on-going biological research.

Field research was conducted in three different agroecological zones of Peru: coastal valleys (Cañete, Huachipa, Callao), highlands (Mantaro, Tarma) and mid-elevation tropics (San Ramón). Similar areas to these three zones can be found in many developing areas of the tropics. In each locality, three promising TPS hybrid progenies were tested: Atzimba x R 128.6, Atzimba x DTO-28 and Atzimba x DTO-33 (Malagamba _et al_, 1984).

3. MAIN FINDINGS AND IMPLICATIONS FOR THE DESIGN OF TPS TECHNOLOGIES

On the basis of the on-farm research carried out within the scope of the TPS multidisciplinary project, some major conclusions are detailed below.

(a) Labor use

More labor is required for production of potatoes from TPS than from seed tubers. TPS technologies can increase labor from 10 to 50%, but total man-days is not more than that used in the production of other vegetables such as celery, onions or beets. Seedling production and transplanting are the two activities that use the greatest proportion of labor. We have observed, however, that labor tends to decrease dramatically as farmers become familiar with the new form of cultivation and simplified practices are developed.

Although in most cases the quantity of labor is not expected to be a limiting factor for adoption (Achata and Monares,1986), labor quality may become a barrier. Cultural practices such as preparation of seed beds or transplanting seedlings to the field are laborious and may require certain skill. We have observed that in traditional potato zones, farmers are less interested and less successful when using TPS, usually due to limited experience with vegetable growing practices required for proper management of this new method of potato cultivation. This would imply that in order to use TPS in these traditional zones, further simplifications in cultural practices, development of progenies with greater seedling vigor or greater ability to produce potatoes through direct seeding are needed.

Some managerial improvements have been suggested by the farmers themselves. In producing seedlings for transplanting, for example, biological scientists initially proposed direct seeding in equidistant rows in seed beds to save seed and to facilitate weeding and irrigation. Most cooperating farmers, however, preferred broadcasting the seed for three main reasons: (1) in their perception seed was not a scarce input; (2) it is easier to apply and requires less effort; and (3) it is a convenient way of assuring proper seedling establishment in the field since

only the most vigorous seedling are selected for transplanting; and (4) it is the method used for growing seedlings for transplanting in most vegetables. Consequently, biological scientists recommend that farmers freely choose their preferred sowing system.

(b) Use of purchased inputs

TPS has been promoted mainly as a technology specially suited to small farmers with low purchasing capacity for inputs. Hence, for TPS to be adopted, the use of purchased inputs should be at levels equal or lower than the traditional seed tuber system. Nevertheless, our first attempts with TPS on farm trials, consistently showed greater utilization of pesticides and fertilizers when compared to the traditional potato cultivation method. Efforts were made to reduce the use of chemicals, substituting them by farm produced inputs. In some environments, however, (warm areas) the process of input substitution has found limits imposed by practical considerations: farmers are not willing to sacrifice yield below certain limits by reducing pesticide expenditures. Most farmers prefer to use minimum amounts of lower priced, but less efficient pesticides (and fertilizers) to guarantee a desirable yield level. As a side effect, it was observed that the reduction in the use of chemicals led to a further reduction in the use of labor.

The main conclusion of this section is that the use of pesticides and fertilizers should not be a limiting factor in traditional temperate potato zones or in vegetable growing regions, but it may become a critical factor for farmers in warm areas. In the latter areas, the development of disease resistant TPS progenies has shown to be the most desirable long-term socioeconomic solution.

(c) Crop management

There is no doubt that the new technology requires more care and perhaps more skill than traditional seed tuber technology. Results from on-farm research conducted in vegetable growing areas suggest that farmers with diversified cropping patterns show greater ability to handle an additional crop such as potatoes from TPS than farmers specializing in growing few crops. Apparently, diversified farmers allocate their time and resources in a way that allows for an easy introduction of TPS within their farming system.

Although TPS appears to fit well in labor intensive small farmer areas, the potential use of the technology tends to decrease as the proportion of activities conducted off-farm increases. In general, the smaller the farm size, the greater the tendency for farmers to look for off-farm opportunities to increase family income, working either as laborers or in local trading of products, and therefore less attention is given to new technologies.

(d) Selection of progenies

Possibly the most important individual factor influencing TPS adoption is the availability of superior progenies with acceptable yields and wide adaptation. Progenies must perform well under the restrictive agroclimatic conditions usually affecting developing farming areas of small farmers in the tropics (poor soils, lack of irrigation, irregular rainfall patterns, frosts, droughts, etc.). Successful progenies must be able to tolerate sub-optiomal cultural practices, be resistant to local diseases and meet consumer preferences regarding tuber size, color and taste. Moreover, the results of our on-farm research suggest that TPS adoption is more likely to occur if progenies have high seedling vigor and the vegetative cycle fits well in the complex cropping patterns of the target areas (mostly warm areas). Some TPS progenies developed by CIP have shown satisfactory performance under these conditions and within the present breeding efforts these characteristics receive priority attention in the selection process. It is expected that new materials will be able to be effectively utilized in many areas of the developing world.

An interesting implication resulting from the on-farm research and related socioeconomic studies (Achata and Monares, 1986) is that the potential profit of the crop from TPS is affected more by yield variations (or output price variations) than variations in cost components such as labor, pesticides or fertilizers. In addition, in those on-farm trials where profitability of the crop from TPS was greater than the traditional potato cultivation method using local seed tubers, the major determinant was not the saving in seed cost --as hypothesized-- but the higher yielding capacity of the new technology. This explains, in part, why better experimental results were obtained in areas and/or seasons when low cost highly infected seed tubers are normally used by farmers compared to those when high cost healthy seed tubers are used.

4. IMPLICATIONS FOR A SYSTEM OF TECHNOLOGY TRANSFER

An important question arising from the socioeconomic analysis of TPS use is whether this technology can be transferred to farmers mainly through informal transfer mechanisms or, alternatively, a formal, specialized transfer system.

Arguments supporting a formal system of technology transfer can be summarized in the following way. First, TPS is not an individual technology, but a group of interrelated technologies, some of them beyond the previous experience of many farmers (for example, using the transplanting technique for proper field establishment of the plants, or the dramatic increase in water requirements during the first six weeks of the growing period). Second, the advantages of adapting TPS are not so obvious for farmers as other technologies such as the introduction of an improved variety or the use of new pesticides. Although attractive, arguments in favor of a decreasing-cost technology, are usually less clearly understood and may be less meaningful to small farmers than statement in favor of an increasing-yield technology. In addition, it may be the case for a new technology to reduce production cost with no improvement in farmer's net income (Monares et al, 1983).

In our view, a formal, well-organized system of transfer appears necessary for extending TPS technology into farmers' field. In this case, the transfer system would play the following roles: first, it would enable farmers to apply several cultural practices that are not used with traditional methods of potato cultivation. Second, it would reduce the period needed for farmers to make a decision on adoption. Third, it would allow the simultaneous introduction of new genetic materials that could compete with even greater advantage with local varieties. Lastly, it would offer small farmers a new option for propagating potatoes according to their needs and their limited access to improved planting materials.

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USER-FRIENDLY SEED PROGRAMS

Gordon Prain and Urs Scheidegger

1. INTRODUCTION

(a) The seed

In vegetatively propagated crops, seed tubers are an important but vulnerable input: they represent a major investment at planting time in comparison with grains. Tubers are difficult to transport, handle and store; and propagation via tubers is a major means for the transmission and dissemination of all virus diseases and many important fungal and bacterial diseases.

Because of these characteristics, seed was selected as one of the major areas of study in the Mantaro Project, an interdisciplinary investigation of one of the largest potato-producing valleys in the Peruvian highlands, conducted by the International Potato Center's (CIP) Social Science Department between 1977 and 1981 (Horton, 1984). One of the findings of the project was the high cost of seed relative to other inputs, a fact also recognized by Agrarian Bank cost estimates, as Table 1 shows.

Table 1. Percentage Production Costs of Small and Medium Farmers: Central Highlands

Input	Mantaro Project 1977/78	Banco Agrario 1977	Banco Agrario 1984
Seed	37.0	32	43
Labor	42.7	44	17
Fertilizer	15.7	19	35
Other	4.7	6	5

The results suggested that seed could be a major constraint to improved potato production in Peru. The importance of achieving such an improvement can be illustrated by a brief profile of the Peruvian potato scene.

(b) The background

There are three main zones of potato production in Peru. In the highlands, potatoes have been traditionally grown for thousands of years on the steeply-rising sides of inter-Andean valleys and in nooks and crannies of the vast expanse of frigid puna plateaux dividing the valley chains. Scattered accross these uplands between 3,500 and 4,200 m.a.s.l., there is a patchwork of tiny fields cultivated usually by hand with techniques highly adapted to the very difficult terrain. For planting, there is a superabundance of several hundred indigenous potato varieties, including over a hundred bitter types with excellent frost and hail tolerance. There is also increasing penetration of modern hybrid varieties, especially at the lower altitudes where there are stronger links with urban markets.

The principal commercial production zones in the highlands, however, are the flatter lands of the inter-Andean valley bottoms between about 2,500 and 3,500 m.a.s.l. They are frequently irrigated, production is often mechanized and they are major suppliers of modern "white" potatoes to urban centers.

Finally, the desert coast is an important "off-season" production zone, supplying large quantities of consumer potatoes to Lima between July and December. Andean rivers emptying into the Pacific cut this desert at irregular intervals, permitting an intensive coastal agriculture in the irrigated valleys. About 9,000 to 10,000 ha are planted annually, or 4% of the total area cultivated.

Of the 475,000 farming units planting potatoes, 363,000 have less than 5 ha of agricultural land and nearly 80,000 have less than 1.0 ha. The vast majority of potato producers are small peasant farmers living and cultivating above 3,500 m.a.s.l. Precise data on production levels are difficult to come by. Figures published by the national institute for agricultural and livestock research and extension (INIPA) in 1978 indicate low national levels and great differences with experimental stations (see Table 2).

Table 2. Average national yields and average experimental station yields for selected crops (kg/ha)

Crop	National Yield	Station Yield Selected Varieties	Location
Potato	6,540	40,000	Coast
Maize	1,650	5,000	Cuzco
S[illegible] potato	11,298	31,533	La Molina
wheat	945	3,791	Cuzco

Source: INIPA 1978

Despite low productivity, potato is the most important crop in the highlands. According to the 1972 census, 61% of all highland farming families cultivate potatoes, with an average total hectarage between 1977-79 of 234,100 ha, more than any other crop. For the period 1971-72, potatoes were calculated to make up 32.4% of the diet in the highlands (Scott, 1985:171).

(c) The project

Given the percieved importance of seed and the general importance of potato agriculture in Peru, it was jointly agreed between INIPA, through its National Potato Program, and CIP to establish a Seed Project with the general objective of improving the economic conditions of the large numbers of Peruvian potato farmers through improving the quality of seed.

Swiss financing was secured and the Project began producing clean pre-basic seed in 1983, using rapid multiplication techniques developed at CIP (Bryan et al., 1982). But it quickly became apparent that the technology and skills for high quality seed production were available or could be achieved with relatively few difficulties. The big problems arose in trying to get this seed to the farmers. This required a full-blown Seed Program, and the Program became the specific goal of the Project.

(d) The seed program

Peru has had other seed programs, most recently in the mid-1960s, but these were generally not successful, in that they did not have a serious impact on yields, farmer livelihood and national productivity (Ministerio de Agricultura, n.d.; Ezeta et al., 1985). The Mantaro Valley Project discovered one reason for this failure: the "improved" seed promoted by the Program was not very good and the farmers' seed was by no means as bad as general opinion suggested (Horton, 1984:8).

Another reason for failure seems to have been a rather narrow, "top-down" conception of a seed program which has been copied from Northern countries, rather than responding to the needs of Peruvian farmers. A seed program should aim to improve efficiency and generate greater productivity by working with what is there, not by trying to replace it. From this point of view a Seed Program does not deal with the transfer of a single technology --seed-- but rather with the organization of a "bundle" of technologies, all of which are important for the farmer. We have identified five major technologies: (1) High quality seed; (2) Varieties, (3) Technology package going with seed; (4) Production Technique; and (5) Delivery System.

The main part of this paper will consider how this approach can make a seed program appropriate. The last section draws together suggestions for further social science collaboration in the Seed Program.

2. METHODS AND RESULTS

We can view these technologies in "top-down" and in client-oriented terms. The top part of Table 3 is certainly recognizable as a seed program that would no doubt work. The lower part of Table 3 offers an example of ways to make it work appropriately.

(a) High quality seed

Recent developments in tissue culture techniques now offer a reliable, quick way to get virus-free germplasm with which to start up a seed program (Espinoza et al., 1984). At the beginning of the Peruvian Program, however, there

Table 3. Generation of a Seed Programme

Technologies	High Quality Seed	Varieties	Technology Package	Production Technique	Delivery System
	Generation from the Top				
Actions	Clean-up	Input by breeding	Not considered	Rapid multiplication; field multiplication	Certification scheme
	Client Orientation				
Questions to be asked	How does seed improve production	What are available? What are desired?	What factors interact with seed and how?	How much seed is needed Where?	How does seed circulate already?
Methodology for finding out	Comparision under farmer conditions	Observation and interviewing farmers; farmer selection trials	On-farm observations and trials; on-station experiments	Survey	Informal and multiple visit interviewing; seed diffusion trials
Results => Actions	Differences are small; advantage will be in long term; => limit production	=> Mel- in wide range multiply popular varieties; involve farmes in selection of new ones	Biological interactions not found to justify promotion of package; => expand R&D to study independent importance of other factors	=>Decentralize production	=>Work with existing seed system

were virtually no agronomic or economic data on the interaction of virus-free material with the farmer's environment. It may be a lot cleaner, but is it much better?

The importance given to methodology in the Mantaro Valley Project and its availability in Working Papers made it possible to address quickly and flexibly this obviously central issue. (e.g., Franco et al., 1980; Franco et al., 1981; Cortbaoui, 1982; Horton, 1982).

On-farm trials were conducted over two seasons (see Scheidegger, 1986 for more details).

In the 1985/86 season 80 trials were conducted using one experimental unit per field (a number of fields considered as repetitions for statistical analysis). This allowed a broad view of the value of the technology under a very wide range of socio-economic and ecological conditions. Results from 50 of these trials comparing project seed that had been stored in diffuse light with farmers' seed stored according to usual practice, found that project seed yielded on average 19% more than farmer's seed and that 46% of the trials produced rates of return on investment above 1.5 whilst 16% had negative rates of return.

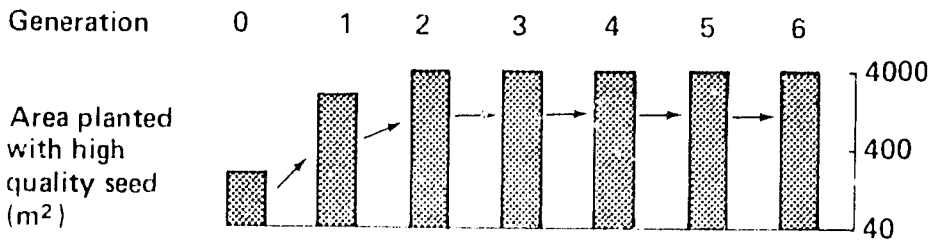
In the 1986/87 season a complete randomized block design was used with four repetitions per field. It is less time-consuming (fewer are needed), and thus less costly. A set of 20 of these experiments was conducted in which seed quality was compared under two types of storage conditions --diffuse light and darkness. Under dark storage conditions the basic seed yielded on average 23% more than farmer's seed and under DL storage the difference was 11% in favor of the basic. There was a tremendous range of difference in the results, from zero to 108%. The really big differences seem to be related to experiments that suffered severe water stress. Rate of return on use of basic seed for one season was above 1.5 in 55% of cases and negative in 35%.

The performance of the basic seed in these experiments cannot be described as sensational. Evidence from some experiments on the coast suggests, however, that differences there will be greater and that demand for the seed can be expected to be high. These benefits are likely to be passed on to the larger, commercial producers in the central highlands who are the main suppliers of seed to the coastal growers.

What of the small highland farmers? The interest in the seed is extremely high and one reason for this is that yield is not the end of the story. Informal interviewing as part of the trials plus data from more extensive informal and formal surveys show the great importance in highland seed strategies of conserving one's own seed for subsequent planting. Results from degeneration trials suggest that this is a viable strategy. In the higher altitudes virus build-up in the seed is slow, reducing the frequency of renovation considerably. Figure 1 analyzes what would happen if farmers obtained high quality seed for the purposes of renovation.

Figure 1

Long term profitability of high quality seed (Model: Farmer multiplication of small lots of seed).



	0	1	2	3	4	5	6	Total
Δ Yield (%)	20	5	5	5	5	5	5	
Δ Costs (US$)	2.4	0	0	0	0	0	0	2.4
Δ Benefit (US$)	7.2	24.0	48.1	48.1	48.1	48.1	48.1	271.7

Δ = Difference as compared to farmer's current practice.

Seed obtained in Generation 0 is estimated to yield 20% more than normal due to the combination of diffused light storage and phytopathological quality.

Thereafter, yield improvement is conservatively estimated at 5%, reflecting only pathological difference. We estimate that the farmer will reach 4,000 m² after two multiplications, starting with 20 kgs of basic seed.

(b) Varieties

The clean-up of seed for a seed program inevitably raises the question: what variety? There is a considerable amount of material available internationally, and local hybrid material is available in the Peruvian breeding program, but the major questions posed in a client-oriented approach concern the types of varieties already in use and the kinds of varietal characteristics sought after by farmers.

The first question can be answered by observing planting and harvesting, interviewing farmers and their families and making varietal collections.

Table 4. Importance of varieties for farmers and for the project in the Peruvian central highlands

	Percent of area planted		Goals for planting area (%) in greenhouses
	Seed Growers (1985)	Small Farm (x 84-86)	
Hybrids			
Mariva	2.5	7.2	10
Perricholi (new var.)	0.7	-	10
Revolución	25.5	12.5	25
Tomasa Condemayta	50.2	22.6	25
Yungay	7.5	27.3	20
Others	13.8 (9 var.)	29.4 (23 var.)	10 (Molinera)
Total	100.0	100.0	100
Native Commercial			
Amarilla	-	9.8	100
Huayro	-	36.8	*
Tarmeña	-	14.1	*
Others		39.5 (28 var.)	
Total		100.0	100

* When Huayro, Tarmeña and Maria Huanca have been cleaned they will be multiplied using 10% total space for each with corresponding reductions in the first five hybrid varieties.

A further important finding from the surveys with implications for a client-oriented program, concerns the range of varieties. Table 4 shows that small farmers maintain a much broader spread of modern and native varieties than the large seed growers. A wide range of native varieties seems always to have been an important risk-avoidance strategy whilst also providing a more varied diet. This has been applied to modern hybrids also. Varieties long since cast aside by the big farmers can be found growing in small peasant fields, often completely integrated into the mix of non-commercial native varieties known as Regalo, Huachuy, etc.

The Program should therefore include a fairly wide range of varieties. Even if this is not the most efficient form of multiplication, it can satisfy an important need.

Desirable characteristics can to some extent also be elicited through interviews, especially in the context of planting and harvesting, but this may not be a sensitive enough method. It is difficult to ask farmers to place qualities such as drought resistance, blight resistance or yield in an abstract order of preference. Resistance is not an absolute quality and preference is highly context- and time- specific. It is necessary to supplement the rural appraisal with farmer-level selection trials to overcome these problems.

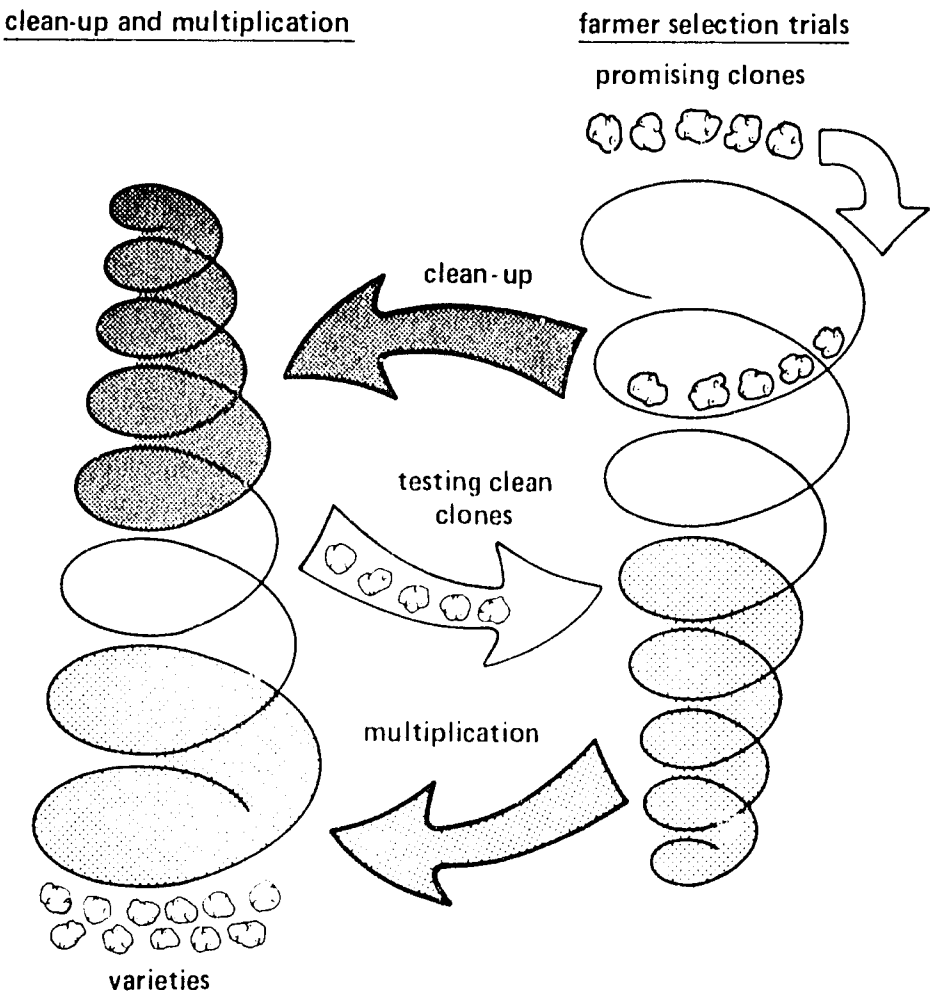
The use of such trials offers the chance to incorporate appropriate, new clones within the clean-up process.

Figure 2 shows how there could be an interdependence between the testing of quite large amounts of new material by farmers and the cleaning of a reduced amount that was found to be important for them. The clean material could then be tested in a simpler set of trials with farmers for rechecking the relative performance. This in turn will help determine the amount of green-house space these clones deserve. These farmers would also go on to multiply the best clones.

Farmer selection trials of this kind are being planned for the 1987/88 season, with ten farmers (two in each of five locations) evaluating a total of 18 clones.

Figure 2

Farmer Involvement in Variety Selection and Multiplication



(c) Technology package

A seed program which considers its only technology as seed, is unlikely to encourage the investigation of biological and socio-economic interactions between seed and other factors. Yet it is important to determine whether seed is going to benefit all farmers or mainly those who have the capacity to combine it with high levels of fertilization, as occurred with rice varieties in India (Farmer, 1978). Indeed, it is always possible that there are other, more serious constraints to improving economic conditions.

The results of experiments conducted with different qualities of seed and different levels of fertilization and density of planting show different results between 1985/86 and 1986/87. In the first season, basic seed of the Yungay variety responded better to higher levels of fertilization than the infected seed, thus making it more of a rich farmer technology. But in the Mariva variety there was no interaction. In 1986/87 there was no significant interaction between fertilization and seed quality in either variety.

The inconsistency of the results of these interaction trials confirms the conclusions of the Mantaro study that packages are inadequate (ibid: 8): the long held view that the effect of combined "improved" technologies is more than the sum of their parts is seen to be an agronomically and economically unsound principle.

In the 1983/84 season, before basic seed had become available in sufficient quantity to be used in experiments, some on-farm trials were conducted on fertilization which identified the independent importance of this factor as a constraint to production. They also introduced the seed production specialist to the realities of Andean agriculture, permitting in-depth observation of farming practices. Participation in farmer-trials allowed a much more revealing interpretation of results than can be achieved when the analyst is cut off from the context.

(d) Production techniques

Although the key technology involved in seed production is rapid multiplication in greenhouses followed by efficient multiplication in the field, this process has to be carefully related to the seed needs of different parts of the country in terms of both quantity and varieties. Seed programs can fail through over-production at the center and a lack of seed or the wrong varieties in the regions.

The characteristics of potato production in selected regions and the corresponding varietal profile described in the diagnostic survey, led to a very firm policy of decentralization. This was partly to deal efficiently with the great diversity in both varieties and techniques of production identified, but it was also the best way to overcome the natural communications problems presented by a mountainous country. Moving potato seed around is expensive and complicated. It also increases the chance of physical damage

and infection, particularly since road links between northern, central and southern Peru all pass along the hot, humid coast.

Regional production needs have continued to be studied using a wide range of methodologies, including formal questionnaires, informal interviewing and observations carried out by members of the project in the field and the collection of secondary statistical and qualitative data from official agencies and their personnel. The flexible approach to methodologies has also included use of the INIPA Extension service to conduct farm-level interviews using questionnaires provided by the project. Given the large size of the country, the inaccessibility of some areas and the small size of the Project team, this is a logical step with possible important "fringe benefits". In practice there are problems with this methodology: data appear biased towards similar types of farmers and in some cases data are too repetitive for comfort, suggesting some not so imaginative "guestimates", instead of answers. The difficulty seems to lie in a failure on the part of some extension workers to understand the point of such information-gathering.

There is thus an urgent need for training in this area and of these grassroots workers. Not only could they become important participants, improving the quality of data on Peruvian agriculture, but the fringe benefits of such training could include a greater personal understanding of the logic of local practices and more effective, fulfilling interaction with farmers.

Results from these studies have helped in setting levels of production for different varieties and for the different catchment areas of production centers, but they have also had a more general influence. The common small-farmer strategy of conserving own seed over several years, implies a modest level of basic seed production to replenish this informal system.

Although we have been considering the farmers as the main clients of a seed program, the whole agricultural sector is also in a sense a client, benefitting from successes and paying for failures. Many different elements of this sector compete for scarce resources, and programs need to justify themselves economically. Cost studies of seed production can help to choose between alternative techniques (stem cuttings vs. in vitro) and make multiplication strategies cost-effective, within the context of other client-centered considerations already mentioned. The exact

balance between the requirements of economic cost-effectiveness --for example, limiting the number of varieties involved in the clean-up and multiplication process-- and the requirements of a farmer orientation --a wide range of varieties for risk avoidance and culinary interest-- will always present problems.

(e) The delivery system

How effective is certification as a mechanism for distributing good seed? It is certainly a common solution to the delivery problem suggested by manuals on seed programs (cf. Douglas, 1980: 111ff.) and is frequently respected by countries where the scarcity of resources is in direct proportion to the complexity of seed legislation. Aside from the institutional difficulties of implementing certification, it is important to investigate whether even the most efficient scheme would be likely to have an impact. How do farmers normally renew their seed?

Results of several Project studies indicate quite clearly that certification is irrelevant to the vast majority of Peruvian potato producers. As Table 5 shows, only 8% of the seed flows to small farmers came from large seed growers, in a study conducted in the central highlands, where commercial production and certification are most concentrated. Moreover, this 8% represents the flow of commercial, not certified, seed. Certification is even less important, since the commercial system is much larger than the official. In the 1982-83 season, for example, the most policed of all the seed flows --between highland seed growers and coastal producers of consumer potatoes-- included only 41% of certified seed. The rest was "unofficial" commercial seed (Franco et al., 1986:67). The interaction of these systems can be represented as in Figure 3.

Figure 3

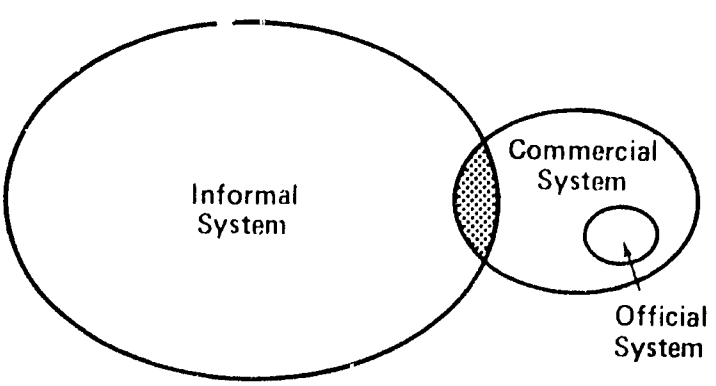


Table 5. Seed sources for three categories of potato in the Central Peruvian Highlands

Sources (%)	Farmers				
Categories	Local	Interlocal	Merchants	Seed growers	Other & unknown
Modern	25	15	27	13	21
Commercial native	43	31	10	1	15
Mixed native	64	9	6	-	21
Total	36	17	19	8	20

Modern varieties: Around 40 have been developed in breeding programs and launched in Peru since 1950. There are also some "escaped" clones from experiment stations which have been integrated as varieties by farmers. Twenty eight varieties and/or clones were identified in the central highlands.

Commercial native varieties: These are indigenous varieties selected by farmers and sold under their respective names. Six important varieties of this type were identified.

Mixed Native varieties: Indigenous varieties produced in mixed plantings mainly for home use. Each has its own name, but they are better known by a collective name: Regalo (gift), Chalo, Huachul, etc. Usually cultivated at high altitudes above 3,700 m.a.s.l.

Both informal and commercial systems have been studied through a range of interviewing techniques and observations of farms, villages and markets. The study of the informal system required a multiple visit approach to become closely involved with the activities of the farmers who collaborated in this study, and to have the opportunity to view the different stages of the system (Werge et al., 1980).

Results from the initial investigation (see Auroi et al., 1985; Prain et al., 1987; Vilca et al., 1987), offer several possibilities for an appropriate seed program delivery system.

