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Anthropology and On-Farm Research

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The recent interest in farming systems research has given rise to a wide variety of strategies for agricultural development. There is growing concern, however, regarding the effectiveness of many of these approaches. This paper describes a set of procedures called on-farm research (OFR) which take a farming systems perspective and are designed to be used by national research programs. The anthropological contribution to strengthening these procedures is emphasized. Particular attention is given to the iterative nature of data collection in OFR and the importance of anthropological fieldwork techniques in the experimental phase. An example of data collection during the OFR process is provided through a discussion of a research program in northern Ecuador.

Key words: agricultural research, Ecuador, research methods

A HIGH OFFICIAL from the Ministry of Agriculture of an African nation recently opened a conference on farming systems research by asking if Africa was not being used as a testing ground for yet another research fashion that would produce only papers and degrees. His concern may not be misplaced, and his skepticism represents a growing feeling that FSR may turn out to be short on practical results. The recent interest in a farming systems approach to small farm

agriculture and a considerable investment by various development institutions has led to a variety of FSR projects around the world. In order for this flush of activity to be translated into a sustained effort it will have to demonstrate real benefits for farmers in developing countries. The purpose of this paper is to discuss one specific set of research procedures based on the farming systems approach and to suggest that anthropology has an important role to play in assuring the effectiveness of this type of research.

With its emphasis on a holistic view of farmers' practices and problems and an interest in understanding the farmer's rationale for management decisions, it is not surprising that FSR has attracted interest from anthropologists and sociologists (Redclift 1981; Whyte 1981; Garrett 1982). It can easily be argued that anthropologists have been taking a farming systems approach for the past half-century (e.g., Richards 1939). Anthropologists feel particularly comfortable with the comprehensive approach of FSR which considers "the whole farming activity (consumption as well as production) to learn how to improve the farmers' output and welfare, to identify the flexibilities for change in the environment, and to evaluate the results in terms of both farmers' and society's interests" (Shaner et al. 1982:4). FSR can serve as a guide for a wide range of anthropological research with an applied focus (DeWalt 1983a). FSR touches directly a number of concerns that anthropologists have about the agricultural development process, including women in development, the impact and equity of agricultural change, and the ecological dimension to economic development.

These are all important concerns, and FSR provides an opportunity for anthropologists to link their expertise and interest in these issues to agricultural development projects. But because more attention tends to be paid to anthropology's role in these policy-related aspects of FSR they will not be treated here. Instead, this paper will concern itself with the place of anthropology in the actual process of generating new agricultural technologies. The concern is that although FSR holds promise for having a widespread impact on rural development policy, the promise will go unfulfilled unless FSR first demonstrates that it is capable of producing technological change. In order to do this, the FSR approach must be translated into specific research procedures.

"The term 'farming systems research' is a generic term used to refer to any type of research which views the farm in a holistic manner" (CGIAR/TAC 1978:12). Because of this, FSR has engendered a wide variety of research strategies (Shaner et al. 1982). The purpose here will be to examine one specific set of procedures, which will be referred to as "on-farm research" (OFR). The reader deserves both an apology for this profusion of terminology and a careful definition. The term OFR has itself been used in various ways, but here it will follow the description given by Byerlee et al. (1982). This type of OFR has the following characteristics: 1) It seeks to generate technology for specific groups of farmers over the short term. 2) It focuses on a limited number of enterprises at one time, but maintains a farming systems perspective by taking into account the interactions between the selected enterprises and the rest of the system.[1] 3) It follows a set of methods which include the diagnosis of the selected enterprises within the farming system, the planning of an experimental program, experimentation on farmers' fields with promising technologies, analysis of the results, and the derivation and diffusion of recommendations.

A rigorous delimitation of the scope and aims of OFR is necessary in order to avoid confusion and misunderstanding, to give potential users a fair idea of what can be expected, and to set it off from the many other equally legitimate approaches to the problems of poverty and development. OFR is motivated by two perceptions about the agricultural development process. The first is the real urgency for improving the technologies available to farmers in developing countries. Most of these farmers could be much better served by their national research and extension programs than they are at present. Technological change is certainly not the only way of bringing about increased rural welfare, but even in cases where social or economic policy interventions are indicated the process of on-farm technology generation can serve as a catalyst for these other efforts.

The second perception which informs this approach is that the methods developed must be within the reach of national programs, with their limited resources and personnel. Although farming systems projects are often initiated by donor agencies, universities or international institutions, their ultimate practitioners are national research and extension programs. The development of research procedures must take account of the possibilities for their institutionalization (Kean and Chibasa 1982; Moscardi et al. 1983; Arauz and Martinez 1983).

