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# PARTICIPATORY-ACTION-RESEARCH AND THE FARMING SYSTEMS APPROACH WITH HIGHLAND PEASANTS

by

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# RESUMEN

Una de las tareas mas desafiantes de la investigacíon y extensión agrícolas en las condiciones multi-culturales y multi-ecológicas del mundo "en vias de desarrollo" es la de proporcionar alternativas tecnológicas apropiadas, basadas en la experiencia del productor campesino. Este problema se muestra claramente en las comunidades alto-andinas, donde las formaciones sociales pre-hispánicas y las prácticas tecnológicas que actualmente se usan en las comunidades campesinas se hallan en conflicto con los intentos del gobierno por introducir el campesino en el sistema nacional de mercado como un medio de mejorar sus recursos económicos y tecnológicos.

La complejidad de los sistemas de producción agrícolas y pecuarios que los campesinos han elaborado, como medio de adaptacíon a las limitaciones presentadas por la variación altitudinal y el clima severo, así como por los problemas de mano de obra y la falta de tierra, hacen difícil el diseño de tecnologías apropiadas, adaptables a amplias áreas geográficas. Recientamente los investigadores y extensionistas han comenzado a reconocer la racionalidad que subyace a los sistemas campesinos de producción, y lo inadecuado de las actuales alternativas tecnológicas para su mejoramiento. Muchos están buscando nuevos y más efectivos métodos de investigación agronómica, que sean específicos a las necesidades del pequeño productor campesino.

Este estudio intenta analizar críticamente una experiencia, en la cual se utiliza la metodología de la acción-investigación-participativa para resolver problemas de producción definidos por los mismos campesinos. Se está seleccionando y diseñando las alternativas desde la perspectiva de que la unidad productiva es un sistema integrado e interactivo propuesto por el Enfoque de Sistemas.

Analizamos aquí las razones por las que se han elegido estas metodologías y cómo han sido implementadas en las comunidades campesinas. Ocho estudios de caso ilustran las posibles implicancias de estas metodologías para la investigación y extensión agropecuarias.

## Abstract

One of the most challenging tasks which faces agricultural research and extension efforts in multi-cultural and multi-ecological situations of the "developing" world is that of providing appropriate technological alternatives, based on the experience of the peasant farmer. This problem is well exemplified by the communities of the Andean highlands where pre-hispanic social formations and technological practices which continue to exist in the peasant communities of today are in conflict with government attempts to insert the peasant into the national market system as a means of improving national economic and technological resources.

The complexity of the cropping and animal production system which peasants operate, as a means of adapting to the constraints levied by altitudinal variation, harsh climate, labor constraints and land shortage, make the design of improved technology adaptable to wide geographical areas difficult. Recently, researchers and extension workers have become more aware of the rationale behind the peasants' system of production and of the inappropriateness of current alternatives. Many are searching for new and more effective methods of agronomic research, technology validation and communication of information, specific to the needs of peasant farmers.

This study attempts to critically analyse an experience where participatory-action-research is being carried out on production problems defined by peasant farmers. Alternative solutions are selected or designed from the perspective that the production unit is an integrated, interacting system put forward by the farming systems approach.

Here we examine the reasons particular methodological tools have been chosen and how they have been used in community situations. A series of case studies illustrate the possible implications of these tools for research and extension efforts.

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# INTRODUCTION

This report synthesizes some of the thinking and experience that has led us to conceive of development in a different way and to search for the means of making this objective relevant to the needs of the rural poor who make up about 70 percent of the population of "developing" countries.

Conscious, moral men and women can no longer decide how "development" should take place without involving those who are affected by it. It is a challenge to reintegrate, in our thinking and in our actions, man, nature and science so that as professionals we may contribute to making human beings, in all countries of the world, rightful subjects of the knowledge and technology at our disposal. It is probable that ethnocentric views of how the future of man should be, combined with the compartmentalized and dehumanized way that Western capitalist-oriented science has tended to look at progress, have led us to the extreme polarization of rich and poor which is so obvious to all.

"Modernization Development" has been thought of as the application of technological packages in "change resistant" rural areas. The ideology behind the "technological package" has led to problem definition by scientists and not by the farmers at whom it is aimed. Pearse (1980) concludes that "packages" have a polarizing effect which tends to strengthen the rich and enrich the powerful, to weaken the poor and impoverish the weak. Those who do not adopt packages tend to be regarded as backward.

Here we discuss the partial experience and implications of a small team effort in rethinking through action, the role of research in supporting the Andean peasant in the improvement of his farming system. This project is being carried out in a group of peasant communities on the western side of the Mantaro Valley in the central highlands of Peru. The methodological basis is a combination of the farming systems approach to agronomic research and validation and participatory-action-research with the peasant farmers.

Eight case studies are used to illustrate how the combined methodology can help in broadening the potentialities for appropriate technological change within peasant communities. We look at the possibilities of building research and extension efforts on peasant farmers' technical knowledge and social organization, and the implications of this for change agents and the institutions they work for.

## RETHINKING DEVELOPMENT

### Agriculture and "Development"

One of the results of agricultural research and extension over the last 45 years has been that the small farmer has been required to adapt his ecological and social circumstances, in order to benefit from the technological "packages" prepared under research station conditions.

Research efforts have been dedicated to high-yield, single-purpose crops, oriented toward either the national urban market or to international export demands. In animal research this same approach has been followed, proposing the importation of breeds and management patterns rather than the improvement of endogenous ones. This orientation has concentrated on large scale technology rather than on replicable small scale prototypes, which could then be adapted to situations of specific ecological, climatic and organizational variation.

Basic assumptions about market demand and price stability, based on static rather than on flow studies, have led researchers and planners to believe that input intensive technology could be cost effective. Although this may occur where farmers have greater access to natural and financial resources, in countries where the majority of farmers are peasants and resources are limited, it is more difficult, if not impossible, to make short term risks pay off over the medium or long term.

### Results of "Modernization Development"

The term "development" has somehow become synonymous with the transfer of technology from the outside, usually by the so called "developed" countries. Rural development was to have come about as a result of the application of the technological package of MODERNIZATION, gearing production for the market, under the assumption that the market would provide for the accumulation of capital for investment in broader sectors of the economy, benefiting the total population with the surpluses produced.

As we gain more experience with the results of modernization policy, we find ourselves questioning the underlying assumptions of externally stimulated monolithic change. We observe that the smaller landholder is becoming poorer, the recently formed middle classes are being eroded, the states are less solvent, and only a diminishing elite is taking advantage of the benefits of "development." As the natural and financial resources at the disposal of this minuscule group grow continuously, the remainder of the population becomes steadily poorer, forcing us to reconsider what development in the interest of the majority of the population would entail. (Hoogvelt 1982)

The erroneous assumptions on which the theory of modernization development are based, have been thoroughly discussed since the sixties by dependency theorists and others. They have clearly shown that the last half century of international development policies has resulted in a steady loss of economic and political independence in the so called "less developed countries." The magic of development has done little to improve the condition of the small farmer, and in many cases his acceptance or incorporation of imported technology has broken the coherence of his own system of production, resulting in lower yields and a more

dependent economic status. Research and extension personnel in Latin America, Africa and Asia are beginning to search for ways of supporting processes of endogenous technological innovation within the peasant subsectors which in many countries make up the bulk of the rural population.

Development vs. Change

The failure of development has caused a reevaluation of the factors that result in innovative change. Change is an ongoing process in all societies. It is initiated from within, on the basis of historical, social and technological experience, and complemented by the experiences of other societies or groups. If we can accept that change is the modification of present beliefs and/or practices due to a rational comprehension and analysis of occurrences and relationships in a specific situation, it becomes evident that it cannot be planned or initiated without the involvement of the society, class or group which is directly interested. Only this group's knowledge and experience of their specific historical, ecological and socioeconomic conditions can offer many of the considerations and projections necessary to determine whether this or that modification in the production system is needed and appropriate.