(i) Seed flows: the locality

As Table 5 shows, locality is an important source of fresh seed. Seed is almost always obtained in small quantities and if it shows promise it is multiplied up over several generations through a series of conservation practices: careful tuber selection, treatment and storage of the seed (Prain and Uribe, 1986). The combination of this self-sufficiency and small-scale purchases can be efficiently utilized to get high quality seed to small farmers. The sale of 20 kg. lots of the seed directly to these producers was first tried on a small scale in the 1985/86 season. In the 1986/87 season, the distribution to 160 farmers was handled through the INIPA extension service. An evaluation of this distribution is in progress, and Tables 6 and Figure 4 present results for 63 of these cases.

Figure 4

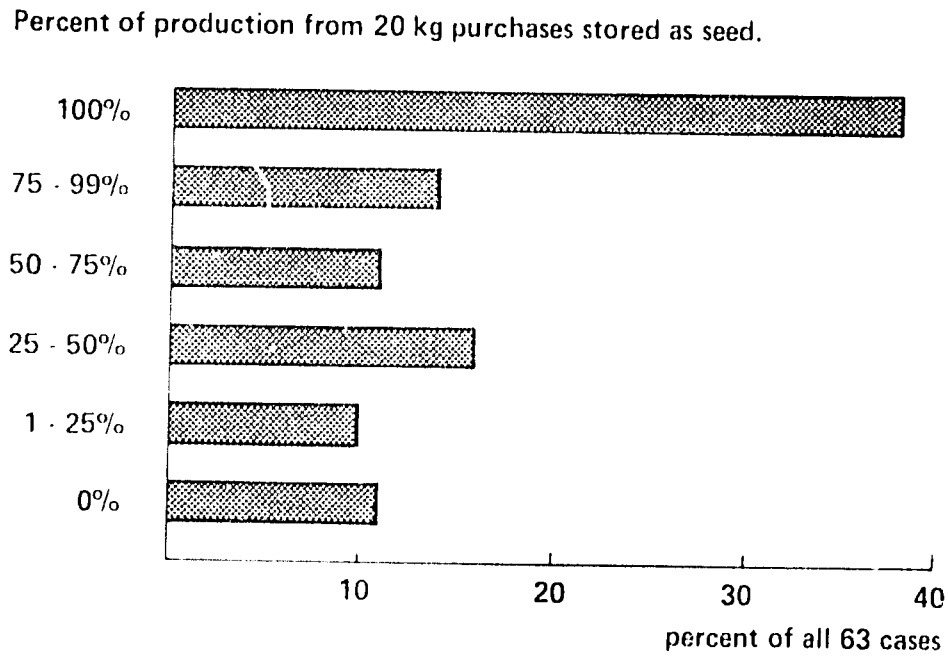


Table 6. Interest in 20 kg lots: purchase of seed (%) in 1987 in relation to variety bought in 1986

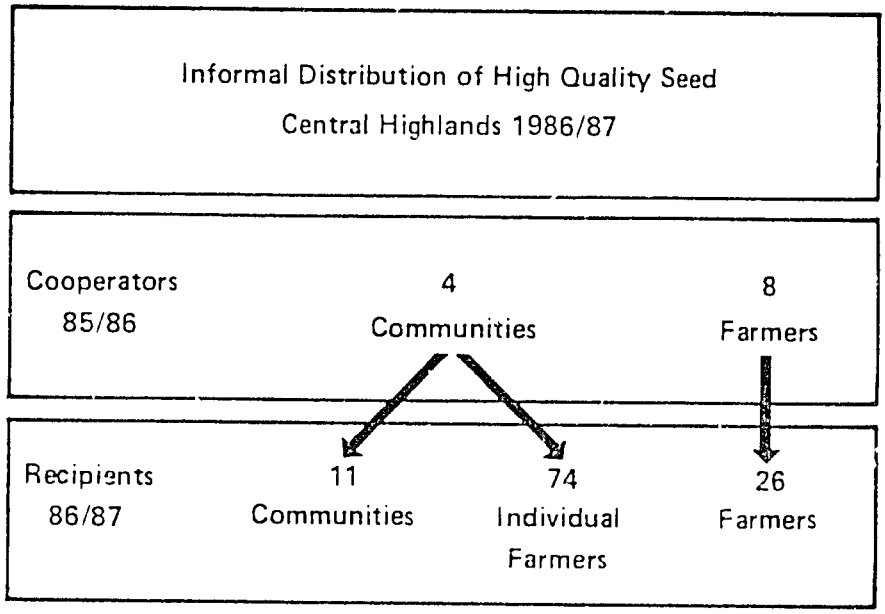
Variety bought 1986	Same variety bought 1987	Other variety bought 1987	No variety bought 1987
Mariva	21	39	39
Yungay	4	73	23
Tomasa	0	60	40
All	11	57	33

(ii) Seed flows: interzonal

Well-established seed flows have been identified between upland zones known for good seed production and zones where climatic conditions make it difficult to maintain seed stocks for more than two or three years. A more general flow of seed descends from the uplands to the lower eastern and western valley bottoms.

This raised the possibility of establishing informal seed plots in these key areas as a means of distributing the seed along existing channels. Trials of this distribution technique were carried out with eight farmers and four communities during the 1985/86 season, and with other cooperators in 1986/87. Figure 5 indicates the type of distribution achieved. CIPA Huancayo is ready to adjust its seed grower conditions to accomodate more of these special cases. The problem with the expansion of this strategy to other CIPAs is the research resources necessary to identify key seed production areas. Some of this information has already been collected by the Project and must be made more widely available. In some CIPAs there are highly motivated agronomists or agricultural extension workers who only need some training in data collection and transportation to be able to organize a small scale study of this kind. Where no such people are available or where the situation is highly complex, the special rural development projects run either by government agencies or through international technical cooperation should be able to incorporate this type of research into their plans and budgets.

Figure 5



So far, we have discussed methods and results from a client-oriented approach to seed delivery for the informal seed system where certification does not apply. Even within the commercial seed system much less than half the seed movement is certified. The fact is that in many developing countries the resources needed for institution-building cannot match the legal and political hopes nurtured through imported modals from wealthier countries. A complex certification scheme requires a large trained staff, adequate salaries to guarantee independence, mobility, an efficient ticketing system and a belief in the institution. Unfortunately most of these things are lacking in Peru.

An important institutional response to this situation has been developed as part of the Seed Program by CIPA XVI in Huancayo. They have established PICPA which began as a plan (Plan Integral del Cultivo de Papa or Integrated Plan for the Potato Crop) and which has become an institution (PICPA 1987). It links the production of basic seed in greenhouses and the Experimental Station lands with further

controlled multiplication among selected farmers. The organizing committee comprises representatives of both investigation and extension, the local credit bank, the Ministry of Agriculture's Certification Department and the leaders of the farmers' Seed Producers' Association. The idea is that with the help of these combined forces, at least the first two generations of high quality seed will be adequately certified. Thereafter, it is accepted that the seed will spread along the commercial channels, which have functioned reasonably well for many years with little official intervention.

3. FUTURE COLLABORATION

The methods and results described above derive from what might be called a socially-oriented perspective. It is orientated towards the reality and needs of the particular group with whom the development effort is concerned: in this case the farmers. This orientation is not the preserve of any particular social science department; rather, it is a particular frame of mind. As such we see it as something that could be generalized to other seed programs. But there are also some specific issues that have emerged which should be confronted by the Social Science Department.

There are four principal issues: surveys, trials, institutions and diffusion.

Surveys involving village extension workers could improve our understanding of the national agricultural situation, whilst at the same time improving the understanding of the extensionists themselves about local agriculture. A great deal more work could be done to help agricultural services benefit from what unfortunately is a much maligned but, in reality, very rich resource.

On-farm trials have been important both for the results they have provided for the value of basic seed and the understanding they offer of farmers' problems and possibilities.

The trials have involved research station staff and extension workers in different CIPAs many of whom are highly motivated to do more and do better. But we often failed to get across the basic concept of on-farm research to them.

This requires a special training approach which can come from the social science department.

The publications being prepared at present by the Department (case studies on CIP's experiences with on-farm trials and on-farm methodology) should offer some useful material.

On-farm trials can be expensive and are usually much more time-consuming than station experiments. One way to make it cheaper is through cooperation between the specialist agronomist and the village extension worker. In this way trials can be managed without major transport requirements. Other ways need to be explored.

Institutions were barely discussed above, mainly because the methods for studying and analyzing them are not available. Yet institutional issues are at the heart of a seed program and probably at the heart of most commodity programs. Some very encouraging autonomous institution-building was described in the Seed Program in Huancayo, but pushing this as a model for other CIPAs requires a deeper understanding of the processes involved.

On a more general level, there is a real need to study the formation and function of National Programs. National Programs offer an institutional structure within which CIP is able to cooperate with individual countries. But how well is this structure understood?

Diffusion is the final area where CIP Social Sciences could usefully get involved. In much social science literature, diffusion studies are practically synonomous with adoption studies. The extent to which the technology has been adopted and possible reasons for its adoption and its rejection are measured; early adoption, late adoption and non adopters are identified. This is an important perspective that needs to be maintained. Yet, it is not the only perspective. Diffusion can also be considered as a phenomenon in its own right, determined by particular relations between people rather than a characteristic of an individual. The idea of the "diffusion domain" (Hilderbrand *et al.*, 1985; Wotowiec *et al.*, 1986) is a useful attempt to think in this way. The work with traditional seed networks in the Seed Program explored ways of using such a domain.

A diffusion domain is a network of contacts along which ideas and/or things pass as part of the normal set of social exchanges linking groups and individuals. We do not know,

however, whether ideas and things pass along the same networks or whether different kinds of technology have different modes of diffusion. The value of understanding diffusion in this sense is obvious. It could have a big effect on the way Extension is carried out, making up for the shortage in technical and financial resources by taking advantage of the tremendous human resources available in the ordinary life of farming communities.

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POTATO FARMING TRIALS: THE COLOMBIAN EXPERIENCE

Pedro León Gómez

Potatoes are the most important crop in the Colombian highlands, where they play a significant role in the daily diet. More than 90,000 farmers plant about 160,000 ha with potatoes every year, although most farms are below 2 ha in 70% of the plots. Thirty-one percent of the consumption of fertilizers and 60% of fungicides is used on potatoes. Finally, potatoes rank third in value after coffee and rice and third in total gross production after bananas-plantains and cassava.

The government is aware of the importance of the potato crop and has stimulated credit, research and extension to increase production and productivity. In this paper I show how potato farming trials were developed in Colombia, the levels of farmer participation and the current situation.

The Colombian government has supported potato research for more than 40 years; in the early years, however, research was oriented toward the identification of problems and the testing of native and introduced varieties. Until 1975, breeding was the main activity of the Potato Program, and 22 breeding varieties were released after several years of evaluation. Farming trials or regional trials, carried out to evaluate new varieties, were conducted every semester with seven to ten promisory clones. At times, farmers only participated by lending and plowing land for trial plots. The research brought labor from planting to harvest and in crop activities. The agronomic practices applied to the crop were the same ones developed at the Experimental Station. Sometimes a field day was organized to show the best clones, but the tubers produced were brought to the Experimental Station. Before a breeding variety was released, some tuber seeds were given to selected farmers to know their concepts of agronomy and quality aspects of the material. The main purpose of the breeding program was to increase yield and resistence to late blight and virus.

Regional trials with the disciplines, began as soon as there was personnel and technical support from the Experimental Stations. The entomological trials were

oriented to find out how the recommendations for chemical control worked on the Andean weevil at the farmer level. Farmers participated in two ways: renting or lending the plot of land and attending a field day which sometimes took place at harvest. At the end of the 1950s, screening for Andean weevel resistance started. Farmer participation in this area was almost nil, despite the fact that the trials were done at the farmer level.

Disease and soil aspects at farm trials were approached in the same way as insects. In 1965, demostrative plots at the farmer level were cultivated, to show the reaction of the native variety to late blight and breeding varieties. In soil, the farmer trials began in the mid-1950s by testing the amounts of fertilizer needed for each potato area.

Developments in technology changed the researchers' attitudes toward the farmers. Before 1975, levels and problems of technology of the crop caused a high percentage of the research to be carried out at the Experimental Station, with little validation at the farm level. Of the technology produced, there was a high percentage of adoption with this system: 60 to 65% of the potato area was planted with breeding varieties produced by the National Program and a high percentage of the farmers used fertilizers and followed insect and disease control recommendations. The adoption of this type of technology resulted in a productivity increase of 4.5 t/ha in 1948 to 12 t/ha in 1975, and a duplication of the planted area during the same years.

In the mid-1970s, the level of technology used by the potato farmers required a change in approach from researchers in order to maintain the level of adoption of the technology. The farmers needed more specific technology in specific areas to solve problems. Good examples of the new approach, where farmers have more contact with development or adoption of technology, are rustic and seed storage and Andean weevil control.

Using International Potato Center (CIP) technology developed for rustic seed storage, the farmers were involved in adapting it to their needs and economic conditions. Comparing how they stored the seed and the new method, it was possible to convince farmers of the economic benefits of the new technology. More than 80 farmers in two years began to use rustic storage for their seed in the project development area. Obviously, promotion is not necessary when the technology is convincing.

In some areas, the general recommendations for chemical control of the Andean weevil did not work and specific research was necessary for areas where the Instituto Colombiano Agropecuario (ICA) does not have Experimental Stations. Farms were selected where the problem was critical and where farmers wanted to collaborate in finding solutions. Insect and potato variety life cycles and all the experiments at the farm level were conducted by the farmer or a member of his family. On the field day, which took place where the experiment was conducted, the farmer was the main speaker.

Until 1984, farmer participation in the execution and evaluation of a new technology was just in one aspect of the potato crop system; namely, insect or disease control. Researchers began to study the potato crop as a system and see how the farmers could participate at the farm level. A multidisciplinary team composed of an agronomist, an economist, a pathologist and an entomologist began work at the farm level, planting two potato crops of 1 ha each at several farms; one of the plots was cultivated by researchers using ICA recommendations and the other by farmers using local technology. These experiments were very useful because they marked the first time all the recommendations had been put together by the researchers. Several of these recommendations did not work well, as they were tested individually, while others were not necessary for some of the farmers. It was interesting for the researchers to know that farmers' decisions about the potato crop depend on the farming system as a whole and are affected by internal and external factors, some of them beyond the farmers' control.

As a result of contact with farmers in the last ten years and the latest experiences working directly with farmers at the farm level, we are trying to develop a new approach using farmers' experiences and interest in solving their problems. A team of three agronomists, one zootechnicist, one economist, one anthropologist, and one postharvest specialist is working for the new approach at the farm level with the technical support of researchers at the Experimental Stations. The first task is to understand the farm system: how it works and how the socioeconomic and biological conditions affect the decisions of the farmers. Parallel to this, farmers are being incorporated into the planning, execution and evaluation research at the farm level, and farmer's meetings are being organized to identify the main technical problems affecting the farming system. Once these problems have been identified, farmers are selected to help find solutions. The farmer has thus become

another member of the research team at the farm level. We hope that with this new approach, ICA can develop the appropriate technology in a timely fashion.

THE AGRICULTURAL ECONOMIST AND THE EXPERIENCE OF INIPA WITH RESEARCH IN FARMERS' FIELDS

Javier Galván

1. INTRODUCTION

The experience of the National Institute of Agricultural Research and Promotion (INIPA) in Peru in conducting research in farmers' fields, is a broad and complex subject. Consequently, the scope of this paper is modest, and it emphasizes the author's views on the following points:

- General aspects on the organization of the agricultural research institute;
- Research performed by INIPA in agricultural fields and the participation of the agricultural economist;
- Presentation of recent experiences of current research and the role of the agricultural economist; and
- The Office of Agricultural Economics (OAE); plans for the future and possible areas of collaboration with the International Potato Center (CIP) in social sciences.

As many of you already know, the new Peruvian law of the agricultural sector has recently been promulgated and will soon take effect. Based on INIPA, this law created the National Institute of Agricultural and Agroindustrial Research (INIAA). In it, several governmental research activities included in the sector are brought together. For instance, INIAA will be in charge of planning and carrying out research in agriculture, forestry and livestock and on the efficient use of water and soil. At the same time, it will also cover the process of technology transfer to producers through institutions that provide technical assistance, whether public or private, as well as other specific actions to ensure the effectiveness of technology transfer. To this end, INIAA will maintain a team dedicated to

transfer of technology, which will serve as a support for research carried out in farmers' fields.

Since this paper deals with research experiences and how economists should complement research work with producers, a brief mention will be made of how the new organization can facilitate a better interaction with other researchers. I feel that there are some points in favor of this action. The first of these points is the agricultural economist will primarily work at the experimental stations and other support centers. This will facilitate permanent contact with other researchers. Second, the work of the agricultural economists will be more specific. An additional factor which reinforces the plan is the establishment of a more direct relationship with national commodity programs.

2. PRIORITIES AND ELEMENTS OF THE INSTITUTION'S ORGANIZATION FOR AGRICULTURAL RESEARCH

The identification of priority products for regional and national nutrition as well as the structure of production has resulted in concentrating efforts on the development of commodity production to supply these products.

Coincidentally with this, the organization of INIAA for the purposes of agricultural research, forsees nine national commodity programs: rice, corn, grain legumes, potatoes, cereals, oil seed crops, livestock, Andean crops, and tropical crops. Of course, this list can be expanded as the justification for establishing new areas of action is made apparent.

The Office of Agricultural Economics views its program as horizontal in nature. Among its many tasks are included joint ventures with the various programs by product line or commodity. Recently, the OAE it has been sought to strengthen the activities of the national commodity programs for the purpose of effectively constituting instruments of planning, execution and supervision of those tasks which are oriented toward the generation and transfer of technology.

In this sense, the Institute has held regular meetings of the national commodity programs with the directors of the agrarian research and promotion centers (CIPAs) and of the experimental stations, throughout Peru. Through such

meetings, research priorities have been established for each group or groups of products, taking into account the diverse agricultural zones. In addition, and intending to overcome the preponderance of verticality in national commodity programs, which tend to have a somewhat biased vision, the strategy of the institution envisions various activities with the common goal of achieving coordintion among the various lines of research. In this sense, "the national programs should not only coordinate the activities inherent to each of the products, but they should also coordinate those activities under the focus of production systems in which the interaction of two or more of these products is produced (INIPA, 1986a).

The new INIAA will re-establish agricultural research as a system at the national level, which includes a greater working relationship with other entities which carry out agricultural research. In this respect, efforts have been made to classify the distribution of agricultural production by agro-ecological zones and areas of influence which each experimental station would have in relation to these zones. In this way, resources will be concentrated on solving priority problems and avoiding duplication of efforts.

This position is complemented with the necessity of carrying out "adaptation" research in micro-agroecological environments and with agroeconomic characteristics defined at the level of each of the CIPAs and/or future regional organizations (INIPA, 1986a). Certainly, additional elements could be incorporated for a more integral vision of that mentioned above. That, however, is considered in gross scenarios how the Office of Agricultural Economics should develop its future activities.

3. RESEARCH IN FARMERS' FIELDS AND CURRENT PARTICIPATION BY THE AGRICULTURAL ECONOMISTS

(a) Research in farmers' fields

All national commodity programs carry out --with greater or lesser emphasis-- research projects in farmers' fields. These range from trials of genetic material to adapted cultivars. That is to say, the process of evaluation of new techniques occurs in many sites and fields away from the experimental stations. Methodologies sponsored by the various international organizations specializing in

research and development of agricultural production are used to this end. These methodologies vary according to the type of commodity. Such methods are, in part, fitted and/or conditioned in their application to the characteristics of agricultural production and priorities by: Agroecological zone. Identifying the problems and limitations on the basis of interaction with farmers; and the experience of the researchers and extensionists.

For the most part, the methods used in the process of research whether on experimental stations or farmers' fields are in many cases limited by the lack of financial resources.

In principle, the approach which the institution has been using in agricultural research can be classified in two groups: The first, and more traditional, consists of an approximation by commodity where the researcher concentrates on finding a solution to the limitations and problems identified at the level of groups of agricultural producers. The second, and less influential, but which is gaining importance, has been the consideration of production systems as a basis of analysis. Here the production unit is examined as a whole.

Both approaches are complementary, but no exclusive. The commodity researcher, in many cases must explicity or implicity incorporate the status of the cultivar within the production system to establish his research priorities. For this part, the researcher concerned with analyzing the unit as a whole, should confront at some point, what technological offerings by commodity can be researched within the existing system. Research and evaluation must be conducted to determine the applicability of the technology on farmers' fields.

Looking over the conclusions of some of the national commodity programs' annual reports, field experiences with farmers and above all with small farmers, the following is observed. In the case of the National Corn Program, for example, it is reported that test plots were conducted in farmers' fields during 1985. These plots "take in a large number of environments in technology depressed areas with the objective of studying the performance of the improved varieties and crop production practices of easy adoption (INIPA, 1986b). The report also points out the following: Farmers often recognized the possibility of increasing production by adopting intermediate technology. Farmers, however, were reluctant to accept them due to financial

limitations and risks. In this case, even though the agronomic and statistical analyses were presented in detail, economic analyses were not included, nor a measure of risks, which could add more elements for discussing with the farmer. The researcher points out that one of the errors to be corrected in the next season would be to ensure the adequate follow-up of production costs, permitting the respective economic analyses to be carried out.

Similar cases could be found in other programs where the economic validation works for new varieties and production techniques have not always been followed on a timely basis. This is one of the main concerns of the OAE. These problems are now being corrected, but this process is only beginning. In the case of launching new varieties or new technology, for example, accompanying economic and risk analyses are required, a task to be carried out by the agricultural economist with the support of those who managed the plots.

(b) The participation of the agroeconomist

We have seen how an important part of the experiments carried out by the National Commodity Programs take place in farmers' fields and with the farmers' active participation. At the same time, it is worthwhile to mention that these experiments provide similar lessons found in other, more accurate and ambitious projects. How, for example, do the ecological conditions and types of producers influence their technological requirements? Why is there reluctance by farmers in adopting new technology for economic or risk reasons?

Active participation by the agricultural economist with multidisciplinary teams in farmers' fields, has not been the usual practice. Two cases under development will be mentioned here. The first is that of the improvement of the agroeconomic systems of a group of farmers in the districts of Jesus and La Encañada in the Department of Cajamarca (INIAA, 1987) whose plots vary in size between 1.5 and 7 ha.

The second refers to research of crops and livestock in plots of ten communities in Puno, under the focus of systems to generate more adequate production alternatives. These are coordinated by the OAE of Cajamarca and the National Program of Andean Crops.

In the case of the farmers from Jesus and Encañada, agroeconomic improvement of production systems is oriented economically toward the elaboration of farm plans for each of the 12 selected farmers. Biologically, the orientation is toward using improved and proven procedures such as: The use of improved seed in all crops; and in some cases the application of chemicals and simple agricultural practices.

The production structure of the agricultural units takes in, essentially, potato, corn, wheat, oats and milk. The project will run for two seasons and the first season has just ended. The results are being analyzed and evaluated based on data supplied by the farmers themselves.

The preliminary findings suggest an increase in real profit of the agricultural unit as a whole as well as an increase in yield by hectare for some crops and producers. The increase of real profit by changes in the crop mixed or by the increase of yields still needs to be analyzed as does the exchange of opinions with farmers on the results.

The team, made up of an agricultural economist, an extensionist and a researcher from the experimental station was complemented by specialists in management commodity.

The farmer was also supported with the use of services of agricultural production such as, the preparation of a request for credit for the acquisition of a tractor. These activities reinforced the confidence of the farmer in the technical team. In spite of only having had one year's experience, other farmers in the above mentioned areas have shown an interest in participating in the program.

In the peasant communities in Puno, the National Program of Andean Crops is carrying out a ten community agricultural research project based on a systems focus. This is taking place within the framework of the PISA-CIPA XXI PUNO project, conducted at various agroecological zones in the highland (altiplano), above 3,800 m.a.s.l.

The project seeks to find adequate technological alternatives for the farmers using a multidisciplinary team (agronomist, animal scientist, economist, and social worker).

Part of the strategy of the team is to gain the confidence of the community. The team was to reside in the community most of the time. This focus permitted the establishment of a continuous dialogue with the farmers in order

to determined their principal problems as well as research priorities.

The project, which is now in its second year (out of five), has determined: (1) the structure of agricultural production indicates six principal crops: potato, quinoa, oats, wheat, cañihua, and fava (habas); and (2) because farmers work in high risk agricultural conditions, the objectives are centered on reducing the chances of failure.

The experiments were conducted by the interdisciplinary team and the farmer. To date, the agronomic results of the experiments are available, but they are still under analysis (INIAA, 1987).

Apparently, the costs of production have not been followed as ideally as they should have been due to lack of funds. Efforts will be made to complete the information about these cost of production so as to carry out an analysis of economic validation.

As a means of illustration, field results for a group of potato experiments, still under analysis, suggest the following:

- Tahuaqueña and Kaira varieties had higher yields in all the communities in relation to the commercial native varieties, even under frost conditions. The differences, however, judging by the average yields presented below, are not very important in relation to a "native commercial variety." Other indicators, such as the range of the yields, were not available at the time of writing this paper.

- Planting, rotation and cultural practices were carried out by the farmers' themselves.

- The average yields of potatoes of these varieties vis-a-vis native commercial varieties (Andina and Ccompis) in three communities (Llallahua, Jiscuani, and Nuñumarca) are detailed below:

Tahuaqueña	6.4 t/ha
Kaira	6.2 t/ha
Andina	5.9 t/ha
Ccompis	4.3 t/ha

- In two communities where the waru-waru or camellones system is used without fertilizers, the yields were much higher and will be analyzed independently so as not to bias the results.

- Some of these experiments will be replicated next season by request of the communities for the purpose of a continuous evaluation.

In both cases, one can appreciate that a multidisciplinary team was established and worked on the project. However, there has been some trouble in the second project with the economist not being able to get to the field due to lack of funds.

Various factors have influenced the fact that the agricultural economist has had difficulty with a more intensive working schedule with the national commodity programs in on-farm research, and these are:

- Multiple objectives of the OAE. It is necessary to concentrate efforts on certain key aspects and to continue expanding its tasks as a function of the availability of financial resources.

- The need to carry out other basic projects which were previously weak. Among them: gathering of production costs of crops and livestock in the entire country; to support the determination of agroecological zones by department; to identify the agricultural, social and economic characteristics in the areas of the extension agencies and its principal production problems; and economic analysis of the results of demonstration plots. Certainly, these are basic tasks in order to determine research priorities or support for extensionists. However, they separate the economist from an interdisciplinary approach and field work with other researchers.

- Concentration of the agricultural economists in the department capitals where the headquarters of the CIPAs are located; and

- The training programs for agricultural economists have not been as effective as desired, due to loss of personnel or lack of funding for opportune travel to farmers' fields in the company of other researchers.

4. PLANS IN PROGRESS OF THE OAE

Certain basic features of the future work of the OAE can be gleaned from what has been outlined above. What follows are suggestions for a selected group of activities which do not exclude the possibility of including others. I feel, however, that those detailed below constitute the principal themes:

- A sustained effort will be dedicated to working more as a team between the agricultural economist and other researchers, for the identification, generation and transfer of the appropriate technologies.

  This will be carried out at headquarters as well as the experimental stations. For the most part, in the latter, to decentralize their actions and facilitate reaching the field.

- In the first stage, without prejudicing other areas, the standardization of procedures to gather field data and the analysis of economic validation and risks will be continued in test and demonstrations plots in farmers' fields. The objective is that this task become a usual practice.

- The process of research is like a closed circuit which ranges from the identification of problems and limitations of the farmer to the acceptance or rejection by the farmer of the technology. The latter serves as feedback for subsequent research. Seen in this way, the agricultural economist should be equipped to participate as part of a group and orients his analysis to those stages of the research process where his professional expertise is most needed. Aside from the process of economic validation, this will be the identification of limitations and problems of the farmer by type of units and agroeconomic conditions, as well as the impact evaluation of the transfer process.

- There exists a desire in the Institution that the national commodity programs should interact more among themselves using a production systems approach. I believe that this is an important area in which the agricultural economist can cooperate, identifying those areas where more interdisciplinary work should be carried out among the national commodity programs; and

- It has not escaped the Office that these tasks should be complemented selectively with others of a more aggregate nature and which should become permanent, such as:

(a) Profitability of the research

On various occasions, the research process is not appreciated in practice by outsiders. This is due to a series of restrictions, principally of a financial nature. Consequently, time and time again, it is necessary to demonstrate the profitability of research in the face of other investment alternatives. In this sense, local analyses of the impact of technology transfer should be completed in order to encourage the committment of resources in this area.

(b) Production alternatives in predetermined zones

One of the problems encountered even on the coast are the limited production alternatives faced by farmers. Few studies indicate if the available resources will be put to better use with different combinations of commodities, whether by the farmer in particular, the region as a whole or by other regions. Certainly these types of problems cannot be reduced to a project of agronomic character. Price policies for the farmers and the impact of certain economic measures have much to do with production patterns, the farmers profit and their capacity to reinvest in new technology. This will be the type of work that we at INIAA will endeavour to share with the new General Office of Agricultural Economy of the Ministry of Agriculture, which will possibly be primarily responsible. However, it is clear that this type of studies can be translated into effective economic policies which also affect directly the fixing of priorities for research in specific regions.

One example will suffice. Recently it was decided that it would be economically more beneficial for the country to encourage certain substitutions in rice growing areas on the north coast by cotton in the next season. However, this requires a change in price policies for the producers of these crops. It also signals the need to reinforce the lines of research in cotton, above all in the case of Lambayeque, which could facilitate rapid policy adjustments in areas subject to climatic conditions and international prices.

The above mentioned tasks imply an important reordering and improvement of the available resources in the institution. In the first place, it requires a concentrating of work on the part of the agricultural economist on fewer but more effective objectives. In the second place, to bring the agricultural economist closer to an interdisciplinary approach, it implies a training process which will make him more necessary in the eyes of other researchers. Also, a task of this nature necessarily requires changes in funding, with more provision for travel. Finally attractive salaries are needed so as not lo lose the agricultural economist once he has been trained. This has certainly been one of the more serious problems confronting by the institution in the past years.

