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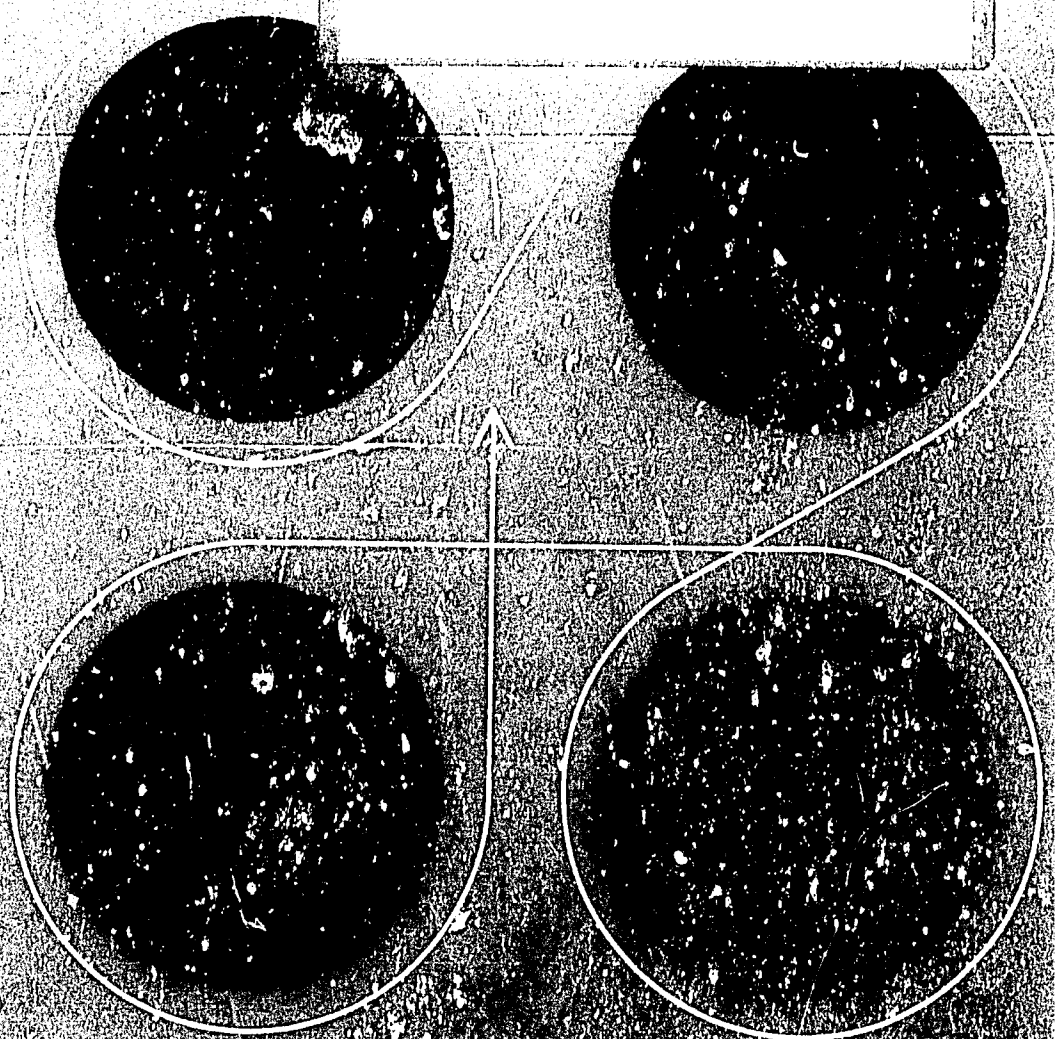

INSTITUTIONALIZING FARMING SYSTEMS RESEARCH AND EXTENSION: CORNELL UNIVERSITY'S EXPERIENCE IN ECUADOR AND THE PHILIPPINES

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1.0.0 Introduction

The question of what is Farming Systems Research and Extension (FSR/E) is asked repeatedly of people working in FSR/E. Most researchers agree with Shaner, Philipp and Schmehl (1982) that it is...

> "an approach to agricultural research and development that views the whole farm as a system and focuses on (1) the interdependencies between the components under the control of members of the farm household and (2) how these components interact with the physical, biological, and socioeconomic factors not under the household's control."

Arising in the late 1970's as an innovative research approach to agricultural development, FSR/E rapidly became the dominant pattern for foreign-assistance funded development projects and agricultural research programs in third world countries.

A decade earlier, the Green Revolution had achieved significant gains in the modernization of agriculture and development of agricultural technology for farmers with access to fertile lands, adequate water, and other resources. To complement and improve upon these earlier gains, FSR/E was proposed as a solution to the technology generation and adaptation problem for small, resource-poor farmers who had not benefited from the Green Revolution. The proposal--to work on-farm with a systems approach and with a marginal agricultural population largely untouched by past programs--was considered radical at the time, with many skeptical of its potential for success.

Unlike traditional research efforts of the Green Revolution era, FSR/E was confronted with a set of problems at its onset, of which we practitioners were only superficially aware. Original assumptions that available technology could be adapted readily to poor-farmer, marginal-resource conditions with only minor modifications were subsequently questioned in the field. Traditional research methods were found wanting and many times inappropriate in on-farm situations. The problems of technology

availability and research methods paled in comparison to the problem of developing local institutional capacity to initiate and carry on FSR/E programs.

Whatever the criticisms directed at international and national research institutions, they represented organizational structures with defined roles, responsibilities, and budgets that were already in place and functioning. FSR/E, to be successful, would have to develop institutional linkages among research institutions, field research teams, and farmers, something that had not been done previously.

The very uncertainties inherent in the early FSR/E approach made it exciting, fertile ground for institutions and individuals with third world agricultural interests. The quick gains in technology generation, the development of agricultural areas with high unexploited potential, and rural populations with resource bases allowing them to modernize rapidly were characteristics of a past era. The challenge was to make inroads in agriculturally marginal areas and among rural populations on the margin of a modernizing world agricultural system. Neither traditional research methods or institutional structures had proven adequate to meet the challenge. The task of FSR/E, then, was to address the socio-economic and technical problems of small-scale production systems in a holistic approach, to develop research methodology adequate to the problem confronted, and to create a sustainable research process/structure in developing countries to carry on this approach.

A decade later, the FSR/E approach and related projects have come under increasing scrutiny as various donor agencies appraise what has been learned and gained to date. There is growing concern that either the approach, the commitment, or both have not provided a satisfactory response to the identified problem. FSR/E researchers and donor agencies are under pressure to review with a critical eye what has been done, what has been learned, and how the process could be improved. The present document represents a brief synthesis of what has been learned from two

FSR/E-type projects in which Cornell University was an active participant.

1.1.0 Cornell University and FSR/E

As a leading American university with strong research and educational interests in rural and agricultural development in the third world, Cornell University's participation in the Ecuador and Philippines' FSR/E projects discussed in this paper continues its sustained involvement in both countries in agricultural sector research and education. As an educational institution, it approached the problem of FSR/E from a development perspective, setting goals and measuring output not only in the successful generation of discrete technologies or research methodologies, but also in the improved capacity of developing-country institutions to learn and eventually to carry on, without external technical assistance, successful FSR/E programs.

1.1.1 The FSDP-EV

The Philippine Farming Systems Development Project-Eastern Visayas (FSDP-EV) represents the longest FSR/E-type project in which Cornell has had sustained involvement. Begun in 1982, the project was still in operation as of mid-1987. It had plans to expand geographically, and to concentrate programmatically more on extension of the first period's results.

From the onset, the project was explicitly designed to be implemented jointly by two governmental agencies: the regional level Ministry of Agriculture and Food (MAF) embodying extension capability and field personnel, and the local Visayas State College of Agriculture (ViSCA) with a solid but still developing agricultural research capacity. The MAF, as lead institution, provided project leadership and field staff for the site teams. ViSCA was to provide backup support to the MAF for on-farm research and backup research conducted on campus. Cornell University's role was to provide long- and short-term technical

assistance to the project and to address a range of training needs, including degree and non-degree training abroad, "hands-on" training in the sites, and formal skill-training in yearly workshops held in-country.

Situated on the two islands of Leyte and Samar, the project's mandate was to work with small-scale upland farmers who had not been beneficiaries of earlier agriculture research programs. Six project sites were selected on the basis of a predominant crop-based farm system in the area.

Within the first year, site teams of five to six members each had been created. Comprising extension specialists with agricultural backgrounds, agricultural economists, and eventually livestock specialists, the teams continue to perform the bulk of all site-based work. They are reinforced by ViSCA researchers from various disciplines.

1.1.2 The Ecuador Bean-Cowpea CRSP

A collaborative research project was established between the Instituto Nacional de Investigacion Agropecuaria (INIAP) in Ecuador and Cornell University under the auspices of the Bean/Cowpea Collaborative Research Support Program from 1981 to 1986. The original research objectives included plant genetics/breeding and farming systems methodology. Emphasis was placed on development of integrated agronomic and socio--economic methods to study farming systems and institutionalization of the process in INIAP. Given its narrow mandate of dry beans and cowpeas, the project could not evaluate adequately the total farming system. Attempts were made to integrate all aspect that directly related to the two legumes.

