

**OLD IMAGES AND NEW CHALLENGES:
RETHINKING THE MISSION
OF AGRICULTURAL SUPPORT SYSTEMS IN ASIA**

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INTRODUCTION

Agricultural support systems include institutional and policy arrangements that provide the technical, educational, economic, and marketing supports for agriculture. Contemporary government-financed agricultural support systems in South and Southeast Asia evolved principally to strengthen productivity growth for basic food and agricultural commodities. During the last three decades, they have been the cornerstones of both rural development strategies (through their focus on bringing technology, credit, and marketing services to selected agricultural producers) and urban food policies (through their focus on stock and price management for basic cereal grains). Today, even as scientists at the International Rice Research Institute talk of a second green revolution for irrigated rice-farming, Asia's agricultural support systems stand at a crossroads between old images of agriculture and rural life and new challenges of rural diversification and transformation. The choices that the systems make for mission and direction will have enormous consequences for rural welfare, agricultural dynamism, and the viability of national food systems throughout Asia.

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During the 1960s and 1970s, many of the agricultural support systems in South and Southeast Asia were mobilized as never before as part of strategies to support the diffusion and adoption of "green revolution" technologies and techniques for rice and wheat production. The focus was strong on lowland, irrigated farmlands and the households cultivating those lands. In the 1980s, the support systems were expected to continue fulfilling this mission while facing declining financial support from government, falling participation by farmers in national rice and wheat production programs, and, in many instances, competition for technological advance from domestic and transnational proprietary agricultural research (Evenson and Pray 1991).

In the 1990s, it is apparent that agricultural support systems in Asia's developing countries face two additional challenges beyond the traditional mission they have pursued for thirty years. These challenges are the issues of sustainable development and poverty alleviation. These challenges do not simply impinge on the systems' capacities to address their traditional productivity mission — they require, in fact, a redefinition of the support systems' fundamental mission. This is true because both issues require the support system to shift its attention from a commodity focus to an ecological and systemic focus and from an endowed area concentration to a marginal area concentration.

The issue of sustainable resource development has acquired wide recognition and has become commonplace as an objective of national resource management plans, but what it actually means for the mission and management of agricultural research and extension is still less clear. Experience with farming systems research and integrated pest management, for example, often involved more intensive cultivation and higher utilization of chemicals. The issue of poverty alleviation is not new, and indeed is the subject of an enormous literature, but it is still not clear that the full implications of this issue have been faced by contemporary agricultural support systems in Asia. This is illustrated by the problems of the systems in dealing with farm households in less well-endowed areas and with landless laborer households generally. What is clear is that, together, both

challenges may mandate a significant rethinking of the mission of the agricultural support system.

To speak of rethinking the mission of the agricultural support system is no small task nor is it a task that can usefully occur in a vacuum. Agricultural research and extension exist and have already played crucial roles in Asia's recent agricultural development. Any reassessment of the roles of agricultural research and extension should not do anything to weaken this system, but rather should emphasize directions in which the system can realistically and effectively move (cf. Echeverría 1990; Antholt 1994). This paper is designed to contribute to this objective by indicating one way of determining what the challenges of sustainable development and poverty alleviation might mean for the mission of agricultural research and extension. To do this, the paper will briefly review some of the most important factors influencing the future of agriculture in Asia, examine the concept of sustainability as a criterion for judging resource management, and comment on the status of Asia's agricultural support systems. With these points as a background, the paper will focus on limited-resource farmers, the group that may be most germane if agricultural research and extension are going to effectively increase their concern for both sustainable resource development and the alleviation of rural poverty. The discussion will focus on a crucial distinction: between agricultural support as a transfer process and agricultural support as a transformational process.

THE FUTURE OF AGRICULTURE

Since the early 1960s, overall production of major food grains in Asia has increased dramatically. For example, rice productivity increased from 1,500 kilograms per hectare in 1965 to over 2,500 in 1985 in South Asia and from close to 1,600 kilograms per hectare in 1965 to almost 3,000 in 1985 in Southeast Asia. This growth is a result primarily of technological innovation represented by higher-yielding varieties and increased utilization of fertilizer, infrastructure improvement represented by significant investments in roads and irrigation, and more intensive cultivation represented by double

and triple-cropping on newly-irrigated fields and the opening of new agricultural areas.

At the same time, in parts of South and Southeast Asia, per-capita food production has grown only marginally and, in some places, grain yields since the mid-1980s have shown evidence of leveling. This is a troubling prospect given the complacency that appears to have set in about agricultural development in Asia. A variety of factors, ranging from environmental degradation and urban expansion to economic mismanagement, civil disorder, and political interference have been associated with declines in prime agricultural areas actually harvested with food crops. For example, food policy — the effort, in principle, to strike a balance between low consumer prices (consistent with reducing inflationary pressures on wages) and high producer prices (consistent with ensuring incentives for adequate domestic production and possibly reducing incentives for rural-urban migration) — has had a mixed record and, in many cases, may be suppressing both agricultural incomes and productivity without noticeably improving overall nutrition levels (Mann and Huddleston 1986). Additional factors, including rural unemployment and population growth, have been associated with increases in marginal areas being utilized for food production. The combined result can be lower average productivity.

At least five additional reasons for existing or prospective problems in maintaining grain yields can be noted.

1. In some cases, changes in agricultural production are statistical artifacts. In many countries, statistical systems for estimating crop production have generally undersampled more remote farmers. As the systems improve their coverage, reports of “declining” yield can be expected. For example, for many years rice productivity estimates in Indonesia and the Philippines were based heavily on samples drawn from farmers participating in the governments’ rice support programs. This tended to overestimate average yields across agroecosystems. Today, as more differentiated data become available, it appears that productivity growth has slowed down

significantly and that average productivity levels are lower than what were previously projected.

2. There are growing problems of pest resurgence. Extensive use of commercial pesticides by farmers who could afford them helped check pest damage on rice and wheat during the late 1970s and early 1980s. However, insect pests evolve and adapt very quickly to environmental changes. There has been evidence for the last decade that the evolution of pests affecting Asia's major food crops is outpacing the evolution of chemicals to control them. Pest problems are becoming more serious and there are no simple answers available in terms of "off-the-shelf" chemicals. Attention is turning to other strategies — ranging from breeding varietal resistance to altering planting and cropping schedules — that might be more compatible with the realities of pest evolution and also more accessible by a wider range of farmers. But in the interim, vulnerability to serious pest problems is increasing.

3. There is a continuing trend of agricultural land conversion and deterioration. This is a result of expanding human settlement patterns. A principal consequence of these processes is the removal of prime agricultural land from agricultural use, especially within the catchment areas of major urban centers. At the same time, continuing population pressure on more marginal land resources, especially in sloping and upland areas and on marginal soils (e.g., coastal wetlands), is weakening the already limited productivity potential of these land resources.

4. There is a continuing problem of irrigation deterioration. Investment in irrigation is one of the major chapters in the "green revolution" story for rice and wheat. However, while the projected need for new irrigation facilities — especially in South Asia — amounts to several billion dollars, maintenance of existing irrigation facilities in South and Southeast Asia has proven less than

satisfactory in many instances. Inadequate maintenance of irrigation facilities can seriously undermine productivity. For example, poor maintenance is frequently associated with poor drainage. Eventually this leads to water-logged soils. Improper canal maintenance can impede water flow, reducing the reliable irrigation service area. In the last decade, more attention has been given to irrigation management (e.g., through support of the International Irrigation Management Institute in Sri Lanka and much greater recognition of the roles of water user associations), but solving the problem of effective irrigation services will take considerable time and commitment. In the interim, productivity within many irrigation systems will continue to be less than what is possible and will show signs of decline.