From this perspective, it would seem that research and extension efforts should support processes of change as opposed to implanting "development." Change processes are concerned with people's efforts to improve themselves as social beings. They ultimately lead to the formation of a collective personality built on man's confidence in himself, which is no less than an expression of faith in his/her own abilities. When people are self reliant, they become the subjects as well as the objects of their personal and group actions. The goal of this kind of change process is the destruction of structural dominance/dependence relationships among the traditionally dominated.

Research and Extension for Change

Supporting endogenous change has broad implications for national rural development policy. It implies that governments accept the possibility of a plurality of change patterns and be willing to make the structural adjustments to permit self reliance. Projects would be built on the collective creativity of research and extension personnel who would actively seek opportunities for supporting small farmers' change efforts. In order to carry out this task, teams would be interdisciplinary so that a synthesis of perspectives could more easily be reached on the basis of technical and social information exchange (Development Dialogue 1977:2).

Multidisciplinary research and extension would look toward the reinstitution of redistributive mechanisms which would contribute to the enlargement of shared group resources through: (1) mobilization of the less advantaged small farmers in a locality; (2) reinforcement of their organizational institutions; (3) Assistance in the building of mechanisms for participation in decision making (Galjart: 1980); and (4) support for the recuperation and innovation of ecologically sound and locally rooted production technologies.

The dilemma is the implication of an outsider's effect on change processes in traditionally dependent or marginalized situations where

historical factors have resulted in the incorporation of internal constraints. When and to what extent are the outsider's capabilities and ideas a favorable stimulus, and when do they represent another form of domination?

A broad knowledge of the sociopolitical, economic and ecological characteristics of the region and society where we work is one of the bases of carefully considered intervention. In many "less developed countries" where national economies are gearing themselves to industrialization, work in rural areas means a clear understanding of the interaction of the peasant production system within the national economic and political context.

## PEASANTS IN PERU

### A Concept of Peasantry

Peasants are rural farmers who produce for their own consumption and for sale, using primarily their own family labor. They possess a degree of independent control over resources and equipment for production. They are not a homogeneous group but can be defined by their subordinate relationship to the market, the state and the dominant culture.

Shanin (1972) argues that the process of land partition and merger common in the peasant community, together with family extinction and migration, limits the peasant family's capacity for economic differentiation unless it has an outside income. The use pattern of family labor makes it possible for the peasant family to work more land in the middle of the family's life cycle, and less at either end when the children are either small or have moved away. The peasant household functions as a small production unit of extremely limited resources. This makes it vulnerable to both the positive and negative forces of nature, the market and the state. Peasant farmers are continually searching for a means of bettering their livelihood, which is a combination of production for home consumption and exchange.

### The Context

Andean agro-pastoralism, in itself complex, is further diversified by salaried labor and artisan activities within family units. The Andean ecology, one of the most diverse in the world, presents challenges to both animal and plant species and is characterized by wide climatic and soil variations. The diversification of the peasant economic system associated with ecological factors makes the selection and incorporation of new technological alternatives difficult. Proposed innovations must fit into the overall system of production, generating only those side effects which the system is capable of absorbing.

Historical processes and the bilingual, bicultural heritage of the Peruvian Andes have left the peasant with a disintegrated body of knowledge for making decisions as to the long term consequences of one or another technical innovation. Development projects since 1945 have attempted to suggest or impose prefabricated development schemes to increase food production for the urban populations of the country. As a result, the living standard of the peasant family and the relationship between technological change and the autonomous process of innovation in

the context of the Andean peasant economy have been taken into account only peripherally by research and extension institutions.

The design of technologies appropriate to the social and economic organization of peasant communities as well as to the specific characteristics of the high altitude ecology (3,600 to 4,000 meters above sea level) has been neglected in the effort to industrialize Peruvian agriculture. Although some advances have been made on the larger land holdings of cooperatives and SAIS (Agricultural Societies for Social Interest), the peasant communities of higher altitudes have been left to their own devices. Their limited economic resources have left them little surplus with which to innovate experimentally. The introduction by government agencies, commercial entities and international projects of imported animal breeds and foreign technologies, with limited adaptability to highland conditions, have left peasant farmer-herders with limited appropriate alternatives for the improvement of agriculture.

Of the 53 percent of Peru's population living in rural areas in 1972, 67 percent formed part of peasant families. These families controlled 41 percent of the rangeland, 41 percent of arable land, 52 percent of the cattle and 53 percent of the sheep population of the country (Figueroa 1984). It is estimated that over 80 percent of the domestic camelids (alpaca and llama) are also raised by peasant communities. According to Figueroa, the community is not a simple aggregate of families, but rather a social sector in which specific economic relationships are established among its members and where collective economic activities and decisions take place. The economy of the peasant community is made up of three productive areas: agriculture, livestock raising and artisan activities (Jamtgaard et al. 1983).

## The Organization of Production

The majority of peasant communities in the Peruvian Sierra combine agriculture and livestock. Most communities are composed of from 100 to 300 families and control from 500 to 6,000 hectares of land, of which only two to ten percent are used for agriculture; the remainder is rangeland and barren mountainside. Water sources are sometimes available and some communal lands can be irrigated. The peasants raise cattle and sheep, and plant potatoes, peas, wheat, barley, broad-beans, quinua, olluco and mashua (traditional Andean crops), using mostly traditional cultivation techniques.

Much of the community land is parcelled for individual family use. Plots are assigned to each family taking into consideration family size, soil quality and climatological factors, for periods of time agreed upon by community custom. The community retains lands for agriculture and/or cattle raising for the benefit of the community as a whole.

Decisions on communal land use are made by a general assembly, led by elected officials who represent the community for a period of one or two years. These officials are in charge of proposing the projects that they, in consultation with the community members, feel to be beneficial for the community as a whole. When a project is approved by the general assembly, responsibility and labor are divided in an equitable fashion among the community members. Most construction, agricultural and herding work for community benefit is carried out in communal work parties. The

earnings from communally produced goods are used for roads, schools, medical and communal centers, etc.

Agricultural Production

Two-thirds of assigned land is fallow at any given time and is therefore used as pasture. Fallow periods range from three to seven years depending on altitude and soil quality (Mayer 1981). Livestock includes cattle, sheep, swine, poultry, guinea pigs, burros, and sometimes llamas and alpacas. Grazing is done on fallow and/or communal lands according to use patterns established by the communal assembly. The total number of animals held by each family is associated with its wealth and is determined in part by the relation between its agriculture and pastoralism. Most of the livestock held by peasants are either criollo (local cross breeds) or criollo crossed with imported breeds. As in crop production, yields in meat, wool and dairy products are low, due to a combination of nutritional, health and breeding factors.

Each family farms many small lots (sometimes totaling up to 35), reaching a total area of not more than six hectares and often less than one. Crops are frequently planted in associations such as maize with peas and beans, quinua with canihua, barley with alfalfa, and so on. A typical household plants an average of eight crops per growing season. Farm implements in the higher agricultural regions include the chaquitaclla or Andean foot plow, pick, shovel and different types of hoes. Sowing and fertilization are done by hand. Cattle drawn plows are used where terrain permits.

Increased dependence on external goods is causing the peasant to place larger quantities of products on the commercial market (especially potatoes and broad-beans). This is resulting in ever more exploitative agricultural practices. These include increased use of chemical fertilizers and pesticides as a substitute for fallowing, traditionally used as a form of soil renovation. (Jamtgaard et al. 1983).

Family and Labor Relations

The Peruvian peasant family is basically a nuclear one. Land is inherited by both sons and daughters in equal proportions. Men's and women's plots do not become common property through marriage although they are usually worked jointly by both partners and their children. Parents and siblings try to live near each other so they can support each other (Lund Skar 1984). Land is, however, the basic family tie.