5. POSSIBLE AREAS OF COOPERATION WITH CIP

We understand that one of CIP's principal missions is to support the strengthening of the National Potato Program, which indeed it has been doing. Without the prejudice of an intensive agenda in the area of new technology generation and transfer, we will endeavour to concentrate on increased relations with CIP's Department of Social Sciences in the area of agricultural economics.

It is pointed out above that there exists a series of areas in which CIP could cooperate, principally in relation to specific projects in farmers' fields with the participation of an agricultural economist. With this in mind, an agenda of cooperation could read as follows:

- Support for the evaluation of the economic impact of a selected group of technologies used in the past few years in specific regions and by the type of products (for example, the evaluation of economic damage of the miner fly as opposed to alternatives of control on the coast).

- The design of methodological procedures and the execution of impact evaluation of a group of "transfered technologies," analyzing its adoption process; and

- Technical and financial assistence for the execution of joint projects of INIAA National Commodity Programs in farmers' fields, guaranteeing the participation of agroeconomists in multi-disciplinary groups.

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FARMER-ORIENTED RESEARCH AND DEVELOPMENT OF INTEGRATED PEST MANAGEMENT

Peter Ewell

1. INTRODUCTION

For two years, I participated in the International Potato Center's (CIP) research program on integrated pest management for potatoes in Thrust V. IPM is a flexible approach for the development of stable, sustainable pest management systems which minimize the use of chemical pesticides. Pesticide use is expanding rapidly in most areas where potatoes are grown. The potato is a high-value crop, with high production costs, subject to many risks. Chemicals are effective in the short run and widely available, but all entomologists know that they are not a permanent solution. Insects become resistant, natural control methods are disrupted, and costs for ever higher doses of ever more expensive products can become prohibitive. Although public pressure is lower in the Third World than in developed countries, the long-term effects of pesticides on the environment and on public health are still serious concerns.

Entomologists at CIP have been working for years on a number of component technologies:

- Varieties--resistent or tolerant genetic meterial.

- Biological control--the introduction or augmentation of predators and parasites. The synthesis and use of pheromones --insects' chemical sex attractants-- for trapping or mating disruption can also be included in this category.

- Cultural control--The manipulation of the crop environment to inhibit the movement or reproduction of pests. Methods include the timing of planting, cultivation, irrigation, and other practices that affect the life cycle of the pests.

- Physical control--the use of traps, barriers in stores, repellant weeds, etc.

- Chemical control--the judicious use of minimum quantities of appropriate pesticides.

It was felt that social scientists could contribute to the integration of these kinds of components into the management systems of different kinds of farmers, under diverse conditions. The job announcement called for "an economist, an anthropologist, a geographer, or an ecologist," which left a lot of latitude about methodology. Our team chose a flexible approach, emphasizing interdisciplinary cooperation.

2. DIAGNOSIS OF FARMERS' CURRENT PRACTICES

Our work began in Peru, where potatoes are grown in many farming systems covering a wide range of agroclimatic and socio-economic conditions. Single-visit surveys provided a broad picture of farmers' perceptions of pests and current control practices. A box of insect specimens, both pinned adult and larvae in vials of alcohol, proved useful in eliciting farmers' perceptions of the prevalence of pests and the damage they cause relative to other risks. It was also an excellent mechanism to establish rapport. The whole family would gather around to look at the specimens, and would talk freely about control methods they had tried or heard about.

Questionnaires focused on pest management and the use of purchased inputs, without trying to detail the costs of production. We found that chemical pesticides are used by essentially all highland farmers who grow potatoes for sale, even on a very small scale. They are used more widely than fertilizers or purchased improved seed, although the quantities applied vary greatly. In general terms, pest management systems can be divided into the following types:

- Traditional systems Potatoes have been cultivated under pest pressure in the highlands of Peru for thousands of years. Traditional methods developed by farmers can be adapted to other areas. One example from Peru is the use of repellant weeds in stores, a principle which is being tested widely in the regions. Many characteristics of traditional systems, such as long fallow periods and the

simultaneous cultivation of many small plots in various different ecological zones, reduce pest risks. These practices survive in plots where potatoes are grown for home consumption, in high altitudes and in isolated areas.

- Intensifying systems. In the major highland agricultural areas, peasant families produce potatoes both for home consumption and for sale. In most cases, potatoes are their most valuable commercial crop, in which they invest their limited cash resources for inputs. Conditions are highly variable over short distances and from one year to another. A bewildering diversity of chemical pesticides is available through well-developed commercial channels. This is a weak area in public research and extension systems, and farmers need better information about a broader range of alternative control methods.

- High-input Systems. The coastal valleys of central Peru, which fall outside of the traditional range of potatoes, provide a classic example of a "pesticide treadmill." Irrigated potato production expanded in the 1950s for the Lima market. The indiscriminate use of pesticides disrupted the natural enemies of a leaf miner fly (*Liriomyza huidobrensis*) which had never been a significant pest. Its population exploded, and it has since developed resistance to all classes of insecticides. Pest control costs, which range from 5 to 15% of the cash costs of production in most areas of the country, rise to as much as 50 or 60% in unusually warm years. Most of the literature on IPM refers to alternative control strategies organized in response to severe crises of this kind. The development of flexible technology for what we have called the "intensifying systems" of the majority of potato farmers in the Third World is an even greater challenge.

4. MONITORING AND SURVEYS IN CLOSE ASSOCIATION WITH EXPERIMENTS

The next phase of the research focused on a few key pests and on a limited range of management practices and proposed innovations. The entomologists laid out experiments on borrowed land in representative production zones. The experimental designs were kept simple, and insect populations and damage were monitored using the the same techniques used in CIP's experimental stations. We selected

samples of 30 to 50 farmers in the surrounding areas and interviewed each family several times during the growing season to collect information on pest management practices and their costs. We constructed simple parameterized budgets and also monitored the same entomological parameters as in the experiments, using simplified methods. These combined methods allowed us to understand the logic of farmers' decisions about pest management under highly variable conditions. Continuation of the exercise for a second or third season considerably improves the reliability of the analysis. The same basic methodology was applied in the study of field pests on the coast and in the Mantaro Valley, and to investigate pests in stores.

5. RESEARCH IN TUNISIA IN COOPERATION WITH THE NATIONAL PROGRAM

The potato tuber moth (Phthorimaea operculella) is the only major insect pest found in Tunisia and throughout North Africa. It causes significant damage to potatoes stored through the hot summer months, when there is no production. In cooperation with INRAT (the national program), a CIP entomologist has been studying the pest in that environment for several years. As a social scientist from headquarters, I assisted in the expansion of the research to include farmers. We encouraged an economist from INRAT to participate in a survey of pest management practices in the major producing region. Entomological parameters were measured in the fields and stores of a small sub-sample throughout the growing and storage seasons. Data were collected at regular intervals in retail markets in Tunis, to trace the price penalty on different degrees of damage through the period when all potatoes on the market come out of stores.

6. SOME FINAL THOUGHTS ON REGIONAL VS. HEADQUARTERS RESEARCH

The IPM project was initiated at the request of the entomologists, and interdisciplinary support was extremely high throughout the project. Nevertheless, I would like to make a final observation on the difference between my experience at headquarters and in Tunisia. The entomologists in Lima are under continuous pressure to carry out research

on a wide range of component technologies in three very different ecological zones. This means that they are constantly running experiments. The potential value of our work was to incorporate an analysis of farmers's conditions and perspectives into the early stages of the development of new technology.

The entomologist in Tunisia was working within a systems framework, looking at temperature, moisture, variety, harvest date, store design, and other factors affect the insect populations and the damage they cause. It was very easy for us to add more variables into the analysis: costs of control, rising prices through the storage season, consumer tolerance for damage, etc. The value of the work was to catalyze interdisciplinary participation of national program scientists in the process of adapting practical alternatives for pest management in farmers' fields.

WHAT NEW CHALLENGES SHOULD CIP SCIENTISTS FACE IN CLIENT-ORIENTED, PARTICIPATORY R&D?

Robert Chambers

1. DEFINITIONS

In this paper:

- clients are both user-clients (poor producers and consumers) and professional clients (other scientists within the International Potato Center (CIP) and National Agricultural Research Systems (NARS), other organizations, etc.).
- client-oriented participatory R&D includes both user-clients and professional-clients.
- scientists includes both natural and social scientists.
- participatory refers to collaboration both between different sorts of scientists and between resource-poor farmers (RPFs) and scientists,
- R&D technology refers to methodologies.

2. SUMMARY

Three new challenges are identified:

- Sweet potato strategies: ex-ante analysis and RPFs' perspectives.
- Methodological frontiers with RPFs.
- Training for "scientists and farmers face-to-face."

3. CIP'S COMPARATIVE ADVANTAGE

CIP's comparative advantage can be identified in relation to what other organizations can and should do best, and CIP's own mandate, specialization, personality, staff, resources, and history. Obviously, CIP's clearest comparative advantage and responsibility concern potatoes and sweet potatoes. But beyond this, five other factors seem to me to stand out.

(a) Closeness to resource-poor farmers

CIP has been a leader and is ahead of the game in its closeness to RPFs. Unusually in the CG system, CIP scientists have worked directly with farmers in a social anthropological mode. This appears to have influenced research priorities and style quite widely. CIP has not had a farming systems research program per se. Paradoxically, this is also part of CIP's comparative advantage, allowing more methodological creativity.

(b) Flexibility

In the social sciences, the lack of a framework has been criticized, but this seems to me to have been a strength. There has to be some order, and priorities have to be puzzled over, but a degree of freedom for social scientists to work on and follow through on what they find most exciting can have big pay-offs, as illustrated by CIP's social science track record. Thrust X on food systems is sensible since, in principle, it includes everything, preserving some of this flexibility and room for creativity.

(c) The prestige and influence of a CG center

This does not need to be stressed but it means that CIP can raise the status and professional interest of neglected subjects (as it has done for the potato and will no doubt do for the sweet potato). It also means that CIP can generate and spread R&D technology (methodologies) involving resource-poor farmers which otherwise would not be acceptable. This has already happened with, for example, the farmer-back-to-farmer philosophy and approach.

(d) Natural scientists who put RPFs first

One of CIP's strongest assets may be the extent to which some of its natural scientists have become like social anthropologists in orientation, sensitive to farmers' needs, and enthusiastic about learning from them and working with them.

The breakthrough, as demonstrated at this workshop, is when natural scientists, not just social scientists, give RFPs priority and wish to work with them.

(e) R&D technology

Production technology is the primary concern of NARs. In general, CIP's comparative advantage lies not in developing production technology but in R&D technology, which is synonymous with methodologies.

Against this background, there seem to be three major new challenges which CIP's scientists should face in client-oriented participatory R&D.

(i) Sweet potato strategies: ex-ante analysis and RPFs' perspectives

In CG centers and NARs generally, social scientists' skills have tended not to be adequately drawn on when making decisions about technical research priorities and directions. CIP has a comparative advantage in that its capacity, if used, brings RPFs' needs and priorities to bear on this sort of decision-making. The question is to what extent it is and will be used.

A major but passing opportunity is presented by sweet potato research. There is a powerful case for rapid social science analysis, including distribution of sweet potato growing and its uses, values, markets, etc. CIP could still break new ground, if it acts swiftly and decisively, to establish strong links between farmers' perspectives and priorities and technical research directions, in ways which have probably never been done before, and which could set a new standard and style. It would be magnificent if CIP could do this, and also document the process and experience for others to learn from. The implications for the relevance and effectiveness of sweet potato research need no emphasis. But the implications for other research systems

are huge and more important. In particular, the methods developed and used at CIP could be relevant worldwide for biotechnology research. Will CIP meet this challenge, and exploit this passing opportunity?

(ii) Methodological frontiers with RPFs

The context of new challenges in participatory R&D with RPFs can be summarized as broad assertions which I believe, despite exceptions, to be substantially true.

Agricultural systems are of three types: industrial agriculture, green revolution agriculture, and resource-poor agriculture. Industrial agriculture and green revolution agriculture have relatively simple farming systems, in relatively uniform and risk-free environments. In green revolution agriculture, this often involves flat, fertile and irrigated land. Normal reductionist agronomic research fits these simple industrial and green revolution systems and serves them well. In contrast, resource-poor farming systems, which are the main concern of CIP, are complex, diverse and risk-prone. The appropriate methods of much R&D for such conditions are different from normal reductionist research. They often involve multiple intercropping and/or land shaping, with which farmers have a comparative advantage over normal scientists. Moreover, the extreme diversity of farming conditions and systems makes it difficult for NARs to provide adequate environment-specific services to RPFs. There are many more farming systems in resource-poor agriculture and far too few agricultural scientists, let alone social scientists, to make up multidisciplinary teams for each system.

There is an immense challenge. In many parts of the world scientists are beginning to work on what have been called **complementary methods** in agricultural research by and with farmers. CIP's traditions and experience of working closely with farmers, together with its freedom from a standardized FSR approach, give it a strong comparative advantage in pioneering the development and diffusion of such methods as a means of fulfilling its mandate, and also contributing to the new frontiers of scientific methodology.

A short illustrative list of the methods involving scientists working with farmers is:

- farmers' groups and panels, including group analysis of problems, potentials and priorities;

- farmer innovator workshops;
- ecological mapping by farmers;
- identifying farmers' own experimental frontiers;
- enhancing farmers' experimental capabilities;
- farmers' systems experiments;
- involving farmers in all stages of the agricultural research process (e.g., seed selection).

Such methods should probably be developed mainly with agricultural scientists in NARs, to avoid problems of technology transfer from the resource-rich environment of CIP to the resource-poor environment of NARs.

(iii) Face-to-face training for scientists and farmers

What happens when scientists and farmers are face-to-face deserves special attention. It is probably the weakest link in user-client participatory R and D. Scientists often stay on their stations (for many reasons), or meet only the better-off farmers. When they do meet RPFs, they adopt a lecturing and superior manner which prevents learning and collaboration. On the other hand, when scientists do learn from and work with farmers, they tend to become excited and enthusiastic. CIP's natural scientists may have a special role here, encouraging and supporting natural scientists in NARs to work with RPFs in new ways. If an effective approach, perhaps in a transferable module, could be developed for enabling scientists to turn things the other way round, and ideally change their attitude and behavior with a new respect for RPFs and desire to work with them, the impact could be immense in the rest of the CG system, and in NARs. CIP's social scientists should be able to make a special contribution here.

(iv) Strategic Decisions

These three sets of activities: sweet potato strategies: ex-ante effects analysis, including RPFs priorities, methodological frontiers with RPFs, training for "scientists and farmers face-to-face" all fit CIP's comparative advantages as listed at the start of this paper. The first would be a short-term commitment requiring top priority over everything else. The second and third are closely related and longer-term.

SESSION IV. Assessing the Performance of R&D Programs

ASSESSING IMPACT: THE GENERAL FRAMEWORK

Douglas Horton

1. INTRODUCTION

As an institution matures, it becomes more important to assess its overall performance and the effectiveness of its programs and strategies. Impact studies can play two useful roles in agricultural R&D (research and development): to document past accomplishments, and to guide future programs. Unless an IARC (International Agricultural Research Center) can present evidence of its performance and impact, it may be difficult to obtain continued support from donors. The same applies to national programs. Impact assessments can also provide lessons from past successes and failures that help decision-makers improve the priorities, organization, and manage R&D programs.

In recent years, numerous international programs have undertaken studies to assess their impact. The most ambitious and comprehensive of these is a study of the impact of the Consultative Group on International Agricultural Research (CGIAR). Other organizations, including the United States Agency for International Development, the World Bank and Canada's International Development Research Centre, have also assessed the impact of their agricultural projects.

This paper, which draws heavily on Horton (1986), presents the general framework for CIP's work in this area, some interim conclusions and suggestions for future work. CIP's first impact studies were initiated in 1982 by Anibal Monares in collaboration with CIP regional scientists and national scientists in Rwanda and Tunisia --two countries where CIP had helped establish viable seed programs within the context of a national potato program. Impact studies formally entered CIP's research agenda in 1984 via a Thrust X research project, "Assessing the impact of new technologies and programs." This project has four goals: (1) develop a conceptual model for impact assessment; (2) conduct a few pilot studies and backstop national, regional and headquarter scientists who wish to conduct their own

impact studies; (3) conduct two surveys: one on "national program status, technologies, and impact," the other on "impact of CIP research contracts;" (4) establish an impact monitoring component within CIP's annual reporting procedure.

2. CONCEPTUAL MODEL FOR IMPACT ASSESSMENT

CIP's studies and those of other international programs form part of a "second generation" of impact studies, drawing on the methodology and empirical results of a substantial body of economic literature on agricultural research, including hundreds of studies of the impact of new technologies. Most of the earlier "first generation" studies, however, were concerned with the development and spread of new wheat and rice varieties and their impact on crop yields, production and social welfare. The mandates of the CGIAR centers now cover many more crops and areas of the world. Moreover, since the immediate clients of IARCs are NARS (National Agricultural Research Systems) rather than farmers, the second-generation impact studies need to also concern themselves with the impact of international programs on research and extension capacity in developing countries.

In this paper I discuss some of the limitations of the first generation studies and argue for broader, interdisciplinary, participatory approaches that, while less elegant and methodologically rigorous, are likely to produce results that are more useful for policy makers, research managers and donor organizations.

(a) Production impact versus institutional impact

In impact assessment, it is useful to distinguish between two types of technology that may be generated by an IARC --production technology and R&D technology-- and the corresponding two types of impact-- production impact and institutional impact. "Production technology" refers broadly to all methods which farmers, market agents and consumers use to cultivate, harvest, store, process, handle, transport, and prepare food crops and livestock for consumption. "R&D technology" refers to the organizational strategies and methods used by research and extension programs in conducting their work (Table 1). "Production impact" refers to the physical, social and economic effects of new cultivation

and post-harvest methods on crop and livestock production, distribution, and use and on social welfare in general (including the effects on employment, nutrition and income distribution). "Institutional impact" refers to the effects of new R&D technology on the capacity of research and extension programs to generate and disseminate new production technology.

Table 1. Examples of R&D technology and production technology

R&D technology	Production technology
Germplasm Advanced lines Breeding strategy	New potato variety
Tissue culture Virus testing techniques Certification	Improved seed
Principles of integrated pest management	Recommended IPM system
Storage principles	Improved storage design

A stream of new production technologies is needed to solve future production problems and maintain agricultural growth. Because of the great variability of farming systems and production problems, national and sub-national programs have a comparative advantage in generating production technologies, whereas international programs have a comparative advantage in generating R&D technologies. It is estimated that the budget of national programs represents about 95% of the total resources available for agricultural R&D in developing countries, and those of international programs only about 5% (CGIAR, 1985). Hence, R&D technologies that improve the effectiveness of national programs in generating new production technology can give international programs substantial leverage in reaching their ultimate goal: to expand food production and improve welfare in developing countries. Indeed, as Evenson (1977) and other have shown,

the countries benefitting most from international agricultural research are those with strong national programs.

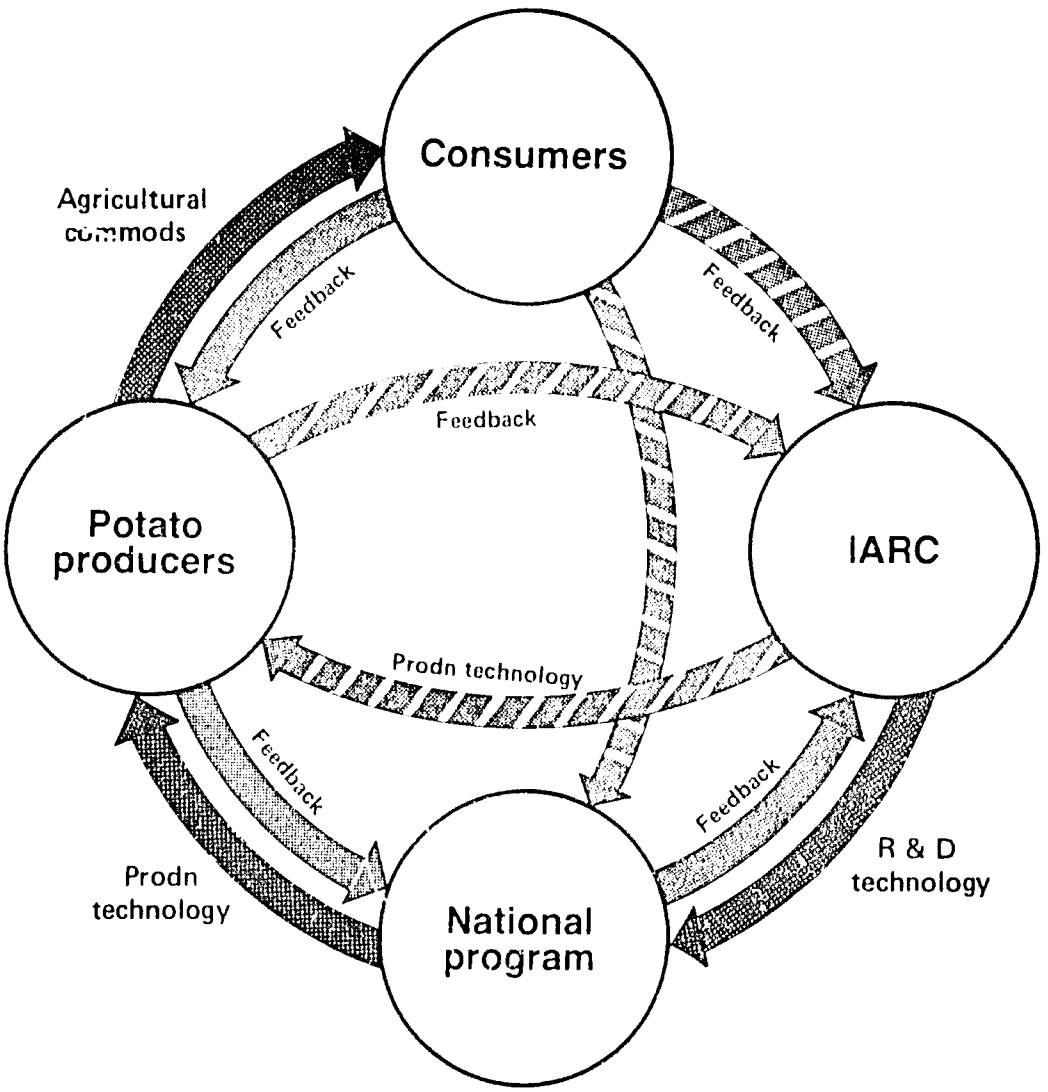
(b) A basic model to guide impact assessment

The interrelations among an IARC, its immediate client (the national program) and the ultimate beneficiaries (producers and consumers) can be illustrated with a simple diagram (Figure 1). The arrows running clockwise from the IARCs through the consumers represent flows of products and services; those running counter-clockwise represent feedback links. R&D technology flows from the IARC to the national program; production technology flows from the national program to farmers, and agricultural commodities flow from farmers to consumers. (For the sake of simplicity, processors and other market agents are not included in the model). Feedback flows principally from consumers to farmers (via the market), from farmers to national program and from the national program to the IARC. Broken arrows represent secondary flows of production technology and feedback. In the early days, IRRI and CIMMYT produced finished rice and wheat varieties that were used directly by farmers. As national programs have grown stronger, however, this type of "technology transfer" has become less common. Secondary feedback loops from producers to the IARC and from consumers to both the national program and the IARC illustrate that both national and international programs must be aware of, and meet, the needs of their ultimate beneficiaries if they are to remain socially valued, viable institutions. (Again for the sake of simplicity, donors and political processes that influence funding are omitted from this basic model).

3. ASSESSING PRODUCTION IMPACTS

Impact studies to date have generally employed a production economics framework to assess the contributions of research to changes in agricultural output. Data required for the analysis include: (1) estimates of changes in production in regions or countries over time; (2) knowledge of major production systems, including "old" and "new" technologies, and the proportion of total output generated by each; and (3) knowledge of production functions for each system. If distributional effects of technological change are to be analyzed, estimates of supply and demand elasticities are also required.

Figure 1. Basic Model: product and feedback flows among an International Agricultural Research Center (IARC), a national program, farmers, and consumers.



Estimates of changes in production are often derived from time series data. While published series may reflect the approximate magnitude and basic trends in crop and livestock production, however, they are poor sources of data for impact assessment. To cite just one example of the more general problem, the FAO revised its estimate of potato production in China downward by 70% in 1978 and then upward again by 230% in 1983.

In recent years, publishing in the field of farming or cropping systems has mushroomed. Unfortunately, however, surprisingly few studies actually describe how farmers grow their crops and tend their livestock. Rarest of all are analyses of how production systems have changed over time in response to the introduction of new technologies.

Production function analysis, now considered "old hat" by agricultural economists in the developed countries, has never been widely applied in most developing countries. Rather than estimates of response surfaces, the best that can be obtained for many crops and areas are single-point cost-of-production estimates which may be gleaned from documents of ministries or agricultural banks. Unfortunately, these often reflect recommended, rather than actual, farming practices. They may be "guestimates" based on no fieldwork whatsoever. Where they draw on farm surveys conducted by government employees --usually extension agents-- they may be misleading because extension workers generally interview their clients: larger-than-average farmers in accessible, commercial areas.

As an alternative to time series and survey data, experimental results are sometimes recommended as a basis for estimating the impact of technological change on crop yields. In practice, available experimental data seldom reflect the performance of alternative technologies under actual farming conditions. For obvious reasons impact analysts seldom have the luxury of being able to design the needed experiments and wait several months or years until results become available.

Many institutions have recently begun to conduct specialized experiments on farmers' fields to quantify the yield differentials associated with alternative technologies. Results of on-farm experiments are useful for many purposes, but they are often misleading for impact assessment, because they exaggerate the yield increases which farmers would actually attain if they switched from their present technology to a new one.

There are four sources of experimental bias in favor of new technology. One is that on-farm experimenters often attempt to prove they can do better than the farmer. A second, less obvious but nonetheless important, source of bias stems from the fact that yields measured on small experimental plots generally exceed those on large fields, even when the same technology is supposedly used. A third source of bias comes from the methods used by researchers to reduce sources of variation among experimental sites by standardizing the levels of non-experimental inputs at assumed "normal," "representative," or "average" levels. More often than not, these standardized levels are above-average. A fourth source of bias occurs when researchers do not include a farmer control treatment in their on-farm experiments, but simply compare the experimental yield of the new technology against the yield of a "representative" farmer's crop or the average yield for the area. Results of this type of comparison generally show a dramatic, but highly exaggerated, yield advantage in favor of the new technology.

These biases imply that impact assessments based on experimental results may over-estimate the benefits of new technologies. In view of the substantial "yield gaps" between experiment stations, on-farm trials and farmers' fields, it seems reasonable to conclude that experimental station results almost certainly overstate the yield increases actually obtained by farmers and that results of on-farm trials probably do so as well.

The change in yields resulting from adoption of HYV has been the central variable in most impact assessments. Many new technologies, however, are adopted by farmers not because they increase yields, but because they reduce costs, increase quality, or allow crops to be planted in new areas or at different times of the year. Such technological improvements may generate substantial benefits for producers or consumers even if they are lower yielding.

The conclusion here is not that costs and benefits associated with technological change <u>cannot</u> be captured in economic analyses of experimental results, but that in many cases they <u>have not been</u> captured adequately. For impact assessment, more detailed knowledge of farmers' physical and socioeconomic environments, decision-making processes and technologies is needed than has generally been recognized.

4. THE ATTRIBUTION OF IMPACT

Attribution of the impacts of agricultural R&D to different institutions is one of the most sensitive issues of impact assessment. Few, if any, new technologies are generated solely by international programs or reach farmers without substantial contributions from national research and extension programs. Hence, it is inappropriate to attribute production increases and associated benefits solely to the work of bilateral or multilateral programs.

Great care is needed to ensure that impact studies give due credit to the various contributors, which in addition to national programs in developing countries often include bilateral agencies, foreign universities and farmers themselves. The following example, derived from Franco and Schmidt (1985) illustrates how complex the chain of causation can be:

> In the early 1970s the Peruvian Ministry of Agriculture requested that CIP help combat a serious outbreak of bacterial wilt in potato crops in northern Peru. To this end, CIP obtained resistant breeding lines from the University of Wisconsin. These lines had been developed from potato samples sent to Wisconsin by Colombia's National Agricultural Research Institute (Instituto Colombiano Agropecuario: ICA). Part of ICA's work had been financed by the Rockefeller Foundation. Researchers employed potential new varieties on government experiment stations in northern Peru. Two resistant varieties were released by the Ministry of Agriculture in the mid-1970s. One of these, called "Molinera," is now among the most widely grown potato varieties in northern Peru. From advanced variety trials, Peruvian farmers also kept and multiplied at least two other clones which are now grown in the area. One has gained such importance that it was recently named and officially released as a Peruvian variety.

Such multiple causation seems to be the norm rather than the exception in agricultural R&D. CIP has also distributed this clone to other developing countries as a potential new variety.

The interactions of various contributors to the technological change process in Cajamarca can be illustrated with a modified version of the model presented in Section 2 above (Figure 2). In this case, contributors to the process included the Rockefeller Foundation, ICA, the University of Wisconsin, CIP, the National Potato Program (NPP) (in fact several different national institutions), and last but not least farmers in the area. It is important to note in this regard that of the two new successful potato varieties grown in Cajamarca and later distributed internationally by CIP, one was selected by the NPP and the other by the farmers themselves.