5. There is a transformation of rural labor markets in Asia which reflects increasing levels of work and income diversification. In some cases, this process is a result of stagnant or declining agricultural productivity. Households are exporting labor (usually women and children) into nonagricultural labor markets in an effort to maintain their welfare levels. Unfortunately, however, the withdrawal of labor from agriculture can lead to a downward spiral in productivity. In other cases, rural labor diversification is associated with rising agricultural labor productivity. In these circumstances, off-farm work becomes feasible as a welfare augmenting strategy. However, here too, if the withdrawal of labor and investment from agriculture is too aggressive, the viability of the household's agriculture base can be weakened. In both cases, labor diversification represents a significant challenge to an agricultural support strategy which assumes that all household members are full-time farmers (Koppel, Hawkins and James 1994).

Consequently, despite the successful agricultural production picture that can be seen in the aggregate for Asia since the mid-1960s, there are many warning signals to suggest that the foundation for maintaining this

success is not impregnable. At the least, the aggregate picture masks considerable variability.

THE STATUS OF AGRICULTURAL SUPPORT SERVICES

In the face of this variability, attention is again turning to the roles of agricultural support services. The institutions comprising the support system have served as mechanisms for bringing goods and services to and from rural areas in ways that have influenced the allocation of land, labor and capital within rural resource systems. The net effects of this system have been widely acclaimed as very positive (e.g., Evenson et al. 1979; Pinstrup-Andersen 1983; Ruttan 1978).

However, it is important to acknowledge that these same institutions also function as policy arenas which permit social, economic and political interests both within and outside the institutions to operate in the allocation of scarce administrative resources in support of agriculture (Burmeister 1984; Chambers 1983; Haas 1979; Inayatullah 1979; Koppel and Oasa 1987; Korten and Alfonso 1983; Lea and Chaudhri 1983). In recognition of this point expanded (de Janvry 1985; Lipton 1985), uneasiness grew – that the institutions of the agricultural support system do not always permit market forces to operate and worse, that these institutions might be promoting interests that are inefficient. Today, this feeling is expressed against a background of increased attention to policy reform, especially with regard to relationships between “government intervention” and market-determined price-formation processes. A fundamental generalization is repeatedly advocated in development policy discussions: Successful economic development in rural areas is the outcome of policy reforms that reduce government intervention in rural commodity markets.

However, asked much less often is: What parts of the political and administrative system would be referred to by the call for reduced participation in the economy? What, for example, does the call for policy reform mean for the status of publicly-financed agricultural support services? Answers to these questions are not straightforward. After all, the state’s

relationships with rural society throughout Asia are multidimensional, employing policies, institutions, and technologies as instruments. Rather than criticizing government's role in agricultural development per se, it may be more worthwhile to first understand the nature and impacts of specific patterns of involvement.

For example, while there are equivalents of the Department of Agriculture in every country, in almost all cases, governments' relationships with agriculture are only *partially* exercised by or through these departments. Moreover, the case can be made that the role of these departments in the overall food and agricultural policy formation and implementation picture is declining while the roles of other agencies, some only nominally connected to agriculture (such as Departments of Finance or Trade), are increasing.

Strategies such as vertical integration and risk shifting through alliances between market power and state action have become important dimensions of change in the organization of rural commodity systems, as the Philippines under Marcos demonstrated. Control of virtually all major agricultural and food commodities — including coconut, sugar, rice, corn, and wheat — was assumed by a variety of "authorities" outside the normal agricultural support system. Since 1986, many of these parastatal entities have been abolished or their roles have been modified, but issues of intervention and administered markets remain important nevertheless.

The Philippine case is not unique. Similar patterns can be seen in Bangladesh, India, Indonesia, and Thailand. The acceleration of state intervention to control rural commodity systems, purportedly to stabilize domestic prices and production in the face of volatile international markets, was a pervasive phenomenon throughout Asia during the 1960s and 1970s (Canlas et al. 1983; Clarete and Roumasset 1983; Dell 1983; De Leon 1982; Harriss 1984; Kruegger 1974; Sathyamurthy 1985). It was precisely against this background that parastatal organizations appeared. These are quasi-state corporations that have been delegated government powers to regulate, allocate, and tax, but are not routinely accountable to "normal" government staffing, financial management, and reporting conventions. Parastatals have

acquired important roles as exclusive agents of the state for commodity trading in many countries of the region. These kinds of changes can have significant implications for the organization and performance of affected rural commodity markets and can be closely associated with the emergence (and state endorsement) of monopsony power in rural marketing systems. An often-forgotten point is that what we usually think of as agricultural extension functions in this complex and frequently unfriendly environment.

Other developments that are already existing or on the horizon can present additional problems for the support and mission of public agricultural research and extension. For example, a technology transformation that is in progress may have more far-reaching effects than the technological change that characterized the "green revolution." Science and technology are holding out the enticing prospect of substantially increased and less variable production but are in the framework of production systems that may be very different from those common today. Biotechnology already shows a significant potential not simply to modify (or in some cases enhance) existing technological bases of agricultural production, food processing and animal husbandry, but also to be very compatible with a restructuring of the economic, institutional and political foundations of Asia's agriculture (Brady 1982; Buttel 1983; Koppel 1985; Randolph 1984; Swaminathan 1982).

For example, what will the hybridization of basic food crop seeds mean for Asia's small farmers, the vast majority of whom do not buy seeds? Will many farmers be motivated by expected economic benefits to buy seed or will income inequalities within agrarian Asia be exacerbated, with the better endowed farmers and millers capturing most of the benefits of technological developments such as hybridization? The broad changes associated with biotechnology have fundamental implications for the roles of public agricultural research and extension and for types and consequences of privatization that may occur in Asian agriculture. Who will be the agents and the benefactors of the more proprietary technology dissemination systems? What will the increasing privatization of germplasm-based research mean for the "publicly" supported agricultural support system? For international

cooperation in technological improvements for Asia's agriculture? For the management of the specific natural systems where these germplasm materials currently exist in the wild?

Biotechnology is only one example of technology transformation. Other examples include the growing importance of processed foods in many Asian diets, the introduction of new preservation technologies that permit longer-term storage of perishable foods, and the effects of transportation technologies on the marketing areas of various products. These are among the signs that postproduction dimensions of Asia's food and agricultural systems are becoming more important. These are areas where extension has generally not been active. As the importance of these postproduction dimensions increases, especially in terms of income and employment generation, will there be pressure on agricultural support services to extend assistance? Will competition for public financing of agricultural support services become more intense? Clearly, these and other transitions have enormous implications for an agricultural development strategy that has strongly emphasized and encouraged public investment in agricultural support facilities.

THE CHALLENGE OF SUSTAINABLE DEVELOPMENT

There is considerable discussion these days about sustainable development. The extent of discussion could lead one to believe that there was consensus on what sustainable development is all about and that whatever it was, it was certainly a "good" thing to support. However, the consensus is largely accidental. At best, it represents endorsement. More commonly it represents acquiescence. For the most part, it does not represent commitment. The good news is that there is a broad idea about development strategy and objectives that people support. The bad news is that the idea is not clear. What are the implications of supporting this idea? What sacrifices may be required if the idea is put to practice? Who will have to make these sacrifices?

As a result, agricultural support systems throughout developing Asia do not yet find themselves in a strong position to support purposeful action based on the idea of sustainable development. What exists is an accidental consensus, an indication of apparently growing global opinion. What do not yet exist, however, are sufficient indications of a shared and authentic commitment. These are required to yield an effective foundation for action. What is needed is an intentional consensus, one built up from explicit and open dialogue, premised on a transparent exchange of information and ideas, consenting to multiculturalism, and accepted and supported by compatible social relations and political institutions.