Economics and Anthropology

The first question to be resolved is whether an anthropological contribution is really necessary in the process of on-farm technology generation outlined above. One does not have to be a cultural materialist, after all, to agree with the impression that farmers' decisions about technology adoption are determined largely by biological and economic factors (Winkelmann 1976). Anthropologists of fairly diverse views have pointed to the primacy of the economic environment in shaping farmer behavior (Foster 1973:70; Barlett 1980b).

Where does this leave a specifically anthropological contribution to OFR? Some would suggest that anthropology's role is merely to serve as a "conscience" which reminds other team members of "the whole farm perspective and social context" of the research (Baker et al. 1983:6). This ignores anthropological expertise in the analysis of many of the most critical issues affecting farmers' decision-making. These include the nature of land distribution, the allocation of labor to various tasks within the household and between households in a community, the organization of marketing, strategies for off-farm income generation, management of the household food supply, and food preferences.[2]

Not long ago there would have been a discussion about whether such factors were "really" economic in nature. But the formalist-substantivist debate was not terribly productive and most anthropologists would agree that although peasant farmer behavior is most often understood in essentially economic terms, "economic man always operates within a cultural framework which defines the values in terms of which he economizes" (Cancian 1972:191). The point is not wheth-

er such factors are in the domain of anthropology or economics, but rather how they can best be recognized and understood in designing technologies for farmers. The issue is thus more methodological than conceptual.

Both disciplines have a number of formal models that are used to interpret farmer behavior. In anthropology, methods based on ethnoscience have helped to clarify farmers' decision-making in such activities as choice of crop (Gladwin 1983), variety selection (Brush et al. 1981) and land preparation method (Ashby and DeJong 1982). This approach is useful for ordering and understanding the factors that farmers consider when making decisions, but has its limits in predicting farmer reaction to new technologies. The farmer's explanation categories must be compared to biological and economic data; emic interpretations should be complemented by an etic analysis.

There is of course more formal modelling done by economists. Of particular interest to OFR is the problem of risk. When farmers refuse to adopt a seemingly profitable practice the factor of risk is often introduced (e.g., Zandstra et al. 1979:195–208). Much has been written on risk, but there is still no agreement on how to measure its influence (Roumasset 1979). It has often been assumed, for instance, that better-endowed farmers are the greatest risk takers, but counter-examples are beginning to emerge (Cancian 1979). There is much truth in the remark that "risk aversion has become the modern substitute for traditional behavior . . . in disguising the complexity of reality" (de Janvry and Crouch 1981:58).

The "complexity of reality" severely limits the abilities of anthropologists or economists to devise models that accurately predict farmer behavior in relation to new technologies. The limitations of any single method or model to give a clear picture of conditions regarding technological change emphasize "the irreducible need for ethnography" (Johnson 1980). OFR methods must involve researchers in the countryside in an iterative attempt to understand farmers' problems and prospects. Anthropology's place in these methods will be discussed in the following section.

The OFR Sequence

On-farm research aimed at technology generation encompasses a sequence of phases which pass from diagnosis through planning, experimentation and analysis and end in recommendations. The following discussion focuses on the anthropological contribution to these phases, with particular attention to diagnosis and experimentation.

DIAGNOSIS. The diagnostic phase is the part of OFR most strongly associated with social science. In this phase researchers attempt to understand current farmer practices and identify likely areas for research. This is usually done through some type of survey. There has been a tendency for these survey methods to go to either one or the other extreme of formality.

The diagnostic phase has been heavily influenced by the formal survey techniques of farm management economics. These include multiple visit (cost route) surveys and/or lengthy single visit questionnaires. There is growing doubt as to whether such survey instruments are the most cost-effective way of going about the diagnostic phase of OFR (Byerlee et al. 1982).

National research programs often experience difficulty in carrying out and analyzing complicated surveys, and one alternative which has emerged is the *sondeo* (Hildebrand 1981). This is a survey of one or two weeks' duration in which teams of researchers, made up of biological and social scientists, interview farmers informally, without a questionnaire, and gradually build up a picture of the local farming system. The method is part of a movement in "rapid rural appraisal" (e.g., Carruthers 1981) which responds both to a disenchantment with the costs and quality of lengthy questionnaires, and a demand from development assistance agencies for a more concise approach to diagnosis from consulting social scientists. The successful application of the informal survey to the diagnostic phase of OFR owes much to anthropological experience (e.g., Rhoades 1982). But it is ironic that the *sondeo* has become identified as anthropology's principal contribution to OFR, because such rapid, superficial approaches are really not representative of the anthropological method (Gladwin 1983)

There are alternatives between the extremes of costly and time-consuming surveys, on the one hand, and a rapid *sondeo*, on the other. One possibility is to carry out a more rigorous informal survey (Collinson 1981) and then use this information to design a short, well-focused questionnaire (Byerlee, Collinson, et al. 1980). The choice of methods will depend both on research resources and the nature of the research environment. The important point is that OFR should be thought of as an iterative process. Diagnostic surveys are not carried out to collect all possible information, but rather to provide a basis for the initiation of an experimental program. Once the experiments are established, further opportunities for data collection will present themselves.