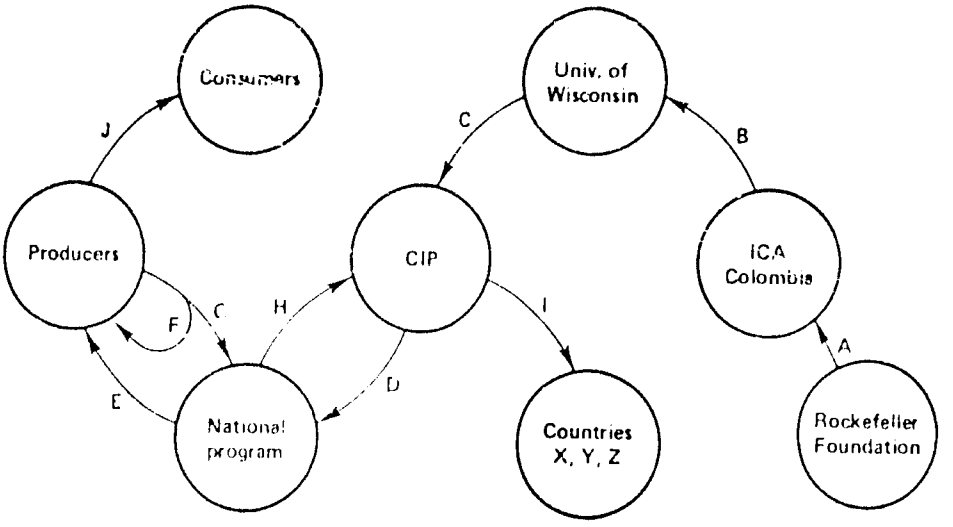
5. TYPES OF INSTITUTIONAL IMPACT

International agricultural programs represent small but strategic components of the global agricultural R&D system. As noted in Section 2 of this paper, international programs are suppliers of R&D technology rather than production technology *per se*. They can have the following types of institutional impact: (1) strengthen agricultural R&D programs in developing countries, through training, supplying research information; (2) link national programs to the global R&D system, through improved communications, collaborative research, conferences; (3) contribute to establishment of priorities in key research and policy areas; (4) stimulate research institutions in developed countries to address problems which are important in developing countries; (5) inform donors and stimulate their continued support.

There is no analytical framework for assessing institutional impacts analogous to the production economics framework for assessing production impacts. The inputs and outputs of international R&D are too numerous and qualitatively variable to be analyzed within a single econometric model. Moreover, the policy environments in which these programs operate significantly affect their institutional performance and impact.

Before these impacts can be *measured* and valued in economic terms, it is necessary to first *understand* the types of impacts being achieved and the institutional strategies used to achieve them. Providing documentation in these areas is one of the most valuable potential contributions of the second generation of impact studies.

Figure 2. An illustration of multiple causation in agricultural R&D: the Cajamarca case



A. RF supported ICA.
B. ICA sent germplasm to University of Wisconsin.
C. Univ. of Wisconsin sent breeding lines to CIP.
D. CIP and Peru's National Program (PNP) selected varieties on Cajamarca Experiment Station and on farm trials.
E. NPP named and released 2 resistant varieties.
F. Farmers selected 2 additional varieties from on farm trials.
G. NPP named one of these as an "official" variety.
H. CIP included promising Cajamarca material in its own breeding program.
I. CIP distributed the new varieties to other developing countries.
J. More potatoes were produced in Cajamarca.

6. CASE STUDIES

Over the last several years, we have conducted a number of case studies of technological change and impact. The original criteria for selecting cases were: (1) The case illustrated a successful process; (2) CIP was involved in the process; (3) adequate documentation was available for the study to be written without in-depth fieldwork. In 1984 five cases were summarized in the book Potatoes for the Developing World (CIP, 1984). These were based on projects in Rwanda, Sri Lanka, Tunisia, Vietnam and a network in Central America (PRECODEPA: Programa Regional Cooperativo de Papa). More recently, reports have been written on India, Korea, the Philippines and a network in Southeast Asia (SAPPRAD: Southeast Asian Program for Potato Research and Development).

The subject matter and methodology have varied considerably, but in each case an attempt was made to cover the following topics: (1) The major institutions involved and their strategies; (2) the apparent keys to success; (3) principal results or types of impact (generally in descriptive terms; in three cases (Rwanda, Tunisia and Korea) in cost-benefit terms).

In the most recent cases, analysis has gone beyond an ex-post documentation of strategies and results to identify key areas for improving institutional performance and impact in the future.

All the cases but one (the Indian case, which was based entirely on published information) have been conducted jointly by a CIP scientist and individuals who were (or are) directly involved in management of the project under study.

7. LESSONS FROM THE CASES

Several lessons for designing and managing potato programs can be derived from the case studies conducted to date.

(a) Strong national commitment is essential

In every case, national policy-makers, researchers or extension workers provided leadership and financial support for the potato program, rather than depend entirely on a foreign agency. In India, Vietnam and Sri Lanka, the programs were staffed and funded locally from the outset. They occasionally sought training, technical assistance and financial support from abroad, but at no time did a foreign agency provide leadership or resident personnel for the program. In the cases of South Korea, Rwanda, Tunisia and PRECODEPA, foreign agencies played important roles initially in catalyzing and supporting local efforts. Foreign agencies provided a co-leader in Rwanda, resident scientists in South Korea and Tunisia, and a coordinator for PRECODEPA in Central America. But in each program, local leadership quickly emerged, and within a few years the budgets were financed principally from national resources.

(b) Potato programs must blend into local institutions

The organizational structures of successful potato programs vary greatly. For example, India has one of the world's largest and most complete potato programs; PNAP in Rwanda is much smaller and less comprehensive. Tunisia's seed program involves five public institutions coordinated by a technical committee; the seed program in Dalat, Vietnam involves a single institution working with farmers. The Korean program involves numerous organizations, several of which appear to have overlapping functions. Although none of these organizational arrangements is necessarily ideal, each has proven to be effective. Building the potato program within existing local institutions is essential to ensure its acceptability and continuity. Many programs have failed because they attempted to bypass local institutions rather than work with them.

(c) Successful programs have clear priorities

Few countries can afford a comprehensive potato research and extension program. The cases show that a potato program can make a significant impact by addressing just a few key constraints to potato production and use, setting aside other problems for a time. For example, careful research on aphid populations in India led to development of the seed-plot production method, which opened the way for

immense expansion of potato production and consumption on the Indian plains. Dissemination of improved storage methods has allowed Sri Lankan farmers to intensify their market-gardening systems by planting potatoes when imported seed tubers are not available. In South Korea, concentration on production of quality basic seed has generated high returns. In Central America, each of the PRECODEPA countries is now focusing on a few key production problems and sharing information with the other member countries.

(d) Most successful potato programs have paid close attention to seed distribution

Whereas improvement programs for other crops generally start with the introduction of new varieties, the most common theme of successful potato programs is seed improvement. In every case reviewed, potato programs placed high priority on improving the seed supply. Due to their bulkiness, perishability, high cost and variable quality, seed tubers are a critical element in potato production systems, and better seed can benefit producers and consumers in many ways. In India, development of the seed-plot system allowed plains farmers to break their dependency on the limited supply of seed from the hills. Similarly, improved seed storage in Sri Lanka is allowing farmers to spend less on imported seed. In Rwanda and Vietnam, new seed systems have allowed the rapid evaluation and dissemination of better potato varieties. These and other experiences suggest that in most developing areas, the first priority for a potato program should be to identify and solve the major constraints in local seed systems.

(e) As the initial seed problem is solved, other priorities emerge

Whereas the best strategy for many programs is to concentrate first on a single problem such as seed supply, as this is overcome, other problems need more attention. For example, once the seed program was in place in India, breeding new varieties has been a key factor in the program's continued success. In South Korea, yields have improved dramatically as a result of improved seed quality, but further expansion of potato production and diversification of utilization to include processing now requires a diversification of varieties and improvements in post-harvest technology.

(f) Small programs can generate high returns

Many seed programs in developing countries attempt to supply a large proportion of all the seed potatoes required by farmers, but few succeed. Most produce no more than 5% of the seed required, and few produce as much as 20% of the total requirement. The inability of a program to meet its seed production goal often results from an overly optimistic forecast rather than from poor performance. Farmers in many areas can multiply their own seed two or three times, and sometimes more, before virus infection substantially reduces yields. Hence, a reasonable target for many seed potato programs is no more than a third or a fourth of farmers' total seed requirements.

Experiences in Rwanda, South Korea and Tunisia have shown that a small, well-managed seed program can generate high returns to expenditures. Making available a small quantity of high-quality seed on a timely basis can have a large multiplier effect. Rather than being concerned with the volume of a seed potato program, managers should focus on the quality of the seed produced and the rate of return generated by the program.

(g) Technology cannot be directly transferred; it must be adapted to local conditions

In none of the cases examined was foreign technology applied directly by researchers or farmers. Local adaptations were needed. The radically different, yet successful applications of tissue culture methods to seed potato production in South Korea and Vietnam, the establishment of an economically viable seed multiplication system for Tunisia's fall crop, and the rich variation of practical applications of the diffused-light seed storage principle in several developing countries provide striking illustrations of this point.

(h) CIP's role varied dramatically

In India, where work began in the 1930s, CIP played no role whatsoever in establishing the program. In contrast, in Rwanda, CIP played a leading role in initiating the program and stimulating local commitment. In South Korea, one of CIP's principal contributions was to keep the potato research and seed programs alive when local support ended. This illustrates the important point that an IARC needs to

tailor its interactions with its client programs depending upon their own needs. There is no single, ideal style of international collaboration.

The major clients of this work have been the participating scientists (who often had much of the needed information but lacked the conceptual framework and skills to do the studies), decision-makers in the respective countries, CIP scientists and scientists and donors. Researchers in other institutions, such as ISNAR, have also shown interest both in the approach used and in the substantive findings.

8. PLANS FOR THE FUTURE

In late 1986, a survey of "National potato program status, technologies, and impact" was prepared and tested by regional scientists during the Annual Meeting. Earlier this year, on the basis of feedback from the regional staff, the survey form was modified somewhat, translated into French and Spanish, and mailed to 73 national program leaders.

Questions in the main survey form are grouped into three sections: (1) Status of the national program (nine questions). This section is related to present research capacity. (2) Status of technologies (25 questions). This section explores whether certain technologies are in the research stage, are being used by the national program, or have been adopted by farmers; and (3) Principal areas of impact (42 questions). This section requests information on CIP's impact on national program capacity and the national program's impact on production. All questions on this form can be answered with a simple "yes" and "no." A supplemental form requests estimates on the human resources assigned to different research areas and to seed production. Our goals with this survey are to obtain general pictures of: (1) the types of client programs we are working with, (2) the status of various technologies "in the pipeline;" and (3) the areas in which national program leaders feel that impacts have been made.

A brief questionnaire has also been sent to individuals who have had CIP research contracts, soliciting their views on the impact of the contracts on: research capacity and the use of new methods or techniques in research, seed programs, extension or farm-level production.

The survey of national program leaders is to be completed this year and major findings are to be reported in 1988. The survey of contract researchers should be completed, analyzed and written up this year. A few contracts may be selected for case study analysis. No additional case studies are scheduled at the present time.

In 1988, an impact monitoring form, based on the national program leader survey, will be incorporated into the annual reporting procedure for CIP's regional staff. Complementary information will be gathered each year at headquarters on training and regional distribution of germplasm, seed and publications.

A "concepts and methods" paper is needed to orient future work on program assessment and impact. CIP staff frequently participate in program review teams. A central purpose of the concepts and methods paper would be to help standardize the review process, focusing it more sharply on goals, strategies and impact at the institutional and production levels.

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ANALYTICAL FRAMEWORK FOR DESIGN AND ASSESSMENT OF POTATO SEED PROGRAMS IN DEVELOPING COUNTRIES

Aníbal Monares

1. INTRODUCTION

Most potato researchers and production specialists believe that poor seed quality is a major factor limiting yields in developing countries (Horton, 1987). It has been stated that a regular supply of certified seed could improve yields by 70 to 100%. Hence, the use of certified seed -- common in developed countries-- is strongly recommended in developing countries. Successful programs for producing certified seed have been implemented in North America and western Europe since the early 1900s. In contrast, in most developing countries, seed potato certification programs have not been as successful as seed programs for other crops.

The main purpose of this paper is to present an analytical framework for improving the design and evaluation of potato seed programs in developing countries. We will first examine some agro-economic characteristics of the crop, making seed potato a very peculiar and complex input. We will then analyze the rationality and functioning of traditional or informal and modern or formal seed systems. Next, the conditions for a successful formal seed system will be discussed. Finally, specific questions, such as the scale of production and the distributional effects of formal seed systems will be addr ssed.

2. AGROECONOMIC CHARACTERISTICS OF THE SEED POTATO

Seed plays a far more prominent role for potato than for any other major food crop. The importance of seed potato is derived from two basic characteristics: (1) it has a low multiplication rate (less that 1 to 10) while for other crops, such as cereals the average is about 1 to 100; and

(2) as a vegetative propagated crop, the transmission of diseases via the seed from one crop year to the next is high. It is hardly necessary to stress the economic implications of these aspects for the functioning of seed supply systems.

The low seed multiplication rate produces two economic consequences: (1) the area required for seed potatoes in relation to the total area of potatoes grown is much larger than the corresponding proportion needed for cereal seed production; and (2) the proportion of seed cost in total production cost is larger than in any food crop. The first fact explains, in part, the chronic seed scarcity observed in developing countries, since in the production of seed, land and other scarce resources are intensively used. The second fact explains why farmers from traditional potato areas try to use their own seed as much as possible.

The transmission of tuber-borne diseases is the main cause of seed degeneration, reflected in the gradual fall of the crop yield with the number of multiplications in the field (Beukema, 1977). Seed degeneration imposes limits on the number of times the farmer can use his own seed. The degeneration is influenced by agro-ecological factors: in temperate zones it is slower than in warm zones due to the lower pressure of tuber transmitted diseases (Brown et al., 1984). This explains why farmers from the tropical highlands or from temperate zones renovate their seed less frequently than farmers from milder climate areas, regardless of their level of technology. At the individual farmer level, the rate of seed renovation can be adjusted in response to factors such as the varieties utilized, farmer experience in seed management, available resources and the market price for healthy seed.

3. SEED SUPPLY SYSTEMS

Seed supply systems in developing countries can be subdivided into traditional or informal and modern or formal.

(a) Informal seed systems

In informal seed systems, it is a common practice for the farmer to produce his own seed, or get some or all of it from other farmers, locally or regionally (Linnemann and

Bruyn, 1987). The role that informal seed systems play and their contribution to potato production is not well known. It is believed, however, that informal or traditional systems contribute more than 80% to seed supply of food crops in most developing countries (Delouche, 1982). We estimate that the contribution of traditional systems to the seed supply of potato is within the range of 80 to 95%.

Informal seed systems play the following roles: (1) they supply inexpensive planting material of acceptable physiological and pathological conditions; (2) since seed renovation can be realized through non-monetary mechanisms such as barter, plot rotation and/or in-kind payments for labor, farmers can obtain seed with no disbursement of money at the planting time; (3) the wide price variation and diverse ways of obtaining the seed in traditional systems allow farmers with different resource endowments and levels of liquidity to satisfy their seed needs; and (4) informal systems are usually the only source of seed of traditional or native varieties (Rhoades, 1987). Small farmers frequently need varieties with stable yields even when the environmental conditions are adverse. For this reason they often plant several varieties. Improved varieties are grown for sale in the market, while traditional and native varieties are cultivated mainly to meet farmers preferences for specific tuber taste and culinary characteristics.

In the cool areas of the tropics and in subtropic temperate zones, informal systems have been an effective way of solving problems derived from seed degeneration and the seasonal scarcity of seed. In these areas their socioeconomic impact on production and farmers' welfare has been greater than formal seed systems. The contribution of informal systems, however, decreases significantly in the warmer areas of the tropics and subtropics, where the rate of seed degeneration is high and traditional varieties are not well-adapted to local environments. The need for satisfying the growing demand for seed in warm climates is one of the most important reasons to develop efficient and self-sustaining formal seed systems.

(b) Formal seed systems

Since their inception, formal or institutional seed systems have attempted to solve three critical problems affecting the potato crop: seed degeneration, low productivity (or yield) in consumption potato production and the

scarcity of planting material generated by chronic or seasonal imbalances between national or regional demand for seed and the amount of seed supplied by traditional systems. To solve these problems, formal systems have applied three main strategies: (1) the introduction of new germplasm material in the form of new varieties (breeding programs); (2) the development of seed cleaning programs and regulations related to the process of seed production (certification programs); and (3) the utilization and promotion of true potato seed.

A description of the number of activities and complex institutional schemes found in the seed sub-sector in developing countries is beyond the objectives of this paper.[1] The purpose of this section is to examine the roles and interrelations of the two institutional components of formal systems that generate new seed technologies: breeding programs and seed certification programs.

In developing countries, breeding programs have attempted to fulfill two general objectives (Evans, 1980; Gomez, 1978): (1) selection of plants with close adaptation to local environmental conditions, resistance to pests and disease, progressively higher yield potential and tuber traits that meet consumer preferences; and (2) continued selection of hybrids similar or superior to varieties utilized by farmers in order to replace one or more of the varieties eliminated by the process of genetic erosion.

Certified seed programs have been established with the intention of guaranteeing the commercial production of high quality seed (Bryan, 1976). The technical and institutional model for producing certified seed currently applied was developed at the beginning of this century in western Europe. It is based on a number of specialized seed production procedures, stringent regulations and mandatory seed inspections (Shepard and Claflin, 1975). It also requires a network of well-coordinated public and/or private institutions and farmers' organizations.

Three main reasons are mentioned to promote certification programs: (1) they supply large quantities of seed of improved varieties with low content of tuber-borne diseases;[2] (2) they help to prolong the useful life of improved and traditional varieties, and; (3) they facilitate the introduction and diffusion of new varieties and seed related technologies among farmers.

Certification programs and breeding programs are often promoted together to mutually reinforce their objectives and activities (Douglas, 1980; Ezeta, 1986). They can, however, be considered as separate institutional components of formal systems intended to solve problems basically different in nature. If a distinction is not made between the two programs, several misconceptions and errors will arise in the design, implementation and assessment of formal seed systems.

In the potato crop, tuber transmitted diseases can be so severe that they restrict farmers from producing potatoes. Certification programs have arisen as an institutional attempt to guarantee the utilization of seed having pre-fixed (minimum) health standards. In practice, it is possible to certify new high yielding varieties with specific disease resistance and/or traditional or native varieties with low potential yield but better adaptation to local environments and the users' socioeconomic conditions.

Potato seed certification programs have had variable success in developing countries. Observed failures have arisen mainly when potato program leaders have attempted to apply developed country institutional schemes without taking into consideration the agro-ecological and socioeconomic conditions prevailing in their setting. In contrast, all breeding programs established in developing countries exhibit good records of impact on local potato production.

Peru and Colombia are two Latin American countries that have developed successful potato breeding programs. Each country has delivered approximately 30 new potato varieties in the last 25 years. The wide diffusion of these improved varieties took place without the support of formal seed programs and official transfer of technology systems. The opposite situation is found in Chile, where an efficient and self-sustaining commercial seed certification program has operated for the last 30 years with marginal contribution from a local breeding program. The Chilean certification scheme has multiplied German and Dutch potato varieties with high yielding capacity, acceptable resistance to local diseases and good adaptation to the country's agro-ecological and socioeconomic conditions.

Although several arguments support the marriage between the genetic research and certification programs --since they work better together than separately-- they should be evaluated on their own merits in order to assess the relative contribution of each in the overall results. In this way,

the frequent error of attributing to certification programs the benefits generated by the introduction of new germplasm material can be avoided.

4. CONDITIONS AFFECTING THE VIABILITY OF FORMAL SEED SYSTEMS

(a) Seed producing areas

Almost all countries have certain regions with favorable climatic characteristics for producing seed potato of good quality. Areas with a natural aptitude for producing quality seed must show a low aphid population, the principal vector of virus diseases (PVY, PVX and Leaf Roll virus). Hence, the first condition for a viable seed program is the availability of agro-ecological zones with low incidence of virus diseases and a slow seed degeneration rate.

The preceding condition, although essential, is not sufficient to make a commercial seed program feasible, since it can only affect the supply of seed. Several studies on the impact of seed programs concluded that a low proportion of the seed produced by specialized seed producing areas is sold within the same area. This implies that the size of the intra-regional seed market is usually so small that it may not justify the operation of a certified seed program. To some extent this is the situation of the Andean region of Latin America. Approximately 85 to 95% of potato cultivated areas of the Andean countries (Peru,Ecuador and Colombia) are located in the highlands where climatic conditions are unfavorable for insect transmission of virus. Hence, most farmers produce common seed of acceptable quality and there are no economic incentives for a sophisticated large scale seed program.

(b) Seed consuming areas

The second condition for a viable certified seed program is the availability of areas where production of consumption potato is highly profitable, but the local production of quality seed is not feasible due to agro-climatic constraints. These areas are usually found in milder climatic areas of tropical and subtropical regions and are often located in fertile valleys close to large urban centers. Potato farmers can obtain high yields and incomes,

factors that give them the economic capacity to buy the high quality but expensive seed produced in the specialized seed growing areas of the country or seed coming from abroad. The more extended these seed demanding areas are, the greater the probability of a seed program's success.

The dynamic force behind the demand for certified seed stems from farmers' perceptions that their yields are severely limited by the pathological or physiological conditions of their seed tubers. From the economic point of view, both characteristics, jointly or separated, may become scarce resources and thus can stimulate the commercial production of the seed. The Tunisian potato seed program, for example, is based on its ability to produce seed with better physiological quality than imported seed, in spite of bearing higher virus infection (Horton et al., 1986). Following a different institutional strategy, the Chilean seed certification program illustrates the positive impact of the utilization of low virus seed potato in ware potato areas, limited in their ability to produce healthy seed (Monares, 1987).

(c) Technological innovations

A third condition for a successful formal seed program is access to technological innovations that help to improve the efficiency and reduce the production cost of the certified seed. In the last decades, a series of new seed technologies (in vitro micropropagation, rapid multiplication and true potato seed) have been refined and transferred to national programs by the International Potato Center (CIP). These technological innovations have improved the quality of the basic seed and have reduced the number of generations needed to produce certified seed. The introduction of these new technologies has stimulated several countries to invest internal and external resources in the seed sub-sector that otherwise could have been channelled to other areas.

A relevant question for several developing countries at the early stage of development of a local seed program is whether new technologies could offset some natural or institutional comparative disadvantages --derived, for example, from unfavorable agro-ecological conditions-- so that the production of certified potato seed may become a self-sustaining economic process.

(d) Institutional development

The fourth condition for a viable formal seed program is the development of a number of public and/or private institutions and organizations supporting the production and distribution of seed tuber. The experiences from certified seed in developing countries provide some evidence in favor of the hypothesis that institutional changes in the seed sub-sector are generated endogenously to the economic system in response to profitable opportunities (Ruttan, 1973). This hypothesis explains, in part, the great difficulties facing some internationally-funded development projects attempting to promote certain aspects of institutional development around the production of the improved seed potato in areas where the quality of the planting material is not a priority yield constraint and, thus, where farmers do not perceive profitable opportunities in the production or utilization of this improved input.

Those countries that have developed a number of institutions to support the production, distribution and financing of improved seed of crops other than potatoes are a special case. This institutional setting can easily be extended to back-up the production of certified potato seed if new investment opportunities in the potato crop emerge as a result of technological improvements, increases in potato demand or favorable agricultural policy measures.

5. DETERMINING THE SIZE OF THE FORMAL SEED SYSTEMS

A frequent concern of potato specialists is how to determine the quantity of seed that makes a certified seed program profitable. We have found three misconceptions that lead to erroneous estimates of the optimal scale of operation of a seed program.

The first misconception is derived from a tendency by leaders of government-guided seed programs to determine the amount of seed to be produced as a function of the available resources and facilities instead of the effective demand for seed.

The second misconception stems from the lack of priorities among the objectives of a seed program. If the main

objective of the program is transferring new potato varieties to farmers, quantities of seed to be produced can be relatively small since the diffusion process of a variety among farmers can take place by means other than the usually complex certification systems. But if the objective of the program is to provide a significant amount of low virus seed tubers, the scale of operation must be determined in accordance to the demand for this class of seed.

The third misconception consists in assuming that the demand for certified seed is either equivalent to the amount of seed that farmers renovate each year, or equal to the amount of all classes of seed farmers buy in the market. As a result, the demand for certified seed is over-estimated, and public and private investment in the various components of formal seed systems are greater than what they should be if a better knowledge of the market conditions were available.

Some seed-demand studies in developing countries indicate that the demand for certified potato seed varies significantly among agro-ecological regions (Monares, 1981). Within the limits of an agro-ecological region, the main demand determinants are: the price of ware potato, the price of certified seed and the ratio of the yield of certified seed to the yield of alternatives sources of planting materials. Other factors influencing the demand for certified seed are the availability of irrigation, the use of fertilizers and the size of farmers' potato fields.

6. DISTRIBUTIONAL EFFECTS OF FORMAL SEED SYSTEMS

The distributional effects of formal potato seed systems have received little attention from potato specialists. The rule is to assess the impact of seed programs in terms of efficiency indicators such as the amount of certified seed produced per year, the proportion of total potato area planted with certified seed, or the internal rate of return of the certified seed program (Rhoades, 1986). This is a complex topic beyond the scope of this paper. Our purpose is to present some concepts that may be useful for future research.

(a) Regional effects

Certification programs benefit both seed growers and seed users. Since the general rule is that seed users are located in agroclimatic zones different from seed producers, most certification programs generate differential regional economic effects.

The principal benefit of certified seed users is the yield increase in potato production in the first multiplication of seed tubers. An additional benefit is the possibility of multiplying the certified seed twice or even three times depending on the observed seed degeneration rate. The users' benefit is the addition of the value of yield increases of consecutive seed multiplications less the addition of cost increases with regard to alternative sources of seed.

The seed growers' benefit is equal to the increase in net return with respect to alternative uses of farmers' resources. The seed price variation affects investment decisions of seed growers. Under conditions of seed price stability seed growers will have incentives for introducing technological innovations leading to high yields, lower average costs and eventually reductions in the seed price.

An indirect regional effect is the utilization of certified seed surpluses (not sold in seed consuming areas) by farmers from the seed producing areas. In some countries this effect can be significative.

(b) Effects on different farm sizes

In market-oriented farming systems, small potato farmers use certified seed less frequently than medium and large size farmers located in the same agro-ecological zone. Farmers in irrigated areas use more certified seed than farmers from non-irrigated areas regardless of their farm size.

In subsistence farming systems, the main source of planting material is the traditional or informal seed system (Prain and Scheidegger, 1986). The relationship between formal and informal seed systems is not well known. Several studies on the diffusion of new varieties among subsistence farmers indicate that informal seed systems are relatively efficient in transferring technology of a genetic nature (Girón, 1975).

The question of whether small farmers buy or do not buy seed from formal systems needs more study. Several hypotheses can be proposed to explain this behavior: (1) small farmers ignore that certified seed is available, and if they know they are not aware of its agronomic advantages; (2) the price of certified seed is too high with regard to alternative sources of planting materials; (3) small farmers are accustomed to using their own seed and they renovate their seed mostly through non-monetary mechanisms. Since they usually sell a fraction of their production, they lack the economic capacity to purchase an expensive input; (4) common seeds produced in the cooler areas of the tropics and subtropics frequently exhibit pathological and physiological conditions similar to certified seeds; and (5) small farmers with low capacity to buy inputs cannot take advantage of interactions among a good quality seed and complementary inputs (Hrabovzky, 1975).

Although small farmers may only occasionally buy certified seed, they can obtain benefits from formal seed systems. There are two main contributions of these systems: access to sources of improved germplasm material and access to sources of low virus seed tubers. Both benefits depend on the magnitude of the multiplier effect of the certified or improved seed. This effect is, in turn, determined by the number of consecutive multiplications of the improved seed carried out by different farmers. The seed multiplier effect increases when the following conditions are present: (1) there exist agro-ecological conditions that make several multiplications of the certified seed feasible; (2) there exist commercial infrastructures and/or develoment projects that facilitate the flow of the seed from large to small farmers; and (3) both large and small farmers cultivate the same varieties. From this analysis it can be inferred that 3 the seed multiplier effect is greater in cool climates than in warm areas, and it will benefit more small, commercial farmers than subsistence farmers.

7. SUMMARY AND CONCLUDING REMARKS

Potato seed systems illustrate the complex relationships among ecological, technological and institutional variables. Certain trade-offs among them can be observed in developing countries. Areas with natural comparative advantages for producing healthy seed tuber have developed efficient informal seed systems in spite of the lack of access

to advanced technologies and official supporting institutions. On the other hand, countries or regions with high technical and institutional development can produce improved or certified seed of acceptable quality in spite of having unfavorable agro-climatic conditions. These situations, however, must be considered exceptions rather than the norm among a wide range of possible combinations of ecological, technological and institutional conditions present in developing countries.

There is also a trade-off between genetic research and seed certification programs. In the Andean regions of Latin America and more recently in Central Africa (Rwanda and Burundi), the diffusion of new locally-bred or selected varieties has offset to some extent the technical and institutional deficiencies of their official seed tuber programs. On the other hand, countries such as Tunisia and Chile have effective certification schemes based on potato varieties bred abroad.

In the long run, the most sensible solution for countries with unfavorable agroclimatic conditions and/or insufficient institutional development is the generation and transfer of germplasm material with high resistance to seed-borne diseases. The more disease resistant the new potato varieties are, the smaller the relative size of certification programs and the lower their operational costs.

In a closed economy,[7] the probability of establishing a successful formal seed system will increase if a country or a region already exhibits or meets the following conditions: (1) identification of agro-ecological zones suitable for producing healthy seed tuber; (2) identification of areas where the production of ware potatoes is profitable, but multiplications of seed tubers are not feasible; (3) development of local capacity for selection and transfer of improved germplasm material and for promotion of new seed technologies; and (4) develop a number of public and/or private institutions and organizations to support the production and distribution of improved or certified seeds.

A crucial implication of this analysis is that the success of formal seed systems will depend on their ability to produce and deliver to farmers one or more truly scarce inputs. These inputs can be seed tubers of improved germplasm, in good pathological and physiological condition or, alternatively, seeds meeting only some of these desirable characteristics. The optimal scale of operation of a formal

system is determined by the effective demand for seed with these specific characteristics.

A second conclusion of this paper is that a country that has failed in establishing a large-scale national certified seed program can be successful in organizing small regional seed programs. This approach can be practical for countries having different agro-ecological regions and a decentralized political and institutional organization.