Understanding the Problem: The Accidental Consensus

What is sustainable development? At first glance, the answer seems to be simple. Sustainable development is a rate and form of development that can be continued given specific natural and man-made assets. Factors which constrain continuance (e.g., absolute depletion of critical resources, high population growth relative to available resources, loss of access to critical resources, environmental degradation) have to be confronted. Better management of existing systems and alternative technologies and socio-economic arrangements are often advocated as solutions. That much appears obvious and is certainly worthwhile.

However, what happens if we ask, "Beyond notions of dependence and limits, what does sustainability actually mean?" There are many answers. While many of the answers are offered with high degrees of self-assurance, on closer inspection many of the answers are inconsistent with each other. For example, neoclassical economic notions of sustainability focus on efficiency, market-determined growth in resources, and (predictable) equilibrium solutions to the allocation of resources. These notions are inconsistent at many points with sustainability as seen by ecology (Batie 1991; Lele 1991), where issues of instability, unpredictability, irreversibility, and the problems of absolute scarcity get strong emphasis. Yet, as shown by relationships between poverty and environmental degradation in the third world and industrialization and environmental degradation in the first

world, the security of economic growth and the integrity of ecosystem development are strongly linked. But how?

The confusion about sustainable development is not limited to arguments about the relevance of disciplinary theories. Sustainable development is considered rightly to be a challenge for policy. As a policy problem, the sustainable development discussion is characterized by a split. Some see sustainable development as fundamentally a "technical" problem susceptible to technical solutions. Others see sustainable development as a sociopolitical problem requiring sociopolitical solutions.

The language of this debate is often one that presents an ideology of neutrality on one side and an ideology of imputed intent on the other side (Koppel 1987). This is important because it reveals that many of the arguments about sustainable development are not actually hypotheses about empirical issues, but rather demonstrations of ideological expectations. As a result, there are few systematic empirical referents for sustainability. Indeed, and this may be surprising to some. We do not now have any agreed satisfactory ways of measuring sustainable development — in natural or managed biophysical systems (ADB 1991; Carpenter 1990).

Many governments now enunciate policies in terms of sustainable development. Yet, these do not differ from what has just been stated. The issue is how to assess both intentions and capabilities. There is a significant amount of new window-dressing in the development business, but we should not fool ourselves: the mannequins are often still the same and the clothes they wear are not necessarily new or different. For example, how many forest policies are now stated in the "new" idiom of sustainable development even as the rationalization of practices from the older idiom of open cutting and the forced relocation of indigenous populations continue?

As both a political and ethical problem, we have to recognize that the calls for attention to sustainable development are also (some would say primarily) calls for (re)distributions of the costs and benefits of development. These (re)distributions reflect both instrumental and expressive purposes. The question is whose values are being expressed and promoted?

What is sustainable development an instrument for? And what power is being exercised over whom to achieve these values? When people demonstrate in Tokyo or New York to save the Brazilian rainforest, who are they really saving it for and who, in fact, are they saving it from? When sustainable development is translated as conservation, protection, and carefully regulated use of upland areas, for example, who actually benefits and who actually loses? We know that the answers depend significantly on who is exercising regulatory power and for what purposes and that these purposes are not necessarily derived from concerns about ecological sustainability (Contreras 1991; Ferguson 1990). Is it a scientific generalization or only a coincidence, for example, that sustainable development is more often a rationale for creating parks and preserves than it is for undertaking agrarian reform?

Finally, it is important to recognize the complex context in which the sustainable development issue rests. The sustainable development issue is in a cross-current of several quite different discourses. There is an international discourse, a local discourse, and an interactive discourse. At the international level, the contours of many of the sustainable development discussions reproduce patterns identified by the North-South debates. Sustainable development is an agenda frequently advocated by affluent countries to developing countries. Industrialized countries are telling other countries in earlier stages of industrialization to reduce air pollution, protect forests, conserve energy, etc. At the local level, there are undeniably authentic local rural protests against resource destruction and resistance to attempts by urban middle classes to impose their own sustainable development agenda on rural peasant classes. An example is peasant resistance to logging in Thailand.

While these two discourses are well-established, a third discourse is emerging. It is about the interrelation of international action and local action. Peasant resistance may not be simply to other local parties, but may be directed at transnational actors. This is the case, for example, in the forest areas of Kalimantan and the tree plantations of Mindanao. The sustainable

development discussion is part of and, in different ways, is representative of each of these three discourses.

Implications for Agricultural Support

The key to sustainable development is the recognition of interdependence—temporally, spatially, and functionally. We need to understand the linkages in development actions between the short term and the long term. This is where ideas about incrementalism, irreversibility, and risk come into play. We need to recognize the linkages of development actions across space and, often, the irrelevance of administrative and political boundaries as quarantines particularly for environmental problems. And we need to accept that development actions in one sector have consequences that are rarely restricted to that sector. We may have recently “discovered” energy-environment and poverty-environment linkages, but those linkages have a long history.

This multidimensional interdependence is not absolute nor uniform. Of particular interest is interdependence among three areas of concern. The first two concerns are widely recognized: economic security (which can cover issues from growth to poverty amelioration) and environmental security (which can cover issues from conservation to exploitation). The third concern is democratic security (which can cover issues from accountability to participation).

The choice of democratic security as the third concern requires some additional explanation since it is especially important for understanding the implications of sustainable development for agricultural research and extension. Political security might have been chosen on the argument that the stability of political arrangements is a necessary correlate of (stable) sustainable development. I would agree that there is an empirical association in many cases of stable political arrangements with economic and environmental security. However, that association should be viewed as a problem rather than as a desirable property. In a fundamental sense, sustainability is the continual making and remaking of a social contract. This is a contract about the nexus of risks and benefits from the intersections of the economy,

the environment, and the polity. Both the contract and the processes of contracting define and reflect ideas about justice and equity in how those risks and benefits are allocated. It follows that what is crucial is not the stability of the state or the durability of any particular regime but rather that the contract and the processes of contracting represent and are accountable to the broadest range of social interests. After all, sustainable development is not a technically determined or ideologically prescribed end-state of relationships among economic, environmental, and political security. Sustainable development refers to characteristics of processes for making choices about the interdependence of economic, environmental, and political security — across different temporal, spatial, and functional scales.

These processes are profoundly social and political. They are social because the issues of economic, environmental, and political security are fundamentally issues about social relations, and about how individuals and groups relate to each other through the sharing of risks and benefits from specific development paths. They are political because these are ultimately issues about the exercise, consequences, and accountability of power. From this perspective, then, the issue of sustainable development is about the interdependence of economic security, environmental security, and democratic security and the capability of societies to grasp and confront this interdependence. More than these, however, is the issue of how choices are identified and made when it may well be impossible to simultaneously maximize the properties and goals associated with each individual area of security (Charoenwatana and Rambo 1988).

THE CHALLENGE OF LIMITED-RESOURCE FARMERS

If Asia's agricultural support systems are going to make significant progress in addressing issues of sustainable development and poverty alleviation and continue their traditional emphasis on agricultural productivity growth, the task will most likely be through redefining their mission in relation to limited-resource farmers. These consist of farmers who traditionally lack access to agricultural support systems because of limited resource endow-

ment, or because the support system is simply not available to them. They include approximately one-half of Asia's rice-farmers who cultivate rain-fed upland and lowland rice, for which relatively little technological support is available. They also include farmers who cultivate irrigated lowland rice, which has received intensive technological support, but who are too remote or poor to attract sustained attention from national agricultural support systems. Finally, these also include many farmers in the semi-arid tropics who have to depend on highly variable rainfall to grow their crops.