Cornell University's role was to provide long and short-term technical assistance to the project and "hands-on" training in country. INIAP provided agronomic technical assistance and on-station research back-up. Research activities concentrated in an upland irrigated dry-bean area with medium- and small-scale farmers and in a dry, lowland tropical cowpea area. Initial

research focused on secondary data collection followed by semi-structured interviews. Interview teams were made up of agronomists, agricultural economists, sociologists, and extension personnel. The results of these studies established the agenda for agronomic research.

The interaction of agronomist and sociologist was maintained during the project for better understanding of the total farm system. This served as a model for INIAP, highlighting the need for integration of these disciplines in the research organization.

1.2.0 The present document

This publication represents a brief overview of experiences derived from the two projects and covering a range of FSR/E topic, including training, research approach and methodologies, and administrative issues. Because of the occasional differences between the two projects, contrasting experiences and lessons are presented, true to the range and variability of those encompassed within the FSR/E rubric.

Training issues and approaches are covered in the first section. This is followed by a discussion of interdisciplinarity, central to the topic of FSR/E. Various methodological considerations are dealt with in the subsequent section. Institutional and administrative concerns, while not central to the theme of FSR/E, affect the development of FSR/E projects and, therefore, are presented in the penultimate section. We conclude with a final statement on FSR/E--as experienced in the two projects here--and its possible future.

2.0.0 Training and FSR/E

Good training may be the single most important element to developing local institutional capacity to carry out FSR/E without foreign technical assistance. This training can take many forms--individual on-the-job training, day- or week-long courses spread throughout the agricultural cycle, site visits to similar projects in other countries, non-degree training, and degree training locally or abroad--and still successfully address institutional needs. Individual projects must evaluate their human resource needs and determine what mix of training is appropriate. Without exception, successful project activities in the Philippines, and to a lesser degree in Ecuador, were the product of repeated training activities that laid the foundation for activity development.

Where, as in the case of FSR/E, an entirely new research approach is being introduced, training should be carried out at all levels in the research system. This method avoids misunderstandings and allows greater coordination of effort if a common understanding exists of what is being done and why. The importance of degree training for senior-level staff is seldom overlooked. Of equal importance, however, is the training provided local field staff in concepts and techniques associated with FSR/E. Where field techniques and methods are being developed as part of project implementation, training for field staff in relevant research procedures needs to be given early and repeatedly. Despite the difficulty involved in training field staff in the conceptual foundations of research methods, mechanistic and cookbook approaches to research methods and analysis that do not instill a basic understanding of research methods should be avoided.

The critical actors in on-farm trial conduct are field staff and farmers. If the research process is to be rigorous and responsive to farmer needs and inputs, field staff need to be empowered to make critical decisions concerning trial design and analysis and trained in research procedures.

One needs only review the proceedings from the annual FSR/E symposium in Manhattan, Kansas, or talk with FSR/E practitioners to quickly become aware of the difficulties inherent in on-farm field trial implementation. A frequent criticism of FSR/E projects is the conduct of too much field research without adequate supervisory personnel to oversee its proper (rigorous) implementation. The short term solution is to reduce the amount of research to the level of available supervisory (technical assistance) capacity, or alternatively, to develop a rigorous set of research guidelines (to be followed unquestioningly) that eliminates possible variation.

From a development perspective, both solutions are unacceptable. The first creates dependencies that undermine a "bottom-up" approach; the latter is highly unrealistic in heterogeneous field situations. The ability to make on-the-spot research decisions that respond to the needs of a field situation while maintaining methodological rigor (or recognize, at least, what is being sacrificed) must be developed in field level project personnel.

There is a tendency at times to provide training to field staff in how things are done and training to senior staff in why things are done. This should be resisted. Few if any third world institutions can afford to release senior-level staff and researchers to attend properly to the conduct of on-farm research. It is possible, as the Philippine project is demonstrating, to train field staff to be sensitive and knowledgeable field researchers rather than mere field hands implementing research designed by others. This requires greater initial investment in training, as well as broad-based agreement within a project that some decision making authority devolve to field staff. Nevertheless, the training and empowerment of local field staff to conduct effectively on-farm FSR/E research is unavoidable if FSR/E is to be institutionalized successfully.

2.1.0 Non-degree training

Early in the field work of a project, each researcher should become familiar with the basic skills of the other disciplines involved in the project. The social scientist should acquaint himself or herself with agronomic skills such as the rationale and procedures for laying out research plots, data collection, and analysis. Similarly, biological scientists need to be familiar with general social science techniques of data collection, survey development, interviewing, and analysis. This will help each to better understand the total research process and how their methods are complementary.

On-the-job training can provide an opportunity for a researcher or field practitioner to improve skills in various subject areas. In Ecuador, the host-country agronomic counterpart worked closely with the Cornell sociologist to learn social science skills needed for field activities. In institutions having few or no social scientists, this technique can be used to familiarize biological researchers with social science methodology.

In both countries, at least two forms of structured on-the-job training were developed. One form involved one to three-day training sessions repeated at various phases of the crop/trial cycle. The courses were developed around specific site research activities and utilized data and case studies that the participants themselves had gathered. Training participants were able to learn or review research techniques at the same time that they reviewed the actual research process. Site visits permitted the training to address field problems in their context rather than in a formal classroom.

In Ecuador, learning-by-doing was effective for farmers and extension personnel. They attended day-long sessions during critical stages of plant development (planting through harvest). Sessions were divided between morning classroom lectures and afternoon practicals. The afternoon field activities were used to compare new methods proposed by researchers and farmers'

practices. Researchers benefited from the opportunity to collect additional social and biological science information from the participants. In one case, four new varieties of cowpea were examined, and farmers instructed the researchers in the criteria they used to evaluate the materials.

In addition to on-site training, the FSDP-EV held annual month-long courses of FSR/E concepts and methods for project staff and other government agency field personnel involved in or wanting to become familiar with FSR/E research. As in the shorter training sessions, the use of field data and field visits to ongoing research activities permitted participants to grapple with FSR/E concepts and procedures in actual situations.

In the face of greater logistics and costs associated with the longer training activities, compounded by a greater difficulty in following up with subsequent reinforcement training, we eventually concluded that the shorter and more focused one to three-day sessions with repeated follow-up may be the more effective approach. These sessions do not require disrupting ongoing activities by lengthy absences of staff from the field and can address field problems while they are salient.

National institutions have great difficulty freeing large numbers of staff (for example, 20 to 30 people) from their respective job responsibilities for a month. When they do so, the staff is often called on to address agency problems that arise during training, effectively disrupting the educational process. One alternative to this situation is short-term training abroad.

2.2.0 Non-degree training abroad

The Philippines project provided for training a large number of individuals in the United States and other countries on a short-term basis. After several years, we concluded that this type of training was more useful when applied to development of specific skills (i.e., laboratory analysis techniques) than learning FSR/E concepts and procedures. The exception to this is

visits to FSR/E projects in other developing countries. In a foreign setting, students found FSR/E concepts abstract, and the techniques were difficult to apply upon the return home. FSR/E training was more efficient and cost-effective when done in-country.

2.3.0 Degree training

Degree training is an important developmental resource for institutions having few individuals with advanced degrees. The decision to provide such training in-country or abroad should take into consideration available local graduate programs first. The Philippines, for example, has good post-graduate degree training in most fields. Consequently, every attempt was made to have degree training through these programs. However, graduate degree training in Ecuador is available in only a few disciplines, requiring that much more degree training be done abroad.

In-country degree training is much less expensive in absolute dollar terms, providing an attractive incentive. Nevertheless, from an institutional standpoint, these dollar savings may be offset by the significantly greater amount of time that students must spend in the program prior to completion of their degrees. The percentage of participants completing their degrees may also be less. Both situations reflect the greater difficulties that in-country trainees encounter in dedicating themselves as full-time students--free of responsibilities and duties to their employing institution--during their study leaves.

Degree training abroad is frequently more prestigious and more remunerative for the trainee. Where local degree training is concentrated within a few educational institutions, training abroad may also introduce new perspectives and greater cross-fertilization of ideas within a discipline. Both situations represent significant individual and institutional incentives for degree training abroad. However, other aspects can be disadvantageous to both the trainee and the sponsoring

institution. Individual trainees may lose opportunities for advancement in the institutional hierarchy during their absence. Conversely, the institution is frequently not able to hold a trainee upon his or her return. When training is provided in-country, the likelihood of either event happening is lessened.

The policy that post-graduate training be relevant to the project's and sponsoring institution's needs is often stated and, unfortunately, equally often ignored. It is not necessary that all training respond directly to project needs if the training contributes to improving necessary human resources in the larger institution. Care should be taken, however, that the training fits within and is relevant to the overall human resource development program of the participating institutions. This generally requires developing a comprehensive training program to meet present and future institutional human resource needs, an activity considered far afield from FSR/E research projects. Exotic specializations, such as training in embryo transplants, should be avoided if ministry resources and programs are not capable of implementing or sustaining such activities.