The diagnosis fulfills several purposes. First, it provides a description of current farmer circumstances and practices. This includes "giving voice to farmers" (Norman 1980:9), and eliciting their views of production problems, which may be quite different from those assumed by scientists (Werge 1977). Second, it identifies key enterprises and production practices that provide opportunities for research. It is relatively easy to form a list of factors which limit production, but it is a real challenge to identify the few areas where research can lead to innovations that will increase productivity, reduce risk, or increase system intensity. The third purpose of the diagnosis is thus to develop an understanding of the nature of the constraints which cause the problems that have been identified, so that technologies can be tested which are compatible with the farming system.

It should be obvious that the diagnosis is much more than an exercise in description. Anthropologists cannot merely "make available to interested agricultural researchers information on small farmer practices" (Redclift 1981:353). The diagnosis is successful only if there is constant interaction between social and biological scientists in order to arrive at an experimental program that addresses important farmer problems. When the diagnostic phase is dominated by social scientists, as it often is, the possibility of reaching this goal is seriously diminished.

EXPERIMENTATION Just as there are too many social scientists in the diagnostic phase, there are too few involved in experimentation. It is not usually appreciated that the experimentation phase of OFR is the time when most useful information is collected, rather than during preliminary surveys. The diagnostic phase typically lasts a few months, while the experimental phase may go several years before recommendations begin to be produced. It is only logical that we put more emphasis on data collection during experimentation.

The very organization of the experimental phase can profit from anthropological field experience. In the selection of collaborators for experiments, for instance, knowledge of rural social organization is crucial to the continuation of the research process.[3] In order to do fieldwork, an anthropologist must learn how to balance information from key informants with that provided by a broader, more representative sample, all the while working in such a way that the data collection procedures are acceptable to the local population. The problems are exactly the same for the management of a set of on-farm experiments.

There are surprisingly few references to the value of the experimental phase as a source of a broad range of data (Byerlee et al. 1982; Potts et al. 1983). The experiments are the principal source of information in OFR, but this information is most useful when seen in a wider context. Agronomists are trained to combine observations of experimental variables with other conditions of the experiment, observations of neighboring fields, and information on general agricultural conditions in order to arrive at their conclusions about the biological responses seen in the crop. Similarly, anthropological fieldwork is based on collecting data in bits and pieces, often informally, cross-referencing it and continually re-working it to form new hypotheses. There is a real parallel between anthropological research and field agronomy.

Anthropology's role in OFR is sometimes questioned because of the belief that "[t]here is a basic incompatibility between the stress on speed in developing appropriate technologies—which was one of the main justifications for a FSR program—and the valuable methods which generally characterize anthropological research" (Baker et al. 1983:6–7). This is not only unfair to anthropologists, but reveals a serious lack of familiarity with the OFR process.[4] The experimentation phase, with its emphasis on planting and managing experiments with farmers, monitoring the experiments and farmers' opinions of them, exploring the ways in which the entire farming system impinges on the target crops, and continually reformulating hypotheses for further testing over a period of several years, is nothing less than participant observation. Anthropological experience on how to elicit opinions from farmers, make and record observations informally, utilize different types of data, and explore a wide range of topics of interest to particular research goals is all directly applicable to the field management of on-farm experimentation (Tripp 1982a).

PLANNING, ANALYSIS, AND RECOMMENDATION. The OFR process, of course, includes more than diagnosis and experimentation. Planning, analysis and recommendation are also essential parts of OFR. Anthropology can make a contribution to each one of these activities.

The planning phase is carried out before each cycle of on-farm experiments, and, as the process continues, includes the increasingly precise definition of "recommendation domains" (Harrington and Tripp 1984). These are groups of farmers who share similar biological and socioeconomic circumstances and who are likely to benefit from the same recommendation. There is no question that if targets are not carefully selected then OFR will not meet its goals (Garrett 1982). Poor targeting is probably the most common source of failure in rural development schemes for small farmers (Cohen 1975; D'Silva and Raza 1980). For many research and extension personnel the world is divided into "progressive" and "traditional" farmers, with no thought to the resource correlates of these categories. Anthropology has a long history of research into variation within rural communities, of refusing to see small farmers as an "amorphous peasantry" (Hill 1968). Anthropological interest in a disaggregation of the research area during the diagnostic and planning phases can contribute to an effective OFR program.