Another important conclusion is that most potato producers in the developing world obtain their planting material from informal seed systems. Linkages between formal and informal seed systems are weak and not well understood. For many developing areas, probably the most effective institutional strategy is to strengthen existing informal seed systems through policy measures, leading to the improved flow of new germplasm materials and new propagation methods toward small farmers. In these countries, the role of formal seed systems should be redefined so that their activities compensate for the weaknesses and deficiencies of informal seed systems rather than trying to substitute for them. From the point of view of efficiency and equity, the interest of most farmers and potato consumers from developing countries will be better served if decision makers attempt to maximize the joint contribution of both seed systems.

NOTES

1. An excellent discussion of these aspects is presented in the book Successful Seed Programs: Planning and Management Guide by J. Douglas (1980).

2. Virus diseases are the most prominent.

3. This last condition is relevant only for the multiplier effect of low virus seed tubers.

4. It is assumed that the international exchange of seed and ware potatoes either does not exist or is negligible.

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IDENTIFYING STRENGTHS AND WEAKNESSES IN SEED PROGRAMS

Charles Crissman

1. INTRODUCTION

Potato seed systems are large and complex[1] and the lack of good quality seed potatoes is often a constraining factor in improving potato production. The special requirements necessary for production and handling of this vegetatively reproduced crop add extra time and create extra costs not needed in seed systems of sexually reproduced crops such as grains. Potatoes have a low reproduction rate and during their vegetative phase are exposed to numerous yield depressing pathogens. Many of these pathogens, especially viruses, are carried from one generation to the next via the tubers. The object of seed programs is to maintain the health and varietal purity of the potatoes during the several generations necessary for production. This paper describes the progress of a CIP research project concerned with potato seed systems. First presented is the background and motivation for CIP in the subject followed by the methodology used to conduct the research and, finally, the results from an initial seed system study.

Because of extra complications in seed production, governments have frequently taken an active role in potato seed systems by developing potato programs in which potato seed programs are prominent. Government programs address a wide range of activities, from providing only limited public services such as inspection, testing and legislation enforcement to complete involvement in the production and distribution of seed tubers. To create or stregthen all or parts of existing programs, governments frequently launch special seed potato projects. These projects may include financial, training and technical assistance from external sources. Numerous multilateral and bilateral institutions have assistance activities in seed potato projects.

Seed programs encompass a wide range of activities that have been or are subjects for research and technology development by CIP. By the nature of its mandate (CIP, 1974)

CIP has actively participated in seed program development and improvement efforts. To better define and understand areas that may constrain the capabilities and to work more effectively with seed programs, CIP has initiated a research project to identify strengths and weaknesses in seed programs in selected developing countries. Conducted as a series of case studies, the objectives of the research project are: (1) to identify and describe the relevant elements of the seed system and how programs or projects interact with that system; (2) to identify and evaluate technical and socio-economic factors that contribute to the success of failure of seed programs; and (3) finally, to assess the factors that affect the influence the incorporation of alternative potato propagation technologies.

Previous CIP research has looked at aspects of the seed systems in Rwanda (Monares, 1984), Korea (Horton et al, 1987), Chile (Monares et al, 1987) Peru (Prain and Scheidegger, 1986), Burundi (Potts, 1986) and Tunisia (Horton et al., 1986). Other research has examined distinct elements of seed systems such as marketing in Bhutan (Scott, 1983) and storage in Sri Lanka (Rhoades, 1986). These and other studies have contributed to a body of knowledge about seed programs that can be extended in several directions by the current research project. The importance of understanding the farmer seed system is highlighted in the Peru and Chile studies. The value of incrementally developing a program was a conclusion of the Tunisia study. Rwanda and Burundi provide examples of the steps taken in developing new programs. The results provided in these studies provide a useful focus for the current studies. This examination of seed programs is part of the Seed Technology Research Thrust. The case study project is expected to be useful to CIP, national program leaders, donor agencies and project managers.

The seed program case studies are a cooperative effort, with national potato program and research cooperators actively solicited through these institutions. Because of the large scope of the research problem and the time constraints involved, cooperation with individuals knowledgable with the local seed potato system is essential. CIP headquarters and regional staff are also valuable contributors for their technical expertise and knowledge of their respective areas.

2. METHODOLOGY

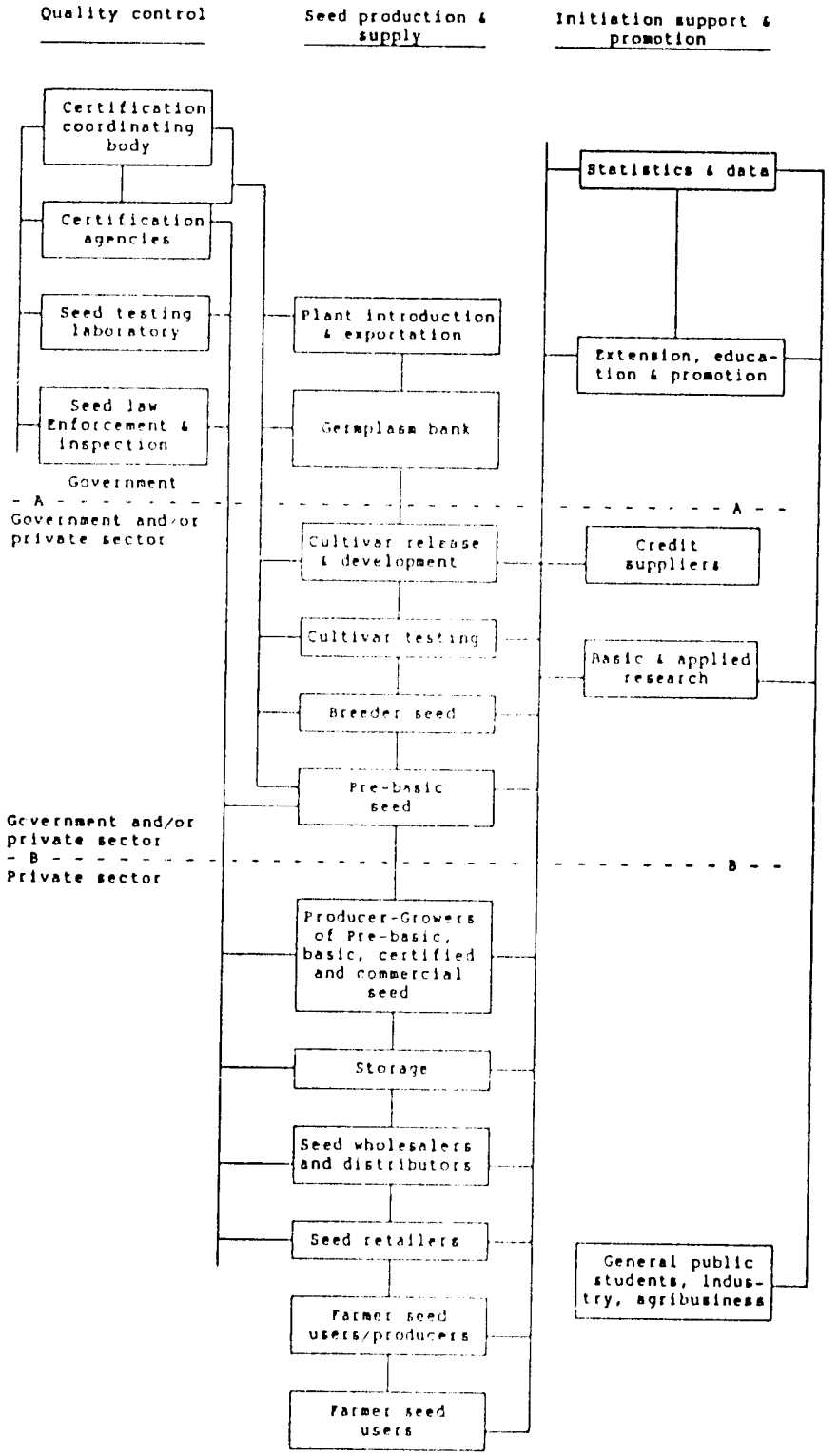
Case studies were viewed as a relevant research model, since many factors influencing the design or success of a program are unique to individual programs. With the input of informed observers, cases are selected which will illustrate particular aspects of seed systems that have useful extensions to other settings. Cases already selected for study include the potato seed systems in Ecuador, the Philippines, Bangladesh; and Kenya while, Mexico, Turkey and Peru are viewed as potential future study areas. There has been no shortage of nominations.

These cases represent distinct geographic and agro-ecological regions. The Philippines is an example of a government establishing a complete seed scheme where none had existed. Ecuador is an interesting case of an Andean country with declining production. There are large and small producers in different geographic regions. The small producers, however, have not been able to shift away from potato production and could improve their financial position by more productive varieties. The problem facing the seed program in Ecuador is reaching the small farmers. Bangladesh offers the opportunity to view and compare two different philosophies of seed provision in a lowland tropical area. Two different arms of the government espouse different views: to base a scheme on imports of seed tubers or to produce basic seed locally via the low cost seed plot method. Kenya, a country with a sophisticated vegetable and grain seed industry, is an example of an interesting public-private sector institutional model. The provision of basic seed is solely a government activity and a para-statal agency handles the certified seed production.

Determining the structure of an individual case study is based on viewing the sector as a system. The elements of a sample seed sytem are presented in Figure 1. The columns highlight three general categories of function and the boxes show individual activities. A potato seed system involves numerous agencies and institutions and a high degree of cooperation is needed to produce quality seed in a timely manner. The horizontal lines represent the authors' perception of the relative efficiency of the public and private sector in selected activities in providing potato seed.

Seed potato projects may address one or many elements of the system. Assumptions about the performance levels of sectors of the system not included in the project frequently

Figure 1. Essential elements of a potato seed system



Source: modified from Gregg Delouche and Bunch.

are the source of problems (Crissman et al., 1987). As the figure emphasizes, to consider only selected elements in the system invites missing essential interactions. The structure of the case study report focuses on the functions of institutions while tracing the flow of potatoes through the system.

The methods used to execute a case study are shaped by time constraints. There is heavy reliance on secondary data, previously published research and official records, and little systematic primary data collection. The case studies are not project evaluations focused on the performance of the activities of the project in respect to its goals and the sustainability of changes after the project is completed. (Ayazi, 1981; Gittinger, 1982; World Bank, 1976). These case studies adopt a broader view for the project within a system. Given the difficulty of defining and collecting data for a quantative evaluation of the compelx web of research, production and extension activities typical of seed projects, the decision was made to assign a relatively higher priority to systems description and analysis.

Data collection has been opportunistic. In the Philippines, information was collected using open-ended interviews, field trips to facilities, reviews of annual reports, collection of previously published research and secondary data. By chance, a formal rural survey was being conducted and in return for cooperation in the data collection and compilation, preliminary information from that work was obtained and incorporated into the case study. In Ecuador, the case study is being conducted parallel to a joint Ecuadorian-US University-CIP study with different objectives, but covering much of the same material. Some of the information collected for that project will be applicable to the seed potato case study.

3. RESULTS

The results presented here are from the Philippine case study and are intended to illustrate the usefulness of a systems perspective in the description and analysis of seed programs. In the case study, the farmer seed system and its links to organized seed schemes were examined. A model of farmer crop disposal decisions was developed demonstrating a

cash flow constraint on the capacity for farmers to hold seed from harvest to the next planting season. This constraint is then extended to a macro-setting and points out the failure of the informal system to provide a market mechanism to bridge temporally mismatched demand and supply of seed potatoes. Based on this information about the farmer seed system, several assumptions guiding the government seed project regarding the behavior of farmers are shown to be erroneous. These mistaken assumptions led to a proposed structure for organized seed production that is inappropriate in the current setting.

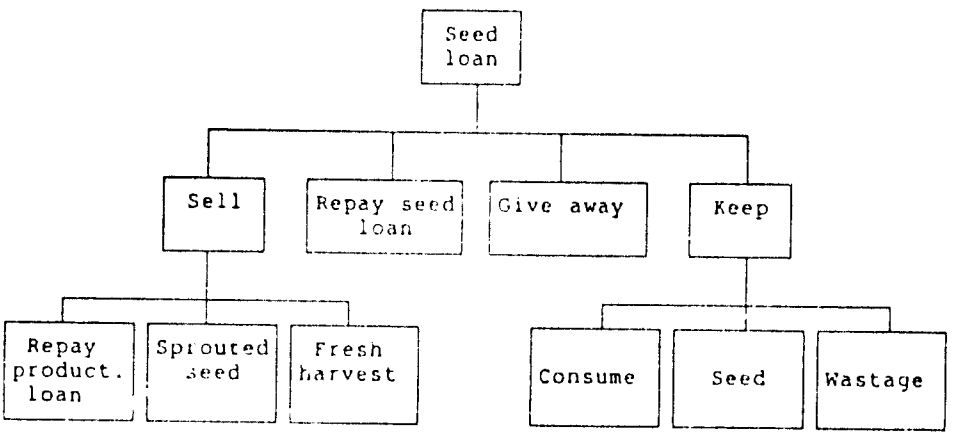
The seed potato system in the Philippines is undergoing rapid change. Much of this change has been accelerated by the government's decision ten years ago to establish the potato as a first priority crop and create the Philippine Potato Program (PPP) to guide the development of the sector. CIP has had an active presence in the Philippines during the PPP's existence, represented by a regional office and germplasm distribution center and the office of the SAPPRAD (one of CIP'S regional research networks) coordinator. The PPP is an inter-agency multi-disiplinary group providing policy guidance and coordinating activities of agencies involved in the various aspects of potato production. Within the PPP, the lead agency responsible for the government's seed production program is the Bureau of Plant Industry (BPI). In addition to the government scheme, several private sector schemes have been recently established. These are designed to supply potatoes of processing quality to the French fry and chip industries.

BPI had a cooperative agreement with the German Technical Assistance Agency (GTZ) to develop the government's seed production capacity. That ten-year project finished this year. Seed potato production in the Philippines is dominated by a farmer-based seed system supplemented by imports. Legislation limits imports of seed to 15% of requirements but the imports rarely account for more than 5% of requirements, their high price being more limiting than legislation.

The farmer seed system is centered in the high elevation (1,500-2,000m) areas of northern Luzon. The majority of potatoes are grown in northern Luzon and most farmers can save seed from the previous season. Disease levels build up gradually, making new seed necessary every three to five years. Farmers in more favorable areas or with good reputations are sought out by farmers who want to buy seed. Potatoes are a high-value but also high-cost crop. Most farmers

finance production through private sector loans. These loans, due at harvest, create a serious cash constraint and limit the farmers' options on how to optimally dispose of his crop. These decisions are illustrated in Figure 2.

Figure 2. A model of potato crop disposal for a BPI seed potato farmer



The model illustrated in Figure 2 shows possible options for farmers receiving seed loans from the BPI-GTZ project. These farmers are expected to become specialists in seed production. Credit and cash flow constraints force the farmer to market the majority of production, precluding the capability to make the investment in holding seed to sell for the next season. Not until planting season do farmers began acquiring the cash to purchase inputs (including seed) and because of the cash flow constraints and the high losses experienced in on-farm stores, most potatoes are sold to the consumer market immediately after harvest. Thus each planting season, farmers complain that seeds are scarce, cost too much and are of low quality. This failure of the farmer-based seed system to match supplies with demand remains a major limiting factor in improving potato production.

The BPI-GTZ project was broad in scope and provided for the development of many of the elements depicted in the Figure 1. The project established a complete European-style

seed scheme which involved screening and *in vitro* maintenance of breeder seed, employing rapid multiplication techniques to produce pre-basic seed which would be grown out and multiplied again to basic seed at a high-elevation seed farm. The basic seed was then loaned out for several cycles of multiplication as certified seed to Seed Grower Associations (SGAs). Quality is maintained with an inspection and testing service established by the project. Development of storage and training of staff and extension-type training of farmers have also been important activities.

The BPI-GTZ project has reverted to regular program status within PPP, with many aspects of the seed scheme well-established and smoothly functioning, but with other areas of continuing weakness. Numerous technical problems have been solved and those aspects of the program that rely on technicians in laboratory-type settings are strong. Examples are the virus testing lab, the *in vitro* maintenance program, the rapid multiplication program and storage. The areas of weakness are management and contact with the farmer seed system.

The quantity of seed material provided by the scheme is small, down from higher levels of several years ago. After ten years the farmer seed system still provides 90% of total requirements. The decline in quantity of seed material is the result of several factors, some short run but others more fundamental. One problem is the lack of good managerial control. Like many such projects, this one employed individuals of recognized technical capabilities in managerial roles. Such individuals may or may not have talent for installing, planning and managing the complex web of coordinated activities of such a project. This was recognized recently by the Swiss-Nepal potato project where an experienced manager administrator was put into a supervisory position replacing managers with technical backgrounds (Beukema *et al*, 1985).

In the case of the BPI-GTZ project, the lack of a management accounting system to give timely information on the status or trends of production in project activities complicated the efforts of management in recent years. The result was an unanticipated decline in program seed stocks that required importing seed potatoes for the first time in several years, a serious setback in project objectives. In a related area, the production of basic seed has been delayed by logistical and managerial problems at the seed farm. The seed farm was arduous to construct and because of its isolation, difficult to staff and manage. It is not

easy to assess the potential of the farm since there are few production records.

The weakest area for the seed scheme is the production of certified seed. The project was designed on the assumption that farmers could become partners in this process via the founding of grower cooperatives. This assumption, however, was based on either incomplete or unappreciated information from the farmer seed system concerning the cash flow constraints of farmers and the impact it had on seed storage and buying customs. These mistakes were compounded by program policies concerning the SGAs which did not encourage cooperation. Research has largely solved the technical problems of seed storage but not the economic constraints faced by most farmers limiting them from holding seed to sell during the next planting season.

Solving these economic constraints was beyond the scope for the BPI-GTZ project, but is within the scope of the PPP. The BPI-GTZ project proceeded on the assumption that marketing assistance and credit would be forthcoming from other PPP members. Credit and marketing are acknowledged to be the weakest portions of the PPP. The BPI-GTZ project has shown flexibility in several areas, but its insistence in pushing through with a European-like seed certification scheme that apparently will not work in current conditions is a major flaw.

The structure of the BPI-GTZ project funding placed the responsibility of providing operating expenses on the Philippine government while GTZ provided facilities, equipment and technical assistance. This formula has required commitment from the Philippine government for the duration of the project. Now that the project is finished, this policy should serve the seed program well by not creating new budgetary items. The viability of the seed program is also well served by its inclusion in the PPP. By coordinating activities and forcing cooperation, the PPP restricts the inclination for agencies to go it alone when expectations are not met. The expectations of the other PPP members also serve as a review and help to maintain work standards.

4. PLANS FOR THE FUTURE

The case studies conducted for this project will augment existing knowledge and contribute to the formulation of

policy concerning the type and form of assistance to seed potato projects. The Philippine case study demonstrated the crucial role that understanding the farmer seed system has in the successful design of a program model. The importance of staffing decisions for project management are also highlighted and conform to the evidence from Nepal. Seed programs tend not to invest in monitoring research except for crop protection. This limits the amount and quality of feedback information and thus the planning that can be done by management.

The case studies will differ substantially in content depending on the important issues, the structure of the system under study and the availability of data. In the Philippine case, a particular project became the focus of attention. The Ecuador case has no such project and so the study will be an examination of a program with longer run objectives.

The case studies will be similar and thus comparable in stressing analysis of function rather than structure as the flow of seed is traced through the system. A comparative study of the individual cases to be done late in this project's life cycle will pull together evidence to illustrate what may prove to be strengths and weaknesses common to many programs. From this wide perspective, refinements or alternatives to existing seed program models may emerge. With this information, more rational decisions can be made to better allocate scarce resources to improve the availability of good quality seed potatoes.

NOTES

1. Unless otherwise stated, potato "seed" refers to seed tubers. Botanical seed is referred to as True Potato Seed (TPS).

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ASSESSING RESULTS OF TRAINING AND COMMUNICATIONS

Manuel Piña

1. INTRODUCTION

Assessing the results of training and communication is not an easy task. This is particularly difficult if the objective is to determine or evaluate events or activities that function interdependently within a larger framework of human resource development. The International Potato Center's (CIP) Training and Communication Department, for example, has identified 38 activities which require coordination within and without the Department (Piña, 1987). It is impossible to evaluate each --individually as well as collectively-- given that most are linked with other departmental activities and nearly all are linked to programs of other units at CIP.

Nonetheless, within the broad concept of human resource development, a significant amount of attention has been given in the past few years to the effects of training on national agricultural systems. This is evinced by the CGIAR's (Consultative Group on International Agricultural Research) Technical Advisory Committee (TAC) Study of Training in the CGIAR System (TAC, 1984), which contributed to a larger study on the impact of the CGIAR; evaluations of special projects on training conducted by independent consultants, e.g., evaluation by the United Nations Development Programme (UNDP) of a CIP-CIAT-IITA training project (Byrnes, 1986); and the requirement by some donors that evaluations be included in all new special project proposals, e.g., a new training project approved by UNDP (CIAT, CIP and IITA, 1987).

To date, evaluations in areas related to human resource development conducted by international agricultural research centers (IARCs) have focused mainly on specific efforts associated with their training, communications, or library and documentation programs. At CIP, where these programs also provide services to administration and research, they operate systematically, facilitating the availability of

technology to national agricultural systems, (Figure 1). In this process, the major driving force is the training program, and available CIP resources are concentrated on technologies or topics which could be of particular relevance to national systems. Since 1972, nearly 5500 researchers, extensionists, educators and agri-businessmen from over 80 countries have been reached through CIP's training program.

Heretofore, CIP's approach to "assessing the results of training and communication" has been oriented toward "following-up" former training program participants (former trainees), with the purpose of identifying continuing or new needs, rather than gathering quantifiable data to substantiate the overall effort. The emphasis has been on improving the way in which appropriate technology is delivered to national agricultural systems.

This paper provides a general background to the methodology used in evaluations and studies on training in which the author has been involved; describes and reports the status of the methodology CIP's Training and Communication Department is attempting to institutionalize; provides a summary of preliminary results; highlights some of the effects this and other studies are having on CIP's human resource development efforts, and advances a suggestion for the future.

2. METHODOLOGY OF PREVIOUS STUDIES

In all studies, evaluations or reviews on training with which the author has been associated, the intent has been to determine the importance of the training received and ascertain the effect of the training on improving individual as well as institutional performances (Barbosa et al., 1987; Byrnes, 1986; Haynes, 1984; Mills, 1984; Moreno and Alvarez, 1983; Nestel et al., 1981; Piña et al., 1985; Piña et al., 1987; and TAC Secretariat, 1986). As such, even when the studies were evaluative, i.e., to improve on-going projects, nearly all were of a summative nature, the kind of study normally conducted at the end of a project where the emphasis is on reporting numbers of trainees, activities, publications, etc.

All studies depended heavily on personal interviews with former trainees, their supervisors and IARC training program coordinators. The TAC study team, for example,

contacted over 1,300 individuals from 18 countries in less than eight months (TAC Secretariat, 1986). Open-ended questions were generally asked, attempting to elicit statements that would indicate how trainees felt about their training experiences and the effect these had on their work performance. Byrnes (1986) was the only interviewer who asked all trainees a common set of questions, blending them into an informal conversation, without necessarily following a particular order. Other interviewers may have had predetermined questions or items to be addressed, but these were not evident in the interviews observed by the author.

Interviews were conducted either singly, in pairs, in small groups of three to four persons or, in some cases --as the TAC study team did-- in larger groups of up to ten persons. Most interviews took place in centrally located conference rooms in the countries visited. Although all interviewers would have preferred to conduct the interviews at the trainees' work stations, this was not possible due to logistical limitations. All interviewers, however, visited some work sites.

Furthermore, some interviewers based their questions on secondary information provided by IARC or national program coordinators. The information ranged from the numbers and backgrounds of the persons trained to tabulated data based on formal surveys. A problem with the former is that the data are often not comparable between groups within a country and much less so between countries. A good example of the latter, however, was the evaluation of a UNDP-sponsored project on the technology transfer of root and tuber crops in which CIAT, CIP and IITA collaborated. In preparation for a summative evaluation of the project, the three centers administered a questionnaire in English, Spanish and French to all former trainees who had undergone training sponsored by the Project. The responses were tabulated and served as the basis for the summative evaluation by Byrnes (Piña et al., 1985). Using this and other information, Byrnes formulated a set of questions which he used in interviews with 70 former trainees and their supervisors in seven countries (Byrnes, 1986).

Two important points about these studies should be noted. The first is that all the studies, or reviews, were conceptualized after a project or effort was underway or nearing completion. More specifically, most of the indicators that will be used to measure the success of a particular effort or project are not clearly understood, or the objectives of a project are stated in such a way that they

permit a wide range of interpretations. This has been a particular issue in the UNDP-sponsored Project involving CIAT, CIP and IITA. This Project has had a number of reviews where the participating centers have used differing methods for reporting accomplishments. This has been further aggravated by the lack of continuity in the composition of the review teams, causing the Centers to reiterate previously reported data during each review.

The second point is that all studies have made important recommendations, but, in the opinion of the author, there has not been enough attention given to following up on these. This is particularly true of the TAC Study of Training in the CGIAR System-1984, the most comprehensive study conducted. Conversely, recommendations made by mid-term reviews of the UNDP project were incorporated into the on-going project. Summative evaluation recommendations made by Byrnes were taken into consideration in preparing a new proposal (CIAT, CIP and IITA, 1987).

3. CIP'S FOLLOW-UP SYSTEM

By late 1979, five years after CIP's inception, the staff of the Training and Communication Department saw a need to ascertain the effect or impact of its training program on national programs. By the end of 1980, it was estimated that CIP had trained an estimated 2,000 national personnel involved in potato improvement. Preliminary steps were undertaken to enable CIP to eventually institutionalize a systematic process for following-up trainees, with the objective of improving delivery of technology.

(a) Course evaluations

Additionally, while this process allowed for gathering information that could contribute to summative evaluations, it also included an important aspect --course evaluations. Designed specifically to improve the quality of training by focusing on courses, other types of events can be evaluated similarly. This process, described in detail by Siri (1986), has been generally accepted by CIP and some collaborating national programs, although it must be constantly promoted by staff from the Training and Communication Department.

(b) Follow-up system

Conversely, the goal of the "continuous follow-up system" is to improve the overall delivery of technology to national programs. Because its usefulness is less understood, it is not as developed as course evaluations, even though the system has been accepted in principle in various internal meetings, reviews and seminars.

The utility of the follow-up system depends largely on the availability of specific information collected continually from former trainees. When this information is processed and analyzed, it can be used by CIP and national program planners to improve the delivery of technology, and provide "feedback" on that technology (Figure 2). Furthermore, the information from former trainees will probably be more valuable and useful when analyzed with other information about the region, area or country.

(c) Questionnaire developed

In 1981, an idea emerged for a survey of all former trainees to get the needed information. In 1982, a pilot questionnaire was developed with valuable assistance from professors of the Universidad Nacional Agraria (UNA) at La Molina, Peru (Moreno and Alvarez, 1983).

In early 1982, the UNA, as part of the CIAT-CIP-IITA Technology Transfer of Root and Tuber Crops project, conducted a course on potato production emphasizing seed production. Ten months later, a first draft of a questionnaire, with input from various CIP staff and professors from the UNA, was sent to all 16 participants, 11 national and five international trainees. There were ten responses to this survey. The intent in this follow-up was to identify the course's effect on farmer and institutional production practices, and to obtain more information for the development of a questionnaire that could be used more extensively by CIP.

Following a review of the responses, course coordinators from the UNA visited four national trainees at their work sites and one international trainee during a visit to Lima. The objective was to get additional information, verify the data and develop the questionnaire.

Figure 1

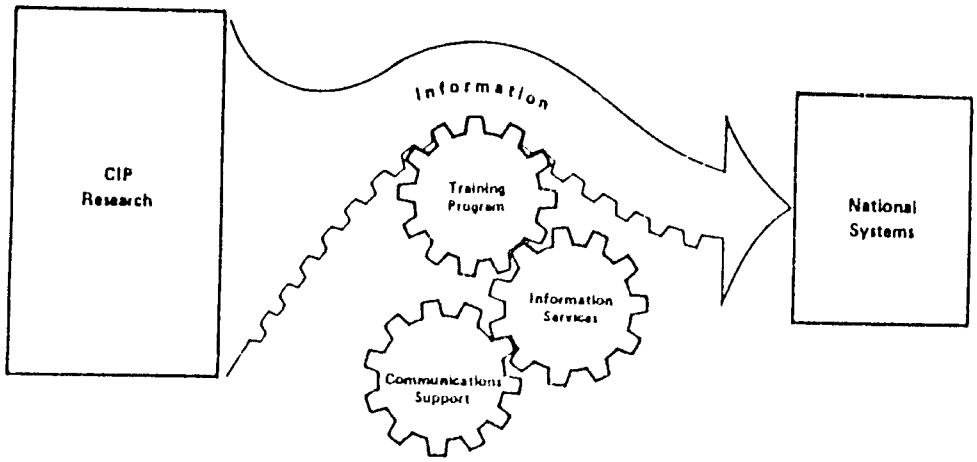
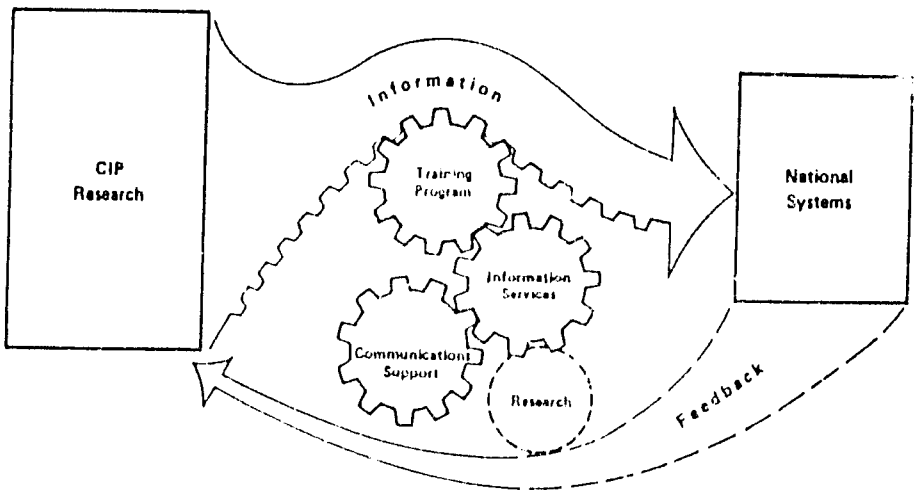


Figure 2



During 1983, the questionnaire was reviewed by B.E. Swanson, who had examined training approaches used by the International Rice Research Institute (IRRI) and International Maize and Wheat Improvement Center (CIMMYT) (Swanson, 1974) and pre-tested in Bangladesh, Chile, Colombia, India, Kenya, the Philippines, and Rwanda.