The task will not be easy. A large portion of what has been learned in the course of Asia's agricultural development experience during the last two decades has come from contact with a large group of farmers who are, relatively speaking, among the more well-endowed, more accessible, more literate, and more commercially-oriented members of the agrarian community. By comparison, limited-resource farmers will expect their farming operations to directly support a broader range of household's food and energy needs. They may not be incorporated into anything other than purely local commodity markets. They may be relatively less connected with the agricultural support systems that have driven much of Asia's agricultural development during the last two decades. They may rely more on their own agricultural experience and orally transmitted local agricultural knowledge than on research station science, formal extension, and printed bulletins. They may live in communities with relatively less commercial and marketing infrastructure or government services, fewer opportunities for off-farm employment, and possibly higher average incidence of unemployment, underemployment, episodic malnutrition, and disease. They are unlikely to be anything other than marginal users of manufactured agricultural chemicals. And the chemicals that they do use are most likely fertilizers.

Limited-resource farmers are often referred to, in some short-handed way, as "traditional." But, in fact, what would this mean? Are the farmers traditional (in some cultural or psychological sense, for example) or are the technologies they use traditional (relative to some standards of "modernity," for example)? Does the term "traditional" convey the belief that such farmers are, in some fundamental way, different from other "nontradi-

tional" farmers? If so, what is the basis of this fundamental difference? For example, are the differences based on the processes which yield decisions and behaviors about resource allocation and utilization or on the outcomes of these processes?

More generally, are the green revolution farmers and limited- resource farmers simply two points on the same agricultural development curve, differing only in degree, or are they points on distinct agricultural development paths, differing in kind? Are the differences between these two types of farmers virtually inherent (and practically immutable) or predominantly acquired (and possibly transitory)? Do the differences reside in the structure of certain relationships, the operation of specific resource management processes, or in the fundamental roots and "rules" of resource allocation and utilization? These are difficult issues. If the differences are inherent, then the challenge represented by agricultural development may be quite substantial (Koppel 1981). It means, for example, that much of what is known about one group would not necessarily apply to the other. If, on the other hand, the differences are acquired — for instance, as a consequence of significant spatial remoteness — then in principle, it is only necessary to overcome or compensate for such an external "distortion," and more familiar strategies can proceed.

Inherent or transitory, it is necessary to understand why the differences occur and why they may be less tractable in some cases than others. One way to begin is to ask what is known about technology adoption and, more specifically, what might apply to limited-resource farmers? Then we can ask what the answers to these questions mean for agricultural extension.

TECHNOLOGY ADOPTION AMONG LIMITED RESOURCE FARMERS

Technology adoption to any kind of farmers can be reduced to some deceptively simple questions.

1. What is being adopted?
2. Who does the adopting?
3. Why does adoption occur, and implicitly, why does adoption not occur?
4. What happens after adoption has occurred?

A good deal of information about technology adoption by farmers in Asia has been learned within the context of sponsored programs of technology diffusion, usually among farmers who do not share most of the characteristics described earlier as being those of limited-resource farmers. This is not to suggest that such programs have not reached limited-resource farmers. They have. However, there are some generalizations that need to be qualified or even reconsidered when limited-resource farmers are defined as a primary group of adopters.

What is Being Adopted?

Adoption research has worked best by identifying a specific material item (such as a seed or a cultivation instrument) that is either adopted or not adopted. In the last two decades what we have seen, however, is not the diffusion of specific material items alone, but rather an increase in deliberate efforts to encourage the adoption of packages of technologies, technology management practices, and, in many instances, financial and marketing practices as well. The agricultural support systems may have been very clear about how all these different parts tied together that they might have considered the packages to be really just one item for adoption. Certainly the descriptions of numerous "integrated" projects that were and are the vehicles for these efforts communicate the image of a merged package.

The lesson, however, is that the farmer's view of this package is not always the same as the support system's view. Some parts will appear attractive. Other parts will elicit less interest and enthusiasm. In fact, the farmer may not be seeing a package at all, but a collection of individual items. The reverse has also been true. A support system may believe it is recommending a specific, discrete item for the farmer's consideration. What the farmer may see, however, is not a discrete item but rather a solicitation to make commitments on time, land, or labor that go beyond what the support system believes it is asking. The question is: *Is enough information understood about the limited-resource farmer and the limited-resource farm enterprise to know what is actually being recommended?*

For example, consider botanical pest control strategy (Ahmed 1984; Ketkar 1976; Schmutterer 1983). This is a strategy that employs plants with useful pest repellent properties such as Neem (*Azadirachta indica*), that farmers could grow on their own fields to control pest problems. We recognize that evaluating this strategy may require rethinking some traditional research station criteria for assessing pest control performance. We also recognize, however, that we do not clearly understand what botanical pest control might mean to the farmer or what criteria the farmer might use to assess such a strategy. Is it a once-and-for-all practice? Is it a series of repeated or episodic practices? Do other aspects of farm management and household resource allocation have to be modified? If so, how much and in what ways? Can botanical pest control simply be compared to chemical pest control (the preference of the agricultural research system) or do the two strategies have other attributes that reduce their comparability? For instance, to what extent does a specific botanical pest control strategy have a role that exceeds the single function of pest management? What assumptions are made about resource requirements, management demands, and the matching of costs and benefits? How do these assumptions compare to the way any specific botanical pest control strategy will relate to the land and labor management practices of limited-resource farmers? If we understand not only what we expect botanical pest control to do (i.e., address pest management problems) but also what botanical pest control *is* within the

context of the limited-resource farmer's relationship to specific parts of the natural environment, we may find ourselves with a better perspective on the question: what is the farmer being asked to adopt? For example, in parts of India and Pakistan, farmers have been using plant materials (especially neem leaves) to protect grains in storage for generations (Ahmed and Koppel 1987) — with virtually no encouragement from any agricultural extension system. Farmers should better understand the benefits (perceived and “real”) of these practices as well as factors that help to explain why some farmers employ the practices and others do not.

Who Does the Adopting?

Many generalizations found in the literature on technology adoption during Asia's green revolution assume that the adopter is a farmer, usually a male household head. If we saw the decision to adopt as a one-time decision, it was not unreasonable to focus on the individual we thought could represent the farm enterprise and, in some visible way, could be identified with the decision. Supporting this was a strong preference, if not an actual bias, by agricultural economists and extension agents to look for and find individual male household heads who were predefined both empirically (often through sampling frameworks which instructed them to contact male household heads) and theoretically (usually through theoretical frameworks that assumed the farm enterprise consisted of a single male manager who had family labor available for allocation). All this now seems to be changing.

One important example is interest in considering farm households as collective decision-making entities (Fortmann 1984; Roumasset 1978; Smith and Gascon 1980). Another example is interest in the role of indigenous farmers' organizations in technology adoption and utilization. Certainly, recognizing technology adoption as the outcome of a collective decision-making process is not novel. In fact, in some places, efforts to make the diffusion-adoption process an explicitly collective one were, and still are, visible in the context of sponsored technology-adoption programs. In the 1970s, for example, local organizations were certainly recognized by many national agricultural development programs, but the organizations

recognized were most often the cooperatives organized by government, usually for purposes of improving the efficiency (that is, agent/client ratios and numbers of farmers contacted) of extension and credit services. Until recently, the idea that effective collective decision-making influencing agricultural resource management might be operating outside of government-sponsored cooperative programs was not widely shared.

Today, ideas in this area are changing, in part because even among the green revolution farmers, the performance record for sponsored cooperatives was perplexingly uneven (Castillo 1983). Consequently, many practitioners now resist the temptation to state authoritatively "this mode of organization and decision-making always leads to this pattern of technology adoption, risk distribution and resource management while this other mode always leads to another pattern." Interest in indigenous farmer organizations, particularly in relation to irrigation and common property resource management, is increasing, but there is relatively little research to build on. Therefore, it is doubtful that agricultural support systems will be able to rely completely on lessons from their earlier experiences with more well-endowed agricultural communities to guide their work with limited-resource farm communities. Instead, it is entirely possible that different starting points will be needed (Coward, Koppel and Siy 1983).