Each cycle's experiments must be subjected to agronomic, statistical and economic analysis. Although methods for the economic analysis of experiments are well-established (Perrin et al. 1976), there is still room for anthropological input. Of particular interest are such topics as the use (and cost of) family labor (Barlett 1980a) and assigning a value to subsistence production (Chibnik 1978).

But probably the most valuable contribution that anthropologists can make to the analytical phase of OFR is in assuring that the farmer's own evaluation criteria are included. This can be done best by seeing that the farmers are acquainted with the experiments and that they have been given a chance to express their opinions and preferences. This is accomplished through casual conversations with farmers, or by more formal methods (Kirkby et al. 1981:15). There is no incompatibility between this and an economic analysis; it is merely done to be sure that the correct values are assigned to the variables being examined.

Finally, anthropological experience is valuable in the assessment of farmers' reactions to recommendations. This should not be done as an isolated ex-post exercise in assessing adoption behavior, but rather as an integral part of the process of technology generation, of completing the circle of "farmer back to farmer" (Rhoades and Booth 1982).

An Example of OFR From Ecuador

In order to illustrate the process of data collection and analysis in OFR, a brief example from Ecuador will be useful. The description will focus on the activities carried out during several years of experimentation in one OFR program which led to a series of recommendations for farmers. The evolution of this research program will be used to demonstrate the iterative nature of OFR and the role of anthropological fieldwork techniques in the process.

The research described here was carried out by INIAP, Ecuador's National Institute of Agricultural Research. The work was done in conjunction with CIMMYT's regional economist and agronomists. In addition, the author joined

TABLE 1. PRINCIPAL CROPS AND PLANTING DATES IN IMBABURA, ECUADOR

Crop	Scientific name	Planted	Harvested
Maize	*Zea mays*	Sept.–Nov.	June–July
Beans	*Phaseolus vulgaris*	Sept.–Nov.	May–June
Wheat	*Triticum* spp.	Nov.–Jan.	May–June
Barley	*Hordeum vulgare*	Nov.–Jan.	May–June
Potatoes	*Solanum tuberosum*	June–July	Dec.–Jan.
		(+ other planting dates)	
Broad beans	*Vicia faba*	Sept.–Nov.	June–July
Lupines	*Lupinus* spp.	Sept.–Nov.	July–Aug.
Quinoa	*Chenopodium quinoa*	June–July Oct.	Feb.–March June
Peas	*Pisum sativum*	May–June Dec.	Sept.–Oct. May
Squash, pumpkin	*Cucurbita ficifolia*, *C. pepo*	Oct. May	June Jan.
Oca	*Oxalis tuberosa*	June–July	Feb.–March
Melloco	*Ullucus tuberosus*	June–July	Feb.–March

the program for two-and-a-half years, from 1979 to 1981, participating in all activities with the INIAP agronomists.

INIAP does on-farm research through its Production Research Program, PIP, which stations agronomists in selected areas of the country to do location-specific research. The research was carried out in the central part of Imbabura Province, northern Ecuador (see Moscardi et al. 1983 and Tripp 1982b for more details). It is a highland area, between 2,200 and 3,200 meters above sea level. It is composed of small communities of farmers, the majority of whom speak Quechua as their first language. Landholdings generally range from 0.5 to 3.0 hectares. The major food crops are shown in Table 1. The principal crop is maize, which is almost always planted in association with climbing beans. The maize may also be intercropped with broad beans, lupines, quinoa, peas, or various types of squash. These crops can be found planted alone or in other associations as well. Wheat, barley, potatoes and the Andean tubers *oca* and *melloco* are also important.

OFR began in this area in late 1976, when INIAP scientists visited the zone and carried out an informal survey. On the basis of this it was decided to concentrate on the maize-bean intercrop for initial research, and a short formal survey which focused on this enterprise was carried out. The survey results helped to identify the following priorities for investigation: the possibility of a shorter season maize; fertilizer levels; control of insects; and weed control. The area was subdivided into three recommendation domains, which were distinguished on the basis of soil type, altitude, and rainfall.

On the basis of these priorities, a series of on-farm experiments were carried out in 1977–1978. As is the case in most OFR, each experiment examined a small number of experimental variables (between one and four) while leaving all non-experimental variables at the farmer's level. These experiments were the first of a program which continues today.

Finding collaborators for experiments was at first difficult for the agronomists, who had little experience in working with peasant farmers. But as they spent more time in the area talking to farmers, visiting fields, and participating in community events, the job of site selection became easier. Each successive cycle of experiments was planted with a more representative sample of farmers.