(d) Questionnaire administered

The final questionnaire was mailed in late 1983 to 1,631 former trainees for whom CIP had complete addresses. Much of the information prior to 1978 was incomplete or out of date; thus, only names and addresses thought to be accurate were used. After a second and third mailing, 564 responses were received.

The questionnaire is divided into six sections: (1) biographical data; (2) use of training; (3) training of others; (4) research involvement; (5) communication with farmers and; (6) contact with CIP. The rationale for each of these sections is evident from the questionnaire.

4. SUMMARY OF SURVEY RESULTS

The data from this survey generated 107 tables. An analysis could generate many statements indicative of the effect of CIP's training program, and provide insight into areas of this work that could be improved. To date no such analysis of all possibilities has been made.

As an example of the kind of information that can be deduced, what follows are a few items which may be of interest to the planning conference (Piña et al., 1987).

- Of the 564 respondents 486 (86%) were male, while 78 (13%) were female.

- Of the 564 respondents, only seven indicated their main profession to be "Sociologist/Economist." This was 1% of the total. Other professions were: agronomist, 214 (38%); pathologist, 100 (18%); breeder, 67 (12%); seed specialist, 61 (11%); physiologist, 18 (3%), and farmer, four (1%). Fifty-two (9%) indicted "other" or did not respond.

- All sociologists / economists were male.

- Of the seven sociologists / economists, three indicated their main responsibility to be research, two indicated administration, and one indicated technician.

- Of the 78 female respondents, 48 (62%) indicated their main responsibility to be research; there was one extension worker.

- As it related to the topic in which training was received, 35 (6%) indicated training in on-farm research and 76 (13%) indicated training in storage/post-harvest topics.

- The 564 respondents indicated undertaking 33 research projects in post- harvest areas following training. These were carrried out on experimental stations (16), with farmers (11), experimental stations and farmers (6), and other (1).

- Of the 564 respondents, 371 (66%) indicated having talked to farmers about changing practices based on the training received, 162 (29%) had not talked to farmers, and 31 (5%) did not respond.

- While many, if not all of the practices could be related to economics, only six practices (1%) were reported to have been strictly on "economic management." The others were seed production, 191 (30%); agronomy, 174 (27%); storage, 154 (24%); and disease control, 119 (18%).

- Of the 564 respondents, 277 (49%) indicated having changed farmers' practices while 246 (44%) indicated not having changed farmers' practices; 41 (7%) did not respond.

(a) Subsample for UNDP-sponsored Project Evaluation

In mid-1983, CIAT, CIP and IITA accepted a recommendation --made by an evaluation team reviewing the Transfer of Technology on Root and Tuber Crops Project-- that CIP's questionnaire be adopted by the three centers for the final evaluation of the Project. It was agreed that CIAT and IITA would administer separate questionnaires that would generate data for 23 tables of the possible total, at that time, of

88. CIP would use its questionnaire in its entirety. Subsequently, CIP was contracted by UNDP to receive the questionnaires from the other two Centers and tabulate and analyze the data.

The three Centers mailed a total of 554 questionnaires, receiving 236 responses (43%). Of those mailed, 364 were sent to former CIP trainees; 161 (44%) responded. The subsample of former trainees from the three Centers revealed four salient points (Piña, 1985). The respondents indicated:

- A general increase in the time they dedicate to the crop in which they received training.
- Training an overwhelming number of extensionists and farmers.
- Involvement in a significant number of research topic areas related to the areas in which training was received.
- A large number of attempts and successes in transferring technologies to farmers.

In the final evaluation, Byrnes employed a case study method using the tabulated data as one of his principal sources of information. He reports that the personal interviews validated the data collected from the questionnaires. He found two clear-cut patterns, related to desires for training:

"(a) The majority of respondents expressed a desire for more and better training in communication, extension and training methods. These subjects were not included in many courses, and in most cases, when included, were criticized for not providing opportunity to practice.

(b) Some trainees with advanced degrees, as well as some others working as research technicians, expressed desires for more extended periods of time for greater specialization or refinement of techniques. For most of these, their orientation was strictly to research."

5. EFFECTS OF STUDIES ON CIP'S HUMAN RESOURCE DEVELOPMENT PROGRAM

All the studies reported in this paper, and others not reported, as well as the experience of CIP staff, will continue to affect CIP's Human Resource Development efforts, i.e., its Training Program, Communications Support and Information Services. Since CIP's early days, this program has attempted to stay abreast of changing conditions within national agricultural systems. Following are some of the more evident past, present and possible future changes.

- Specialized group training was first conducted at headquarters before decentralizing courses to the regions. However, as new technologies develop, it may be necessary to consider conducting some of these courses at headquarters again.

- Specialized individual training on topics that cannot be taught elewhere has been conducted at headquarters and, in some cases, at the regional level.

- More emphasis is being given to finding outside donors for advanced degree scholarships in developed and developing countries.

- More emphasis is being given to collaboration with developed and developing institutions of higher learning for thesis research at CIP-Lima or regional headquarters, supervised by CIP scientists.

- More emphasis is being given to identifying outside donors for enabling national scientists to conduct priority research at CIP-Lima or regional headquarters, in collaboration with CIP scientists.

- Production-oriented training is being entirely conducted in-country or regionally, with strong collaboration, support and input from national potato program scientists.

- A special effort is being made to ensure that former trainees in specialized topics receive updated information relevant to their research.

- National scientists will participate more actively in the exchange of information amongst themselves within countries, between countries, and between regional research networks.

- Production-oriented training will need to be lengthened to ensure that participants have ample opportunity to perform cultural practices in the field. The "call system" appears to be a good alternative to achieve this goal, particularly in in-country courses.

- Regional production courses with emphasis on seed production will need to be increased worldwide with adequate practical experience. An alternative is more collaboration with national insitutions of higher learning who can organize and conduct these courses on a more sustained basis.

- Involvement of national scientists and extensionists as instructors in all training activities will continue to increase.

- Production of training materials to support an increasingly decentralized system will have to be intensified. This is particularly true for visual material to complement already existent printed materials for specialized and production-oriented training away from Peru.

- Efforts to perfect the skills of the national staff to bridge gaps between national-level programs and farmers will have to improve. Topics such as national systems analyses, on-farm research, farm-level diagnostic skills, extension methodologies, and communications training will become important parts of in-country and regional production-oriented training.

- There will be increased involvement of national training and communication staff in support of in-country production-oriented and specialized regional training activities.

- With increased decentralization and national program involvement, the evaluation of training activities will need to be emphasized, in order to improve in the quality of the training.

- There will be more active involvement from CIP headquarters and regional scientists and national collaborators in the follow-up system.

- As regional networks mature, there will be an increasing need to coordinate human resource development activities with not only CIP regional and national program staff, but also network training coordinators.

- CIP's Research Thrust Leaders will need to play more active and important roles in designing human resource development efforts.

- There will be more inter-center collaboration in human resources development, particularly in areas not directly associated with respective center commodities, such as on-farm research, extension methodologies, research management, communications training, and information service, i.e., library science and documentation.

- Former training program participants will play more active roles in improving support for international agricultural research.

6. SUGGESTIONS FOR THE FUTURE

A suggestion related to "assessing training and communication" is made for the CIP Social Science Research Planning Conference --that the "country profiles" effort of the Social Science Department be revitalized as part of research in Thrust X, the "food systems thrust," and that the "continuous follow-up system" comprise a part of that effort.

Specific data, of the type collected by the survey and validated on-site, can be of immense value for research and human resource development programing, when complemented by other data on the area, country or region. The systematic collection and analysis of accurate feedback on information and technologies delivered to national programs is fundamental to CIP's worldwide mandate for potato and sweet potato improvement.

The basic foundation for achieving this already exists. Some valuable experience with the country profiles exists in the Social Science Department. There is interest in the Training and Communication Department for collaborating in this effort. Recently, CIP has acquired computer equipment and employed computer specialists that would facilitate the undertaking. This collaboration could motivate scientists from other departments and regional staff to assume some responsibility for conducting on-site interviews with former trainees as they carry out their research and training functions worldwide. At the same time, national programs could assume similar responsibility as they would have access to data for preparing programs for their countries.

It is one thing to assess, ascertain or determine from time to time the effect or impact a program is having. Normally, CIP has taken a reactive posture, i.e., reacting to a request, pressure or urgency to get information on the importance or value of a program. It is another thing to continually follow-up to be assured that all current activities are responding to real needs, based on feedback from clients of the technologies delivered. When a process like this is operational, data to meet urgent needs will not only be immediately available, it will also be current, and no particular effort will be needed to attain the data.

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THE ROLE OF ASSESSMENT RESEARCH IN IMPROVING R&D PERFORMANCE

Gustavo Nores

The objective of this brief paper is to discuss the possible role of assessment research, particularly with regard to those issues meriting discussion because of their implications for future research. I shall comment first on the conceptual model to guide impact assessment presented by D. Horton. I will then attempt to identify some of the more direct roles of assessment studies vis-à-vis the different clients and their perceived needs. Finally, I will briefly summarize some of the more general issues that in my view merit discussion.

1. THE CONCEPTUAL MODEL

The differentiation proposed by Horton between production technology and R&D technology is useful in as much as one can associate these more clearly with the areas in which NARS and IARCs have their respective comparative advantages. Classifications of research activities in basic, strategic, applied and adaptive, or in component research and systems research, are less encompassing. They refer only to research activities and do not explicitly incorporate the institutional support and building role of the IARCs.

The proposed differentiation, however, does not facilitate impact assessment. Assessing institutional impact implies assessing the "effects of new R&D technology on the capacity of research and extension programs to generate and disseminate new production technology". Ultimately, such an "enhanced capacity" should be assessed by the value of its output; that is, by assessing the improved effectiveness of NARS in achieving production impact. It follows that institutional impact cannot be disassociated from production impact. As they interlink, both types of impact need to be assessed as part of the same studies. The case studies

referred to by Horton, Monares and Crissman in their respective papers clearly illustrate how close those links could be, though they may vary from case to case.

Because agricultural research is a long term and costly endeavor, the institutions (both IARCs and NARS) need, as inputs into their management and planning processes, to be able to assess the effectiveness of their programs and strategies, as well as the potential payoffs of new strategies, programs and projects aiming at specific (intermediate or final) outputs. The types of R&D technologies listed by Horton in Table 1 are intermediate outputs that could be the subject of ex-ante assessment in terms of potential impact. Granted, this is more easily said than done; there are many sources of bias normally leading to overestimations of potential benefits, it requires probabilistic analysis and a considerable degree of subjective judgement, and it takes time and human and financial resources. Yet, as long as there is a need for such ex-ante assessments, social scientists could play a role in proposing alternative methods, with an analysis of their attributes, costs and limitations. I would suggest we expend some time discussing which types of CIP's R&D technologies or types of outputs are amenable to impact assessment (ex-post) and which types could be amenable to ex-ante assessment of potential impact.

2. CLIENTS FOR THE OUTPUTS OF ASSESSMENT RESEARCH

There are at least three groups of clients interested in the outputs of assessment research, but their needs, as we perceive them, are different. These are the donors, the Center and the Center's clients.

(a) Donors

Donors need information on actual, forthcoming and potential accomplishments as well as impact, both as individual agencies and as members of the CGIAR. As individual agencies, donors must satisfy their constituencies that their funds are being appropriately used and that future contributions would produce significant social benefits. They are also interested in learning about areas in which marginal investments through bilateral projects might have high potential social payoffs. As members of the CGIAR,

donors need information on which to base their decisions. The Technical Advisory Committee --TAC-- also needs information on actual and potential accomplishments and impact on which to base its recommendations to the CGIAR. TAC's role in monitoring and recommending priorities for the CGIAR is seen as a continuous process and is the subject of a paper endorsed recently by the Group. The following quotes illustrate TAC's views on the subject (TAC, March 1987):

> "The "Impact Study" recommended that Centers develop mechanisms for monitoring their impact... It is now widely accepted that monitoring and evaluation of potential and actual impact of CGIAR supported activities, should be an internal function of each CGIAR Center... It is TAC's contention that monitoring potential impact is appropriate and that it is reasonable to attempt to judge whether Centers are producing research results and technology components which could have significant impacts in the areas of intended use... However, TAC cautions against using final impact as the sole means of evaluating impact because final impact depends on adaptive research and extension activities in national programs and on the policy and institutional environment."

Working Group 1 might wish to discuss, for example, what type of quantitative information on potatoes and sweet potatoes might be useful to TAC in recommending priorities to the CGIAR. Working Group 4 might wish to discuss what kind of information might be useful to the Center and TAC in assessing whether or not research results and R&D technology components might have significant impacts in the areas of intended use.

(b) The Center

CIP's Board of Trustees, Management and Staff are perhaps the most direct clients for the outputs of assessment research. I would submit that all three groups need information on actual and potential accomplishments and impacts, although with different levels of detail, in order to perform their different research, monitoring, steering and planning functions. Scientists need it as key feedback for enhancing the relevance and the effectiveness of their research and cooperation strategies. Management needs it to perform its specific functions, in particular its project

evaluation, selection and monitoring functions (Greig, 1981), and for strategic planning. Finally, the Board needs it for its steering and policy functions.

The questions are: what types of information, on which subjects, programs, projects or activities, at what level of aggregation and degree of quantification, etc., are needed by the different clients within the Center. The answers to these questions are, obviously, client- and time- specific. For example, I would imagine that at this particular time, strategies regarding sweet potatoes, and tradeoffs vis-à-vis potato research and cooperation activities, are high in the Board's and Management's agendas. Because "next to nothing is known about sweet potatoes in developing countries food systems, especially [on] the socioeconomic component." (CIP, 1987), it would seem to me particularly important to place the collection and analysis of relevant primary and secondary data on sweet potato production, marketing and utilization very high on the research agenda. Similarly, an analytical study on actual and potential markets for sweet potatoes in the developing world, which attempts to identify priority research areas in terms of potential payoffs, would appear to me of great value to CIP, TAC and the CGIAR. Such a study would clearly fall within the area of assessment research. The group might wish to discuss its need and feasibility.

(c) The Center's clients

The third group of people interested in the outputs of assessment research are the NARS, including agricultural policy makers, research, extension and development program managers, and biological and social scientists engaged in research/extension on potatoes and sweet potatoes. Although their particular needs vary with their specific roles, they are all interested in the assessments of both production impact as well as institutional impact in both their own countries as well as in other countries.

Policy makers welcome information on production impact to satisfy their constituencies that their money is invested in activities with high social returns. They also need information on institutional impact as an indication that the institutions concerned are dynamic and searching for ways and means to be more effective and continuously improve their performance. Furthermore, they welcome ex-ante assessments of potential impact as an input into their

planning and resource allocation processes. In many instances, assessment research may highlight policy constraints that impinge on impact, thus might lead to improvements in policy, programs or regulations.

Research, extension and development program managers can effectively utilize the various outputs of assessment research in upstream extension (their interface with policy makers, international agencies and donors), but it is in their specific planning and monitoring functions where the outputs of assessment research can be most useful, even if they refer to other countries. The keen interest shown by research managers on third country case studies is evidence for their perceived value, particularly as they refer to inter-institutional and organizational strategies.

Finally, biological and social scientists in developing countries are both producers and clients of assessment research. They are interested in alternative methodologies, in carrying out collaborative research with biological and social scientists from the IARCs that have had experience in assessment research, as well as in the results of the studies as they might affect their own research activities. Research assessing production and institutional impact is by nature interdisciplinary, in the sense that different disciplines need to interact to disentangle the effects of the different components, and in the case of ex-ante assessments, to pass judgement on probability of outcomes. Questions may arise on the perceived objectivity of studies carried out with dominant participation of scientists directly involved or responsible for the program or project being assessed. Because of this concern with objectivity and transparency, perhaps the best scenario is to draw as much as possible on their knowledge, but to rely on other expertise to assess judgmental issues. Working Group 4 might wish to address this subject.

3. SUMMARY

Some of the more general issues that in my view merit discussion are:

- The differentiation between "production technology" (NARS affairs) and "R&D technology" (IARCs affairs) is useful, but does not appear to help much in facilitating impact assessment. How could the definition of "institutional

impact" be modified so as to facilitate assessment? What types of CIP's R&D technologies or outputs are amenable to impact assessment, and what types are amenable to ex-ante assessment of potential impact?

- The various clients for the outputs of assessment research (donors, CIP and the NARS) need information that could be grouped in three types: (1) on production impact achieved; (2) on (CIP and NARS') achievements and their potential impact; and (3) on the potential impact of proposed new initiatives. The case studies discussed address the first, but the second type of need partially. The Working Group might wish to discuss how to address fully the second and third type.

- For the first time, CIP is involved with inter-commodity priority setting. Thus, there is a new need within the Center for information that facilitates priority setting not only within sweet potatoes (and potatoes) but also for information that facilitates the assessments of tradeoffs between different levels of activities in both commodities. CIP Management may help clarify their information needs for strategic planning. The Working Group might wish to discuss how to address such needs.

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INTRODUCING ANTHROPOLOGY INTO REGIONAL AND NATIONAL PROGRAMS: THE CASE OF PERU

Ella Schmidt

Recently, while doing field work in Mexico, we interviewed a campesino who gave us very detailed and interesting information about his agricultural practices. After we finished with the questionnaire, we thanked him and continued with our work, but near the end of our field study we decided to go back and ask this campesino a few more questions. After an exhausting three-hour conversation, we again thanked him very much and much to our surprise he told us that we were the ones to be thanked. Of course, we did not understand and asked him why. This campesino, who had never been as far from his home as Mexico City, but who did have a television, told us that for years he had been watching television, seeing scientists all over the world asking questions of different people about many interesting subjects, and he wondered when somebody would notice him so he could also be interviewed.

For all of us involved in agricultural research, it is sometimes difficult to remember that behind a kilogram of potatoes or corn there lies a complex human network of labor and knowledge supporting their production, and ultimately the perpetuation of a way of life. It is important that agricultural research keeps in mind the main actors: those farmers and campesinos that our research affects and perhaps benefits.

Anthropologists involved in agricultural research have done much to help change the generally mistaken image of supposedly idle campesinos to one that more closely coincides with reality. Reality shows that campesinos often have a wealth of information about their agricultural activities which they use to make rational decisions concerning agricultural and marketing practices that, in turn, reflect careful cost-benefit calculations. The holistic approach used by anthropologists, in which agricultural systems are considered in their whole socio-economic, regional and even national level, is one of the most important

contributions that anthropology has made to agricultural research.

Scientists have wondered for years why farmers would not adopt new technologies which seemed positive contributions to their economic existence. Here again, the role played by anthropologists has also been important. On various occasions anthropologists have explained why Andean campesinos, for instance, would not easily adopt potatoes with very high yields, but that, due to their higher water content would not be suitable for long term storage. This is an example of the need for a interdisciplinary approach in agricultural research. It is not always possible for scientists involved in specific agricultural research to be able to test all aspects of the technology being developed in the field. The contribution made by each scientist (with his/her particular specialization) to a particular research project is very valuable; between each member of a interdisciplinary team, feedback can be established, moving the investigation forward. During field work on traditional storage systems in the highlands of southern Peru, I was told by a farmer that he sometimes did not have enough time to store all his potatoes at once and that some of them would stay outside for a couple of days. But, he added, these late-stored potatoes would be much more resistant and productive when used as seed. I wondered why these potatoes, when planted, would yield stronger and more productive plants (this happened when I first joined CIP and I had not heard about diffused light storage). I was then told by one of the technicians of Peru's Ministry of Agriculture, who always accompanied me to make the necessary contacts with community members and who was also patient enough to answer all my questions about the region, such as production problems, etc., that this was a consequence of leaving the potatoes outdoors where they could get enough light to turn green and thus have all of the advantages of green seed. The input given by national scientists and technicians to those of us doing short-term anthropological research in different regions of the world is of the utmost importance. The scientists and technicians of national programs deal, on a daily basis, with problems and realities specific to each and every region, even micro-regions. It is very important to note that these people are most aware of the problems the campesinos confront and even what the answers to those problems are. Many times, however, national programs lack sufficient resources and personnel to be able to conduct socio-economic surveys and ex-post-facto evaluations of the possible or real impact of new technologies on the peoples with whose agricultural practices they are involved.

Let me illustrate what I am saying with an example. In 1985 I did a short evaluation --sponsored by the International Development Research Center of Canada-- on the rates of adoption among farmers of the central highlands of Peru --namely the Mantaro and Tulumayo Valleys in the Department of Junin-- of diffused light storages (DLS) developed by CIP (Rhoades, 1985; Schmidt et. al, 1985; Horton, 1984). While CIP built demonstration models of DLS units in conjunction with the Peruvian National Potato Program demonstrating the usefulness of the technology, the dissemination of this technology was in the hands of the National Program, as CIP's mandate is to develop technology and is not responsible for its diffusion. In this particular case, scientists and technicians of the Peruvian National Potato Program understood the principle of potato greening underlying this DLS system. This enabled them to adapt the knowledge to each individual's needs. The results were as follows:

Table 1. Farm size and type of potato storage used by farmers surveyed

Cultivated land (ha)	Number of farmers	Diffused light storage		Dark storage
		Separate building*	Adapted building	
<1	5	2	2	1
1-5	23	15	7	1
5-10	7	6	1	0
>10	10	5	5	0
Total	45	28	15	2

* In corridors, second floors, terraces, sheds, etc.

Criteria for this evaluation used the principle of potato greening --instead of counting how many DLS units were being used in the region. As the figures show, 62% of the farmers were not using a structure, but the principle of potato greening. These figures not only illustrate the knowledge farmers have and how they adapt a proposed technology to their specific needs, but that technicians and scientists of the nationl programs had understood that the most important thing was not to repeat and copy the structures being proposed, but to use their imagination and try

to apply the principle of potato greening, adapting it to the farmers' possibilities and resources. Even though DLS units are very easy to build in this particular region, where Eucalyptus wood is available and rather cheap, there were still some farmers who could not afford either the wood or the wire and the nails needed for the structure. The most important aspect for us to remember is that technicians of the Peruvian National Potato Program understood the problems involved in potato storage and were able to adapt this understanding to the specific needs of each farmer. Even though it seems that the process of diffusion is rather slow, one has to bear in mind, on the one hand, that geography sometimes make contact with highland farmers difficult, and on the other hand, the immense financial difficulties and lack of personnel that many national programs suffer from. The conclusions I arrived at in this specific follow-up survey were, first, that in spite of the many problems and shortages (in personnel as well as in funding), diffusion was taking place, slowly but surely, especially because the technology was flexible enough so as to be adapted to each campesino's needs, and second, that if the farmer's socio-economic conditions would not have been taken into consideration and the survey would have only been interested in counting how many DLS units were already built, one would have missed all these other aspects -- probably the most important-- that showed that campesinos actually are active participants in the process of technology transfer and not mere recipients.

It was once said that the data I gathered in this survey seemed reasonably easy to obtain and that the results of my survey should be verified with further investigation. Robert Rhoades suggested to the person who thought the work needed further research, that probably this researcher should also be a woman in order to get this type of information. Dr. Rhoades was right. Even though I do not intend to bore you with feminist issues, I do have to say that storage, or better stated, the administration of stored products, in the Andean region is the responsibility of women. Less than two decades ago, agricultural researchers would not have thought of interviewing Andean women, as they believed to be only responsible for house chores with little or no voice in household decisions or in the administration of the household's produce.

Although the image we have is of women with little or no participation in the community assemblies, research done by many scholars has demonstrated that Andean women do have an important role --voz y voto-- in household management and

in the community itself. Taking this into consideration, I decided to always ask that the wife be present during interviews with the farmer. This turned out to be a very positive decision which shed much light on my own vision of Andean reality. While male researchers may be just as capable as women in most situations, there may be occasions in which a female researcher might be more readily accepted, just as there are times when being female might present problems. The holistic approach that anthropologists use in understanding the socio-economic and cultural system once again helped me perceive this reality as a system of roles and relationships and helped me understand that the responsibility for the perpetuation of the Andean system is shared by men and women.

In 1984 (Franco and Schmidt, 1985), an agricultural economist and I carried out a survey in northern Peru --in the Department of Cajamarca-- to find out what the diffusion of Molinera, a potato resistant to bacterial wilt (a problem that forced the Peruvian government to declare a great part of northern of Peru in quarantine). We found out that this potato was not only widely spread, but it was even being sent as far as Lima's wholesale market, for it turned out to be not only resistant to bacterial wilt, but also had a rather high dry matter content that made it desirable for consumption.

The story of how Molinera was developed is a very good example of how an international center such as CIP can help in specific problems seriously affecting potato production in developing countries such as Peru. In 1969, the Peruvian National Potato Program requested the North Carolina Mission to provide them with clones resistant to bacterial wilt. In 1972 --after the North Carolina Mission withdrew-- CIP started working on a corporate basis with the University of Wisconsin. After several trials by the Peruvian National Potato Program in the infested regions, there was, by 1976 material ready to be given to the National Program to begin its last adaptation and propagation phases. Several years after this material was released by the National Program, it was very difficult to asses the impact of this variety due to lack of funding. CIP's survey in this specific case, helped not only to define the extent of diffusion of this particular variety, but also helped to pinpoint and understand the particular processes of diffusion and adoption taking place among farmers. It was interesting to find out that there were not only official (or formal) channels of diffusion --that is to say, the diffusion network set up by the Peruvian National Potato

Program-- but that informal diffusion processes were also taking place, following traditional exchange flows of seed set up in ancient times. Another important finding of the survey was that this potato was very flavorful, creating a demand in regions outside the quarantine area, and thus allowing its producers a wider market.

I hope these two examples illustrate how institutions such as CIP, with funding and human resources, can play a key role in helping national programs, not only in the development of new technology, but in ex-post-facto evaluation of the possible impact these new technologies might have had on farmers. The national programs may not have the resources to invest in finding out whether a technology is being adopted, and if not, what are the reasons.

Here once again, anthropologists can play a key role in finding out **why** farmers may or may not want to adopt a new technology, or a new potato variety. Anthropologists, with their holistic view that aims to understand the social, economic, political and cultural aspects of human groups as **systems** connected with regional, national and even international systems, can, I think, help in understanding rural societies such as the Andean society.

During my last field work in Cuzco --before begining my doctoral studies at the University of California, Davis-- we were interested in finding out the decisions farmers made when adopting new potato varieties. What were their reasons for adopting or not adopting a specific variety of potato, and if adopted, what place would this potato take in the existing array of different potato varieties. Our results were very exciting.

Farmers were ready to abandon a very good, from a culinary view, potato variety when the variety began to have lower yields. As one can imagine, it is very difficult for a farmer to produce everything he and his family need to survive, making him dependent on the market. To be able to buy the things he doesn't produce (such as sugar, oil, candles and even matches) he needs to sell part of his production. Under these circumstances, farmers are often forced to stop planting a potato variety --regardless of its qualities, high dry matter content, good storage qualities, etc.-- because continuous attacks by pests and disease have degenerated this specific variety to the point where it is no longer productive. Farmers are obliged then to turn to other potato varieties. One of the problems that farmers encounter at this stage is that the potatoes they adopt are

often not exactly suited to the ecological rigors of their region or their economic resources. Sometimes the potatoes being proposed are affected by frost, drought or to a specific disease spread out in the region. Farmers are then confronted with problems that they should not have to face. We found farmers having very serious storage problems, as the adopted potato varieties were high in water content (a frequent characteristic of high yielding varieties). This meant that in less than three months these potatoes would have started sprouting with the consequent lose of water. These potatoes would then lose weight, sprout very early and --probably the most important consequence of this dehydration-- turn bitter as there was not enough dry matter content that makes stored potatoes become sweet. These new potato varieties were being adopted because they had very good yields, and, as I have said, farmers need to sell their produce. It is obvious that the farmers hoped that the higher yields would improve their economic condition. The sad part of the story is that these potatoes were not suitable for these highland farmers who are obliged to store their potatoes for over eight months each year. If anthropological research had been conducted prior to the diffusion of new varieties, perhaps this problem could have been avoided and precious time saved in seeking an effective solution. Anthropologists could have aided the geneticists by letting them know what characteristics were needed and desired by farmers. Such anthropological research would also help national programs which are mainly responsible for diffusion, by informing them of the nature of various potatoes and situations in which the potatoes might or might not meet local needs. In this instance, the Peruvian National Potato Program, which had originally diffused the improved potatoes, made the wise decision of starting to clean and rediffuse native varieties high in dry matter content and known for their high yields. We can only make such decisions when farmers' opinions are sought and their problems taken into consideration.

Some improved varieties have found a place in the rather complex universe of potato varieties, in which each variety of potato may be used for a specific and different end. Some improved varieties are now considered, as papa huaña; that is to say, a potato that can be dehydrated and turned into chuño (dehydrated potato), as its water content allows for this processing. Another example is the variety known as Renacimiento, a variety developed by Carlos Ochoa a dstinguished member of CIP, and classified as huayco papa, a potato with a rather high dry matter content, suitable for baking and sometimes used in soups.

To understand how Andean farmers classify their potatoes by either color,dry matter content or different culinary needs is to understand the needs of farmers. If the goal of international centers such as CIP is to help develop technology that will, in its turn, help people to not only acquire a higher standard of living, but at least not lose the one they already have, communication channels should be left open and all social and natural scientists of all institutions, need to get together and listen to what farmers have to say. I realize that this is not necessarily an easy task, as my own experience at CIP and through extensive contacts with the Peruvian National Potato Program has indicated. But when everybody agrees that the farmer is the key protagonist of our raison d'être, then we have already made a great leap forward.