There are two common forms of labor exchange. Minka, where labor for one task is reciprocated for labor on the same task between family and neighbors; and faena, where group labor is organized for special personal or community projects. "Reciprocal non wage labor arrangements are largely restricted to subsistence activities and communal work projects" (Lund Skar 1984:94).

Production for the market is a flexible endeavor. Lund Skar (1984:84) explains that "It is the flexibility of the relation between the capitalist and subsistence sectors of the economy that is crucial to village autonomy, as well as household (and interhousehold) viability. The relative complementarity of these two economic sectors is a basic element in cultural as well as social well being, in that the impact of

fluctuations in one of the sectors is buffered by the successful outcome of economic activities in the other."

Labor is shared by all active members of the family. Herding is done mostly by women and children, while agricultural activities are the responsibility of the men, although women participate fully in planting, cultivation and harvesting activities. Women are also responsible for seed selection and food processing. The peasant family labor force averages four people.

Mantaro Valley High Altitude Communities

The Mantaro is an inter-Andean valley which constitutes the center of institutional and commercial activities of the central region of Peru. The valley itself and its surrounding highlands are divided into three provinces (Huancayo, Concepcion and Jauja), where 254 legally recognized peasant communities are located. Of these, 64.2 percent (Jamtgaard 1982) are characterized by mixed crop and animal production. The communities where the present project is located are found on the east side of the valley at altitudes of over 3,500 meters above sea level.

The soil varies from clay like to sandy, and from black to red. The peasants take both color and texture into consideration for purposes of classification. Their capacity for water retention increases with altitude. Natural vegetation is mainly native grasses, while shrubs are more common than trees. The rainy season lasts from September to March and crops are planted between October and December in staggered fashion.

It is not uncommon for family heads to work seasonally outside the community either in mining or as agricultural day laborers. The communal assembly is made up of all male heads of families together with widows and single women who maintain a household (Swindale 1984).

## METHODOLOGICAL CONSIDERATIONS

Participatory-Action-Research

Participatory-action-research is a methodology which evolved to support conscious, committed action for change in urban community projects. It proposes that the definition and subsequent study of the causes of a problem by those affected by it, is a way of bringing about group involvement in the design of coherent action strategies for the solution of common problems. In many of the cities of Latin America, the methodology has been used to find solutions to sanitation, transportation, health and political representation problems through the mobilization of group resources and/or group pressure on local governments. The objective is to build a consciousness of the causes of problems faced by a community and to reinforce the poor's capacity to gain control over their collective destiny through joint planning and evaluation of change efforts.

In Peru the methodology was first used in rural areas during the 1970's by SINAMOS (Sistema Nacional de Mobilizacion Social) to better integrate campesinos into local and national government. The CENCIRA (Centro Nacional de Capacitacion y Investigacion para la Reforma Agraria)--Holanda Project studied the use of the methodology for the solution of productive problems in the Calca Valley in 1978 (Rengifo et al. 1979).

Presently it is used by independent projects in rural areas, but has not as yet been incorporated into the research and extension activities of INIPA (Instituto Nacional de Investigacion y Promocion Agropecuaria). Some National University research stations, such as those of the Universities of Cajamarca and Puno, have adopted it in pilot projects. This is probably due to the facts that: (1) those most experienced with the methodology tend to be social scientists or social workers who are not readily found at the planning level of agricultural programs; and (2) the development goals at an institutional level are based for the most part on the introduction of "modern" technologies that are considered to be appropriate for the whole rural population.

In traditional research efforts, research and action rely on external expertise, capital, know-how and equipment resulting in dependence. Research methods use Western models which orient development toward the use of imported technology and the increase of the GNP. It is the researcher who decides on the focus, methods and outcomes of the study in question (Fernandes and Tandon 1981).

Alternatively, participatory-action-research is based on modes of change evolved by the participants. It is directed toward qualitative outcomes and goal oriented action. Research is viewed no more as an "objective study" but as a process of liberation which begins with faith in people and their capacity to make their own decisions. Participatory research emphasizes action processes. It aims at increasing self-confidence, organizational capacity and awareness which result in collective empowering. Participatory research seeks an equal distribution of power, reliance on local resources, continued control by the people, locally evolved technology, and therefore processual, qualitative, human outcomes.

The long-term goals of a participatory-action-research process are: (1) elimination of the distinction between researcher and the people; (2) research that becomes an action-reflection-action process between the researcher/catalyst and the local people; (3) making the critical resources the people who contribute ideas, information and insights; (4) research that leads to action because the knowledge and outcomes are shared by the people; and (5) evaluating outcomes with criteria determined by the people (Fernandes and Tandon 1983).

The methodology presupposes that the directions of change are locally rooted and that the peasant farmer take an active part in the definition of problems and in the design of their solution.

There is tacit recognition that participation must take place from the definition and study stages of a problem through the action and evaluation phases. Action directed research is not mechanistic or task oriented. It implies the creative and analytical observation and understanding of sociopolitical, ecological and technical phenomena and of how these interact with other components of a system historically.

The participatory-action-research method entails building a process over time by and with peasant farmers who have common needs and interests. This group must be involved in all stages of the projects and programs of collective action at all times. Plans for action must

emanate from the group as a result of the elaboration of strategies for the attainment of goals which it has set.

It is here that the facilitator/catalyst and source of new information and technology must carefully respect the community's process toward the design of self-satisfying modifications in its production system. Oakley (1984) cites the following stages in outside agent support of the implementation of a participatory action process: (1) contact with an interested target group; (2) support for the process of group structuring; (3) work with the group in terms of building a basis for participation; and (4) decision for action to implement participation.

Within this context a project or program becomes a means of supporting endogenous change through a dialectical, non-directive process of mutual learning and problem solving for the field team and for the community, and between both.

In this kind of extension and research, the field team, supported by the institution it represents, must keep the aims of participation, self reliance, group action, and group autonomy ever present in the form of working criteria against which to measure the worth and or priority of any action in which it takes part. The team must be flexible, open and creative with possible forms of organization, communication, research and action; and it must give preference to farmers' initiatives. It is inevitable that it will have to foster a resistance to the use of inputs and technologies available to the minority, overcome its doubts as to the coherence and rationality of the farmers' knowledge, and learn how to build effective organization-strengthening bonds.

To increase their effectiveness, extension and research teams should themselves work toward the use of participatory-action-research methodology within their institutions. Living the methodology will lead to a deeper understanding of the process going on within the rural communities. Strategies for assuring the attainment of community, as well as field team goals include the ability to: (1) recognize and cope with opposing interests; (2) seek the promotion of social as well as economic benefit while minimizing costs; (3) allow for differences in concrete conditions; and (4) accommodate ongoing interaction between theory and practice in an interactive evolutionary process (Jiggins and Roling 1982).

The outside agent here becomes a facilitator/catalyst as well as an information source who is conscious that change through participatory-action-research will ultimately strengthen a political struggle on the part of peasants to gain enough power within the society to protect their interests.

Peasant farmers lack this power due to the historical processes of colonialization, imperialism and centralization that have taken place (in varying forms and to different degrees) in all of the so called developing countries. This erosion of power over time has resulted in the loss of peasants' self-reliance, self-respect and confidence necessary for exercising control over their own destiny. Participatory-action-research is a methodology which attempts to overcome the historical

constraints which have limited the poor's ability to maintain the initiative over a process of autonomous self directed change.

Participatory-action-research has not often been used to generate and test hypotheses, but to provide information that can be used to improve a program of joint social action. When combined with the farming systems approach to production improvement, it may interact toward the goal of self-reliant technological change.

The Farming Systems Approach

Agriculture is an activity of human beings, based on the deliberate and controlled use of plants and animals to produce food, feed, fiber and fuel within a specific ecological and social context. It uses resources in a calculated way. It involves people as operators, as consumers, as producers of inputs, and as components of managed systems. In the process of transformation men use their hands and skills as well as their energy (Spedding 1980).