Whether host-country scientists are trained locally or abroad, their thesis research should be relevant to the local situation. One way to ensure this is to encourage trainees to do their research in-country and in the project area. If it is not possible to do research in-country, effort should be made to do it in a similar developing country on relevant project-related problems. In the Philippines, the perceived benefits to the MAF, ViSCA, and the project of staff doing research for advanced degrees in the project and on project-relevant problems were viewed as sufficiently important that special accommodations were made to facilitate the research. Conversely, where research was done abroad on project-related problems, special efforts were made to incorporate the results into the project program. Initial evaluations of these research contributions to the project have been positive and supportive of further work.

3.0.0 FSR/E and Interdisciplinary Interactions

Given the holistic nature of FSR/E research, interdisciplinary interaction and cooperation is a central feature of the approach. Interdisciplinarity is not only a strength of FSR/E, but also a major weakness because of the difficulties inherent in such work. The obstacles that disciplines confront when attempting to work together arise from differences in concerns, methodologies, levels of analysis, and the institutional framework in which FSR/E researchers/practitioners interact. Thus, the set of problems that hinder interdisciplinary work at the field level may differ from those encountered within an academic setting. When researchers and practitioners work across levels (i.e., from the research station or college to the farmer's field), successful interdisciplinary work becomes even more of a problem. The obstacles at each level require separate treatment.

3.1.0 University structure and interdisciplinary work

Formal departmental structures and disciplinary divisions in colleges and universities represent a recognized and continual problem to interdisciplinary work. The largely international nature (from a US institutional perspective) of FSR/E within universities introduces differential recognition and legitimacy among the social and biological sciences.

Social scientists are more likely to have international interests and responsibilities as part of their job descriptions. They are better able to define their involvement in international FSR/E activities as a major part of their research responsibilities. Biological scientists, on the other hand, are rarely expected to be involved in international research; if they are untenured, such involvement is often discouraged.

By and large, both social and biological researchers with junior status place themselves at risk with involvement in FSR/E because such work cannot be evaluated readily within traditional

disciplinary and departmental frameworks. If interdisciplinary work within FSR/E is not to become self-sacrificial, the degree of participation in FSR/E and involvement in field work must be restricted until tenure is obtained. Consequently, the interdisciplinary nature of the work suffers.

Other factors, such as age of researcher, philosophy of individuals, and professional incentives, are important. Not all faculty receive equal recognition in the form of additional research funds, salary increases, advancement, or reduced work load in other areas. Without proper recognition, individuals tend to place less emphasis in working closely together. University administrations can strengthen interdisciplinary interaction by providing incentives and recognition for international activities.

Social and biological scientists frequently operate within different time frames that, if not well understood, may interfere with interdisciplinary work. While the social scientist need respond only to administrative deadlines and the strictures of an academic calendar, biological scientists are forced to confront the reality and vagaries of seasonal patterns and crop cycles as a determinant factor around which all other work must be scheduled. Social scientist insensitivity to the pressures of timely field trial management may create frustration and resentment among biological scientists when meetings and discussions are scheduled that conflict with field operations. The conflicts become a tradeoff of working with social scientists rather than a mere cost of operation.

Interdisciplinary work at the university level cannot develop overnight. It takes mutual interest and willingness to cooperate and to understand other viewpoints. Social and biological scientists have been trained differently and use different research tools. The research team needs to meet regularly and discuss research in progress. Ultimately, accommodations will have to be made by all parties. This accommodation, along with open communications among members, can

help to determine how one's research can best fit within the larger research process.

3.2.0 Interdisciplinarity and field-level research

Interdisciplinary work at the field level is also, admittedly, a difficult process. It requires willingness and interest among all parties, proper personality traits, and sufficient broad-based training and understanding of other disciplines to be successful. Given all this, it is still possible to structure field work to promote greater interdisciplinary rather than individual work efforts, and vice versa.

Take, as a case in point, the "sondeo" and other Rapid Rural Appraisal (RRA)[1] activities. These are already recognized as a critical first step to team formation as well as data collection. Unfortunately, the utility of these techniques is often limited to a one-shot application early in the research process. The effectiveness of these techniques for promoting team and interdisciplinary work is enhanced if they are used regularly (once or twice a year) and all members participate.

Similarly, joint research activities can be kept focused and interrelated as social and biological scientists share and participate in each other's field work. Much can be learned about labor relations and household allocation patterns while social scientists plant and harvest field trials with farmers and agronomists. In like fashion, biological scientists can identify important farmer considerations concerning crops and cultural practices if they become involved as participant observers.

Both biological and social scientists need to be disposed to learn from their colleagues in the other sciences. Each needs to do FSR/E relevant work that complements the project and to work

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[1] Rapid Rural Appraisal has been defined as "any systematic activity designed to draw inferences, conclusions, hypotheses, or assessments, including the acquisition of new information, in a limited period of time (Grandstaff et al., 1985).

always as a full member of a team.

At the same time that broad-based training is emphasized in FSR/E, team members need to be careful not to intrude into areas out of their expertise in such a fashion that they create resentment among other disciplines or jeopardize their own credibility among farmers that will hurt them as specialists within their own field. Interdisciplinary work can suffer when the delicate balance between interdisciplinarity and intrusion in another's field is breached.

Involvement of social and biological scientists should take place at all stages of research (planning, design, implementation, and evaluation). Cooperation should be stressed throughout the length of the project. Social science interdisciplinary involvement does not stop because a survey is finished and a report written. Nor does the biological scientist cease interdisciplinary work once field trials are underway.

Funding agencies and host-country institutions often want to see early and concrete biological results and become concerned when a project takes two or three years to produce initial results. Yet, time is needed to collect secondary data, to perform site surveys, and to help set research objectives. Working together, biological and social scientists can place preliminary trials (i.e., variety trials) on farmers' fields the first year that will provide agronomic research data. These same trials can help to open doors in the community to social scientists. Farmers generally are not as reluctant to provide information on land tenure, yields, pricing, etc. if they can see some benefit to themselves. Social scientists also can use the field trials as a tool to collect additional information on other subjects. Planting the first cycle of field trials as a team helps bring farmers and scientists together and helps develop common objectives.

A major obstacle in interdisciplinary work--particularly between social and biological scientists--is the respective research time frame(s) of each. There is growing recognition

that many substantive research activities of both social and biological scientists require several years to complete.

Rapid Rural Appraisal activities--highly valued because of their much shorter time frame for implementation--tend to be placed within the purview of social scientists. Too often, however, the role of the social scientist is viewed by others as confined to this area of research, without explicit recognition that other substantive social science phenomena cannot be addressed within the time frame and methods appropriate to diagnostic work. Frequently, the short-term contributions of the social scientist to the diagnostic process and to the delivery of information for field trial design and development overshadow the long-term contributions that can also be made; the two time frames and distinct research procedures are not made explicit. For example, gender-related or household labor allocation issues go unexplored all too frequently--much to the frustration of many social scientists--because often there is no defined place within FSR/E for such research.

Much confusion between biological and social scientists can be avoided, we found, when these distinctive research activities are clearly delineated and there exists a consensus on the types of problems addressed and methods used within each. This concensus avoids unwarranted expectations on everyone's part over the time needed to produce specific research results, whether a specific set of research activities should be undertaken, and at what cost.

Even such simple problems as lack of transportation or scarce facilities that must be shared can manifest themselves as interdisciplinary problems. The social scientist may require three or four days' work in the field while the biological scientist can finish his or her work in a day or two. If only one vehicle is available, the biological scientist may need to stay in the field longer than the immediate task requires, delaying research at another location. As indicated above, close coordination and integration of each others'work can help to

redistribute workloads, promote strong interdisciplinary interaction, and avoid frustrating situations where time is unproductively spent waiting while others work.

Common location of team members is also important for cooperation. In the Philippines project, two staff members were posted on opposing sides of an island. This situation reduced the degree of interdisciplinary interaction desired on various research projects because of travel and communication difficulties. Where this situation exists, frequent meetings among team members may be the only alternative (an admittedly expensive one) to help coordinate research.

3.3.0 Gender issues

The dynamics of interdisciplinary work also come into play when other team-member differences exist. In many cases, group composition includes not only differences of discipline, but also of social status, institutional affiliation, culture, and gender.

Common experiences in the two projects discussed require that special mention be made of the gender issue because of the significant benefits that accrue with incorporation of both men and women in the research team. It is now recognized that in many parts of the world women play significant and often determinant roles in agricultural production. Less common is the realization that male-researcher access to the female farm population is restricted by virtue of sex and local customs. Where specific production activities fall within the female work domain (i.e., seed selection, production, and storage, or care of livestock), the presence of women on the research team is invaluable. Projects should seriously consider employing women professionals in areas beyond those traditionally assigned to them, such as health and home economics.

In Ecuador, women select dry bean seed and do most of the planting. A male researcher was able to obtain basic information on seed selection, but when more detailed information was needed, only female researchers were successful. The female researcher

also was able to enter the home more easily and discuss issues of nutrition, food preparation, and storage. Consequently, efforts were made to include a female researcher on each survey team to permit accurate information gathering.

Given the rural and field oriented nature of FSR/E, the presence of highly trained, generally young, and often unmarried female members on FSR/E teams is certain to introduce additional dissonant elements into the already complex social dynamics associated with team work. Where team members reside in communities, the presence of unmarried and unchaperoned women on a team can also create problems. However, it is the authors' experience that, whatever the nature of the problems that may arise by having women on the team, they are heavily outweighed by the advantages gained in research effectiveness.