More careful distinction between technology adoption that follows from a single adoption decision and from a number of adoption decisions (Koppel 1976, 1978) is needed. If the latter is the case, as it can be for any collection of tasks or technologies that have recurrent costs, it may be necessary to acknowledge the existence of different decision processes, different adoption curves, and even different decisionmakers for various aspects of adoption commitments. In such circumstances many decisions are often decisions of degree — not simply "accept-reject" — that can be changed over time. If, indeed, a series of decisions are operating, what is the relationship between prior decisions and subsequent choices? How is this relationship organized socially? How is this relationship influenced by what is being adopted at any given point in time as well as who the effective decisionmakers are at different points in time? An important point about

adoption decisions follows. Seen from the perspective of the technology generating and disseminating system, the process may be characterized as adoption. Seen from the perspective of the farmer, however, the process may be better characterized as *adaptation*, incorporating and modifying something into fuller compatibility with the farmer's specific situation (Rambo, Dixon and Wu 1984; Ruddle 1974).

In the context of a discussion about what is being adopted, it is quite natural also to be concerned with the corollary questions: from *whom* and from *where* is the technology *adopted*? Most discussions of agricultural development strategies associated with the successes of the 1970s can be located in reference to these corollary questions. However, if the discussion is about what technological strategy is being adapted, then attention shifts quite naturally to other corollary questions: by *whom* and to *what* is the technology being *adapted*?

Why Does Adoption Occur?

Adoption research offers two broad types of evidence for answering this question: motivations and attributes. Research on individual motivations for adopting new technology has been extensive and has concentrated on answering two questions: Are farmers price (or benefit) responsive? Are farmers risk-averse? The research says repeatedly that farmers are price responsive which can be translated to mean that technologies which reduce marginal costs or increase average returns will be favorably viewed, *all other things being equal*. The research on risk offers the general insight that farmers, operating as they do in an aura of some uncertainty, determine and apply what amount to risk premiums when they evaluate new technologies.

Ecologists and anthropologists have also examined motivations for technological change among farmers and have pointed to some additional factors. Research on stability and uncertainty emphasizes that household subsistence and security are intimately tied to the agricultural enterprise. Consequently, farm households are visualized as trying to minimize episodes of variability (primarily in output) that can ultimately threaten the integrity of the family unit. Research on social, cultural, and religious values

that can influence perceptions about the generation and disposition of surpluses, the allocation of family labor, land-use intensity, financing production costs, etc., emphasizes that choice of agricultural technology is deeply embedded in a sociocultural context.

Work on price responsiveness and risk aversion has tended to concentrate on the more surplus-oriented farmers. The "who" in this research has been predominantly the individual farm household head, although in recent years this kind of work has been extended to time and labor allocation within the farm household. Work on stability, uncertainty and values has tended to concentrate on the more subsistence-oriented farmers. The "who" in this case has tended to be the farm household (not necessarily defined in nuclear terms), with broader kinship relationships and village affiliations often considered as well.

Research on motivational aspects of technology adoption has been considerably better at explaining the adoption of specific technological artifacts (seeds, fertilizers, tractors) than it has at explaining the adaptation patterns for these artifacts or the adoption and adaptation of associated practices (for example, through patterns of complementary private investment in land infrastructure or reallocations of family, community and hired labor). For probably similar reasons, motivational research has not provided too many useful generalizations about the dis-adoption or abandonment of previously accepted technology. A special example is technology succession, the replacement of one technology by another. A well-known illustration is the rapid turnaround in seed variety choice demonstrated by large numbers of Asia's rice farmers, a turnaround that may say more about extension's effectiveness in getting seed materials to farmers than it does about farmers' reasons for replacing one variety with another. What are the dynamics of technology succession among limited-resource farmers, especially among farmers who are not currently well-linked to the agricultural support system?

Motivational studies of adoption in the context of technological succession should be cautious in assuming how an old technology and a new technology differ and why this difference would lead a farmer to replace

one with the other. When is succession best understood as technologies *replacing* other technologies or as a cumulative and incremental process, occurring along a continuum of decisions, practices and investments? For example, much research labeled as agricultural mechanization actually focuses on the narrower issue of tractorization. However, among Asia's farmers, is mechanization most usefully seen as the adoption of a particular piece of equipment that is essentially discontinuous with prior tools, or as the cumulative enhancement of labor productivity by a progression of tools and skills? Most motivational research about technology adoption maintains a strong tendency to view adoption as a dichotomous (accept-reject) and a one-time decision.

Adoption research implemented to focus on attributes rather than motivations can be seen, in part, as an attempt to ask: under what circumstances are generalizations about motivations likely to hold? This research asks: are attributes or characteristics of early adopters different in some systematic way from late adopters and from those who do not adopt? For example, if early adopters of new agricultural technologies are, as a group, more literate and educated than late adopters, then attention should be directed to understanding the relationships, between education, literacy and the adoption decision. Indeed, there is considerable research which correlates technology adoption with factors such as land size, land tenure, family size, land quality, market access, farm operator's age, average income, socioeconomic status, level of living, etc. However, the research is more persuasive in providing descriptions of adoption than it is in accounting for delayed adoption, nonadoption, or dis-adoption. While the need to look beyond attributes of the individual to attributes of the individual's physical, social and economic environment has been recognized, the focus of that recognition has been understandably restricted. The question that has received most attention is: what are the relationships between characteristics and adoption behaviors of individuals and the levels of infrastructure (especially support services) which are available and to which they have access, etc.?

However, much work remains to be done if the question turns to relationships between individual characteristics, adoption behaviors, and attributes of the social organizational environment. For example, if higher literacy in an individual is associated with earlier adoption, what difference, if any, does it make if, in one case, a highly literate individual lives where the distribution of education is highly skewed to the low end or the high end? Income, land size, or land tenure can be substituted for education in the example. If adoption decisions are purely and entirely individual or household decisions, then the answer may be: "no difference." To the extent, however, that decisions are not that autonomous, then there may well be differences. In fact, research still only provides largely idiosyncratic examples of how and why social context, individual behavior, and technology adoption have configured in the ways they have.

Experience during the last few decades suggests that Asia's agricultural support systems know where technology adoption is more likely and rapid. This is knowledge accumulated through successful participation in the diffusion of green revolution technologies. However, most of this experience is based on technologies and associated development strategies that assumed essentially homogeneous end-users: specialized, relatively well-endowed, and commercially-oriented lowland irrigated wheat and rice farmers. Much less is understood about technology adoption by farmers who have not been the primary focus of agricultural development efforts in recent years. Moreover, and this is perhaps the most troubling, *it is not certain what can be generalized from experience with the first group to efforts with the second*. In the face of this, it follows that applied development efforts may need to rely less on generalized knowledge about technology adoption, opting instead to be more carefully informed by site-specific technology adoption research. This is, of course, part of what appears to be farming systems research. It may also be the most promising course for any efforts that will focus on limited-resource farmers.

What Happens After Adoption Has Occurred?

Research traditionally has not concerned itself with what happens after adoption, at least not as an empirical matter separate from attempts to explain why adoption occurs. An alternative view, however, has developed. Sometimes called "technology assessment," this view is that adoption research should not be restricted to the questions: Will it be adopted? Who will adopt it? When will they adopt it? Why will they adopt it? Two additional questions also need to be asked: How will the technology work? What happens if the technology is adopted (Koppel 1979)?

The question of *how* a technology works encompasses the question of *whether* a technology works, but it is also more than that. Awareness has broadened in the last decade, demonstrating that the working of an agricultural technology in the carefully controlled environment of the experiment station does not really indicate whether the technology will work in other environments, nor, what is even more important, does it indicate what kinds of variability can be associated with the performance of the technology when it is inserted into different agro-ecological and farm management environments. As a result, on-farm research is becoming an accepted element of the agricultural research process. However, agricultural support systems still attempt to understand how to make experimental sense out of the enormous variability in the off-station environment.