Agricultural systems differ from natural ecosystems in that they do not simply function as a result of internal checks and balances. In the peasant situation they are managed by men and women who are unique among components in terms of the extent to which they influence the system toward the achievement of their objectives (Spedding 1984).

Agricultural systems are directed toward a purpose and their purposes are usually economic, particularly if this term is used to refer generally to the efficient use of resources and not necessarily to a monetary expression of their use. Since agriculture must always be concerned with efficiency (no one is interested in output without regard to cost), it is essentially an economic activity. This is as true of subsistence farming as of production for sale (Spedding 1980).

Any system (linguistic, ecological, market, production) is made up of a number of interacting components which are capable of reacting as a whole to external stimulae. A system is unaffected by its own outputs but has limits which are based on the inclusion of all significant feedbacks.

The systems approach recognizes that the operational units of agricultural production are systems and that changes in components or parts represent improvements only if they improve the system as a whole. One of the characteristic techniques is model building. It is used to conceptualize the complex interactions of the diverse components of a system. Considerations in building a model for the improvement of farming systems include the following: (1) description of the system in terms of its essentials (trivial vs. important) and its boundaries; (2) agreement with the farmers as to the definition of what an improvement is; (3) determination of what could be done to benefit the farmer so that he/she will not be at a competitive disadvantage with a larger neighbor; and (4) choice of the simplest model that serves a specific purpose and is built upon observations and information from real life.

Model building is aimed at the repair, improvement, modification or replication of an agricultural system. Neither the problem nor the solution can be correctly framed with reference to a single component part of the whole system. A "solution" to a problem has to result in an

improvement to the whole system or at least to the restoration of its former level of performance. Any attempt to modify a system should be prefaced by a clear response to the question of (1) what is the system to be improved? and (2) what constitutes an improvement? (The person who owns the system must tell you.) (Spedding 1984)

Much of farming systems research has focused on the improvement or modification of the technological components of farming systems. Peasant farmers, however, cannot easily separate their farming from the rest of their lives. They have to integrate their whole way of life because whole families combine to undertake all essential activities. This means that the relevant components in a peasant farming system may be of greater complexity than in non-peasant ones. Here the removal of constraints has to be economic and has to satisfy many other cultural, political, social and religious criteria as well (Spedding 1981).

The farming systems approach is based on the suppositions that: (1) a system is made up of interacting parts--ecological, social, economic and technical; (2) the owner of the system has an active role in the decisions that affect changes within it; and (3) techniques such as modeling are an aide to understanding the effects of a change in one component on the whole.

This would seem to provide a particularly appropriate framework for working with peasant farming systems. Although this application has not been widespread enough to be able to suggest the most efficient ways of comprehending and analysing the interaction of the components specific to peasant systems, it would seem to provide the flexibility necessary to allow the creative researcher or specialist to develop, with groups of farmers, the tools necessary for designing goal oriented improvements.

## The Working Proposal

Given the urgent need to search for viable alternatives for improving the peasant production systems in highland Peru, a pilot project was set up in 1983 as a joint effort between the High Altitude Research Station of the Veterinary Institute for Tropical and High Altitude Research (IVITA) of the San Marcos University of Lima and the University of California Small Ruminants Collaborative Research Support Program. The project was designed around the experiences of national institutions such as IVITA-Pucallpa, the National Technical University of Puno, and non-governmental projects such as PISCA-Cusco.

The basic objectives of the pilot project were:

1. To understand the socioeconomic, technological and economic rationalization and limitations of the production system in use.

2. In a joint effort with community members, to propose groups of alternative technologies (recuperated, invented or introduced) which could increase productivity and standard of living.

3. To validate the alternatives proposed in order to guarantee their appropriateness in the initiator, and similar communities.

The basic assumptions brought to the effort included:

1. Change processes are generated from within a society and influenced from without and must lead to the attainment of the goals of the members of that society.

2. The production system of the peasant community has an internal coherence and rationale which aims at the most advantageous utilization of land, labor and resources.

3. The peasant farmers' knowledge of biological and techno-productive processes, gained through experience and socialization, should serve as the basis for experimentation to improve the system.

These assumptions led us to the conclusion that the most appropriate means of implementing the program would be through participatory-action-research, which would entail:

1. Joint planning and research with the farmers.

2. Information exchange within the community and between the community and the technical team.

3. Progressive analysis of socioeconomic and technical information with the community.

4. Continuing evaluation and readjustment of the organizational, educational and technical aspects of the work, giving priority to those most effective in the solution of small farmers' problems.

The farming systems approach provided the second part of the methodological framework of the project. It was hoped that parallel to the usual baseline study, research station designed technologies could be validated to provide appropriate alternatives for weak points in the system. Shortly, however, two thing became evident. First, farmers had technical and/or scientific questions which they felt would permit them to make useful technological decisions on their own, when answered. Second, the ecological situation and farm scale of the communities were such that research station technology was either inappropriate or unavailable. As a result, the multidisciplinary team responsible for the project was required to broaden the farming systems approach to encompass on-site agronomic experimentation.

## THE EXPERIENCE

### Introduction

It is one thing to design a methodological framework which can provide a set of adequate tools for a given situation. It is another to adapt the framework and the tools to a specific social context. This task becomes more difficult when research or extension is to be carried out in an ecological and cultural setting where the field team does not have firsthand and/or sufficient knowledge of the techno-productive and human organizational system of the area.

For this reason, and because communities need to solve immediate problems, it was felt that time should be built into the initial phase of a project to: (1) develop the participatory process with comuneros; (2) allow for a period of data collection during which the specific criteria for more systematic information gathering, based on the particular system itself, could be set up; and (3) Permit the field team to gain credibility within the community while offering technical services to solve immediate problems.

Therefore, during the first agricultural season of the project, priority was given to the design and implementation of experiments, a community information series (programmed talks and discussions to which the whole community was invited), technical assistance and general data collection on the inter-relationships between the social, ecological and technical aspects of the system.

The method of data collection was based on the anthropological techniques of participant observation and descriptive recording. Each team member would daily record experiences, observations or incidents which were not common knowledge among team members or which would give more insight into the system. Three copies of these "cards" were prepared on a small portable typewriter: one for the community file, one for the writer and one for the project office. These cards included information on subjects such as: technical information concerning climate, soil, vegetation, crops, animals; use of inputs; disease treatment; labor use, family organization, decision making and community action; crop and animal yields; commercialization, production use and exchange.

The field team was made up of two veterinarians, two agronomists, one animal science specialist and one anthropologist. The agronomists and animal science specialist resided during three weeks of the month in the central community of the project area. The animal science specialist and the anthropologist were women.

The following short case histories have been chosen from this store of information as indicative of some of the particular problems confronted in using the methodological framework and setting directions for future planning and research. It is on experiences and data such as these that the second phase of the project was planned.

Should We Take the Risk?

The community where this incident took place is one of the first invited to work on the collaborative research effort. It is the central community in a group of fourteen smaller ones--one where the rest gather for animal markets and other district activities. Also, all traders from the higher surrounding mountain area, as well as from the valley centers, come there to exchange or buy. However, from the beginning, the community authorities were wary of being "taken" again. The previous two seasons they had prepared agricultural plots for experiments with another project that never received the necessary funding.

Eight months after the initial contact, we took part in a community assembly at the corral of the communal sheep farm. The attendance was good, but as the meeting took place during a communal work party, the number of women present was larger than usual. (When the family head

cannot participate in the work parties, another member of the family is sent in his place.) The animal science specialist described the objectives of the project, the partnership agreement that could be signed and the working method proposed. Only a few of the men showed interest--the younger ones--but two women stood up in turn to state that the dry season was unusually harsh and that many of the lambs were dying. If they agreed to the project, they asked, would there be a chance of solving some of the animal health problems? The men remained skeptical.