Table II traces the progress of this experimental program by research theme. The theme of an early-maturing maize variety is particularly interesting. The local maize varieties required between 8 and 9 months to mature, thus eliminating the possibility for planting more than one crop per year. Researchers reasoned that a short-season maize would open the possibility for planting a second crop (not maize) in the same year. A number of early-maturing maizes were tested, and as Table 2 shows the result was a new variety, "INIAP 101," which matures about 50 days earlier than the local varieties. It is now released and is being used by farmers. Research continues on the experiment station and on farmers' fields to develop other early-maturing varieties with improved characteristics, and a thesis in agronomy is underway which examines farmers' adoption and use of "INIAP 101."

The research that led to the release of the early-maturing maize was not confined to formal experiments. The agronomists had to solicit farmers' opinions about the new maize's agronomic characteristics, marketability, and adequacy for local maize preparations. One of the early problems in the research was the high degree of tillering in the new maizes. In some areas of the Andes maizes that produce many tillers are appreciated for their forage quality. Agronomists conducted informal interviews with collaborators and their neighbors on the subject of tillering. The results showed that tillering was not highly valued, and breeders worked to eliminate this characteristic from the new maize.

Another agronomic question concerned the possible range of planting dates for the earlier maize. The agronomists solicited the help of the farmers as researchers. They found that several farmers had taken small quantities of the early maturing materials from the first year's experiments and planted them at different times. The agronomists distributed seed to other farmers and encouraged them to do the same. The information obtained from this experience was used in judging which types of rotations with the new maize would be worth pursuing through further research.

Researchers also had to assess farmer acceptance of the cooking qualities of the new maize. This meant spending time with farm families, occasionally sharing their meals, and learning how the new maize was being prepared. Samples of the new maize were also distributed to a number of women for more formal testing. In the third cycle of research a qualitative dietary survey was carried out by the author. One of the results was a more precise understanding of the types of maize preparations that were most important for these farmers.

A second research opportunity was fertilization in maize. Most farmers were not using fertilizer on their maize, and those who were tended to use a formula more appropriate for potatoes. It was originally thought worthwhile to investigate the responses of normal season maizes to fertilizer. As research progressed, however, the focus shifted to concentrate on fertilization of the early-maturing maizes, especially in rotation with other crops. Before fertilizer recommendations were finally produced for the different recommendation domains a great deal of formal experimentation and other investigation was done. The latter included observations on minor element deficiencies in farmers' fields, conversations

TABLE 2. EXPERIMENTAL PROGRAM IN IMBABURA, ECUADOR

Cycle	Theme					
	Early-maturing maize	Fertilization	Insect control	Weed control	Beans	Other crops
1. 1977–1978	Test several materials.	N, P with normal season maize.	Control of soil insects and fall armyworm.	Chemical weed control.	–	–
2. 1978–1979	Continue testing best materials from previous year.	N, P with early varieties. Experiments on response to minor elements.	–	Same as 1.	New bean varieties for the early-maturing maize.	
3. 1979–1980	Continue with new variety, "INIAP 101."	N, P with "INIAP 101."	New method for ear worm control. Storage trials.	–	Same as 2.	New pea varieties to plant in rotation with maize. Fertilizer levels in maize/pea rotation.
4. 1980–1981	Verification experiments with "INIAP 101." Test new early maturing lines.	Verification of N, P levels with INIAP 101.	Same as 3.	–	Same as 2.	Same as 3.
Subsequent cycles	Recommend INIAP 101 Continue testing new early and intermediate varieties.	Recommend N, P levels for INIAP 101.	Recommend storage methods for maize.	–	Same as 2.	Recommend new pea variety. Experiment with peas and potatoes after early maize. Broad bean disease control experiments.

with farmers about manuring practices and fertilizer use, a small study of the relation between planting density and soil analysis in a sample of fields, and a short formal questionnaire, carried out during the fourth cycle of experimentation, on rotation patterns. Thus a wide variety of data collection methods were exploited in order to derive fertilizer recommendations that farmers could use.

The issue of insect control provides an even better example of a shift in research themes over time, and gives further evidence of the value of participant observation. Initial research focused on control of insects that attacked the maize in its early stages of development. Methods were tested which were effective but were found not economical for the farmer. Research shifted to control of earworm, and an unsuccessful attempt was made to develop economical methods for applying insecticide during later stages of plant growth. But as the researchers spent more time talking with farmers and observing their operations it became obvious that maize storage was a serious problem. The floury maize grown in the area was susceptible to weevil attack and with only one harvest a year storage was a particular concern. The issue had been covered in the formal survey, but farmers had been more cautious in their responses than they were in their conversations with the agronomists who were now working with them. The INIAP entomologists were consulted and on-farm storage trials were designed which led to the development of recommendations for better maize storage methods.

In the case of weed control, several herbicides were tested, but the work was abandoned after two cycles. A particular difficulty for chemical methods was the very long growing cycle. It was concluded that much more basic work on the experiment station was necessary before local weed control methods could be improved upon.