4.0.0 Methodological considerations

4.1.0 The research process

Although much is written about FSR/E research procedures, too little literature reflects the exploratory and adaptive research process that characterized both the Ecuador and Philippines projects. Seldom is mention made of the simultaneous training and learning that must accompany the development of research methods and processes if local capacity to carry out FSR/E is a primary goal. Yet, to ignore the learning and training side of the research process would be to pass over the essence of what has been gained from both projects.

The lack of a developed and accepted set of FSR/E methodologies and the frequently limited knowledge of the targeted area by FSR/E-type project staff often require that appropriate research methods and a basic knowledge of the research area be developed as the first step in project implementation. This is often done concurrently with team development among expatriate and host country researchers and with the training of field staff. Both Ecuadorian and Philippine projects followed this pattern.

The problem of establishing a minimum knowledge base and identifying or developing appropriate field research methods early in a project's life is compounded by a belief that the conduct of on-farm trials is less difficult than the conduct of on-station research. On-farm research, some feel, requires less sophisticated knowledge of research design and field trial implementation procedures. We hold that the reverse is true because of reduced control over trial management, physical and climatic resources, and factors external to the trial.

Due to the lack of consensus on this issue, knowledge of both the basics and subtleties of agricultural research methods that researchers require of staff implementing on-station trials, is often not considered a requisite for field staff implementing on-farm trials. Consequently, efforts to provide equal levels of training and an appreciation of the time necessary for people to

develop commensurate levels of research skills and sensitivities are often lacking or go unappreciated. The initial phase of on-farm research and extension fulfills several additional functions in addition to testing hypotheses. It provides a setting for the field team to develop good relationships among themselves and with local farmers, to increase understanding of the farming systems and problems, to develop a pertinent on-station and on-farm research agenda incorporating farmer input, to develop good research skills, and to demonstrate improved technology, where available and appropriate.

The involvement of both social and biological scientists is particularly important through this process. Initial activities include the revision of available secondary data, the conduct of diagnostic research using Rapid Rural Appraisal techniques, and the preparation of a preliminary diagnostic report. Through these studies, an interdisciplinary team can become aware of the larger cultural and economic variables affecting agricultural production in the region as well as the social and biological factors endogenous to the farm system. The initiation of the first series of on-farm trials is the concluding step to this phase.

4.2.0 Diagnosis

Diagnostic or Rapid Rural Appraisal techniques were utilized in the Ecuador and Philippine projects to address concerns ranging from intra-regional variation in types of production systems to the identification of local-level systems of indigenous soil and land-use classifications. The type of RRA procedures utilized varied according to the level of analysis chosen. The Ecuador project decided to rely heavily on secondary data analysis and semi-structured interviews[2] with key informants

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[2] Semi-structured interviews utilize guide topics or questions to lead the interviewer along a generally predetermined line of questioning with a respondent. Clarifying and probing questions developed as the interview progresses may be asked.

to identify intra-regional variations in production systems for purposes of site selection (Garrett et al., 1986). Farm level variability within the identified sub-regions was of secondary importance: the research objective, in this case, was to differentiate individual communities or blocks of communities according to several dominant production systems (Uquillas and Garrett, 1986).

The level of analysis of the RRA activities was gradually reduced as the project progressed and site selection was completed. This reduction allowed consideration, in a subsequent phase, of on-farm and across-farm variation in order to develop and implement on-farm field trials. The regional approach used in Ecuador was considered most useful in selecting research areas in the bean-cowpea project.

The above situation presents a distinct contrast to the FSDP-EV where six research sites were chosen in the original project design before project staff was involved. Because site selection was already a given, the Philippine project was primarily concerned with local intra-community variability of production systems and with variability within the farm system. Consequently, greater weight was given to individual farmer experience with and knowledge of the local agricultural systems.

Several approaches to farm-level diagnostics were tried in the Philippines. These ranged from the use of semi-structured interviews with preformed guide questions and formal sampling of respondents to the use of anthropological techniques for identifying indigenous knowledge systems.

Initial diagnostic activities utilizing the "sondeo" procedures developed by ICTA (Instituto de Ciencia y Tecnologia Agricolas) highlighted the utility of the technique for developing good working relations and a sense of group or team identity among the participants. The initial formation of strong

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Respondents are not necessarily selected with any formal sampling procedure.

team identity, in the life of the project, probably proved more valuable than some of the information obtained.

Status differentials within the team, particularly during the first set of diagnostic activities, markedly affected what information was obtained, what importance it was given, and how it was interpreted. Lower status individuals with greater familiarity and experience in the field at times made political concessions to higher status individuals or withheld information that conflicted with a position of the latter. The degree and importance of the status differentials on the quality and reliability of the information collected and synthesized became apparent only after other research was underway and the initial set of information was called into question. As team formation and identity improved, the effect of status differentials on RRA activities declined, and information reliability and quality improved.

Experiences in both projects suggest that care must be taken with the use of guide questions if a probing or exploratory diagnostic approach is desired. Guide questions all too frequently became rigid, excluding information that did not relate directly to the original questions. The interview process was unconsciously redefined by many interviewers to become a highly structured activity, with little possibility of discovering additional information not directly sought. This was particularly true when used by project staff not well versed in the use and rationale of exploratory diagnostic techniques. As with other research methods, periodic training and reinforcement through follow-up and practice contributed to a more proficient use of research skills.

Unlike the semi-structured interviewing technique of the more conventional RRA methods, the use of non-directive

techniques[3] for eliciting farmer knowledge and classification systems required greater initial knowledge of and sensitivity to the context within which the farmer operated. In the Philippines, site research staff had several years of prior field experience before an attempt was made to use non-directive questioning. Once the initial hurdles--the tendency to slide back into directed interviewing and leading questions--were overcome, the quality, depth, and comprehensiveness of information that resulted from the interviews far exceeded that of earlier directed interviewing. Even here, our ability to assimilate the information learned and organize it into an understandable form was mixed, with differential skill levels readily visible. Although some project staff members were far quicker than others to utilize the technique successfully, most were able to use it (with encouragement) in an effective fashion. Some of the uses of this information are presented later.

Given the range of RRA techniques available, we feel there is a desired sequence. Projects, in general, should begin with more structured and formalized methods (e.g., the "sondeo") and progress to less structured, non-directive methods only after the staff has gained a basic understanding and feel for the field situation.

The returns on information gained from directive and non-directive RRA activities are qualitatively different; RRA techniques with directed interviewing can provide a broad overview without requiring a great deal of knowledge of the local situation. Non-directive interviewing techniques, on the other hand, require at least a basic understanding of the local situations but permit a greater in-depth understanding from the

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[3] The non-directive techniques referred to here are based upon the ethnomethodological techniques of linguistic anthropologists. Rather than relying on direct questions framed by the interviewer and reflecting his "outsider" understanding of the situation, stress is placed on eliciting from the farmer an understanding of his environment, its properties, and associations as perceived within the local cognitive framework.

farmer perspective of the operating environment and production strategies.

The progressive learning that takes place as project staff members become familiar with the farm situation and the implementation of on-farm trials is characteristic of the diagnostic process. The utility of RRA-type activities and the quality of the information collected improved each time a diagnostic activity was undertaken. While such improvement can be attributed to practice, greater familiarity with RRA methods, and improved teamwork, the ability of project staff to assimilate discrete bits of information previously known also improved. Readily available information was largely ignored early on because of lack of familiarity with the area and production systems. With increased familiarity and knowledge of the production systems, staff members were equipped with a "gestalt" within which the information took on new meaning.

Although time spent in the actual collection of data during RRA activities was relatively short (less than two to three weeks), time required to train staff in the use of the techniques, in analysis and interpretation of the data collected, and in the writing up of the results easily extended the time required for the diagnostic activities from three to six months.

4.3.0 Research station and FSR/E team interaction

Some FSR/E practitioners feel research station personnel have little or nothing to offer medium- and small-scale farmers. This belief, based on early research station history, ignores more recent developments in experiment station research orientations. Research stations in developing countries were established in the second and third decades of this century and following World War II. Primary interest was on export crops (i.e., coffee, cacao, bananas, and rubber), where small producers were not designated beneficiaries. More recently, experiment station research has emphasized crops more important to the local economy. This emphasis has resulted in the development of

largely scale-neutral technologies appropriate under both large- and small-scale farm conditions. Consequently, the results have become more relevant for use as a basis for on-farm trials.

Ideally, the involvement of experiment station or university-based researchers should be an integral part of the FSR/E process, as occurred in the FSDP-EV. The formal inclusion of experiment station/university-based researchers--with defined roles, responsibilities, and adequate funding to ensure their ability to participate actively in the field--allows FSR/E researchers to devote more time to the complex mechanics of actually integrating station and on-farm researchers in a meaningful fashion.

In many projects, formal institutionalized linkages between on-station researchers and the FSR/E team are not an integral part of the project design. Under such conditions, extraordinary efforts often must be made to facilitate sustained interaction between traditional and farming systems research groups.