In response the animal science specialist explained that parasitism increases when nutrition is unsatisfactory, and that most of the sheep were infested with intestinal parasites. This was causing the wool to fall out and general physical weakness, especially in the young. When the shepherdess mentioned that a lamb had just died in the corral, an immediate suggestion was made to dissect the carcass to determine the cause of death. While the woman went to get a knife, the whole assembly gathered to see the animal science specialist at work. In front of everyone the abdomen and then the intestines were opened to show an enormous quantity of parasites. The point was made. Standing around the specimen, the decision was made to take part in the project and the collaborating group was named (five male comuneros who volunteered their time) to represent the entire community.

COMMENTARY

The most important conclusion to be drawn from this incident is that any community project has to confront comuneros; lack of confidence in outsiders. This attitude is due to many historical factors not the least of which is a general disillusionment with government programs which have promised much and solved little. The comunero in his desire to better his situation has in many cases tried new ideas and methods suggested by specialists. Most will tell you, half jokingly, that the "engineer" doesn't know how to farm and can offer evidence to illustrate a lack of practical experience.

The fact that the community was finally persuaded when they observed the animal specialist's competence at her job as well as her respect for their own concern and diagnosis in a practical situation speaks for itself. The fact that it was the women who were highly influential in giving the specialist an opportunity to prove herself as well as in influencing the final decision is of no surprise as it is the women who have greater responsibility and therefore interest in the animal production part of the system. Similarly the work party, organized to repair the communal corral, was participated in by many women who replaced their husbands in a duty which was considered by the men to be of a low priority.

Utashayli

The group of collaborators gathered one morning with the animal science specialist and the veterinarian to discuss the most common diseases in the sheep population of the community. A list was drawn up which included liver fluke, hidatidosis, diarrhea, "worms" and ectoparasites. The main contributor was a man who had almost no agricultural lands and who had been a shepherd on one of the large land holdings in the area before the agrarian reform began in 1968. After reviewing

symptoms and causes as the farmers saw them, an attempt was made to evaluate which of the diseases was the most urgent to tackle. As the discussion took place in the dry season, when forage was scarce, it was felt that the most urgent problem was parasites which were further weakening the animals. Dipping and dosification with veterinary products was brought up, but the group pointed out that although they had used these treatments until the end of the 1970's, at present the products were too expensive for all but a very few families. The discussion then turned to alternatives and two suggestions were made. One was a "green salt" which was said to contain copper and had been used on the hacienda to control internal parasites. The other was a wild tobacco, locally named Utashayli, to control external parasites. As the "green salt" was not to be found in the community, it was left aside until the research station staff and collaborating group could identify its properties, source or an economical alternative.

That left the possibility of testing Utashayli for the control of external parasites. The young comunero who had suggested Utashayli explained that he had seen his grandmother use it together with black soap on horses, cows and donkeys. The leaf itself was rubbed into the animals' hide and the parasites were seen to fall off seconds later. The possibility of using the plant on sheep was discussed and the group felt that if it were ground and diluted in water, it could be used as a dip. A day was set for the trial, leaving the group the responsibility of collecting the plant and preparing the mixture they thought appropriate.

The group decided that for the first trial, as many families as possible would be encouraged to bring a few of their sheep to be dipped so that they could observe the results firsthand. Careful measurements would be made of the mixture that was prepared.

On the day of the experiment, two veterinarians participated with the community in observing the effect of the dip on the animals. All agreed that its action was even more immediate than that of the chemical products they had used previously. In evaluating the experience, the group decided on the next steps to be taken. (1) Begin talking with all the families of the community about the need for dipping all of the animals at the same time so that contamination could be reduced. (2) Give new impulse to the construction of the community dip (an oil drum had been used for the experiment) which they had already planned. (3) Begin observing areas where Utashayli could be found and to estimate its supply so that provisions could be made for protection and multiplication of the species as it was improbable that the present supply was sufficient.

The research station team proposed that the plant be analysed in the laboratory, that successive experiments be carried out to verify the initial results and that the minimum concentration of Utashayli needed to make the dip effective be determined.

## COMMENTARY

When the possibilities of validating external, input dependent technologies in the peasant farming situation are evaluated, it must be remembered that the overall contraction of the national economy affects

the smallest producer first. The foregoing is disadoption of a technology, not because of its lack of effectiveness, but because of its cost. It is an example of the exchange of an adequate or adaptable traditional technology for an input-dependent one which, in less than ten years, resulted in an extreme decline in animal health and management practices.

The recuperation of the traditional technology and its adaptation to present needs, on the basis of the comuneros' experience, has probably greatly reduced the time required to develop appropriate technology through pure research. The alternative tested, however, is not adequate for individual use as the availability of the plant requires joint action by all community members for its conservation in the native habitat, as well as for distribution. The alternative will only be successful if it is part of a community program involving education, especially among younger farmers who have never regularly been able to avail themselves of any kind of parasite control technology.

The Liver Fluke Life Cycle

When the problem of internal parasites in sheep had been discussed with the community collaborators, a high incidence of liver fluke in sheep was cited. Research station personnel considered this to be endemic, and the means of control was identified as breaking up one or more links in the life cycle of the organism. Community members expressed the belief that this "illness" was caused by the ingestion of a small leaf found in marshy areas or at the edge of streams. For this reason cattle were kept away, when possible, from areas where the leaf was found. The technical team clarified that it was not the leaf itself which was responsible for the disease, but that the cysts which later developed into the parasite were to be found on vegetable type leaves in humid places. Because of comuneros misunderstanding, it was decided to include a talk on the liver fluke life cycle in the programmed community information series.

The talk was prepared by a research professor, with complementary graphics and programmed consecutively in three participating communities. The three sessions were attended by mixed groups of men, women and children of between 50 and 100 people. At the first meeting it became evident that although the specialist had taken great effort to make the exposition clear, in common Spanish vocabulary, the public had problems relating to what was expressed verbally and in the graphics. At the end of the meeting, when petri dishes were passed around with specimens of the shell in them, it became clear that people had envisioned the size of the snail to be about 10 times that of the real one. The coloring terms had also been misunderstood, leading all the participants to identify in their minds a benevolent snail, commonly found in the same areas as the liver fluke cyst carrier.

Between the first and second session and with the aid of the community collaborators and the field team, an effort was made to identify the local vocabulary used to designate relevant plants, animals and insects in order to facilitate a clearer communication of the problem. The petri dishes were passed around both before and after the second session; and a size comparison was made between the real life specimen and the graphics, to avoid size misconceptions. During this second talk

it was immediately evident from the interest shown and from the questions asked, that much more was being understood.

## COMMENTARY

Detailed and complex anatomical and diagnostic knowledge of cattle was exhibited by all participants in the discussion. Their attribution of liver fluke infestation to the ingestion of a certain kind of leaf was most logical, given comuneros' sources of information, observation and the elders. By taking the time to understand this rationale, it was a simple task to put more complete information at their disposal.

Our attempt to explain facts and organisms not directly observable by the naked eye, made us aware of the distinctness of the visual and verbal codes the comunero utilizes. This seriously impaired our capacity to make the information decodable. If this problem were projected, it could be inferred that in many situations, even when there is a mutual openness to exchange between researchers or extension agents and the small farmer, this communication gap may be a major reason for misunderstandings or lack of confidence on both sides.

### Bring The Women In

When the community expressed a desire to participate in the joint research effort, it was requested that five or more comuneros be named to work more closely with the project team in planning activities. These people would be responsible for making the entire community's needs known, as well as for presenting the proposed plans to the assembly for discussion and approval. They would be responsible for continuous research activities within the community such as taking climatic measurements, observing experiments daily, and working with the team to collect socioeconomic data. Although there was no gender restriction on collaborators membership and in spite of our request that women be included, the community named only men.