During the course of the experimental work of the first four years, a number of other research themes were developed, based on various sources of information. From the beginning of the research high priority was placed on identifying bean varieties that would be compatible with the early-maturing maize. Several local varieties could be planted with the new maize, but they were a bit aggressive for the shorter, thin-stalked maize, which often lodged. Informal observations and conversations revealed that the vast majority of farmers grew beans as a subsistence crop only, and that they were willing to accept a wide variety of types and

colors of bean. The development of better early-maturing beans has been slower than the work with maize, but several promising varieties have now been identified.

Conversations with farmers, and observations in their fields, revealed that broad bean production had declined substantially, because of disease problems. Other work, particularly the small diet survey, showed that broad beans were a particularly valuable item in the diet. They were often prepared as a flour and mixed with maize flour to make a nutritious gruel. The experiment station began to work on this problem and eventually identified new varieties and disease control methods to be screened on farmers' fields.

As it became obvious that the early-maturing maize would be accepted by farmers, the question of crops to plant in rotation with it became more important. Farmers were particularly interested in peas as a source of cash income, and rotation experiments with some improved pea varieties were initiated during the third year. One of these varieties has recently been released to farmers, and experimental work continues on the management of this rotation. The diet survey conducted during the third cycle identified potatoes as a principal food purchase, especially for poorer farmers, so work was also initiated to develop viable early-maize/potato rotations which could serve to increase household food supplies. The small formal survey which was carried out in the fourth cycle was particularly useful in planning the new rotation research for the different recommendation domains.

This summary of the experimental program in Imbabura illustrates three interrelated aspects of OFR. First, the researchers who carry out the work may not be anthropologists, but much of what they do bears a strong resemblance to anthropological fieldwork. Second, there are a variety of data collection methods that are appropriate to the conduct of OFR, and anthropological techniques are prominent among them. Finally, the OFR process is an iterative one, and a flexible approach to data collection and analysis is essential.

With respect to the first point, the research strategies in Ecuador included a significant element of anthropological methodology. Although OFR is an interdisciplinary venture, scarcity of resources and personnel dictated the necessity of assigning one or two agronomists to do almost all of the fieldwork in a given project. This meant that the agronomists had to acquire a very wide range of skills. The experience in Ecuador indicates that this is an acceptable compromise. Emphasis was placed on developing agronomists whose analytical skills included the ability to take a systems perspective, and whose fieldwork techniques included those familiar to anthropologists; of particular importance were sampling, participant observation, informal interviewing and note taking.

The agronomists who began to work in OFR had little experience in thinking about the countryside. The success of the work depended on their developing the ability to recognize the variation in socioeconomic circumstances that existed and to identify representative farmers. This determined the quality of the samples used for on-farm experiments as well as for other data collection activities.

It would not be unfair to compare much of what the agronomists did with participant observation, although it was certainly not as intensive as that which characterizes some anthropological fieldwork. The researchers learned how to use visits to farmers' fields and homes, as well as participation in key community events, to expand their knowledge of the farming system.

Informal interviews were a very important source of data. The agronomists soon learned that an attitude of honest curiosity, rather than one of technical omniscience, served to gain the confidence of the farmers. Their interviews covered topics ranging from beliefs regarding planting, to food preferences, to the availability of labor.

Finally, the agronomists developed skills in note taking in order to accommodate the wide range of information they were receiving. The traditional agronomist's field book soon expanded to include pages designed for recording other types of information besides experimental observations.

The second lesson from the OFR in Imbabura was that there are various data collection techniques, each one appropriate to different sets of problems. The data from the on-farm experiments were complemented by information from informal interviews, observations and formal surveys. In their conversations with farmers the agronomists had to both pursue predetermined topics, such as opinions of the new maizes, and keep their ears open for new issues which could lead to modifications of their experimental work, such as the problem of maize storage. Field observations ranged from the casual (manuring practices) to purposive (symptoms of minor element deficiencies) to rigorous (the small study on planting density).

In the later cycles, small formal surveys were deemed necessary for certain topics. One was the qualitative dietary survey and the other the study of crop rotation practices. It should be emphasized that both of these surveys responded to data requirements that appeared well after the experimental program was underway, and because they were informed by several years' field experience in the area they were carried out with much more ease and precision than the original diagnostic survey. In addition, the agronomists were responsible each cycle for the collection of other data that were used in interpreting the experimental results, including rainfall data and market prices for inputs and crops.

Finally, the Imbabura experience should make clear the iterative nature of OFR. It is obvious that even with perfect hindsight no diagnostic survey could have accommodated all of the issues that appeared in the first several years of research. The initial diagnosis served to identify a series of opportunities; some were fully developed (early varieties), others were modified (insect control), and still others were discarded (weed control). In addition, the very success of some research led to the evolution of other themes (varietal research in maize leading into research on peas and potatoes); and completely new themes (broad bean diseases) also appeared.