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THE ROLE OF THE FARM HOUSEHOLD IN POTATO AND SWEET POTATO RESEARCH AND DEVELOPMENT: A PROJECT PROPOSAL

International Potato Center

I. OBJECTIVES OF THE PROPOSED PROJECT

The rise of client-oriented, participatory farming systems research and development in the 1980s has significantly expanded our understanding of production constraints and helped generate appropriate solutions for improving the economic well-being of small farmers in developing countries (Simmonds, 1984). Despite these advances, however, the focus has remained narrowly on the farmer in isolation from the farm household where agricultural decisions are made. Virtually no attention has been given to the household, the most important form of social organization in the agricultural sector of developing countries (Singh et al, 1986). As a result, women, members of the household other than the male head, and many food production and utilization activities and institutions have been ignored or relegated to a minor position in research efforts. Emphasis has been on field production as opposed to pre- or post-production activities in which all household members play important roles.

The International Potato Center (CIP) is developing a project to correct this imbalance by identifying, training and supporting young individuals from developing countries in Asia to conduct research on topics related to household food production, processing, marketing and utilization. The focus will be on activities related to root crops --specially potatoes and sweet potatoes-- which have been neglected to date.

The objectives of the project are:

- Support interdisciplinary research projects in selected developing countries in Asia in an effort to document, analyze and improve the present situation of household food activities related to potatoes and sweet potato.

- Train and give young developing country researchers and professionals an opportunity to work with technical scientists in root crop improvement programs, in an effort to foster interdisciplinary research focussing on the diverse users of technology.

- Test simple technologies and develop research methods appropriate for improving and understanding important activities in the food system which have been neglected through field production-focussed research (e.g., sweet potato or potato storage, harvesting, processing, marketing, consumption, preparation, nutrition).

- Sensitize agricultural scientists now working in national programs to the users perspective and the importance of household decision making in the process of technological change.

2. IMPORTANCE OF UNDERSTANDING THE FOOD SYSTEM FOR NATIONAL FOOD SECURITY

Food security in developing countries is a concept which has been debated from many different angles in recent years (Noonan, 1985). What is clear is that problems of food supply and demand will not be solved by a single approach but rather by many strategies. Estimates signal that, in order to maintain 1984 levels of food intake in Asia, already extremely low in developing countries, food availability will have to double by the year 2000. Yields must be increased significantly; new agricultural land must be brought under cultivation, and cropping systems must be intensified by expanding cultivation of high-yielding crops like roots and tubers. The efficiency of distribution and marketing must be improved. Agricultural organizations worldwide have responded to these challenges by diversifying research directions and exploring the use of promising new approaches like multiple cropping, integrated pest management, reduction of post-harvest losses, promotion of food gardens, and agroforestry.

There is also a growing awareness that the users of new technology must be involved in the research and development process from beginning to end (Rhoades and Booth, 1982; Whyte and Boynton, 1983; Chambers, 1985; Horton, 1984). Until recently, it was assumed that the targets of new

technology were "family farms with a single production function headed by individual males who command the resources of individual household members" (Fresco, 1985:14). This assumption stems largely from the fact that agricultural researchers, themselves mainly male, have through training and experience focused on the field as a unit of study and development. The main user, therefore, was assumed to be the male head of household.

Research on the complexity of Third World agriculture has indicated that this model of farming households is not only simplistic, but holds back effective technology design and transfer (cf. Fresco, 1985). Expanded production through introduction of new varieties, for example, can only be successful if accompanied by necessary changes in activities further down the food chain, such as storage, marketing and seed preservation. Once the production phase is seen in its proper perspective within the complete food cycle, the concepts of users and clients must be expanded to include the decison-making household. In other words, agricultural research and policy must be tailored to the need of diverse technology users, including but not limited to women.

3. SPECIAL NEED FOR HOUSEHOLD-BASED FOR INTERDISCIPLINARY RESEARCH ON POTATOES AND SWEET POTATOES IN ASIA

Stimulated by the "Green Revolution", the pace of change in Asian cereal grain production has been rapid, as has been the growth in technical research capacity. The separation of the human and biological sciences in agricultural research, however, still remains great. One of the basic reasons has been the historic institutional separation between these different scientific disciplines, and the subsequent lack of exposure by biological scientists to the human and social sciences, and vice versa (Rhoades, 1984). Other relevant food related fields such as nutrition, household sciences, marketing, processing, and communications have likewise been on the margins of the technical agricultural research efforts.

An understanding of the agricultural household which the non-technical sciences can give is particularly important in the case of root crops. The dual strategies of commercial and subsistence production, by householders in particular, must be brought to bear on project design.

Especially potatoes and sweet potatoes are frequently produced for household consumption and, due to their perishability and special home preparation needs, involve post-harvest activities not required for the grains. In addition, crops like the potato which are now expanding into non-traditional production areas, women and other household members will be important to the success of acceptance, since new crop experimentation, gardens, food preparation, storage and processing are typically managed by women, In fact, many food preparation and utilization activities within the household are culturally inaccessible to men. Labor use, household cash flow, alternative demands on time and household allocation of resources also impinge on the success of technical efforts.

Building a household perspective into potato and sweet potato research and extension will require teams that are able to study and understand the special technological needs of women. In this regard, women need to be trained and involved in crop improvement teams.

The model to be employed in this project is a variant of the "farmer-back-to-farmer" approach, successfully applied by several national programs in their production and post-harvest work (Rhoades and Booth, 1982). The clients, however, would be the diverse technology users of the household, not just the male head.

Potatoes and sweet potatoes are excellent crops for illustrating the effectiveness of client-oriented agricultural research and development approach that looks beyond production to broader aspects of the food system. The potato, as discussed below, is a rapidly expanding crop undergoing, with its producing household, rapid technological changes. Producers frequently face high costs and unpredictable markets, but high potential profits. The potato is still a luxury for most urban consumers. Conversely, the sweet potato is a poor man food with its own consumer and demand problems. Despite these differences, potatoes and sweet potatoes are both perishable, bulky root crops with a high water content. This makes the post-production phases of handling, storing, processing, marketing and food preparation extremely important.

(a) Potatoes

Significant increases in potato production have been taking place in Southest Asia over the past 25 years

(Table 1). Whereas world potato production has remained more or less constant since 1960, Southest Asian potato production has increased at an average annual rate of 3.3%. Although Asia started at a low production base, it has experienced a much higher growth rate that other food crops. With a high population density and population growth rate, Southest Asia requires more food production per unit area per time. The potato is unequalled in this regard (CIP, 1984).

Table 1. Potatoes: Total and per capita production 1984, and average rate of change 1961/65-84

Country	Area (000 ha)	Production (000 t)	Yield (t/ha)	Production per capita (kg)	Avg. annual % change prod. (1961/65-84)
Burma	16	155	9.5	4	5.0
China	4,005	55,033	13.7	52	3.3
Fiji		2	5.9	3	n.d.
French Polynesia		3	7.8	19	5.1
Indonesia	26	196	7.5	1	5.3
Korean Rep.	26	436	16.8	11	-0.0
New Caledonia		2	5.0	13	3.2
Papua New Guinea		1	9.0	0	n.d.
Philippines	4	44	10.5	1	5.0
Sri Lanka	7	90	12.5	6	15.2
Thailand	1	8	10.9	0	4.6
Vietnam	30	250	8.3	4	16.3
Total	4,115	56,220	13.7	38	3.3

Source: FAO Production Yearbook 1976 and 1984.

One reason for the expansion of potato production has been the development of tropical agronomy, germplasm adapted to warm climates, new rotational patterns and microenvironment manipulation of climate (Midmore and Rhoades, 1987). Potato does extremely well after paddy rice during dry, cool winter months when paddy fields are normally fallow. As production increases, however, a number of important socio-economic and technical issues related to technology adoption

and change, marketing, processing, and consumption will arise. The potato is still considered a luxury, high priced vegetable for many Asians, and consumption per capita remains low (Table 1). It is, however, an important cash crop for households in potato producing areas.

(b) Sweet potato

Research focusing specifically on the human aspects of sweet potato agriculture in developing countries is rare. Despite the fact that sweet potato ranks fifth in terms of its dietary contribution in developing countries, even less is known about it than was known about the potato when CIP social scientists began their documentation research ten years ago. A number of useful anthropological studies have been conducted; most deal with sweet potato plant migration history and ethnographic descriptions of production and storage, mainly in Oceania. The economic literature is virtually non-existent, probably because the sweet potato is primarily a subsistence crop having very little to do with international trade. Some macro-level, national statistics are available and the marketing problems of this perishable, bulky crop have been touched upon.

A major theme which has fascinated sweet potato scientists, but has not been the object of serious study, is the crop's perceived low status by consumers in developing countries. This image, in turn, leads to wide-spread resistance to eating sweet potato except in periods of great economic or nutritional stress. Thurston (1984) for example, reports that in the Philippines the way to tell someone to "go to hell" is to say "go eat camotes" (sweet potatoes). Tsou and Villareal (1982) argue that the resistance to eating sweet potatoes derives from several factors, including seasonal fluctuations in supplies, high sugar content and flatulence. On the social psychological side, they note that "sweet potatoes are considered a survival, or poor man's food." Filipinos and Taiwanese have negative associations with the crop since they were forced to survive on it during the Second World War. Sweet potato is often dried and mixed with rice to lower consumption costs in the People's Republic of China. In the Philippines it is widely used to feed swine. The only exceptions to the culturally low status of sweet potato are found among a few Polynesian and Oceanian societies where the crop is used in ceremonial rituals.

Some observers (e.g., Yen, 1982) note that despite consumer prejudices, sweet potato has been growing in importance because of ease of production, low costs and low labor inputs. Both tubers and leaves can be used as food and animal feed. The crop has no strict seasonality, and is amendable to mixed cropping with other roots, tubers, vegetables and even grains. It grows well on marginal, steep slopes without intensive irrigation, and like the potato, can be grown in field crop systems or small, kitchen gardens (Niñez, 1984). In countries like Papua New Guinea, however, where increasing urbanization and a shift to cash earning is taking place, consumers are increasingly favoring cheap, imported rice over traditional root crops such as sweet potatoes.

In addition to special sociocultural aspects, sweet potatoes play a major nutritional role in resource poor households. During periods of rice scarcity, for example, sweet potato is processed and mixed with rice to carry families through food crisis periods. Sweet potato is a backyard kitchen crop supplying nutrients to family members.

Table 2. Sweet potatoes: Total and per capita production 1984, and average rate of change 1961/65-84

Country	Area (000 ha)	Production (000 t)	Yield (t/ha)	Production per capita (kg)	Avg. annual change prod. (1961/65-84)
Burma	5	24	5.2	1	5.8
China	5,028	97,933	19.5	93	0.7
Fiji	1	8	10.0	12	2.2
French Polynesia		1	2.3	6	0.0
Indonesia	268	2,050	7.6	13	-1.9
Korean Rep.	37	895	24.4	22	-3.2
New Caledonia	1	4	4.5	26	1.3
Papua New Guinea	102	464	4.5	129	2.0
Philippines	214	1,000	4.7	19	1.4
Sri Lanka	15	130	8.7	8	4.1
Thailand	40	355	9.0	7	2.9
Vietnam	390	1,900	4.9	33	2.3
Total	6,101	104,764	17.2	71	0.6

Source: FAO Production Yearbook 1976 and 1984.

4. PROJECT DEVELOPMENT AND IMPLEMENTATION

(a) Project phases

Despite the importance of both potato and sweet potato for Asian households, little attention has been given to the non-technical aspects of the crop by national vegetable research systems. This implies that a careful introduction of the food system perspective will be necessary. The initial project will run for three years and have three stages of project evolution.

- Stage 1. (1987-88) Establish ties with participating institutions and identify participants. Form the co-ordinating committee. Train and begin initial baseline studies in selected areas.

- Stage 2. (1988-89) Intensify research and work with technical scientists, identify and test simple technologies with client households.

- Stage 3. (1989-90) Continue research, prepare final report and evaluation. Hold final symposium on "Reserach on Households in Food Systems: The Southeast Asian Potato and Sweet Potato Experience".

(b) Project procedures

- The first step will be to identify, in conjunction with national program leaders, CIP's Southeast Asian Regional office (Southeast Asia) and SAPPRAD[1] young social scientists or researchers form other non-traditional agricultural disciplines from each country and who are interested in agricultural research and development. Preferably, these persons should be practitioners who will continue to work in a food improvement field after the training. Individuals on sabbatical from the extension service would be ideal candidates. This will not always be possible, and in some instances, these individuals may be students from universities who are working on these or special reports.

- Following an initial orientation in their own countries on potato or sweet potato improvement efforts, these individuals will develop research projects relevant to the goals of their country's crop improvement programs and to the national food system.

The projects will be linked closely to potato and sweet potato improvement efforts currently underway in each country. It is advisable, but not always mandatory, that the food systems projects in SAPPRAD member countries should focus on the area of specialization that a particular country has within the network. In any event, the research project should address issues that are relevant to the national program goals.

- The first stage of each project should involve the study of the present circumstance of households within the target areas and the full production cycle of the given crop under consideration. Three general questions will be entertained:

  - What are household members presently doing in potato or sweet potato food production and utilization?

  - Why are they doing what they are doing?

  - What are the problems perceived by the household members?

- Following this rapid diagnostic stage, projects should then focus on significant activities in the full production cycle of the selected crop. It is expected that major concentration will be in the pre- and post-production phases. Special areas of emphasis may be (1) seed procurement and selection by households; (2) harvesting; (3) marketing; (4) storage; (5) processing; (6) preparation and; (7) consumption and nutrition. Additionally, other areas under household female management, such as home gardens, may receive attention.

(c) Supervisory Committee

The reserach projects will be supervised and backstopped by a Supervisory Committee with the following members:

- Project coordinator (e.g., Dutch Research Associate in Southeast Asia or other individual).

- Prominent Asian Scientists (representing national programs or universities).

- Senior Scientists from the Agricultural University, Wageningen.

- SAPPRAD Coordinator.

- CIP's Southeast Asian Regional Representative.

- CIP Headquarters and Regional Staff, including Leader of Food Systems, Head of the Social Science Department, and Leader of Post-harvest Technology and Management.[2]

In addition, the project will coordinate with IRRI's Women in Rice Farming Systems Network. Although the present proposal is phased in terms of roots and tubers, it is felt that the food systems approach is equally valid for the grains.

5. SELECTION AND ASSIGNMENT OF PARTICIPANTS

Project participants will be individuals from universities or government institutions in Southeast Asian countries. Numbers of participants will vary, but conceivably two to three from each country could be trained over the life of the project. This would mean fielding 20 to 25 specific projects. They will work directly with biologists or technical scientists in researching problems of relevance to farm families, as well as research directions which have been taken on experimental stations, and on-farm testing already underway. In Thailand, for example, a social scientist from a highland university might conduct thesis research on post-harvest problems and technology at the household level. In the Philippines, a social scientist from a regional university might be assigned to work with the Philippine National Potato Program in its efforts to introduce new varieties in small-scale production systems. The important point is that trainees should conduct research that has clear relevance to the program goals of local potato or sweet potato improvement efforts.

Periodic research progress reports and a final thesis or report summarizing research conclusions will be required of each trainee. In each national program, trainees, in collaboration with biological scientists and program leaders, will formulate a research schedule that fits the local needs and agricultural cycle. The length of each project will vary according to national program needs. Planning for each project should be highly participatory, decentralized and adapted to local circumstances.

6. INSTITUTIONALIZATION OF EFFORTS

The first major step in the institutionalization of any new approach to agricultural research and development involves exposure, experience and the exchange of ideas. New approaches to agricultural research often fail because of communication problems and differing assumptions on the part of the various disciplinary specialists on how to solve problems. This project --on the role of households-- will bring together scientists from differente disciplines, as well as extensionists and diverse clients, promising to set a more solid basis for continuining client-oriented research and development.

Although it may be unreasonable to expect immediate placement of the trainees in positions within potato or sweet potato programs (placement is often possible only in loosely affiliated groups), it is likely that an "informal institutionalization of a client-oriented perspective will take root. To foster this perspective, participating institutions will be asked to give continuity to successful projects after termination of this specially funded project. Feedback of the project's efforts to national systems will be fostered by careful selection of trainees who are enthusiastic and in a position to disseminate their findings in an influential way, and through publication of findings and a low budget newsletter.

This project should lead to institutionalization in the following areas:

- Greater sensitivity on the part of production programs of the need to understand agricultural households within food systems and the important role played by women, particularly in post-harvest management and preplanting activities.

- Development of research models and prototypes which can be applied to other crop improvement efforts that could benefit from an increased involvement of clients.

- Greater interaction of the various agencies and individuals involved in the project, i.e., a kind of institutionalization of interaction of new perspectives on agricultural research.

7. RESPONSABILITIES OF THE PROJECT STAFF AND SUPERVISORY COMMITTEE

- Project Coordinator (Dutch Research Associate or other individual assigned). The duties of the full-time project coordinator are:

  - Coordination of the Projects Suvervisory Committee;

  - Identification of students and projects in coordination with Supervisory Committee;

  - Fostering contacts with the Agricultural University, Wageningen.

  - On-site training; and

  - Monitoring and follow-up.

  - The Dutch Research Associate will most likely be located in CIP's Region VII office in Los Baños, Philippines. A special office for the project is presently available.

- Prominent Asian Science Advisers

The role of the Science Adviser from each participating country will be:

  - Oversee trainees' research projects within their national institutions;

  - Identify with the Project Coordinator and the Supervisory Committee projects and students relevant to the technical and socioeconomic needs of SAPPRAD countries;

  - Backstop to assure that the best quality research is being conducted;

  - Provide senior level leadership in the interdisciplinary context.

- Supervisory Committee

The Supervisory Committee, in addition to the Project Coordinator and Senior Country Scientist, will be made up of the SAPPRAD Coordinator, CIP's Region VII Representative, scientists from the Agricultural University, Wageningen, and members from CIP-Lima. All Committee members will serve as source persons as well as guarantee the direction of the overall project and of individual trainees' undertaking. The Supervisory Committee will ensure that trainees and projects are selected so that the activities will have a better chance to be institutionalized in national root and tuber programs after project termination.

8. BUDGET AND SCHEDULE

The project will run for 36 months from date of funding and involve approximately $290,000 U.S. In addition, CIP will commit an approximate amount in indirect costs, salaries of CIP scientists, travel, and use of CIP facilities. The project will be reviewed after the first year to determine funding for the last two years.

9. EXPECTED RESULTS

- By introducing the household and client perspective into root crop research and extension, the project will enhance the technology generation and transfer process;

- On-site training of young scientists concerned with improving the food system;

- Make new technologies relevant to the needs of producers and consumers and involve clients, particularly women in research and transfer.

- Dissemination of appropriate models and methods for analyzing and incorporating the household perspective into developing national programs dedicated to improving food systems and making available affordable food and nutrition to consumers.

In addition, trainees will be required to submit a report based on their research which will be published either separately or jointly. A final symposium on "Research on Households in Food Systems: The Southeast Asian Potato and Sweet Potato Experience" will be held toward the end of the project in 1990 or 1991.

NOTES

1. SAPPRAD is a network of five countries that has as its basic objective the investigation and interchange of research information to improve potato production. These countries are Indonesia, Papua New Guinea, Philippines, Sri Lanka and Thailand.

2. Project supervision will be further enhanced by the placement in 1987 of CIP's Post-harvest Technology and Management core research in Bangkok, Thailand. The leader, Dr. Siert Wiersema, is a Dutch national and could play a key role in the selection and guidance of projects related to post-production.

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TRAINING THROUGH MARKETING RESEARCH: THE CIP EXPERIENCE

Gregory Scott

1. INTRODUCTION

Most developing countries lack sufficient trained personnel to carry out broad-based programs of research on food crop marketing (Riley and Staatz, 1981). Nevertheless, problems associated with food crop marketing often demand a detailed knowledge of location-specific factors in order for viable programs and policies to be designed and implemented. Potato marketing presents perhaps the most formidable challenge in this regard. The problems are frequently complex; but given the limited knowledge available, require considerable expertise and effort to diagnose and solve. The purpose of this paper is to discuss efforts of the International Potato Center (CIP) to help improve research capacity of national programs in the area of potato marketing. The paper initially outlines the training objectives set and activities undertaken in the marketing field. It then describes in greater detail the recently initiated collaborative research project in the Andean countries. The impact on research agendas as well as the broader diffusion of ideas and methods are treated throughout. After explaining plans for the future, the paper concludes by identifying three key ingredients for their successful realization.

2. TRAINING OBJECTIVES AND ACTIVITIES: AN OVERVIEW

(a) Objectives

Most national potato programs are increasingly aware of the importance of marketing issues to overall crop development. They are less certain of the role of local social scientists in addressing these issues. CIP first began to focus intensively on these concerns in 1981 when a research

project on potato marketing in developing countries began. Among the most important training objectives of this project are to: (1) provide policy makers and researchers in developing countries with illustrative case studies of potato marketing to improve their understanding of marketing problems and potential solutions; (2) assist national researchers to carry out marketing studies through on-the-job training, collaborative projects and facilitating links with researchers in other countries; and (3) publish training document(s) on research methodologies.

As this project started just after the previous Social Science Planning Conference, it had the recommendations of that meeting very much in mind, namely, to promote: (1) "the integration of research with training; (2) the participation of national social scientists in research activities; (3) the creation of opportunities for national social scientists to participate in the analysis of potatoes in an interdisciplinary framework."...

...As part of the backup to the regional research and training program, research-oriented training materials need to be prepared (SSR/ CIP, 1981: 18-19)."

I will now briefly review the various activities that have been undertaken to achieve these objectives so as to adhere to the recommendations of the previous planning conference.

(b) Activities

Training efforts in the marketing field have been either included in or a part of the following activities:

- Courses and specialized training
- Student theses
- Teaching and seminars
- Workshops and forums
- Contract research
- Project implementation
- Marketing case studies, and
- Project development.

(i) Courses and specialized training

This type of training has involved presenting one or two lectures on marketing concepts, patterns and policies,

the distribution of research materials and the preparation of short summaries for publication in the production course document (Scott, 1987c). It also has meant participating in the planning and organization of the first interdisciplinary course on potato processing to be held next year. Social scientists have also visited CIP-Lima for specialized training in marketing. This activity has included supervised readings, preparation of research proposals, survey questionnaires, etc.

(ii) Student theses

A steady stream of students has approached CIP for advice on thesis research in the area of potato marketing, among other topics. This training covers everything from helping define a topic to revising drafts of the theses themselves. In the process, every effort has been made to ensure that the topic is of interest to the national potato program and that a serious attempt is made for collaboration with biological scientists.[1]

(iii) Teaching and seminars

Every year, CIP social scientists give classroom lectures, lead seminars or participate in university forums here in Lima. This participation has been intended to interest students and professors in becoming more acquainted with potato marketing issues and methods. It also has served to build closer ties between local academic institutions and the national potato program. The Social Science Departament's seminar series, in which marketing seminars formed only a part, has enabled people from outside CIP to become better acquainted with work going on at the center, in the national potato program and vice-versa.

(iv) Workshops and forums

Part of the time devoted to training has also been spent organizing and participating in special meetings, for example, the workshop on domestic food marketing in Latin America held in 1984 (Scott and Costello, 1985). Training in this case involved working with participants on their respective workshop papers and orienting the discussions during the workshop itself.[2] Efforts were made to put workshop participants in contact with national potato program personnel in the process. Furthermore, the workshop

document includes results and methods of either direct relevance (Jones, 1985) or ready application to potato marketing (Pacnico et al., 1985). More recently, Department members cooperated with the Latin American Potato Association to include a panel discussion of marketing problems, methods and policies at the last triennial meeting (Scott and Ezeta, 1987).

(v) Contract research

During the last year, contracts have been granted to researchers at the Universidad del Pacifico, Lima, Peru and Kasetsart University, Bangkok, Thailand. Although these social scientists are being paid to carry out marketing studies, they have received active support in terms of defining specific topics, designing survey questionnaires, working with biological scientists in the national program, etc. Similar efforts were undertaken jointly with the UN's Center for Root and Tuber Crops and the Center for Agro-Economic Research, Bogor, Indonesia.

(vi) Project implementation

Development groups in Peru and India have both received grants from donor agencies to develop simple processing technology. Individuals from each organization have received individualized training for carrying out marketing research during the last 12 months.

(vii) Marketing case studies

Since the last Social Science Planning Conference, collaborative case studies on potato marketing have been completed on Bhutan, Peru, Burundi-Rwanda-Zaire, Thailand, Bangladesh and Madagascar (Scott 1983, 1985, 1986, 1987a, 1987b, and Rasolo et al., 1987). In each of these studies the training procedures have been multifaceted. Here it is useful to distinguish between the process of carrying out the case studies and the final product itself, because both have important training functions.

Collaborating with national potato programs in carrying out case studies of potato marketing involves three training components: (1) sensitizing national program personnel about marketing through informal interviews, seminars and exchange of publications; (2) educating local scientists

about the resources at hand to address marketing problems i.e., the locations of important offices and libraries as well as identities of local researchers working in this field; and (3) offering instruction in appropriate research procedures. Thus, for Bhutanese potato program officials as well as CIP's local representative, to hear first hand the opinions of Indian potato traders had a remarkable impact on their thinking about market requirements, e.g., volumes, quality, characteristics, etc. Similarly, it was instructive for my Burundese counterpart, who had just completed his thesis on potato marketing using secondary data, to go into the local markets and carry out informal views with traders --something he had not done previously.

Local counterparts have also had the opportunity to prepare reports (Rwanda), preliminary findings (Madagascar) or articles (Randianaivo et al., 1985, Scott and Gutierrez 1987, Scott and Thongjiem, 1987) based on what they have written. In short, the training received by national program personnel involved in carrying out the case studies, has varied from problem definition, to data collection, and report writing. The exact nature of the training has depended on the circumstances, time and interest of the respective national potato programs.

(c) Marketing case studies as training documents

In addition to the individuals trained during the process of conducting the case studies, the studies themselves are intended to serve the following training purposes: (1) provide baseline statistics, references to earlier research and a list of contacts; (2) suggest specific topics for future research; and (3) offer methodological guidelines.

Methological guidelines have varied depending on the nature and scope of the study itself. The Peruvian study, for example, devotes an entire chapter to different approaches to food marketing research. It also includes an appendix that discusses the collection and analysis of primary data e.g., collection of the sample, survey design, interview techniques and tabulation of the data. A second appendix is devoted to secondary data. It reviews the respective sources prior to the presentation of an extensive set of statistics. The studies on Thailand, Burundi, Rwanda and Zaire each conclude with a methodological appendix that provides a list of research questions and a short set of guidelines on how to go about collecting the necessary information to answer them.

The case studies also provide an example of how to organize marketing data into a coherent report. The researchers in Madagascar, for example, used the Bhutan report as a model for their study. The research team in Indonesia has taken up parts of the Thailand study as a useful reference in determining the scope and depth of their investigation. Overall, the studies offer the reader an array of suggestions covering topics from marketing concepts and theories, to relevant research questions, data collection and analysis. Moreover, the collection of studies from different countries permits researchers from national programs to profit from the different problems and results analyzed in other countries.

The case study document also serves as a catalyst for future collaboration in the area of training between CIP and the national potato program. In that respect, the case study generates a certain momentum for national programs to identify individuals and resources so as to institutionalize this line of research. Thus, for example, Bhutan has agreed to hire a recent university graduate to work on production and marketing problems, requiring additional training. Thailand has contacted researchers at Kasetsart University to work on a follow-up study in collaboration with CIP. Moreover, Peru, in cooperation with neighboring Andean countries, requested CIP to help establish a regional network of researchers on potato marketing.

3. PROJECT DEVELOPMENT: MARKETING RESEARCH IN THE ANDES

The case studies have served to sensitize national program leaders to the need for and usefulness of potato marketing research. They also have been helpful in explaining the issues and methods involved. Institutionalizing this research is the goal of a recently initiated collaborative marketing project in the Andean countries.

(a) Project history

In 1982, national potato program leaders in Bolivia, Colombia, Ecuador, Peru, and Venezuela jointly set about preparing a proposal to establish a regional network for potato research. The network was intended to enable the individual countries to expand the scope of their activities

despite their limited resourses by gaining access to the results and methodologies of neighboring countries. Moreover, each country was to do research on a priority topic and to advise other countries in that area. To ensure the horizontal transfer of experience, methods and results, principal researchers and national program leaders were to meet together once a year. In the preparation of the final proposal, however, only five topics were included: (1) Bolivia: Simple Methods of Potato Seed Production with Small Farmers; (2) Colombia: Control of the Andean Weevil; (3) Ecuador: Rapid Seed Multiplication System for Potato Virus-Free Clones and Varieties; (4) Peru: Evaluation of Economic Damage and Study of Integrated Pest Managemet in the case of Potatoes; and (5) Venezuela: Low-Cost Conservation of Seed and Ware Potatoes.

Although national program leaders unanimously agreed that marketing was a priority in their countries, no country was prepared to assume the leadership for marketing research because none felt it had sufficiently qualified personnel to do so. As a result, they requested CIP to work with them to develop a second project on potato marketing (PRACIPA, 1986).

A critical component of the project was also made explicit from the outset; namely, that the countries themselves represented by their principal researchers would be responsible for conducting the field work, writing reports and preparing the findings for dissemination. CIP was only to provide technical assistance in defining the topics, specifying and employing the methodology, and in facilitating contacts with an interested donor.

The project development was a collaborative experience in at least three respects. First, it called for the exchange of ideas between program leaders and the individuals designated to carry out the study. This helped the researchers appreciate the technical (agro-biological) dimensions of the problem. It also sensitized program leaders and biological scientists to socio-economic concepts and methods. Second, it allowed the donor's economists to interact with the researchers and national potato program personnel. Third, it enabled CIP to appreciate the limitations faced by national programs and brought to the project the experience accumulated in the region and in other parts of the world.