From the onset of the group meetings, the collaborators (men) expressed more interest in cropping, than in animal problems. Due to the nature of the project on the one hand, and the evident importance of animals in the family and community economy on the other, the team tried to alternate the discussion in the collaborator sessions between cropping and animal production themes. The parasite experiment had been quite successful, but we found it difficult to move further into animal management.

At one group meeting, the team's animal production specialist began a discussion on the possibilities of carefully identifying a sufficient number of good quality rams within the communal herd for reproduction. The rest would then be castrated so that selective breeding could lead to better quality animals. The discussion went slowly; the collaborating group members were mostly silent until one finally said: "If we're going to talk about animals, you'd better get the women in here." End of discussion.

This suggestion was brought before the communal assembly and three women were appointed to the group of collaborators. In subsequent

meetings, however, it became evident that these women did not feel comfortable in the group. They remained silent, or commented on the great time limitations they had, though they expressed interest in the project.

## COMMENTARY

In a production system based on age and gender division of labor, research and extension efforts must be directed at those who have the experience and responsibility for certain tasks. In most mixed production systems in the Andes the women take charge of animal production. Any attempt at working either with this component or with the system as a whole must focus on female involvement.

Many female designated activities, such as animal husbandry and small child care, tend to demand constant attention, limiting women's possibilities to participate in activities away from home or pastures. In addition, women's lower education and lack of experience with active group discussion makes them feel shy and inadequate before those (the men) who have more formal education. For this reason it would seem more appropriate to design activities especially for women, in the productive areas of most interest to them and in situations to which they are more accustomed--for example, grazing.

### The Degradation of Natural Pastures

The community group did not bring up the problem of degradation of natural pastures (communal lands to which all of the families have use rights). But when asked about pasture quality they indicated that this had decreased noticeably since they were children. Three possible causes were cited by the collaborating group: (1) community authorities had ceased to designate areas for grazing during specific seasons of the year; (2) the number of families in the community had increased as children married and built up their own herds; and (3) community authorities had ceased to control the number of animals permitted in the family herds. As wealth is stored in animals, each family has as large a herd as possible.

The difficulty of changing this pattern of wealth storage was immediately recognized by the team; but it was considered important to begin talking about the effects of over grazing. The topic was included in the community information series. After a careful study of plant species in the grazing areas, a talk was prepared on the selective grazing habits of sheep. Its main point was the positive selectivity for leguminous species which, if allowed during periods of initial plant growth, would gradually decrease plant multiplication.

The talk was announced in the community and the first noticeable difference in the assembly room was that the audience was 75 percent women. The exposition went well in terms of vocabulary and examples, as the animal science specialist had been living in the area for six months. As discussion progressed, the men standing at the rear, appeared to be bored; but the women whispered among themselves every time a new species was mentioned. They commented on the area where each species is found and on which animals in their herds found it most palatable. When the talk was over, the men drifted out of the room, while the women remained

to ask questions and give examples of what they had observed of their animals' grazing habits.

## COMMENTARY

The male collaborators' disinterest in the quality of the natural pastures is probably due to the fact that they have little direct experience with grazing. This incident pointed again to the need for working with those who have most responsibility and experience in working specific areas of the system

The women's interest in plant quality and growth opens up possibilities for research projects with them On the improvement of natural pastures. Implementing such projects might be constrained by the availability of women range specialists who, considering the customary gender divisions in Andean society, are important.

### From Child Spacing to Changes in Cropping Patterns

From the beginning of our work in the community, the men had asked the team for information on child spacing. We had avoided this question doggedly for two reasons: (1) project was defined as one of production systems research; and (2) we could think of no way to put the community into contact with health specialists who could provide them with adequate information, given their isolated situation.

However, it became more and more difficult and disrespectful to ignore an insistent request based on community need. The men argued their position by stating that: (1) their wives are partners in the productive labor effort, and that their health is being seriously affected by almost yearly pregnancies; and (2) since children now spend the majority of their time in the local school, there is a chronic labor shortage which means that a couple cannot themwelves work the amount of land required to feed numerous offspring.

At the time, the field team did not have any women members. So we asked a woman graduate student who was living in the community, doing research on potato storage, to look into women's attitudes toward sex education, their knowledge of family spacing methods and cultural and physical limitations that might influence the selection of alternative solutions.

We then designed a community information series of two talks (one for women and one for women and men together) where we spoke of the human reproductive system, limitations of artificial family spacing methods in the community situation, and natural methods of birth control. The meeting was attended by all the women in the community and by girls from the age of about eight. During the question period an older woman stood up to say that neither she nor her friends had regular monthly cycles. This problem was confirmed by all.

Upon analysing the situation later, we concluded that such a widespread abnormality would most likely be caused by dietary deficiencies. The team immediately programmed an information series on nutrition, based on native crops. This session was well attended--more women were present than usual. It was the end of August, and design of the season's

cropping pattern was under way. We talked of the nutritional value of each of the native grains, tubers, legumes and, also the introduced crops. We limited the alternatives to foodstufs which were readily available.

During the discussion, it was explained that two traditional crops had been eliminated from the family rotation system in the past five years. One was tarhui, a very high protein legume which is abrasive to thresh by hand and difficult to process for consumption due to its high tannin content. The other was quinua, a high protein, high altitude grain which had suffered intense attacks from birds who, the farmers reported, consumed up to 50 percent of the yield. Because of these difficulties, comuneros had decided that growing these two crops was not worthwhile.

Two months later, when the planting season was over, we observed that on 50 percent of the plots of those who had participated in the nutrition information session, small amounts of tarhui and quinua could be found. Some of the farmers said they would have planted more, except that it was now difficult to obtain seed as there had been little production in the area for a long time. The threshing, processing and bird problems remained to be tackled within the community collaborators' program.

## COMMENTARY

This situation reiterated the lack of practical scientific knowledge available to the small farmer concerning the nutritional value of crops planted for human consumption. The specific need for this knowledge has probably been created as a result of the introduction of new crops, which are easier to produce or are in higher demand on the market. Their progressive introduction into the family diet has in many cases broken down the traditional pattern of nutrition, which had guaranteed a high standard as long as customary eating habits were maintained. Studies have shown that the traditional Andean diet is of very good quality; and there seems to be little doubt that a conscious scientific rationale was behind it at one time in history. As the peasant community has lost access to this ancient knowledge, it has been left with only custom to observe. On this basis however, it is impossible for the farmer (men and women) to make judgments about substitutions which the process of innovation foments.

Peasants search for ways of producing more efficiently. When an innovation is accepted or rejected, various factors are weighed. One of the most important is how much and what kind of labor is saved or added. When an option is taken to adopt or reject new cultivation practices, the availability of technology which can make the production and processing phases more efficient must be considered. When the balance of the farmers' considerations is altered so that partial advantages are weighed differently, it is possible for innovations in or recuperation of farming practices to take place in a very short time.

This example also demonstrates women's influence on the decision making process related to family cropping plans and processing considerations. The information to which they had access immediately altered their husbands' cropping and land allocation plans.

Contour Plowing

As you stand in the plaza of the community and observe the surrounding hills you see hundreds of small plots. In February, the potatoes are in bloom. The next thing that calls your attention is that the furrows run in different directions from one field to another--in some, along the contour; in others diagonally; and in many vertically. Why? Three older farmers coincided on the following explanation. The diagonal furrows are used for slopes that tend to flood, allowing for gradual water runoff if the slope is not too steep. Contour furrows are used on the steep slopes to help water retention and avoid erosion.

But why the vertical plowing? Well, the farmers said, contour plowing is the most difficult. The farmer must be able to gauge the slope in advance and drive his ox team along the curve that he has projected. This can only be done with oxen that have been perfectly paired and trained, because they must move along together, each on a different level and both at an angle. Diagonal plowing is less difficult, but does require a well trained ox team. Since younger farmers have spent their childhood and some of their teenage years in school, they have not learned the skills of ox training nor of contour projection from their fathers or relatives. They can only do vertical plowing because it is the simplest. Everyone knows the erosion is greater, but maybe they think their children will move to the city and not have to depend on the land, they commented.