An example is the division of labor between on-farm and on-station research. For example, a review of existing research practices leads to the hypothesis that technologies or practices that are likely to be used in a relatively uniform way — which will be essentially independent of variabilities in other farm operations, and which will be applied under agro-ecological conditions similar to those on the research station — can be usefully assessed by basic testing on-station and verification on-farm. However, for technologies and practices that may not be applied with much uniformity such as those which are specifically dependent on other farm operations, larger shares of the technology development and verification processes may need to occur on-farm.

The real issue is not *where* the research is physically taking place, but rather *on what terms of reference* the research is being conducted and evaluated. Using experiment station methods on-farm really proves very little unless the methods used on-station are also close to farmer methods — *for the farmers thought to be the end-users of the technology under development*. As agricultural research moves towards greater immersion in on-farm research, it therefore needs to become more deliberate about what kinds of farms and farmers it chooses to work with. This is particularly important as agricultural research goes further than it has previously to develop technologies for specific types of farms and farmers, in some cases types with which it is not too familiar. The adoption issue surfaces *before* the technology research, when we ask: for what types of farms are we working? — not after the technology research, when we are implicitly in the position of asking: for what types of farms *were* we working?

Closely related is another question that, in one sense, is commonly asked and, in another sense, is very infrequently asked: *What if the technology is adopted?* This question is commonly asked through assumptions and expectations about benefits and costs that will accompany adoption. Increases in income, employment and output, or reductions in pests and weeds are already discussed. Other aspects of the question are not commonly considered. For example, environmental impacts of adopted technologies are often not given serious attention. This is partly a result of focusing on individual farmers and farm households as adopters and neglecting to aggregate and ask what the cumulative environmental impacts might be if concentrated adoption occurs in contiguous areas. It is also a result, in some cases, of inadequate knowledge about what kinds of environmental impacts may even be likely. In this context, it is possible to admit that predictive ecology is an infant science, but does it follow that longer-run environmental consequences should not be part of adoption research?

Sometimes the focus is more on who one hopes will adopt the technologies than on who might actually be adopting. Identification of the latter group requires clarity about what kinds of resources (human, material, land, capital) will be required to make effective use of the technology; how the

extension and diffusion systems are operating or are likely to operate in diffusing the technology and what all this may mean for: (1) farmers who have early access; (2) farmers who will be most assured of getting supervision or assistance for early problems of acquiring and using the technology; and (3) how patterns of adoption by one group or type of farmers may influence the feasibility, rate, patterns, and costs of adoption by other groups and types of farmers.

What if the technology is adopted? — is not really the question. Rather, it is — what if the technology is *utilized*? The issue is not the accept-reject decision, but the graduated decisions involved in adapting the technology to the existing farming enterprise and resource endowment. It is important to improve not only the concern of how well the agricultural support system answers the utilization question for itself, but also that of how well the agricultural support system understands how different types of farmers might answer that question. Such an effort might illuminate some benefits not considered, some possible consequences not anticipated. In either case, there are implications for technology development, verification and dissemination processes.

Attention to probable forms of utilization can also highlight another key issue: what kinds of variability are probable on the farm and what are the likely major consequences of this variability in terms of the technology's performance and the farmer's welfare? For example, experience with chemical pest control shows that, under certain circumstances, farmers may misuse this technology. They may mishandle or improperly mix chemical materials, application may be done incorrectly or at the wrong times, and so on. Such farmers have adopted chemical pest control technology in the sense that they have acquired some of the material artifacts associated with the technology, but practice or utilization is not as hoped. In some cases, the result is uneconomical, a consequence the farmer may also see, resulting in substantial reduction or even termination of use, i.e., dis-adoption. In other cases, the result may have adverse health consequences, except that the farmer may not know this until it is too late.

Experiences like these illustrate the challenge of considering variability in utilization: What kinds of variability are probable? What are the probable causes of this variability? What are the likely consequences of the variability? In the illustration just discussed, we can hypothesize that sometimes there are basic incompatibilities between the support system's understanding and the farmers' understanding of plant-pest relationships and/or the roles of chemical pesticides to manage these relationships. In the same vein, what assumptions are now being made about the current utilization of botanical pest control strategies? For different kinds of farmers (and for different kinds of scientists), what will be "new" or "subtle" in the strategies presented by the extension services that may be subject to different interpretations or practices? Are there any forms of variability that should be worried about, such as variability leading to forms of environmental damage, or contaminated food, etc.? Are particular levels of utilization likely to influence and be influenced by variability in other parts of the farm enterprise, variability which may be an important part of the farmer's ongoing adaptation to changing environmental and ecological relationships, market conditions, labor opportunities, etc.?

Variability can be discussed in strictly biophysical terms, variability that is related to climate, soil properties, hydrological factors, etc. That kind of variability is already routinely considered in the technology development process. However, another kind of variability, less routinely considered, comes from differences in farmer resource endowments and orientations. The very interest in limited-resource farmers, the desire to develop technologies that are, in the words of former International Rice Research Institute (IRRI) Director General Dr. M.S. Swaminathan, "resource-neutral," *potentially* signals two important shifts that may be under way in understanding variability being employed by agricultural support systems. One is a shift to consider a set of highly variable agro-ecological environments that were not formerly given sustained attention. The second is a shift to consider more deliberately the variabilities associated with farmer resource endowments. The latter shift, however subtle, represents a shift in focus from the farm as an essentially biophysical entity to a focus on the

relationship between variabilities of the biophysical entity and variabilities associated with the farm household — a social, cultural and economic entity.

Issues of utilization are strongly behavioral issues. They underlie the importance of understanding the farmer and the farm enterprise from the farmer's perspective. This does not mean that everything needs to be understood nor does it mean that component technological research has to be integrated for, and conducted on, a farm-by-farm basis. It does mean, however, that it is necessary to understand those relationships within the farmers' systems which most strongly influence how new technologies and practices will interact with the farm enterprise already in place.

IMPLICATIONS FOR AGRICULTURAL RESEARCH AND EXTENSION

Several strategies are available for translating the ideas and questions raised thus far into some operational procedures for learning about adoption, adaptation and utilization. However, such procedures cannot be considered independently of the institutional and programmatic context in which they will function. This means understanding how the research system, in particular, and the agricultural support system, more generally, visualize their relationships to farmers and what this visualization implies for the probable types of learning.

Figure 1 offers a schema for visualizing the relationships between agricultural support systems and farmers and methodological strategies for learning about farmers. The figure asks two questions about assumptions:

1. What is the agricultural support system's relationship to the linkage between what it does (its output) and the effects of what it does (i.e., adoption, adaptation, and utilization by farmers). The question is not posed in administrative terms but rather in terms of the assumptions or "models" which guide what kinds of administrative relationships, communication flows and problem identifica-

FIGURE 1
How A Support System Learns About Farmers

<p>ASSUMPTIONS</p> <p>THE FARMER</p> <p>THE SUPPORT SYSTEM</p> <p>The Role of the Farmers in the Technology Generation and Diffusion Process is as a:</p>	<p>A Support System's Relationship to the Linkage Between What It Does and the Effects of What It Does</p>	
	<p>Active</p> <p>Adapts Utilizes Chooses Transforms</p>	<p>Passive</p> <p>Adopts Accepts Follows</p> <p>Sells Monitors Transfers</p>
<p>WHO capable of defining own interests and needs</p> <p>WHAT fits predefined category</p>	<p>Interactive-Based Understanding</p> <p>Participation Experiential Systemic Analytic</p>	<p>METHODS</p> <p>Indicator-Based Understanding</p> <p>Confirmation Reconnaissance Systematic Hypothetical</p>

tion processes are probable. Two stylized possibilities are indicated. "Active" means the support system is involved interactively with farmers. "Passive" means that the support system's involvement is more unilateral. The fashionable phrases "bottom-up" and "top-down" are expressions of a similar distinction, but the hierarchical imagery of the phrases actually freezes us in the very way of thinking how the phrases hope to counter. Active and Passive can be hierarchical; they can also be collateral. The emphasis is on content, not necessarily position.