It will also be noted that it took four years of experiments before recommendations began to appear. The process may have been delayed a bit because this was INIAP's first attempt at OFR, but this is not an unusually long time span. The need to test technologies over different cycles and locations, the inevitable loss of experiments due to weather conditions, animal damage or misunderstandings, and the number of false leads that have to be pursued in this type of work, all mean that the research process will normally take several years.

Anthropologists, Technology and Applied Research

An important prerequisite for effective anthropological participation in OFR is to come to terms with technological change. There has always been an ambivalence in anthropology's association with agricultural development, in which it has either been a bit suspicious of technology, on the one hand, or has found itself involved in the uncritical promotion of recommendations, on the other. Neither of these stances is very helpful in developing a role for anthropology in OFR.

The anti-technical bias can lead to a real misunderstanding of OFR. OFR begins with the farmer's practices and proposes modifications that are compatible with the farmer's circumstances. The very viability and rationality of local farming systems means that any improvements are likely to come from outside. The solutions that OFR will be able to offer will most often be technical ones.

For example, several social scientists (Gostyla and Whyte 1980; Redclift 1981) who have written about ICTA, Guatemala's innovative national agricultural research institute, have chosen to concentrate on a series of experiments which examine alternative planting systems for maize. Gostyla and Whyte (1980:21) report that ICTA "simply replaced single rows of maize with double rows within the farmer's traditional set of practices . . . . Initial trial results indicated that the system could produce 45% more maize . . . ." ICTA's actual recommendations are much different (ICTA 1980), involving increased input use and planting other crops between the double rows of maize. The danger is that one is led to believe that only minor adjustments in planting methods or local varieties will yield significant benefits for small farmers. Anthropological common sense should indicate otherwise. If a highland Guatemalan farmer who has several millennia of experience in planting maize could really get a 45% higher yield by simply rearranging his rows of maize, then all theories of peasant rationality and adaptation should be re-examined.

But the opposite course, in which anthropologists are asked to become salesmen for "scientific agriculture" (Foster 1973: 230) and to overcome various "cultural barriers" to its adoption is not recommended either. There is a "pro-innovation bias" (Rogers 1976) in most adoption studies which assumes that recommendations are in fact appropriate for farmers. Because most recommendations have not been derived under farmers' conditions, low adoption rates often reflect simple biological or economic incompatibilities rather than cultural constraints.[5] OFR offers anthropologists the opportunity to participate with farmers and other scientists in the development of recommendations. It is well known that farmers are themselves experimenters (Johnson 1972; Biggs and Clay 1981). OFR can be seen as an attempt to increase the effectiveness and range of their experimentation.

It must also be emphasized that OFR requires interdisciplinary cooperation. For a group that prides itself on a holistic approach, anthropologists certainly have a terrible reputation in interdisciplinary endeavors (e.g., Baker et al. 1983). Anthropologists are often seen as being critics, or at least as having the tendency to go off on their own. To be sure, the structure of many farming systems projects has not been conducive to cooperation. There seems to be the impression in some quarters that farming systems research involves simply fielding a team of specialists and letting them go their own way. This is not likely to produce results, and is certainly a bad example to national research programs. Anthropologists have a special responsibility to see that OFR is truly an interdisciplinary enterprise.

It should be obvious that anthropology's part in OFR offers relatively little opportunity for traditional academic research. There is definitely a place for anthropology here, but if it is to be realized uneasiness with applied work will have to be overcome.[6] The methods of OFR do not call for sophisticated anthropology, but they don't call for sophisticated economics either. Elaborate studies of kinship will not be necessary, but neither will linear programming models. The future of OFR will rely more upon sensibilities, experience and solid field procedures. Anthropology's role is not going to be overwhelmingly large, but it will be important. And there will certainly be the need for specialized anthropological studies for particular problems (see, for instance, Goddell et al. 1982 and Doherty et al. 1982), just as other specialists will be called in from time to time.

But for the most part we are talking about the role that anthropologists can play in developing effective diagnostic, experimental and analytical tools for national research program personnel. Anthropological fieldwork experience is a key to the development of these techniques. Although direct participation by anthropologists in OFR programs would be ideal, most national programs currently employ few social scientists of any kind. Thus over the short term anthropologists must help develop OFR techniques that will be utilized by researchers with little social science background. In the long term, however, OFR has the potential for stimulating a greater participation of anthropologists in national research programs, and encouraging more relevant training for them in their universities.