Experiment station personnel can be a critical element within the farming system research process when their participation is encouraged. Ideally, they should be involved in research decisions from the onset of a project. In Ecuador, this meant that before semi-structured interviews were carried out, the interview guide was discussed with station-based researchers. This made them aware of the type of information desired and allowed them to contribute to the development of questions pertaining to commodities of interest. Subsequently, written results of the surveys were provided to the researchers so the information could be integrated into their research program if desired.

Involvement of research station personnel throughout the FSR/E project will help to institutionalize their continued participation in subsequent on-farm research. However, developing and maintaining interest may initially take extra effort and time. Early in a project, efforts should be made to visit on-station researchers in disciplines directly and

indirectly related to the research program. These visits should include all members of the FSR team to allow their acquaintance and interaction with station personnel. The visits provide an opportunity (often the first) to see what has been done, pick-up written information, and start developing personal relationships that can be built on later. Where possible, FSR/E team members should work directly with programs at the research station for a time (2 to 4 weeks, for example) to help build mutual understanding and cooperation.

Similarly, research station personnel need to be encouraged to visit project sites. Initially, the FSR/E staff may have to facilitate this participation. Formal invitations may have to be offered and, if necessary, the visit financed by the project. The timing of meaningful visits is critical. They should coincide with stages of plant maturity, pest problems, or animal development relevant to the research.

These visits provide an opportunity for FSR/E team members to acquire technical information pertinent to their research, and for station researchers to familiarize themselves with growers' practices and problems in the field. Once the procedure is developed, these visits can be incorporated into the researchers schedule for following years.

The desired number of trips to the project by station researchers is a function of the research problem and available resources. Ideally, visits should be made at least twice during the cropping cycle (during early plant growth and near harvest).

Regular meetings should also be planned to coordinate research between FSR team members and station researchers. An initial meeting could focus on planning for the coming cropping season. Each group would explain its plans and identify potential areas of cooperation. Assigning all off-station trials belonging to station researchers to the FSR/E team members should be avoided. The objective of coordination is to improve the total research process.

The second meeting is best held after the cropping cycle or

at the end of the year to report on results of field research. This reporting is critical to maintaining a working relationship. Further, research reports must be written and distributed to all members at the meeting.

4.4.0 Trial procedures

4.4.1 On-farm trials

Pressures to commence research activities--particularly on-farm field trials--are generally intense at the beginning of a project. These pressures occur even before adequate diagnostic methods are fully developed, local project staff trained or the production systems sufficiently understood to allow the identification of appropriate research methods. Such pressures combined with strong faith in the appropriateness of traditional research methods led (early-on, in the Philippine case) to the initiation of cropping pattern research and the intensification of cropping systems by introducing a third annual crop. While such a choice was natural, given the experience with and popularity of the approach in the Philippines, the decision to proceed along this line proved to be inappropriate (Cornick and Repulda, 1984).

Invariably, the initial approach to on-farm trials in both projects relied too heavily on traditional, relatively complex research methods and approaches that subsequently encountered problems with the production system. Eventually, researchers moved away from rigid trial designs to informal and flexible designs permitting greater farmer involvement. However, it was also necessary to overcome the momentum generated in the initial trial series and redirect or complement it with additional research. Hard decisions to continue or discontinue inappropriate trials one to two years before their completion had to be made. This was a costly and time consuming effort.

In retrospect, we argue that projects should have as an initial implementation strategy the use of simple field trials (at most, single-factor trials with a few treatments) restricted

to varietal screening and perhaps fertilizer use. These trials would provide visible, concrete research activities that reduce the initial pressure to put out complicated (i.e., multi-factorial) field experiments. Yet, these can be changed later without considerable effort or investment should better understanding of the system require it.

Such a strategy would reduce initial training needs and logistical requirements that must be satisfied for the successful implementation of on-farm trials. In both projects, at least some project personnel had little experience with laying out the simplest field trial. Trial implementation suffers when newly trained staff are required to handle complex designs or collect complicated data before they have mastered the mechanics of applying fertilizer or planting.

The use of simple experiments and observational plots was found to be more suitable for on-farm work than more conventional trials, even in the second and third year of a project. Informal observation plots were utilized for obtaining farmers' assessment of crop varieties. These experiments were preceded by initial farmer meetings to select varieties for testing. Following the farmers' selection of the preferred varieties, small amounts of planting material were distributed to ten to fifteen farmers. Farmers planted these materials along with their own varieties using local cultural practices, and without researcher-imposed restrictions on plot location, size, dimension, or husbandry practices. Researchers monitored farmer practices and the various criteria farmers used to assess the varieties.

Such simple observational trials helped to identify relevant farmers' objectives in crop production and desired characteristics of the preferred and local materials. These goals were then reformulated as new objectives for breeding varieties more suited to small-farm conditions. In Ecuador, new breeding objectives for dry beans included plant type and the green shell character. In the Philippines, new breeding objectives identified for sweet-potato production for home

consumption included rapid vining, weevil resistance, and ability to store well for long periods in the soil.

Not surprisingly, all projects found that maximizing yield per unit area, per se, was not the primary objective for the majority of farmers. For instance, in Ecuador, dry bean and cowpea seed-coat color and seed size were as important as yield. Farmers indicated that higher yielding varieties with the wrong seed color would not be adopted because they were not in demand.

4.4.2. Superimposed experiments

In both the Philippines and Ecuador, observational trials were supplemented with simple (few treatments) overlaid or superimposed trials replicated across ten to twenty farms. As in the observational plots, the trials were farmer-implemented with researchers providing instructions in the application of treatments. No restrictions on the size or shape of field plots were made.

One example of such a trial from the Philippines involved the application of a locally available calcareous soil as a lime substitute. Farmers, with the help of site staff, collected, ground, and applied the local limestone to field plots at the recommended rate of 3 tons per hectare. Crops grown in the superimposed plots and the surrounding field were either corn or peanuts. Observations on soil pH and crop yields were taken and an economic analysis performed for test plots and adjacent field areas.

4.4.3 Managing research on distinct system levels over time

The progression of diagnosis, data collection, and field research in FSR/E generally moves from a broader, comprehensive overview of a system (or systems) to a more narrow and focused approach as specific problems are identified. This natural progression and focusing of research efforts was followed in the Ecuadorian and Philippine projects although the narrowly defined mandate of the bean-cowpea project did not allow research on all

aspects of the farm system.

In both projects, the progressive focusing of research activities resulted in orientations moving from regional analysis to site specific on-farm research in dry beans or cowpeas (in the case of the bean-cowpea project) or from consideration of whole production systems to specific crop or livestock-related problems in the Philippines. Our experience suggests that the consideration of relevant factors external to or within the system affecting the specific research must be explored in the beginning and reevaluated as the project continues. This procedure requires maintaining a research focus that encompasses several levels of systems and subsystems simultaneously while concentrating on specific problems.

As research problems and specific target farmers are identified, there is a natural tendency to focus research activities and resources on them to the exclusion of other crops and production systems. However, an overly narrow focus can result in research activities identifying relevant concerns initially and then failing to deal adequately with them.

This situation occurred in a Philippine trial where usufruct grazing rights in one community was identified early as a probable hurdle to the establishment of forage legume trials. As the research focus narrowed, only target farmers were dealt with to the exclusion of other community members. While targeted farmers assured researchers that they could control usufruct grazing rights, this proved not to be the case. Consequently, plots were lost or badly damaged from carabao grazing. Although farmer cooperators were in a position to control grazing behavior of their own animals, many were unable to influence their neighbors. Thus, establishment of forage legumes became problematic because insufficient consideration was given to the social acceptability of the experimental technology for non-cooperating farmers. Because the level of analysis did not consider the community surrounding the target group, important considerations influencing the appropriateness of the technology

were overlooked. This type of problem can arise wherever common property and collective usufruct rights to local resources are found.

4.4.4 On-farm research strategies and trial design

Difficulties associated with on-farm field trials in FSR/E have been well documented elsewhere (Barker and Lightfoot, 1985; Hildebrand and Poey, 1986). The types of problems encountered are strikingly similar to those encountered in Ecuador and the Philippines. The movement of agricultural trials off-station and onto farms generally results in the introduction of levels of variability in the research that traditional research designs were not developed to handle. Particularly when researchers work in marginal areas, on-farm variability of the physical environment is far greater than that encountered in research stations. This is frequently true even when field trials are restricted to a single farm.

Further variability is introduced during field trial establishment, even when researchers attempt to control for it by strictly overseeing the implementation of on-farm trials. Fluctuating climatic conditions, stray animals grazing field plots, and theft of the harvest by neighbors are all common and unavoidable problems that plague on-farm research.

The decision to replicate trials across farms and to incorporate greater farmer involvement in the research activity also increases the potential for greater variability. The decision of researchers in both projects to use cross-farm replicates and high levels of farmer involvement in the field trials reflected the feeling that the added variability introduced by increased numbers of farmers and farms was offset by the increases in information obtained. Given the already high levels of variability in on-farm research, any additional loss in statistical precision was judged insignificant in the face of the information gained.