2. The rows in Figure 1 ask: What is the significance of farmers in the assumptions or "model" that the support system has of its relationship to farmers. Do farmers exist as a "who," representing possibly complex and unique systems, that should be understood from within those systems? Or do farmers exist as a "what," known by the support system according to variables selected and defined by the support system itself? The stylized "methods" noted in the box are types of understanding which follow from the intersections of the two row and column questions. Essentially what Figure 1 attempts to convey is that the choice of method is a decision derived from the type of understanding of the adoption process a support system believes it needs.

Basically, there are two kinds of choices.

Utilization. An agricultural support system firmly oriented to utilization and adaptation objectives will be inclined to need an understanding of the farmer's context, in some sense, on the farmer's own terms of reference. This plus the tendency for utilization and adaptation objectives to establish requirements for recurrent support means that the support system will need to place itself in some *interactive* mode with the farmer. For example, the redefinitions of relationships between on-station research, agricultural extension, and on-farm research that characterize the institutional innovations of farming systems research can be seen as illustrations of efforts to improve the form of communication between farmer and scientist.

Acceptance. If the support system's orientation is more towards acceptance of objectives, then it will be inclined to need profiles of farmers and farms to facilitate monitoring and evaluation of acceptance rates, usually in terms of correlations with specific indicators of farmer characteristics. Many innovations and improvements in program monitoring systems are illustrations of efforts to increase the availability and accuracy of such indicators for program management purposes. They are examples of acceptance.

If interactive research proceeds from the assumption that it is the difference in farming systems which mandates an intensive understanding of specific systems, then indicator research proceeds from the assumption that it is the common characteristics of farmers and farms which mandate an extensive understanding of numerous systems. It is important to note that agro-ecological and socioeconomic theory, in one form or another, is important for both types of research. For interactive research, theory is needed to provide some map for identifying a system and the key relationships in that system. For indicator research, theory is needed to identify variables and relationships and to attribute credibility to specific empirical indicators. Both approaches can fall victim to any of two fallacies: (1) they underemploy theory, become extremely empiricist, collect and possibly are overwhelmed by too much data, and avoid any clear conclusions; or (2) theory's presence is so pronounced that data illustrate more the theory than provide understanding about farmers.

Both types of research generate and support understanding about adoption, but they generate two different kinds of understanding. Interactive research does better at understanding what is happening and why it happens in specific situations. It provides what can be called contextual knowledge. It is less useful for providing generalizations which can be applied to numerous other situations. This can be a problem for national agricultural support systems that are not characterized by capacities for regional variation in research trials and extension strategies or are otherwise accustomed to implementing standardized and uniform national recommendations. Indicator research does better at explaining what might happen in a large

number of situations and what can be called "generalizable knowledge, but it may be less adept at providing much insight about any specific situation. This can present a problem to more regionalized or decentralized national agricultural support systems, particularly if regional parts of the system are expected to develop adoption understanding that can directly support the formulation of national programs as well as the development of their own more area-focused programs.

These two "types" of understanding, interactive-based and indicator-based, are not prescriptive or mutually exclusive, but rather are stylized characterizations of what is most likely. By inference, it is considered unlikely that a technology generation, verification and dissemination program oriented heavily to acceptance rates would go to the trouble of interactive adoption research. Similarly, it is considered unlikely that a program heavily committed to technology utilization would be satisfied with indicator based information about farmers. Most programs, of course, will be somewhere in-between, varying with the stage the programs are in, the possibilities represented by staffing and resource constraints, and the policy guidelines influencing the focus, level, and pace of research. Each agricultural support system should ask where its programs belong and where they are heading in terms of the types of questions raised by Figure 1.

SOME GUIDELINES FOR A MINIMUM BEGINNING

Assuming that an agricultural support system knows where it is on Figure 1 and that it is candid about what skills, resources and time may be available for any baseline research efforts related to technology adoption, adaptation, and utilization by limited-resource farmers, what can and should be done? It would be possible to identify a minimal and even common information base for a national program focused on limited-resource farmers. In fact, the focus should first and primarily be on the kinds of understanding needed. Consequently, it is essential that information-gathering methodologies should be seen as the means, not the ends. That is because what is needed most is not a minimum base of compatible information, but more funda-

mentally a minimum base of useful understanding. A baseline understanding needs to be developed of (1) who are the limited-resource farmers; (2) what characterizes their farming enterprises; (3) what are their existing problems; and (4) what strategies they currently choose to address these problems. In Appendix A, each of these categories of understanding is illustrated through a list of questions. The questions are not items for inclusion in a survey questionnaire, but rather examples of substantive areas of understanding that would need to be developed.

Minimum baseline understanding can be obtained through several channels, depending on specific situations and orientations. Probably the most important methodological guideline that can be offered is this: the more contact there is between farmer, farm, and scientist the better is the chance that the scientist will work from a vision of limited-resource farmers beyond stereotypes and statistics. This contact can be obtained through participant observation, process documentation, rapid rural appraisal, group meetings in the field, or the like. In these cases, it is important to get away from the road, to talk to more than the male household head, to actually stand in farm fields, and to go beyond the obligatory ceremonial events and visits by research station scientists. If surveys are to be conducted, they will be more useful when they are combined with some type of *prior* experiential strategy that provides at least an overview of the field situation. Experiential information can guide the development of both the sampling frame and the actual survey instrument.

For efforts beyond the minimum understanding base, the issue is not the complexity of information but the communication patterns that will be established and used between farmer and scientist during the course of the technology generation, verification, and dissemination processes. This goes back to the discussion around Figure 1 and the questions asked there: to what extent are agricultural support systems proposing to work *for* the limited-resource farmer and to what extent are they proposing to work *with* the limited-resource farmer?

This question has already led to a very substantial concern with farmer associations as an important component of contemporary agricultural ex-

tension strategies. However, here we believe it is important not to confuse means and ends. While interactive understanding can readily imply the utility of farmer organizations as the intermediary between individual farmers and the formal extension system, the presence of farmer associations does not necessarily endow extension arrangements with interactive attributes. We believe this point needs emphasis because it is unlikely that improvement of agricultural extension can be built on fads and fixes. What is needed instead are arrangements that are products of solid understanding of specific situations. For this reason, we want to briefly raise a few questions about the roles of rural organization in agricultural extension.

THE ROLES OF A RURAL ORGANIZATION IN AGRICULTURAL EXTENSION

From the Philippines' *Zanjera* to Nepal's *Moeya* to Bali's *Subak*, indigenous irrigation associations which are primary examples of locally organized resource management are being "discovered" (Cernea 1985; Coward 1980; Dani and Campbell 1986; Esman 1982; Siy 1982; Uphoff 1982). This is the most recent phase of a tradition pioneered by the Comilla project (and innumerable others) advocating the role of farmer organizations as intermediate arrangements between individual farmers and the support system. At least two important issues have arisen during the course of this diverse experience. It is important to recognize and learn from these issues to ensure that innovations in agricultural extension are actually steps forward.