COMMENTARY

This exemplifies the role of formal education, valued by all, in the breakdown of the indigenous system of apprenticeship in farming methods. The inference might be made that although formal education is important, it often has a high cost in the abolition of other learning processes.

Technology in the peasant situation would seem to have a broader definition than it has in larger scale and resource rich production situations. Much of peasant technology is in the form of knowledge and skills rather than tools and machinery. The capacity of and opportunity for the individual farmer to learn and implement these skills, which have no direct monetary cost and cannot be purchased, can make the difference between adequate and inadequate production techniques.

Planning and Implementing Experiments with the Community

At the end of July we began discussing, with the community collaborators, experiments which should be carried out during the next agricultural season to begin in September. The principal crop in the area is potatoes (around 25 varieties are planted), which form both the main consumption and exchange base. It was therefore to be expected that the discussion be centered here. Experiments were suggested on comparative yield between native and improved varieties of seed, seed degeneration (especially with improved varieties), the effect of fertilizers on yield, and the effect of the moon on plant growth.

When these problems were listed in order of priority, the one at the top was the effect of the moon on plant growth. The older comuneros explained that their ancestors had arranged the planting periods by the phase of the moon, planting only from the the beginning of the second ascending quarter through the third quarter. This was done to insure a stronger and higher yielding crop. The group insisted that it wanted to know once and for all if the phase of the moon during which planting was done, has any effect on crop yield. The experiment was included in the list of those to be implemented.

The group then suggested that since the community planted some land jointly, this should be used for the experiments. As a result, the whole community would take part and be able to observe the results. Land was allocated, as was native seed gathered in small quantities from each family. Improved seed was obtained through the Ministry of Agriculture and the International Potato Center. One of the most discussed points was the area which would be used for each trial. The comuneros felt that five to ten square meters would not be adequate for observing results. As it seemed that experimental plots were difficult for the group to visualize, an attempt was made to design larger plots if seed was available. This was impossible in the case of the improved varieties because of the limited number of tubers available.

Having decided on the experiments and the varieties to be used, it was necessary for the team to devise research designs with simple planting procedures that would not disturb the organization of communal labor (faena). This task proved difficult as most of the agronomists had carried out experiments only on research stations, where it is easier to control conditions and management of plots. They found it difficult to simplify designs, taking into account the community's need to carry out and observe experiments within their own cropping experience. After much effort, a research design and evaluation procedure was agreed upon. Although there were some problems with the modifications required by different treatments, resulting in more work for the community, everyone was anxious to see the results of the experiments, and many predictions were made before the harvest.

Control of the experiments was carried out by the community group members and the team agronomist, while cultivation was done by the communal work party. As harvest neared, it became evident that many of the improved varieties were not doing well, and comments flew as to the worthlessness of experimentation.

One week before the set harvest date, a threat was made by a neighboring community to harvest the potatoes--which they maintained were planted on their (disputed) lands. When the threat became known, the first community (men, women and children) moved at daybreak, to save the crop. The harvest took place in such haste that only a portion of the experiments reached final evaluation.

## COMMENTARY

Identifying problems and setting priorities in participatory situations is usually a slow process. Frequently, farmers' and research or

extension worker's conceptions as to what should be done differ. Continuous group involvement can prevent giving priority to problems which are not commonly felt; but even then a balance must be maintained between experimentation and validation which will bring long-term and short-term results.

Experimentation is often seen by those not accustomed to it as a waste of resources in the initial stages, until the possibilities of avoiding a larger error can be demonstrated. Different members of the community perceive these limitations or advantages differently. The level of community involvement in decision making (total participation remains the ultimate goal) at different stages of specific activities must be carefully assessed to guarantee the success of a specific part of a strategy.

The difficulty of designing experiments or validation procedures for community situations and under community control is a big challenge. Peasants need to become more aware of the utility of isolating variables and researchers must become more creative about experimental designs which can show conclusive results to both the user and the scientific community.

Conclusions

These eight case studies point to some of the special considerations needed when carrying out research and extension in peasant communities. For the purpose of further analysis, we have grouped them under the following headings: (1) the limits of peasant farmers' knowledge, (2) factors influencing technological innovation and adoption, (3) the real producer and division of labor, and (4) the process of mutual learning and information exchange.

It is probable that these considerations have become more evident in a shorter time due to the participatory-action-research methodology used. The next chapter addresses some of the implications of these when working with peasant production systems.

## IMPLICATIONS

The Limits of Peasant Farmers' Knowledge

The case studies show that peasant farmers, both men and women, control complex bodies of technical knowledge which is often retained and transmitted along gender lines. The knowledge and skills which each gender group controls is in many cases based on accumulated social experience. In the Mantaro Valley communities, much of this can be traced to pre-Hispanic cultivation, grazing and processing technology. It would be wrong to suppose, however, that this technical knowledge is limited to that passed on within the boundaries of the society itself. New information, skills and practices have been incorporated over time, from personal experience of community members in contact with outsiders and from exposure to mass media and extension programs. Which of these channels has had greater influence on the incorporation of introduced technologies and skills has not been sufficiently studied. It must be recognized, however, that modifications made to the system are, or were thought at one time to be, of advantage to the achievement of production goals by the peasant farmers themselves. On the other hand, certain

traditional technologies survive as coherent blocks, little modified over the years.

In Andean highland communities, where the superstructure of the society was virtually destroyed by Spanish conquest, the organization of technological innovation and scientific explanation has been lost. As a result, the inherited knowledge has lost much of its explicit rational base. In many cases, it remains only in the form of skills and practices which are passed on from one generation to another through apprenticeship. This is not to say that innovations have not been generated; but this has taken place more as a result of individual farmers' initiatives than as a concerted group effort. One outcome of this process is that when farmers as individuals or as members of a group evaluate the possible effects of a proposed innovation on the system, the criteria levied are not as far reaching as they could be. Both endogenous and exogenous innovations are adopted on a trial and error basis, and the effects on the system as a whole may not be observed for years. During this period of empirical observation, if the innovation is found to be unfavorable, former skills may be lost and/or irreparable imbalances in the system may occur.

The inability of the post conquest society to provide a basic scientific body of knowledge to the small farmer, against which he can evaluate and project the causes and effects of production practices and modifications, has made him totally dependent on the limits of his or her personal and/or group analysis. Under these circumstances, this analysis is based only upon what can be observed by the naked eye and experienced in a limited social and ecological context.

Factors Influencing Technological Innovation and Adoption

Peasant farmers tend to use knowledge and skills as the main factors of production rather than tools, machinery and other external inputs. This is due to their limited access to capital and the intensive use of human labor. Knowledge and skills as well as physical capacity are inherent to the value of labor. Multiple tasks and varying degrees of responsibility over certain parts of the system are required of all working members. These special characteristics of the peasant production system must be considered when evaluating the effects of technological innovations. Tasks and practices cannot easily be passed across gender lines, just as tasks cannot be added during times and in places where other tasks must be carried out. Imbalances may be created not only on a physical or technical level but also in power distribution within the community as well as between sexes.

Since the peasant production system seeks the most efficient use of resources and therefore integrates multiple productive activities, the considerations levied on innovations are many. Distribution of power and seasonality and location of tasks can be added to the more apparent ones of labor availability, capital resources and land use. Only a small portion of peasant farming production is put on the commercial market. The majority is destined for home consumption and for non-monetary exchange outside the marketplace. Produce is exchanged for labor, expertise and services, and is used to meet many types of social obligations. These uses often require certain types of crops or animal products at specific times of the year. Crop or variety substitution

then is not always evaluated in terms of absolute yield but by other criteria such as social acceptability, processing quality, storage capacity and palatability. Another major consideration may be possibilities for multiple use as fodder, stubble grazing and human food. Introduction of improvements in the plow, for example, must take into consideration not only the depth of topsoil in a given area, but also the capacity of an ox team to pull it under high altitude conditions where the oxen are small and their physical capabilities limited by poor nutrition.