Confronted with high variability in on-farm research,

Ecuadorian and Philippine researchers had two strategies. One was to attempt to reduce the variability in on-farm research by strictly controlling trial implementation and management, including the selection of uniform field sites, access to water, avoidance of steep slopes, etc. This control required the explicit recognition that such a strategy did not examine the new technology under the full range of physical, climatic, or socioeconomic conditions that existed in the research area.

A second strategy was to accept the high variability of on-farm research as a given and to utilize a large number (10 to 20) of across-farm replications to increase statistical precision and to value the qualitative information obtained from the trials. Concomitant with this strategy was the recognition that the initial research conclusions, whether agronomic or economic, be considered tentative.

That the two strategies are complementary rather than diametrically opposed was not immediately recognized in either project. There was a strong tendency to rely solely on the first strategy and then change to the second or mix elements of each as a separate approach. Rather than striving for a single composite methodology for on-farm research, we believe there is a need to delineate discrete, complementary methodologies. These should explicitly stress statistical rigor or more qualitative results. Researchers need to identify the appropriate uses and conditions for each. Both should be used within a research program that balances the use of the respective methodologies with clearly defined research goals and objectives.

In the past, FSR/E researchers have frequently defined a progression of on-farm research methodologies that move from the statistically rigorous trial phase of testing and evaluation to a verification and outreach phase where qualitative results were emphasized. We argue instead for a process of simultaneous, interspersed research activities in which the considerations of statistical rigor and qualitative data are addressed concurrently. Although the mixture and sequencing of trial types

is judgmental and situation-specific, qualitative input from farmers early in the research process is essential if their involvement in treatment selection and design issues is to be accommodated.

The use of multiple across-farm replicates was found to be necessary if the research was to reflect the type and range of conditions in the research areas. However, the logistical workload created by having to manage 10 to 20 on-farm trial plots for each experiment was enormous and increased greatly with increasing trial complexity. As the number of on-farm trial replicates grew, it became necessary to reduce the complexity and formality of the trials. Otherwise, the danger of trial failure from problems in implementation or supervision made it difficult to separate the cause of poor results between the treatment effects and the implementation process.

4.4.5 Land ownership, farmer involvement, and trial establishment

Researchers must decide and articulate with farmers their objectives and procedures for on-farm trials. Answers to the following questions must be provided: "Who is providing inputs and labor? Will any product be removed from the field by the research team? If so, what portion of the production will go to each party? What data needs to be collected and when?" Once these decisions are made, objectives and procedures must be clearly communicated to all participants. When tenure divisions such as sharecropping and renting spread decision making among various parties with potentially competing interests, this communication process is made more difficult.

Establishment of on-farm trials is a delicate process. Too often researchers assume that what the farmer and the research staff will contribute is clearly understood. Yet, come harvest time, the farmer may not allow the researcher to remove samples from the field because of poor communication of researcher expectations. Other confusions arise when the researcher makes

trial arrangements with only one member of the family, later to find that this person is not the family head or has migrated.

That women often play an important part in decision making may not be readily apparent to researchers. At one Ecuadorian site, arrangements were made to place an observation trial on a farmer's field. The trial was planted with the grower's participation, but during the cropping cycle he was largely unavailable to evaluate the technology. When harvest approached arrangements were made with him to remove plant samples for evaluation. The sampling process had been agreed upon before planting by both the researchers and the farmer. The day of harvest, the grower was away selling dry beans, with no likelihood of returning within a week. The decision to proceed with the harvest of the samples was rejected by the farmer's wife. The data from the trial were lost because it had not been realized that the wife actually controlled the land and the husband only sold the production.

This is not only a gender issue. In both projects, land tenure posed problems. The establishment of perennial cropping systems in the Philippines was not widely adopted by tenant farmers. The sharecroppers feared that they could be removed from the land at any time without receiving benefits from the crops planted. In other cases, landowners discouraged the planting of perennial crops when they were perceived as strengthening the tenants' potential claim to the land.

Tenancy was also a problem in Ecuador for establishment of annual crop trials. Most of the dry beans in the project area were grown in cooperation between landowners and sharecroppers. The landowner provided seed, pesticides, and water; the tenant prepared the land and provided the labor during the cropping cycle. At harvest the production was divided. Some tenants had complete control over planting decisions, which reduced the problems in establishing trials. However, at other times both landowner and sharecroppers were involved in negotiations; problems arose when they did not share the same goal.

4.4.6 Farmer involvement in trial implementation

The habit of providing incentives to motivate farmer participation in field trials is ubiquitous and frequently questioned. Government research programs in some countries have, in the past, given all inputs and the resulting production to participating farmers, without requesting anything in return. As a result, farmers have not felt themselves part of the process and have not attended to or shown interest in the trials. From our project experience, we feel that farmers need to invest in the FSR/E process in order to feel themselves active participants. Even in farmer-managed trials, where researchers contribute only seed, a portion of the production should be available to the researchers. By the same token, if researchers are contributing all inputs and labor, the farmer should retain a portion of the production. For example, in Ecuador, variety trials were planted in four-row plots, with the grower receiving the two rows. Setting standards and guidelines for each type of trial at the onset helps to avoid misunderstandings and trial losses.

Farmers quickly recognize insincerity of purpose and respond accordingly if someone is not really interested in their opinions. Nominal levels of participation can be achieved quickly, but sustained and substantive participation are possible only if researchers have demonstrated genuine interest in hearing and learning from farmers. When we fell short of that mark, for whatever reason, the decline in active and substantive participation was readily seen.

How does one deal with farmers and/or landlords in planning trials? Contacts need to be made early to see what interest exists for cooperation. These initial contacts can be made during the RRA process. Not all farmers who say they are interested truly are; nor will researchers necessarily want to have trials with all those who are interested. However, since the objectives and procedures have been worked out in advance, site selection for trials is made easier. Once the general trial

site areas are selected, the FSR/E personnel need to discuss with interested farmers, individually and in group meetings, the trial objectives and rationale for the research. The advantage of the group meeting may be to lessen pressure on the individual to cooperate.

Previous results from other areas or research stations will help show what information can be obtained. Whether the FSR/E team talks to individual farmers or to a group, the farmers need to feel they are part of the trial planning. Adjustments of trials and management procedures are a likely outcome of these discussions.

Once the individual cooperators are defined, the FSR team should visit each individual to assess how he or she is progressing on harvest of the previous crop and land preparation. Failure to consult the farmer on a regular basis may lead to the conclusion that the researchers are not serious about trial establishment. When the researcher appears a few days before planting to see if the area is prepared for the trial, he or she may find the land not yet prepared, or, conversely, already planted. This happened in both projects. The need to follow through with continued expressions of interest and intent is many times overlooked but is critical to the success of the research.

During the course of the trial, a member of the FSR/E team should talk to the grower at least every two weeks. This is best done in the field. At a minimum, during critical times in the trial, they should visit the field together. At harvest or take-off of livestock, participation of both researchers and farmer is equally important. By this time, farmers will have developed distinct impressions of the research that should be recorded. These impressions may be more important than the actual yield data.

Farmers' perceptions of on-farm trials are important for fine-tuning research and for making it relevant to the farming system under study. Farmer interest is exhibited at two levels. The first concerns the methodology used in the trial, (i.e., the

way the trial is laid out, the procedures used, and the information collected). The second concerns the trial results. Important questions include: "How do the treatments look? Are there differences? Would the farmer be interested in cooperating again? Why or why not?"

If samples are removed off-farm for yield determination or other measurements, the results should be given to the farmers as soon as possible. The longer the delay in providing results, the less meaningful they become. Also, the likelihood of farmers providing their own interpretation or comments on the results is reduced.

It is particularly important to provide results to the community at large as well. In both projects, group meetings were held to discuss results and let farmers select the next step in the research. Within-group differences would sometimes arise that served to re-affirm the correct identification of target farmers, or conversely, to highlight a need for more careful determination of the targeted population's needs. In Ecuador, farmers decided which varieties of dry beans would be studied further.

Even when farmers genuinely want to participate in research activities, we found that the cost to them of their participation can be extremely high. This high cost can occur when conventional field trials are rigidly implemented. Where farm size is small and fragmented parcels even smaller, field plot requirements of 500 to 1000 m^2 are often viewed as excessive. In other instances, although the total area might be sufficient, the trial plot may comprise the entire area dedicated to a single crop. Thus, an intended superimposed trial would leave no field for a control plot. In other instances, it would alter a farmer's allocation of land for specific crops if a control plot were imposed by taking land from another crop. In such cases, it was more effective, we learned, to reduce the plot size required if farmer participation was desired, rather than markedly affecting by being inflexible, the farmer's willingness to

participate.

The frequent occurrence of situations similar to the above make decentralized decision making essential in the implementation of on-farm trials. Because such decisions affect the integrity of the trial design, high sensitivity to methodological issues is required of the field level staff. The alternative is high supervision levels on the part of those responsible for the research. This is often impractical and detrimental to the FSR/E process.

4.4.7 Working with farmer goals and objectives

As other researchers have noted, we found farmers seldom manifest yield maximization as their sole major criterion for production. In most cases, risk aversion led farmers to give higher value to stable production rather than high yields under uncertain conditions. Considerations of yield were nearly always tempered with competing concerns, such as size and color in dry beans, or differential maturation rates and weevil resistance in sweet potato stored in the ground for long periods.