(b) Research projects

Overall project development centered on the preparation of separate sub-projects for each country. The purpose of the sub-projects is two-fold. First, they are intended to address priority marketing problems in each of the countries. In this sense, they are studies that the national potato program and their parent organizations have an operational interest in, thus assuring that: (1) the principal researchers focus on relevant marketing topics; and (2) the requisite support from the institutions involved is forthcoming.

Second, they are intended to train local social scientists to carry out this type of research. This training involves project preparation, execution and reporting. Each of the sub-projects will now be discussed briefly along with their impact since formal initiation in May 1987.

(i) Institutional seed marketing in Bolivia

A major thrust of the Bolivian national program is the introduction of improved quality seed, and the sub-project focuses on the institutional distribution of potato seed in the Cochabamba region. About ten bilateral aid projects, producer organizations and private companies, as well as the regional development corporation are involved in the multiplication, storage and distribution of improved quality seed received from the Ministry of Agriculture's experiment station. Although several of these entities have distributed seed for a number of years, no comparative study exists on basic information such as quantities multiplied and distributed, varieties handled, areas served, procurement and disbursement practices or problems encountered. Technical personnel in the national potato program and the different institutions involved have expressed keen interest in this sub-project for both better planning and coordination at the local level as well as to foster improvements in similar schemes in other parts of the country.

The impact of the Bolivian sub-project has already been considerable. Several institutions contacted have requested that specific information be gathered for them. Moreover, they have already called for a local short-course (planned for next year) to train their personnel to do similar work. Social scientists in Ecuador and Argentina have requested and received more information about the focus and methods of this study. The project's principal researcher is now

working with a local university student, who intends to use some of the data to prepare her bachelor's thesis.

(ii) Market potential for processed potatoes in Colombia

The remarkable increase in potato production in Colombia during the last 20 years --over 7% on an annual average basis-- combined with seasonal price patterns have generated rising interest in alternative uses for potatoes. The Colombian sub-project aims to evaluate the market potential of simple processed potato products. CIP-Lima staff trained a post-harvest specialist at the National Agricultural Research Institute of Colombia (ICA) in processing techniques. His subsequent local experiments found the processes feasible in Colombia. Although the idea of simple potato processing has been talked about in Colombia for years, this sub-project will provide the first socio-economic evaluation of its potential.

The initial focus of this sub-project has been to tabulate the costs of production for different processed potato products. These data have already provided suggestions on how to improve the technical aspects of processing so as to make it more economically feasible. National potato program personnel participated in a recent taste test and a series of informal interviews. They also helped design the survey questionnaires to be administered to growers and consumers in the Pamplona region this year. In addition, the location (adjacent to the Venezuelan border) and the focus of the Colombian sub-project has resulted in the interchange of ideas, draft survey questionnaires and plans for informal meetings between the principal researchers for Colombia and Venezuela. This sub-project also has benefited from and contributed to the execution of a similar study now underway in Peru involving a team of social scientists from the Universidad del Pacifico.

(iii) Producer seed marketing in Ecuador

Successful introduction of tissue culture and rapid multiplication techniques in Ecuador have rapidly transformed the national potato program's capacity to produce improved quality seed. Consequently, program leaders and technical personnel are acutely aware of the need to know more about the market requirements for this product. Thus, for example, in order to avoid producing too much seed or multiplying varieties that only a few growers are interested

in, the Ecuadorian sub-project intends to examine the marketing practices of seed producers in the central and northern part of the country. No study of potato seed marketing has been conducted before.

This sub-project has attracted considerable interest on the part of national potato program technicians who have been involved in the design of the survey questionnaires and the planning of the interviews. Results of the first year's survey will provide critical input to the plans to expand and regionalize the program's seed multiplication and distribution capacity.

(iv) Potato market information in Peru

One of the most persistent problems facing producers, national program personnel and policy makers in Peru, is the lack of accurate, up-to-date information about tuber and seed potato marketing. This traditional concern has been further heightened by the recent national potato program project to multiply and distribute improved quality seed. The Peruvian marketing project addresses this issue in two ways.

First, it aims to identify the relevant statistics now being generated by different institutions concerning potato production and marketing in the central region (both highlands and coast) of the country. For example, what statistics are available vs. what one would like to have? Is there re-duplication of effort?

Second, the project will evaluate the usefulness of this information, once synthesized and disseminated in simple bulletin form. In other words, one very short questionnaire aims at asking the representatives of retailers, wholesalers and producers as well as selected government officials their opinions about the value of the data presented. The intention is to modify the bulletin according to the comments received so as to make it more responsive to clients' needs.

The principal researcher for this project now participates in regular meetings with Ministry of Agriculture officials to discuss developments in the potato sector. He and his associates in the Ministry's Office of Agricultural Economics have received a complete set of marketing data from an American graduate student associated with CIP's Social Science Department, who is developing a times-series

model to estimate the impact of income, population and the availability of potatoes on potato prices for his master's thesis. In other words, as additional statistics are collected, a data bank is being established and the capacity to analyze the information is being developed. National potato program leaders in Colombia and India have made known their interest in finding out more about the methods and results of this project to address similar problems in their countries.

(v) Potato marketing in the Venezuelan Andes

As part of a national effort to improve self-sufficiency in food production and promote rural development in the more isolated parts of the country, Venezuela's national potato program has made considerable efforts in the last several years to improve productivity and increase potato production in the Andean region of the country. One example of this effort is the work done on improved storage, constituting the focus of the PRACIPA-production project. The marketing project intends to complement this initiative by studying table potato marketing patterns. Seed procurement and use is a secondary research topic of the project.

The launching of the PRACIPA marketing project in Venezuela has already prompted a decision by the Ministry of Agriculture to carry out a similar study in the lowland potato producing areas. This project has been approved and is entirely financed by the Ministry. The respective researchers have been encouraged to collaborate so as to facilitate subsequent comparison of their findings. Furthermore, the PRACIPA project was formally presented to national potato program scientists in May at the annual internal review. On this occasion, all program members had an opportunity to provide comments and suggestions. The result was that leaders of every experimental station wanted to have the project begin in their area. Plans are now underway to probe the extent of this interest through a small questionnaire about potato production and marketing in each locality. These findings will also help put the results of the producer survey in the Andean region into a national perspective.

4. FUTURE PLANS

Researchers working on potato marketing in national programs are not only few and far between, but also lack a professional peer group that fosters the exchange of ideas and encourages further development as scientists. Therefore, the most immediate training plans in the marketing area are to hold a two day workshop for the principal researchers of the Andean project in Lima in early November. The purpose of this meeting is to allow the researchers to became better acquainted with their respective projects, methods and results. It also will give them the opportunity to provide constructive criticism and answer their counterparts' questions about on-going research.

Plans have already been made to hold regional marketing workshops in Latin America and South Asia in 1989; similar workshops in sub-Saharan Africa and the Far East are tentatively scheduled for 1990. The Latin American marketing workshop will enable the Andean researchers to share the results of their studies and consolidate the network. It also will facilitate the exchange of ideas, methods and results among and between scientists who have done work on potato marketing in other Latin American countries.

Case studies on potato marketing have also been initiated in Bangladesh, India and Pakistan during the last several years by local social scientists. Some of this work has been done quite independently from the national potato program. The South Asia workshop intends to bring the researchers into more direct contact with each other. It also is intended to foster closer ties with biological scientists in their respective countries.

Work is also underway on a purely methological publication about potato marketing research, bringing together the methods and experience utilized and outlined in the separate case studies. Short training documents on storage and marketing as well as processing and marketing are also in the works.

National scientists are frequently unaware of publications that exist in their own country on marketing. To fill this void, an inexpensive list of publications on potato marketing --by country and by topic-- that are in CIP-Lima files is now being prepared. Once the list is complete, it can be circulated and photocopies of the publications sent to either national program personnel or CIP regional staff.

The job of maintaining and up-dating this list can then be turned over to junior staff.

Training through research is already taking place in processing, as was mentioned earlier. Plans have been made for an international interdisciplinary course next year. Follow-up backstopping related to processing research in Colombia, India, Peru and Thailand is also anticipated. How far and how fast training activities advance in this field will partly depend on the outcome of the research and course planned during the next 12 months. It clearly will require more input from the Social Science Department than has been true in the past.

Sweet potatoes present an additional challenge. Training through collaborative research on sweet potato marketing was a recommendation of the recent seminar on sweet potato improvement in Latin America.[3] As a result, plans are being made to undertake two joint case studies during the next 24 months: one for the hot lowlands of Central America and the Caribbean region and another for the cooler growing areas of South America. The procedure envisioned is similar to that adopted in the PRACIPA project. CIP-Lima staff will advise on defining the topic and preparing the methodology, but local researchers will carry out the studies.

5. CONCLUSIONS

National programs are increasingly aware of the need for improved research capacity in marketing. CIP's response to these requirements has been a multifaceted effort of training through research. In summary, these efforts can perhaps best be characterized as both flexible, problem-oriented and intended to promote greater collaboration between biological and social scientists. The importance of the problem, the resources available and the specific concerns of each national program vary considerably. The training through research discussed above has illustrated CIP's willingness to adopt not only technology but also institution-building to particular national needs. Furthermore, although the case study approach represents a learning opportunity, it also involves grappling with genuine problems. In this sense, the approach acknowledges the urgency of the issues at hand, the limited manpower available to

deal with them and the need to show results now as well as develop capacity to solve problems in the future.

CIP can play a key role in sustaining efforts to improve research capacity in marketing in national programs not only by working with individuals or groups in particular countries, but also by facilitating the international exchange of ideas, methods and experience. This effort involves three key ingredients.

First, it will require increased communication and coordination, both in planning and executing training activities, between CIP's social scientists, other CIP-Lima staff, CIP's regional representatives, national program personnel, and social scientists not presently associated with national programs. This communication and coordination refers to the whole gamut of training endeavors, from courses to projects to publications.

Second, an expanded budget will be needed to cover contract research in processing and on sweet potatoes. In the past, Thrust X and the Social Science Department staff have had to try and secure funding outside CIP; e.g., the Andean marketing project, for this type of activity. This practice makes effective planning difficult and also places an additional burden on staff occupied with research and training.

Third, additional support staff would insure effective backstopping of regional and national program efforts. Senior staff can assume more responsibility for supervising research, participating in training or preparing proposals for outside funding through the delegation of responsibility to experienced junior staff. The past practice of hiring inexperienced social scientists for a brief, one or two year period of apprenticeship before heading off to graduate school has its limitations in this regard. Creating a middle tier between the recent graduates we hire and senior staff would help improve the scope and effectiveness of social science training in the future.

NOTES

1. Two students in Peru have completed bachelors's theses (La Fosse, 1983; Gutierrez, 1987); another is working towards his Masters on seed marketing. Two others are well on

their way in Ecuador. Two students from Holland and one from the United States of America are progressing; another from the United States of America, is just beginning his field work in Rwanda. I also had the pleasure of sitting on the evaluation committee for two students at the University of Burundi, whose joint thesis was passed with distinction (Ndimira and Christensen, 1983).

2. The workshop also proved effective in establishing the usefulness of such research in the eyes of the donor who subsequently financed the Andean marketing project (See below and PRACIPA, 1986).

3. International Seminar on Sweet Potato Improvement in Latin America, International Potato Center, July 9-12, Lima, Peru.

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SOCIAL SCIENCE TRAINING: PAST EXPERIENCE AND NEEDS EXPRESSED BY NATIONAL PROGRAMS

Rainer Zachmann and Garry Robertson

1. INTRODUCTION

The concern with the efficiency of technolgy transfer from international agricultural research institutions to farmers through national research and extension services is not new. Two decades ago, the International Rice Research Institute (IRRI) concluded that "...the typical extension worker...lacks background knowledge...and has little or no first-hand...experience..., he lacks the necessary diagnostic skills, he cannot identify the problems in the farmers' field and thus cannot advise him on appropriate action. Consequently, he is reluctant even to approach the farmer ..." (IRRI 1967).

Twenty years later, there is still concern about the efficiency of technology generation, adaptation and transfer through national programs. This is confirmed by the statement of CIP's Director General that "the gap between national programs and farmers is bigger than the gap between CIP and national programs." CIP believes that transfer of technology to farmers depends more on the ability of national programs to make use of a technology than on the technology alone (Interpaks Interchange, 1985).

Whether these statements are well-founded or not is a separate issue. They do, however, indicate a serious problem: as long as national programs do not interact with farmers in the right way, the value of CIP's efforts is limited.

This paper describes how the Departments of Training and Communications, and Social Science could collaborate in approaching this problem.

2. WHAT IS THE PROBLEM?

Diffused light storage of seed potatoes, a technology adopted by farmers in many developing countries, can be used to illustrate the need for a proper approach to the process of technology diffusion by a national program.

CIP's biologists and social scientists, national programs, and farmers collaborated in the generation, adaptation, and adoption of seed potato storage using diffused light. In many parts of the world, the technology spread almost unaided amongst farmers. A few demonstration stores installed on-farms served as examples for other farmers to copy and adapt. In one country, however, farmers continued to complain about detioration of seed potatoes that they traditionally stored in sacks in the dark, while the demonstration stores, installed at the experimental station, were empty and not being utilized in the process of technology diffusion.

This example indicates deficiencies in the extension process. Several studies, in fact, have concentrated on constraints that affect extension work. Johnson (1983) summarized 22 major obstacles. Watts and Claar (1983) mentioned 12 major conditions for effective extension. Kellogg (1983) related a series of constraints to national policy, technical content, human resources and extension systems.

There is strong evidence, however, that the problem is not based on a list of technical constraints or lack of funding. Evidence points towards obstacles in communication among scientists, extensionists and farmers, and a lack of awareness of the role of farmers in the process of technology generation. This lack of awareness exists not only in national programs, but also at some well-known international agricultural research institutes, as indicated by the following (mistaken) statement: "The use of social scientists in changing farmers' attitudes toward adaptation of new technologies is a good example ..." (Anonymous, 1986). Evidently, it is scientists, extensionists, and administrators who must change their attitudes, not farmers.

3. TRAINING NEEDS

Many years ago, IRRI noticed that the content of its training courses concentrated on the techniques of rice production and gave little attention to farm management, processing, marketing and economics, as experienced by the individual farmer. IRRI revealed dramatically that most extension officials and even highly trained researchers were ill-prepared to demonstrate rice production technologies to the farmer and remedy problems (Ahmed and Coombs, 1975).

Ampuero (1981) stated that research and extension personnel were surprised and discouraged when they noted (mistakingly) that farmers were "ignorant" and "resistant to change". He indicated that the actual problem was that national agricultural services attempted to introduce new technologies without understanding the conditions, circumstances, and needs of the farmers.

It is still difficult for some scientists to accept that farmers have developed a great wealth of experience over the centuries, that rural people have knowledge valuable to scientists, and that small-scale farmers are also professionals from whom it is challenging to learn (Watts and Claar, 1983; Chambers, 1985).

One of the reasons for past failures was that the persons responsible for transfer of technology were scientists and administrators who did not recognize that farmers are experts. It was difficult for them to accept that an alternative selected by farmers may only be a second-best option, but an option that can be realistically implemented (Chatterton and Chatterton, 1982). Researchers lacked perception of the socioeconomic problems confronting the small-scale farmer (Ampuero, 1981).

It became evident that both researchers and extension staff must be trained to respect and thereby learn from the farmer. Also, they had to learn the importance of having farmers take part in the research process (Shaner, 1983). Ampuero (1981) concluded that training should include diagnosis of farmers' problems, research methodology, economic and market analysis, and communications techniques, as well as basic production systems that include all phases of the cultivation process. A similar view was recently confirmed by Byrnes (1986): Scientists trained by international centers indicated desires for more training in communication, extension and training methods.

In a study of the training program of IRRI, Ahmed and Coombs (1975) found that a six-month training on technical matters may be unnecessarily long, but the curriculum too narrow.

In conclusion, training on purely technical topics is obviously not enough. A national administrator confirmed recently (personal communication) that teaching technical information was not the problem, but that it should be complemented by instruction in communications and social science topics such as surveys and farm-level diagnostic skills.

4. CIP'S TRAINING STRATEGY

The strategy of CIP's training program is based on the supposition that national programs: (1) must be able to generate new or improved technologies by themselves; and (2) have the ultimate responsibility to reach farmers with these technologies.

In the mid-1970s, before CIP's regional research network was established worldwide, CIP's training program comprised courses and individual training at headquarters in Peru. Today, CIP's training is no longer limited to CIP's facilities, but is carried out in collaboration with national programs throughout the world. More advanced national programs may take complete responsibility for planning and executing a training activity, providing facilities and instructors. In other cases, more intensive involvement of CIP is required. Nevertheless, no matter at what level CIP is involved, care is taken that the training objectives are accomplished.

Later, CIP's regional network allowed decentralization of its training program. Apart from cost-efficiency, decentralization has permitted a much greater involvement of instructors from countries in South and Central America, Africa, and Asia. Today, CIP's training strength lies in the national programs. CIP's experience is that training organized in collaboration with national programs is more appropriate and longer lasting than training organized by CIP alone.

The training program is highly flexible and includes two types of training: production-oriented and specialized.

Production-oriented training focuses on general principles of potato production, marketing and utilization, and is designed to enable researchers and extensionists to respond to farm-level problems. This type of training is carried out as group-training on an in-country or regional basis. None of CIP's production-oriented training is executed at headquarters.

Specialized training is designed to provide researchers with technical information and practical skills to conduct research in such topics as germplasm management, integrated pest management, true potato seed, nematology, and virology. This training is given as group or individualized training at CIP headquarters or in the regions.

5. TRAINING EXPERIENCES

Some years ago, CIP began incorporating social science components in its training program. One of the first experiences was an on-farm research seminar for high-level national staff. It took one week to get participants away from their pre-conceived ideas on agricultural development. It was not until the second week that participants were able to interpret the results of farm surveys in order to understand the problems as conceived by farmers. Several participants admitted that they had never before visited a farm.

After other experiences with specialized on-farm seminars and courses, the idea was accepted that social science subjects should not be treated separately, but incorporated into CIP's technical training, together with activities on research management and communications. These new topics were not just added as other theoretical lectures somewhere towards the end of a course, but included as intensive practicals throughout the training activity.

The social science practicals consisted of informal and formal surveys, socioeconomic analyses of agronomic techniques, their corresponding theoretical introductions and discussions. During the past four years, social science topics have been included in a few courses in Latin America to gain experience on their integration into technical training.

The first attempt to include social science subjects into a production course was only partially successful. A social scientist with experience in agronomy and training, contracted by CIP, succeeded in convincing the participants on the need and value of examining farmers' perspectives of potato production. The course coordinators, however, who had not participated in the substantial introductory session, remained unconvinced of the necessity, implications and value of these topics in the course, and did nothing to assist in the integration of the topics into the technical training. At the end of the course, the participants concluded that social science was interesting, but that the organization was disastrous.

More successful was the attempt to integrate farm surveys into a specialized course on pathological problems in seed potato production. The course organizers agreed that pathological problems affected the farmers and not the scientists, and therefore the farmers' perspectives should be taken into consideration. On this occasion, CIP contracted a social scientist from Central America, who had good experience in farmer surveys, but less experience in training. The involvement of the participants in the discussions and their comments in the daily evaluations, however, indicated the relevance of the activity. Unfortunately the final course evaluation did not record opinions on the social science subject separately.

Since 1982, CIP has cooperated with an agrarian university in organizing an annual international course on potato production. In the first attempt to include aspects of social science in the course, CIP had to use its own staff because no local counterpart could be found. The following year, a counterpart was available but did not have experience. It was only in the third year that the same national counterpart, with better appreciation of the objectives of this exercise in the course, made a significant contribution.

In spite of these initial problems, participants who attended these courses, reacted very positively to the experience:

> "I noticed with surprise that the farmer had already much technical knowledge, but did not apply it because his conditions did not allow".

> "Very useful, especially for researchers that many times do not have this relation to small farmers".

"The most instructive and important practical of the course".

"Should be introduced in all courses".

Nevertheless, apart from these and other encouraging comments, criticism was made on the structure and organization of this aspect of the course. Obviously, more experience is needed to improve the integration of social science topics into the course program.

6. CHALLENGES

What lessons have been learned? How should social scientists react to the challenges?

(a) Demonstration of the need for social science training

CIP's social scientists should convincingly demonstrate that social science training is essential not only in production-oriented training but also in specialized training. Initially, emphasis should be placed on its incorporation in all production training since it is extensionists and researchers involved in on-farm research who work closely with farmers and appreciate their problems. The training of national researchers and educators in specialized topics, such as pathology, germplasm management, integrated pest management and even *in vitro* micropropagation techniques, must include social science to ensure that the perception of the farmers, the ultimate users of the technology, are not ignored.

(b) Change of attitudes

Social science training is most affected by lack of social science awareness among technical course instructors, course coordinators, and research and training administrators. "The use of social scientists in changing attitudes" is extremely important whenever change of attitudes is not directed towards farmers, but towards scientific colleagues and administrators.

(c) Training of national social scientists

The incorporation of social science topics into training courses is also affected by the lack of trained counterparts in national potato programs. In most countries, there are few socioeconomists involved in agriculture, and the majority of them only gather and compile production and marketing data. It is rare to find socioeconomists working directly with researchers, extensionists, and farmers in the generation of technologies; those that do, have little or no teaching experience.

Since CIP draws heavily on national instructors in its training activities, the biggest challenge for CIP's social scientists is to identify counterparts in national programs and train them properly. This is now critical because group training activities are conducted in over 40 countries, and the integration of social science topics into technical training is being expanded.

(d) Collaboration with the Training and Communications Department

The successful improvement of human resources depends on the quality of the training curriculum developed by the Training and Communications Department. The Department has the responsibility for planning the training program with Thrust Leaders and Regional Research staff, and for coordinating all training activities carried out by CIP staff. The training program is central for bringing new technologies to national scientists, and for ensuring that national scientists and farmers can help each other adapt technologies to meet farmer's needs. This will only be achieved by incorporating social science topics into the training curriculum through close collaboration between the two departments.

7. CONCLUSIONS

The gap between scientists and farmers seriously affects the process of generation, adaptation and adoption of new production techniques. Increasing evidence points towards a lack of awareness of the role of farmers in this process. Little attention has been given to the teaching of skills such as the diagnosis of farmer problems, research

methodology, socioeconomic analysis, and communication techniques that are essential complements to technical knowledge. These skill are required by national scientists to improve the present situation and help bridge the gap. The increased involvement of social scientists in training courses will be a major contributing factor.

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STRATEGIES FOR ENCOURAGING SOCIAL SCIENCE RESEARCH IN REGIONAL AND NATIONAL PROGRAMS

Luis Paz

The problem of feeding a population is not, nor has it ever been, one of agricultural technology; rather, it is and has been the result of a complex of problems with political, institutional and socioeconomic roots, as well as the relationships between countries and groups in power within those countries.

The possibility people have to feed themselves during their lifetime does not only depend on the availability of food, but on acquisitive power as well, which in turn depends on one's position in the local or national power structure. All people participate in a country's food system in accordance with their social status, their economic power or their cultural level.

The effective demand for food by different population groups does not depend exclusively on one's biological needs, but rather on the capability to offer goods or services in exchange for food. Market values --be they services and goods as much as the kinds of work in which the population participates-- determine the terms of exchange; for this reason a tendency exists to generate differences among different occupational and social groups of one area or country, which finally creates differences in people's ability to feed themselves.

The growth of world population and the widening gap between per capita earnings in the industrialized nations with respect to other countries creates a shifting demand for food.

Due to tendencies in world economics, the non-industrialized nations must make a tremendous effort to decrease their dependency on imported foods and assign priority to investments and political measures oriented toward nutritional self-sufficiency, yet without jeopardizing the economic advantages gained by exporting foods to the shifting markets of the industrialized nations.

One of the objectives of the institutions at the service of agriculture should be to increase earnings and the well-being of rural families as a basis for the general development of the population. Increases in production and productivity on only one product could contribute to improving the income of the farmer, but it is not sufficient to guarantee the efficient and effective use of the resources. Crop rotation, and the combination of agricultural activities (different crops and types of livestock) could contribute to the better use of resources such as soil, water, labor and a better adaptation to market conditions.

To reach the optimum use of the limited financial resources destined for research and technology transfer, an analysis of the food systems of each country and each region in question would be opportune. This analysis could be carried out while keeping the global food system, or the product, in mind. Figure 1, titled "Principal Elements of Agrarian Policy," illustrates the complex of elements presented in a systems form and, which, according to the country, or the product involved can influence the development or the stagnation of production. Any of these elements can become the "minimum factor" and limit the effects of the other elements on production increase.

The proposed strategy to follow is to identify those elements which hinder the potential of the other analyzed elements, to propose alternatives for its correction and thus continue, concentrating efforts of research and diffusion on the most limiting factor of production.

AGENDA

PLANNING CONFERENCE FOR THE SOCIAL SCIENCES AT CIP

September 7-10, 1987

Objectives: This planning conference will assemble an authoritative, international group of researchers and decision makers for the general purpose of examining how well CIP's needs are being met by the social science program and what changes should be considered to improve overall institutional performance. Three specific goals of the planning conference are:

1. Review the past program and plans of the social sciences.

2. Critically examine how effectively the social sciences are contributing to:
   - Identification of client needs and opportunities
   - Generation of technology needed
   - Assessment of new technologies and programs
   - Strengthening regional and national programs

3. Develop guidelines and recommendations for a 5-year operational plan

Venue: CIP headquarters in the outskirts of Lima, Peru.

Invitees

R. Chambers. Public Administrator. IDS, United Kingdom.
M. Collinson. Economist. CGIAR, USA.
P. Ewell. Economist. University of Cornell, USA.
J. Galvan. Economist. INIPA, Peru.
P. Leon Gomez. Geneticist, ICA, Colombia.
E. Mayer. Anthropologist. Univ. of Illinois, USA.
G. Nores. Economist. Argentina.
F. Nweke Economist. IITA, Nigeria.
L. Paz. Economist. Peru.
E. Schmidt. Anthropologist. UC Davis, USA.
R. Werge. Anthropologist. USDA, USA.

Monday, September 7, 1987

Session One

Chairperson: Kenneth Brown

08:30 Welcome, opening remarks and objectives.
R. L. Sawyer

Monday Morning (continued)

08:50 Review of the recommendations of 1981 planning conference and 1983 external review.
P. Gregory

09:10 The social sciences at CIP.
D. Horton

09:40 Food systems research.
R. Rhoades

10:10 The role of the social sciences in meeting farmers and national program needs.
P. Accatino

10:30 Coffee

11:00 Discussion 1: CIP's social science program in the context of the CGIAR model: Is there a CIP model?
M. Collinson (51-101)

12:00 Film, "What is CIP"?, and brief tour of facilities.
D. Cunlitte

12:30 Lunch (working group 1).

Monday Afternoon

Session Two
Identifying Client Needs and Opportunities through Global Studies

Chairperson: R. Werge

14:00 Presentation of working group 1.

14:10 Root crop data base.
D. Horton

14:20 The reference file method: an eclectic approach for improving.
R. Rhoades

14:40 Constraints to production and utilization of potatoes and sweet potatoes.
D. Horton

Monday Afternoon (continued)

15:00 Coffee

15:30 Potato marketing and demand in developing countries.
G. Scott

15:50 Discussion 2: Targeting R&D: How well are CIP's and national programs' needs being met?
Discussant: E. Mayer (5'-10')

17:00 Working group 2.

Tuesday, September 8

Session Three
Generating and Diffusing Appropriate Technology through Client-oriented R&D

Chairperson: G. Robertson

08:30 Presentation of working group 2.

08:40 CIP's philosophy on farmer participatory research.
R. Rhoades

08:50 Potato processing: Learning from a traditional Andean system.
N. Yamamoto

09:10 Design of a client-oriented technology: the case of true potato seed.
A. Monares

09:30 Coffee

10:00 User-friendly seed programs.
G. Prain, U. Scheldegger

10:20 Potato farming trials: the Colombian experience.
P.L. Gomez

10:40 The agricultural economist and the experience of INIPA with research in farmers' fields.
J. Galván

Tuesday Morning (continued)

11:00 Farmer-Oriented Research and Development of Integrated Pest Management.
P. Ewell

11:15 Discussion 3: What new challenges should CIP scientists face in client-oriented participatory R&D?
Discussant: R. Chambers (5'-10')

12:30 Lunch (working group 3).

Tuesday Afternoon

Session Four
Assessing the Performance of R & D Programs

Chairperson: P. Malagamba

13:45 Presentation of working group 3.

14:00 Assessing Impact: the general framework.
D. Horton

14:20 Analytical framework for design and assessment of potato seed programs in developing countries.
A. Monares

14:50 Identifying strengths and weaknesses in seed programs.
C. Crissman

15:10 Assessing results of training and communication.
M. Piña

15:30 Coffee

16:00 Discussion 4: The role of assessment research in improving R&D performance.
Discussant: G. Nores (5'-10')

17:00 Working group 4.

Wednesday, September 9

Session Five
Strengthening Regional and National Programs

Chairperson: P. Accatino

08:15 Presentation of working group 4.

08:30 Introducing anthropology into regional and national programs: the case of Peru.
E. Schmidt

08:50 IITA's experiences with integrating social scientists into National Programs.
F. Nweke

09:30 Coffee

10:00 The Role of the Farm Household in Potato and Sweet Potato Research and Development: A Project Proposal.
R. Rhoades

10:15 Training through marketing research: the CIP experience.
G. Scott

10:30 Social science training: past experience and needs expressed by national programs.
R. Zachmann

10:50 Discussion 5: Strategies for encouraging social science research in regional and national programs.
Discussant: L. Paz (5'-10')

12:00 Open forum to establish small discussion groups' objectives and procedures.
R. Werge

12:30 Lunch (working group 5).

13:45 Presentation of working group 5.

Wednesday Afternoon Small Discussion Groups

Thursday, September 10

Morning	Based on the reports of each discussion group and of the earlier sessions' discussions, a "writing panel" prepared a summary report of conclusions and recommendations.
Afternoon	Presentation, discussion and revision of the summary report.

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