Most peasant systems in the world work within an historically developed, coherent organization of production where innovated technologies have been seen adequate for solving particular problems. Many technologies introduced today aim to solve the same problems more quickly or effectively. This is true for the substitution of traditional control of animal parasites with plants by chemical control. In many cases, chemicals can be more effective if the capital to obtain them is available. But since the peasant has such limited access to capital and since his relationship with the market fluctuates drastically, introducing external, input dependent technologies may simply guarantee the future degradation of farming. When capital is not available to obtain the necessary inputs, the farmer will probably obviate what might have been important management practices. There is little evidence that the peasant will re-adopt traditional technologies when introduced ones have been adopted and failed, unless he is externally stimulated to reevaluate his own historical technological practices.

The Real Producer and Division of Labor

As noted above, most peasant mixed farming systems have organized production around a division of labor by gender. This is not only a division of labor among family members by sex, but also a social division along gender lines that has a long history. The implications of this are not only that male and female members of the society carry out certain tasks, but that they control the bodies of technical knowledge and the skills needed for managing the areas of production for which they are responsible. This control over knowledge and skills related to specific production areas is linked to the decision making power men and women have over the production process itself, as well as over the destiny of the production. This is not to say that within a family unit men or women have complete liberty to make decisions, even within their areas of responsibility; but there is evidence that responsibility itself implies varying degrees of decision making power depending on the specific social situation.

Anthropological studies give evidence of the existence of checks and balances within peasant family and community units which permit women to check men's productive and political decision making power and vice-versa. This suggests that decision making responds to a complex interaction of checks and balances which safeguards the responsible producer's more profound knowledge of the problem, at the same time that other members of the joint productive effort are guaranteed enough control over some production elements so as to maintain a recognized influence. For example, although men in the Mantaro Valley are responsible for agricultural production, women do the seed selection and distribute the stored produce.

The interaction of tasks along and between gender lines has broad implications for the transfer of knowledge and technology. In the situation described here, it would be useless to train men in potato seed selection if women carry out this task. If the task itself were transferred from women to men, the men would not control the historical technical knowledge available to the society which would permit an easy incorporation of new skills. Furthermore, their takeover of the task might result in the loss of women's control over any decisive part of the agricultural production. Training men in animal management could be a risky undertaking in the same system, as it is women who manage the animals. Such training might be wasted; or worse, men might then, with their new knowledge, feel the right to make decisions that override those of women who retain, in this activity, their area of productive independence.

In a social system where activities of all kinds, social and productive, are divided along gender lines it is logical that outside agents will cause less damage to the power balance within the community if they respect this division. When a male animal science specialist enters a community where women are responsible for animal husbandry, he still tends to find contact with male counterparts easier. He therefore unconsciously reinforces men's right to give information and make decisions regarding animals. This can later be reflected in the respect men show toward their wives' productive efforts. The same specialist could feel that little is known about animal health, management, breeding and grazing, therefore deeming the peasant ignorant, when in truth a great deal of knowledge exists, but among the women and not among the men.

It is quite possible that a complete balance between male and female decision making in production never existed in peasant systems, or that the influence of other more male oriented societies has created or reinforced the existing imbalance. In most situations, women are now at a disadvantage. They have had less access to formal schooling as well as to contact with outside agents and institutions. This often makes them put themselves voluntarily into secondary positions when communication with researchers and extensionists is needed. This means that if research and validation are to be carried out with the producers themselves, when these producers are women, much more time must be given to the building of participation and allows for the expression of ideas and knowledge among women.

## The Process of Mutual Learning and Information Exchange

The main channels of knowledge concerning the skills and technologies required for efficient production within peasant communities continue to be contact with elders, personal and group experience and observation. Most techniques and biological facts are learned in apprenticeship situations. Girls work with their female relatives and young boys work beside their fathers. The school, implanted in most peasant communities in Peru has interrupted this apprenticeship in two ways. First, it occupies children's time in the classroom when they would have been learning through working with their parents. Second, it reinforces an urban bias which ultimately leads children to think of their future in urban rather than in rural areas. If future peasant farmers, men and women, are to again become creative and innovative in their production

activities, they must begin to revalue themselves within their rural context.

This process can be enhanced by the respect that outside agents show for the farmer's knowledge, and by his or her willingness to learn from the peasant producer, for pride in ourselves grows when we become aware that our knowledge can be of use to others. Where historical conditions have contributed to the progressive loss of peasants' self-respect or have directed their goals away from agricultural production, rebuilding a sense of confidence, dignity and equality can be slow.

Areas for Further Research

Peasant farming systems link agro-ecological and social factors more closely than other types of farming systems do. Research is needed on the interactions between the social and technological factors of the system. An understanding of how to support change within peasant production systems could be increased if more was known about the following phenomena: (1) the effect of sex, age, multiple tasks and labor migration on availability of labor for specific tasks, distribution of knowledge and skills, and possibilities for measurement of labor input; (2) the social and economic uses of non-monetary exchange, and the effect of these mechanisms on the desirability, value and types of crops and animals raised; and (3) the technologies (i.e. cultivation practices) learned by the subsistence farmer through family apprenticeship (informal education and experience) which is not standardized but which is an important input into the system.

## CONCLUSIONS

The case studies and their implications have exemplified the complexity of the process of improving the peasant farming system, both for the small farmer and for the researcher or extensionist. They highlight:

1. The need for an interdisciplinary effort aimed at group strengthening, communication, education, research and validation, with the peasant farmer.

2. The need to involve more and more of the poorer farmers who, because of their poverty, are the most difficult to reach.

3. The need to involve the age and gender groups responsible for different parts of the productive process. This entails taking into consideration social and organizational patterns specific to different peasant situations.

4. The need to design, with the peasant farmer, appropriate methods of data collection and analysis on the interrelated parts of the farming system so that the enhanced knowledge can serve as a basis for farmer, researcher and extensionist to set priorities on problems to be solved.

5. The need to direct research toward cost-effective, easily adaptable technologies, from modern Western efforts as well as from traditional systems.

6. The need to support the interaction of peasant community groups so that solutions can be easily interchanged and adapted.

The overview of the problems of "development" together with the review of methodological considerations have led us to put special emphasis on these theoretical statements.

Change is an ongoing process, built upon the historical knowledge of a society and drawing on outside experiences. It leads to the modification of relationships and technologies in such a way as to better utilize human and physical resources available, for what is considered by a specific group to be to the best advantage, toward the attainment of short and long-term goals.

"Development" is a term used to describe a specific kind of externally stimulated and controlled change which is only assumed to be advantageous to all.

Participation describes human interaction. It is what has permitted people to modify their social, political and productive organizations over time. The value placed upon it historically in a given society has differed, but every human being participates and can participate more.

Although all methodological frameworks constantly undergo a process of evaluation and modification, we feel that a combination of participatory-action-research and the farming systems approach for the support of change processes in peasant communities has shown positive results. Only time and experience will lead us to better state their limitations and possible ways of overcoming them. A methodology is no more than a means for attaining an end. The intermediate end is that of involving researchers, extensionists and peasant farmers together in the task of improving the quality of life of the rural poor.

The final aim is the attainment of self-reliance, defined by Galtung (1980) as the state in which there will be an absence of dependence attained through an equal access to and distribution of resources within a society. Social groups will interact and exchange but not be bound or subjected to disadvantageous situations, nor will they cause them.

Self-reliance can be achieved only by building on experience so that the participatory learning process which is a corollary of self directed change can take place successfully.

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