In many cases, farmers manage multiple varieties within their systems because each exhibits unique characteristics important within the larger production system. As a rule, farmers did not evaluate new varieties against a single criterion nor as potential replacements for all other local varieties. Instead, farmers frequently looked for positive characteristics in a new variety that would suggest its incorporation into their system without necessarily replacing an older variety. Clearly, they did not regard a promising new variety as a replacement for the entire set of older varieties. Small-scale, subsistence-oriented farmers manifested continued interest in maintaining diversity in the range of seed materials available to them.

4.4.8 The FSR/E need to satisfy different audiences

Apart from producing results that are useful to farmers,

on-farm trials must also contribute to the work being done by extensionists, researchers, and those formulating policy. This requires that the analysis of socioeconomic and agronomic data and the preparation of findings accommodate different audiences. Findings must be prepared for use in decision making by cooperating farmers, in determination of basic research agendas, in development of information for extension, and in provision of information for ministry policy makers and planners. Each audience may require that special steps be taken in data analysis and report preparation to make the intended results meaningful.

Both social and biological scientists working in the field need to adopt strategies for the production of reports and diffusion of research results. In adopting a writing strategy, field teams should keep in mind the type of audience they want to address: farmers, professionals, administrators, or policy makers. Both projects produced a series of working papers oriented particularly to a professional, multidisciplinary audience of FSR/E practitioners.

Another important consideration in a writing strategy is authorship. To institutionalize a collaborative research process, projects need to adopt a strategy of collaborative writing and joint authorship. This usually requires a disposition to accept more work, time delays and flexible standards of scholarship. The long-term benefits of field staff members seeing their names on reports for work in which they have participated far outweigh the short-term costs incurred from joint authorship.

4.4.9 Farmer experimentation and local knowledge systems

Earlier, the issue of farmer involvement in the research process was raised in the context of a growing awareness that such involvement has serious implications for the statistical rigor and design of field trials. Farmer involvement frequently implies a series of necessary tradeoffs in order to fully take advantage of farmer input and insights. These tradeoffs

generally affect the methodological integrity of the field trials. However, when farmer involvement is willingly accepted, recognizing the possible costs in trial implementation, the rewards are likely to offset the cost of that involvement.

Farmer participation in research and extension programs need not be restricted solely to involvement in formal field trials. Time spent in the Ecuadorian and Philippine projects following farmer-initiated experimentation and identifying local classification systems contributed to the development of more formal research activities. It also permitted researchers to refine their own research methods as farmer considerations became salient for their own work.

For example, farmer classifications of soil conditions, land types, and associated cropping practices proved very useful in aiding researchers in the design and location of trials in the Philippines. Following a series of training activities where field staff were introduced to anthropological field techniques, it was discovered that farmers consciously elected to plant either cereal or root crops into recently cleared fallow areas, depending upon the density of Imperata cylindrica and other grasses prior to clearing. Where dense stands of Imperata cylindrica were found, farmers planted only root crops. If other grasses had replaced Imperata cylindrica in the vegetative succession, then farmers planted cereal crops.

Researchers had not previously considered the presence of Imperata grass in fields prior to planting field trials as an important factor in the selection of trial sites and crops to be included as treatments. This omission resulted in several series of cropping pattern trials with cereal crops as their main components on lands recently returned to cultivation from Imperata fallow. Local farmers' knowledge of the allelopathic nature of Imperata grass and the differential effect on germination rate for cereal and root crops was subsequently validated by the discovery of Indonesian research documenting the phenomenon. Project researchers now utilize the farmers'

criteria of considering the vegetative cover of fallow areas and the type of crop to be grown when selecting sites for trials.

In both Ecuador and the Philippines, it was farmer initiated experimentation that identified the appropriate uses and growing conditions of promising new varieties. Maize 101 in Ecuador was taken far higher in altitude (up to 3200 meters) than recommended by its developers when farmers recognized that it was an ideal variety for production of green cobs. Researchers had tested it only below 2800 meters and evaluated it in terms of its greater dry grain yield. Following a traditional testing of the new seed varieties at higher altitudes, farmers identified new micro-environments that were suited to green cob production but were not suited for dry corn.

Similarly, Philippine farmers found that one of the new upland varieties of rice (UPLB-IR5) did not have a competitive advantage over local varieties when grown under true upland conditions (without bunding). It was suited as an intermediate zone rice adapted to rainfed bunded areas where water stress would occasionally occur. Again, it was farmers' testing in their environments that led to the identification of the variety's utility within the specified micro-environment.

4.4.10 Farmer training and extension outreach activities

Finally, farmer involvement has proved as useful in extension outreach activities as it has in purely research-oriented activities. Initial experimentation in the Philippines with farmers training farmers in the use of technology previously adapted to local conditions proved enormously successful (Cornick et al., 1986). Farmers were able to communicate effectively the requirements of the technology and the various steps necessary for its successful implementation and maintenance (Leucaena hedgerows, for instance). Because they had no vested interest in extending the technology per se and because they were able to use their own fields as object lessons, they created a nonthreatening and relevant learning situation to which

other farmers responded positively. Such training cannot overcome difficulties of transfer of technology to a less suitable environment, however.

5.0.0 Institutional Issues in Collaborative Work in FSR/E

5.1.0 US universities and host-country institutions

Cooperative agreements between a US institution, Cornell University, and host country entities, INIAP in Ecuador and MAF and ViSCA in the Philippines, have had institutionalization of FSR/E methodology as a main objective. Effort was invested in the establishment of stable relationships and mechanisms for long-term, on-going joint activities between host country and US institutions. Even greater pains were taken to develop the local capacity of cooperating national institutions to carry on FSR/E activities after project completion.

Additionally, Cornell's involvement in both countries had the explicit purpose of contributing to the development of agricultural production technologies through the farming systems research approach. In Ecuador, the original emphasis was on farming systems methodology and plant genetics for the improvement of dry bean and cowpea production. In the Philippines, initial research was predominately focused on staple cereal and root crops. It also included the introduction of new species of fowl and small ruminants into the local systems and the development of locally produced livestock feed supplements.

An important difference between the two projects was that the Philippine project made serious attempts (in at least one of the research sites) to bridge the gap between research and extension through the development of a mechanism of technological transfer. In Ecuador, the project did not have an extension component because INIAP's legal mandate limited its role to research.

Cornell's experiences in both countries suggest the need to establish broad objectives in project documents and to accommodate and document changes in direction and activities. In both projects, the original approach underwent substantial modifications. Thus, while the original project document in Ecuador included a heavy focus on genetics and physiological research on dry beans, this objective was subsequently discarded

in favor of an FSR/E approach because INIAP expressed little interest in the former topic.

In the Philippines, the objectives incorporated both research and extension efforts within the same project. Initial emphasis was given to mechanisms for developing and disseminating appropriate technology for small farmers. Subsequently, greater emphasis was given to the extension of specific technologies following their development and testing. The proper balance between research and extension continues to be an ongoing process of redefinition as changes in technology and agency policies develop.

Institutionalizing FSR/E often requires creating and/or strengthening linkages with other national and international organizations. International linkages were relatively easy to establish but took extra effort to maintain. Creating national linkages in the host countries proved more complex and offered contrasts between Ecuador and the Philippines.

In Ecuador, there was reluctance to establish collaborative agreements with some local universities and research institutes. For example, a local university requested broad technical support from the project to direct thesis research and to do joint field work. While this cooperation would have been an excellent opportunity to expand project linkages to local academic institutions, it was not possible due to the host institution's previous unsatisfactory experience with this university.

In contrast, the Philippines project had a mandate to institutionalize the relationship between MAF and ViSCA. The successful institutionalization of this effort is seen in the recent inauguration of the Farm and Resource Management Institute as an independent institute within ViSCA. However, attempts to build on and formalize relations with other agricultural colleges were not successful. The experience from both countries suggests that, because of funding arrangements and institutional differences, the identification of desired institutional linkages must occur during project design and be explicitly incorporated

into the project structure. Ad hoc and post facto attempts to develop institutional linkages not articulated in the project document are often frustrated. Moreover, institutional changes at the highest administrative level will often require that existing inter-agency linkages be reassessed and evaluated by the new administration.

Establishing linkages with extension agencies was deemed desirable by both projects, but the form in which the linkages were established varied. In Ecuador, there was little direct extension activity. Contacts between research and extension personnel existed largely on an informal basis because of INIAP's restricted mandate. Extensionists at one location were involved in farmer surveys, selection of short-course participants, and on-farm trial sites.

In the Philippines, field staff came from the extension service; the project was directly responsible to the regional director of the MAF, a situation that facilitated continuous linkage between research and extension. Close ties with college researchers were developed through the creation of joint working groups that functioned actively in the field and at programmatic levels.

A US institution can strengthen linkages by initiating and promoting meetings of research and extension personnel when such initiatives are not forthcoming locally. When a newly established project does not directly include extension, the local extension service personnel should be informed and their advice solicited. By seeking even informal participation early in a project, improved relationships between research and extension can be established, which can lead to continued cooperation.