Conclusions

Farming systems research is in danger of becoming an international assistance juggernaut which will produce career-long baseline studies, flying consultancies, elaborate simulation models and endless scholarly paeans to the small farmer and his intercropped fields. It will proceed until a lack of funds and tangible results leads to its abandonment. If this happens it will mean the end of a promising approach to agricultural development which is particularly sympathetic to anthropological concerns.

This paper has argued that a redirection of the farming systems approach requires more attention to methods that can both generate technological change for farmers and be used by national research programs. A set of procedures, called on-farm research, which are consistent with the farming systems perspective, have been described. The anthropological contribution to OFR received particular emphasis.

This focus on the generation of technology for farmers is not meant to deny the importance of the larger policy issues envisioned by the farming systems approach, nor to propose a "technological fix" for every problem that farmers confront. But unless results are forthcoming from OFR, unless it can be demonstrated that this type of research actually works, its chances for playing a broader role are minimal. There are

important links between OFR and such issues as credit policy (Hildebrand 1976), nutrition (Tripp 1982b), integrated rural development (Uphoff et al. 1979:68–84; Kirkby et al. 1981) and land tenure policy (DeWalt 1983b). But an OFR program which is generating new technologies is the first step towards the realization of these broader goals. Not only does it offer tangible results that farmers and policy makers can build upon, it also organizes and deploys a wide range of development personnel (not just social science researchers) to the countryside to confront both technical and socioeconomic realities.

Although anthropologists are not the major actors in OFR programs, they can contribute a great deal to the success of such endeavors. This paper has argued that the anthropological role in OFR should be reconsidered. It must be conceded that in general OFR has invested too much time, and too high a concentration of social science, in the diagnostic phase. Similarly, it has paid too little attention to the social science role in experimentation, analysis and recommendation. These phases of OFR are precisely what anthropology does best—the careful, iterative examination of selected research themes through participant observation. Not only the anthropological contribution, but OFR itself, is best thought of in these terms.

NOTES

[1] This approach, which selects only a few key enterprises in the system for research at any one time, is sometimes called "FSR-in-the-small." "As long as the concept of the whole farm and its environment is preserved not all factors determining the farming system need to be considered as variable—some may be treated as parameters . . . FSR may be . . . distinguished as FSR-in-the small (low ratio of variables to parameters) or FSR in-the-large (high ratio of variables to parameters" (Harrington 1980:4). It is to be distinguished from a commodity approach, however, because the enterprises are not predetermined.

[2] Such "traditional" anthropological topics as kinship, the household cycle, religious affiliation, political organization, ethnicity, belief systems and even aesthetics may also be relevant to understanding technology adoption. In an Indian village, farmers who recognized the value of contour ploughing still did not adopt it because hillside land was inherited in vertical strips (Lipton 1968:339). In Swaziland, Low (1982) showed how the household development cycle affected the adoption of new maize technology. Long (1968) has shown how membership in Protestant sects in Zambia is correlated with a more entrepreneurial approach to agriculture among small farmers. In a village in Mindanao, Moslem and Christian rice farmers were separated politically and had different farming practices and adoption behavior (Tan 1975). Neighboring Welsh and Latin farmers have quite different farming strategies in Patagonia (Williams 1977). Many farmers in highland Guatemala insist on planting seven (a sacred number) maize kernels per mound, and refuse to thin them (Shaner et al. 1982:261). Kentucky farmers claim that ploughing is good for their fields in the face of zero-tillage experience to the contrary (Choi and Coughenour 1979).

[3] One problem, well known to every anthropologist who has ever had to get established in a strange community, is the fact that many times the people who are initially most cooperative with outsiders like OFR personnel are outsiders themselves. Their social positions may make them both unrepresentative technically and/or unacceptable to the majority of the local population as sources of information or innovation (e.g., Shaner et al. 1982:100).

[4] The judgement is made by researchers in Botswana, who report six separate types of survey being carried out in order to arrive at a single set of experiments that examine alternative planting methods (Baker et al. 1983:4–5). This is a case of the diagnostic tail wagging the experimental dog.

[5] In one adoption study in Guatemala (Beal and Sibley 1967:55) the recommended fertilizer application for wheat was 30 pounds per *cuerda*. To rate adoption, a farmer was awarded one point for using less than 30 pounds, two points for 30 pounds, and three points for applying more! Given that the recommendation was almost certainly derived under the conditions of an experiment station and that in any case farmers' fields are not all alike, what is being measured here is the farmer's enthusiasm at taking advice from strangers.

[6] When Rhoades and Rhoades (1980), for instance, offer some modest "nuts and bolts" suggestions for increasing anthropology's role in agricultural development, they are told that "agricultural anthropology will be better served by those who can engage in theory building about human ecosystems and participate in decision-making about the future of agriculture . . . ." (Cleveland 1980). The point is, of course, that those who are engaged in theory building are precisely the people who are *not* participating in decision-making about agriculture.

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