5.2.0 Factors affecting project progress

Institutionalizing FSR/E is a long and difficult process. Once the parties involved have reached consensus on a common set of objectives, there are steps that can be taken to reinforce the

working relationship. In the following paragraphs, we briefly deal with some factors that, from experience, warrant special attention.

5.2.1. Broad political and economic changes in the US and host countries

During the last five years, political, economic, and social changes affected the orientation of both projects. Changes at the executive level of government produced a reordering of priorities in the agricultural sector of the economy. Important changes in world markets had repercussions on public policies on production and trade. For instance, a drastic drop in the world price of oil had direct implications for agricultural and livestock production in many countries, particularly on the prices of agrochemicals and fuel. In Ecuador, where close to 70% of the national budget depends on oil revenues, changes in the price of oil led to sharp budget cuts and austerity measures. The changing economic conditions and a new political orientation gave priority to export-oriented agricultural production, diminishing the importance given to food crop production and to projects primarily oriented to smallholders.

5.2.2 Host-country participation in project design and annual work plans

The degree of involvement of national host institutions in project design and planning of annual activities has direct consequences for their active participation in later work. When institutions feel a project proposal has been imposed upon them from outside, their participation and overall support tends to be low. On the other hand, when they share work and provide inputs to project design, they tend to identify with the project and to collaborate strongly. INIAP's participation in the Bean/Cowpea CRSP is a case in point.

At first, despite a decision to collaboratively work with Cornell, participation was relatively low. This may have been

due to INIAP's perception that it had limited input in the initial project design and selection of the research agenda. Later, after a series of meetings with Cornell representatives culminated in a joint planning workshop, INIAP's participation in the project was wholehearted. INIAP participated actively in drafting the 1985-88 project proposal and annual work plans and felt these documents responded to its needs.

The Philippine project offers a direct contrast. Cornell University joined the project one year after it had begun and supported work plans developed by project staff. Because it is a host-country project, the initiative in program development and implementation are rightly primary responsibilities of the lead institutions.

5.2.3 Project personnel

A project's progress depends on the professional qualifications, degree of stability, and commitment of team members both from the US and the host country institution. In Ecuador, for example, it became apparent that the host country institution evaluated Cornell University's commitment to the project by the type of personnel (graduate students or faculty) assigned on a short- or long-term basis. Cornell's decision (responding to requests from INIAP and suggestions from the project review panel) to place full-time PhD professionals in the field, to appoint a half-time administrator, and to put the project under the International Agriculture Program was well received by INIAP. By the same token, Cornell responded favorably to steps taken by the national host institution to maintain a high level of involvement and to assign project personnel on a permanent basis.

On the other hand, Cornell's involvement in the Philippines was manifested in placement of short- and long-term professionals in the field from the onset of its work with the project. Short-term participants helped to develop initiatives and aid the ongoing work of the long-term participants, while long-term

participants provided continuity and follow-through for activities developed by short-term participants in conjunction with their project counterparts. The mechanisms for integration of long- and short-term professional staff from Cornell within the project activities and structure has proved satisfactory through the sixth year of the project. The contributions provided by host country and Cornell graduate students doing degree research in the project was sought after and welcomed by the project. The demand for such student participation was never fully satisfied.

Additionally, project results depended on the training level and overall background of the research team. In the day to day relationships, it was obvious that people who had extensive prior field experience in addition to university degrees were able to make greater contributions. For US institution field staff, fluency in the host country language and/or cross-cultural experience greatly facilitated relationships with national scientists, administrators, and farmers.

5.2.4 Management and finances

When research projects are externally funded, the actual distribution of project resources and the perception that the host-country institution is receiving a "fair" share is critical. Host-country personnel should be involved in development of project budget and accounting procedures. In contrast, when projects are funded through a host-country contract, the US institution is not expected to be involved in (and need not be concerned about) management of funds except where it has separate budget responsibilities.

The inability to transfer funds on time can severely reduce the efficiency and outcome of a project. All project institutions and donor agencies need to work together at the beginning of a project to decide on the management of finances and to ensure that procedures are working to everyone's satisfaction at all times.

Wage differentials between the US and host country employees require careful management. Expatriate salary information is usually not provided in budget figures to local institutions. It is common policy, however, to provide person months of service to the project, thus alleviating the need for specific salary figures. This same procedure was followed for locally hired researchers to avoid any antagonism that might arise with members of the host-country institution over salary differentials and benefits.

5.2.5 Administrative and research role differentiation

Despite the continued progress toward achieving greater interdisciplinary and team oriented research in FSR/E projects, there exists a tendency toward separating administrative and research functions. This is frequently done without the realization that the proper functioning of research activities is predicated upon close coordination and communication with the administrative side of the project.

The division between substantive research agendas and those of administration tend to place the two project functions in conflict with each other for the allocation of scarce resources. Similarly, the close coordination of project and research goals is made more difficult because of the split.

While the differentiation of administrative and technical roles is a natural process in project development, efforts to resist the strict separation of administrative and research functions should be made. Both project management and research are more sensitively and effectively carried out when the people responsible for them are involved in both.

The combination of administrative and research functions is not achieved without cost. The priority that budgetary and other administrative matters play in project operations places these items high on agendas for project meetings. The expense associated with bringing staff from distant areas to attend meetings often results in combining administrative and technical

matters in a single agenda. The usual result is an overly long agenda, with administrative issues taking precedence and technical problems receiving insufficient attention. The treatment of technical matters suffers because of time constraints and low priority. Project efforts to have administrative and technical staff jointly attend administrative and technical meetings with distinct agenda have proven fruitful because each topic area receives adequate treatment. If technical and administrative meetings cannot be separated for reasons of cost, the topics should be handled on separate days. This solution requires predetermined agendas and adherence to a timetable.

Administrative activities, especially with multi-disciplinary team involvement, take more time than is generally recognized. To reduce conflicts between administrative and research roles, clear job descriptions with realistic time allocations need to be developed. These descriptions should be reviewed yearly to determine if adjustments are warranted.

6.0.0 Conclusions

The FSR/E approach to agricultural research and development is probably too new to allow a definitive evaluation. Clearly, if we had to look at the production of concrete technologies in either of the two projects, the strongest statement made would be a tentative "maybe successful, with a tremendous amount of potential yet to be realized." The bits of technology successfully adapted, generated, or spontaneously adopted by farmers in each project contain second-generation problems that require further research. Any justification of project success and continuation based solely on the concrete output of new technology would be weak at best.

We approached FSR/E not as a discrete activity with a pre-defined, concrete output of technology, but as a still developing research process subject to considerable experimentation and substantial doubt. Evaluated as a relatively recent and ongoing development effort, FSR/E has a more positive prognosis.

For the present and near future, FSR/E as a major development activity will continue as long as it maintains the interest and support of the international donor community. In the long run--and despite such support--the ultimate success of FSR/E will be measured by the extent third world countries have adopted and institutionalized it within their formal research/extension structures. Although FSR/E originated as a "bottoms up" approach, it has been promoted for developing by the US and Western Europe. Cases of its imposition on unwilling recipients and bureaucracies are known. Perhaps the most positive lesson to come from the two projects discussed here was that strong support and appreciation for the FSR/E approach could be developed in Ecuador and in the Philippines. In the latter, at least, feelings run sufficiently high that were external funding not available, local institutions would continue the approach on their own, subject to their own funding constraints and realities. If the ultimate test of technology is its adoption by farmers, then the ultimate test of FSR/E must be its

willing adoption by third world countries as a viable approach to agricultural research. In this sense, we find both projects successful.

Despite the initially heavy technical assistance input in both projects, progress has been made in developing local capacity to carry on FSR/E. The approach and methods can be learned by local-level agency personnel and successfully utilized. Moreover, it is possible to institutionalize linkages between research and extension within an FSR/E approach. It is hoped that they will continue.

Research innovations are a dynamic and expensive proposition. Developing country national programs are often hard pressed to provide funds to carry on existing programs, let alone FSR/E projects. The international donor institutions are better equipped to support developing research approaches. It is hoped that they will continue to fill an important role in supporting experimental research approaches such as FSR/E until they are sufficiently proven to be incorporated without risk into the national programs and adapted to local needs.

The most obvious lesson to be derived from any comparison of the bean/cowpea CRSP and the FSDP/EV is that tremendously different project activities fall within the FSR/E rubric. Separating the common elements of FSR/E from the discrete characteristics of the two projects was a chore, made more difficult by the still strong emotional attachment and association of each author with the two projects.

Given the differences between the two projects dealt with here and even greater differences in other projects resulting from the locally specific nature of FSR/E activities, what is the essence of FSR/E that merits retention? Clearly, FSR/E as a project and foreign-funded approach to research will run its course as new initiatives find favor with donor communities. What will or should remain?

Three elements of FSR/E seem critical to the approach. The rest is largely cosmetic and subject to change as local needs and

situations dictate. The three elements that we find essential to the spirit of FSR/E are: 1. interdisciplinarity, 2. a holistic approach to the production system (or parts), and 3. farmer participation.

It is these three elements, separately or, preferably, in combination that must be incorporated into national and local research efforts if the goals of FSR/E are eventually to be met. Both projects--in Ecuador and in the Philippines--provide strong support for the contention that this can be done. We believe what can be done, in this case, should be done.

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