The first issue is the question: *who governs* (Bagadion and Korten 1980; Illo and Chiong-Javier 1983; Korten and Klauss 1984)? This question becomes important to the extent that enhancing the roles of local organizations represents challenges to interests which pursue and maintain their own governance claims through manipulation of the policy management and institutional support system. The challenges do not always materialize. During the 1950s and 1960s, community development in South and parts of Southeast Asia "gave" rural communities a chance to provide certain amenities for themselves, but in most cases, there was no intent that rural

communities (individually or as a group) were empowered to alter (favorably) any fundamental characteristics of their relationships with the state. Community organization strategies have attracted considerable new interest in recent years, but these strategies still appear to be unfolding within terms of reference that do not represent significant departures from basic relationships between the state and the rural periphery (Castillo 1983; Goodell 1983; Oommen, 1984). Illustrative are the moves towards decentralization in Bangladesh and Nepal promulgated at about the same time as decisions which strengthen the state's role in economic and political development and the co-evolution in Korea of a "New-Community" program with growing state participation in managing the economy.

This leads to a second issue, namely, what is the status of local organizational resources as rural resources? This issue is really the question: *what is governed?* "Old" rural organizational resources (such as the social organization of labor reciprocity, the household as a foundation of the division of labor, culturally or ethnically-based property management regimes) may be replaced by "new" ones (such as tenant or farm worker unions, local chapters of national political groupings, the privatization of natural resource management). Complex relationships between old and new organizational resources and other rural resources can result. What are the implications for the meanings of "local participation" and "local leadership?" What are the consequences for the viability of local governance strategies?

For example, considerable interest is being shown by rural development specialists in common property resource management systems. These are indigenous systems for managing and using natural resources involving the regulation of individual resource utilization patterns by collective norms and procedures. For instance, some communities in Nepal are reported to have established rules for cutting firewood and fodder and for harvesting fruits, timber and other products. These rules specify both individual and group rights to use the same piece of land. What is attractive about these systems is that they may represent indigenously organized (rather than externally imposed) cases of sustainable natural resource management.

However, recognizing that such systems exist has led to an idealization of the strategies, an idealization that might be very inappropriate. In many cases, common property resource management systems are being advocated as the "answer" to problems of maintaining sustainable productivity in degradable environments. However, social forestry and other common property resource management arrangements should be assessed in the context of the types of demographic, social, economic and ecologic pressures operating in Asia's more "fragile" rural environments. Common property management cannot always be best understood primarily as a strategy for maintaining (or achieving) important stewardship relationships between Asian rural households and their natural environments. There will be times when common property resource management is better understood as a strategy to ration access to some natural resources, not necessarily in the interests of environmental welfare, but as a tactic for consolidating the state's role in more marginal areas. In the political economy of rural Asia, limiting access to selected natural resources can be a strategy for linking state power to the "rent-seeking" behavior of rural (and often urban) elites. There are also reasons to suspect that the viability of common property management regimes will be quite sensitive to a variety of local factors such as population pressure, employment opportunities, and food security status (Blaikie 1985; Khaleque 1985; Putterman 1985; Russell and Nicholson 1981).

Consequently, whatever common property management and other "organizational fix" strategies for rural environmental management there may be in theory, in practice, they may vary in food deficit areas like North-eastern Thailand and Nepal's Terai or diversifying areas such as Northern Pakistan or Eastern Luzon in the Philippines. Since it not well understood how these systems actually function, there is reason to ask: what happens when such strategies are imported by the agricultural support system into existing customary land management systems? Where does "control" over natural resources effectively (if inadvertently) pass?

CONCLUSION

This paper has attempted to outline some of the challenges agricultural support systems face as they confront the problems of sustainable development and poverty alleviation. The paper argues that in practical terms the pressure to address these issues will come from the increasing contact that support systems have or will have with limited-resource farmers. In that context, the challenges of sustainable development and poverty alleviation will take the form initially of understanding how limited-resource farmers differ from the farmers better known by the agricultural support system.

In this process of reassessment that is already unfolding, an important distinction may emerge between the functions of the support system as fundamentally a *transfer* process and as a *transformational* process (Cernea, Coulter and Russell 1985). For example, we often think of extension as the vehicle for transferring technology and knowledge from the agricultural research system to the farmers. Farming systems research has introduced new forms of complexity and interaction to the agricultural research system, but here too we are still frequently speaking of a (enhanced) technology transfer process.

However, the discussion of technology adoption among limited-resource farmers strongly suggests that many of the assumptions that permit a transfer emphasis to proceed may not be valid. The botanical pest control example suggests that we may be functioning in an area where continual learning and adaptation must be occurring — by both farmers and the support system. For example, extension as education has long been recognized, but the notion of continual joint learning as an element of this education has some interesting implications for how we might think about the central emphasis of agricultural extension.

Thinking about agricultural support not strictly as a transfer of knowledge and skills process but more broadly as a transformation of learning process (Hawkins 1988) is a potentially important distinction for at least two reasons.

1. The distinction invites a more active emphasis on the learning that is actually occurring among farmers and support system personnel to complement a more traditional emphasis on the provision of inputs (technology and advice to farmers, funds and facilities to extension agents) that are assumed to support learning.

2. The distinction accommodates recognition that the learning associated with transitions in a farmer's commitment to productivity and an extension agent's commitment to more interactive-based understanding may not be strictly "vocational," but may also be a matter of orientation to new learning processes.

The paper has strongly suggested that much of what is known about technology adoption by farmers in Asia is not based on experience with limited-resource farmers. That *may* be a problem for developing both research hypotheses and practical expectations about technology adoption among limited-resource farmers. The word "may" is emphasized because we really don't know. Ultimately, what each agricultural support system must decide is: how well do the support systems now "know" limited-resource farmers? How well do the support systems *need* to know limited-resource farmers in order to properly evaluate the adoption, adaptation and utilization prospects of any agricultural development strategy? Once these questions have been answered, the systems can better determine how they need to be organized, managed, staffed, and evaluated. In the course of this process, the support system is most likely as well to confront the challenges of sustainable development and poverty alleviation.

A final point. Over the last decade, agricultural support systems in Asia have been pulled in another direction — increased emphasis on support for agribusiness. In one sense, this is simply another interpretation of an older interest in improving agricultural incomes. As such, it is not inherently in conflict with emphases on sustainable development and rural poverty issues. However, an emphasis on agribusiness also reflects a judgment about where public funds in support of agriculture can be most usefully allocated.

What is clearly problematic is that this judgment often carries an explicit insistence that the issues discussed in this paper should be ignored.

In reality, as the agricultural economy diversifies — and throughout Asia it clearly does — the agricultural support systems also must diversify their missions if they are to remain relevant and justifiable. However, the matter is not simple. Contemporary agricultural support systems face limited budgetary resources, competition from the rise of commercial support systems, and the continuing demands to be more than simply a technology transfer mechanism — demands which are implicit in the broader social development roles of rural, agricultural, and food policies. It follows that the diversification of the rural economy also requires agricultural support systems to be clearer about priorities — in terms of farm households, commodities, and regions.

Making these choices can be difficult, not least because of the politics and perceptions influencing rural development policy in particular (cf. Castillo 1979; Ito et al. 1989). And here it is important to recognize that the argument over the mission of agricultural support is not only about the realities of diversification, but also about the consequences of stylized understanding. To illustrate this point, consider a full page advertisement in the *Manila Chronicle* several years ago from a major agricultural chemical firm. A shadowy picture of a Filipino farmer plowing a field with a carabao fills the page. Across the picture are the following words in bold type: “The Filipino Farmer: You may never see him but he is there.”

The Filipino farmer — both he and she — is definitely there. The challenge for agricultural support is to break through old images of a backward peasantry and construct a mission that reaches the farmers that is relevant for them.

APPENDIX A
Guidelines for a Minimum Beginning

1. *Who are the limited-resource rice farmers?*

- Where are the farmers who are no longer part of the green-revolution complex?
- How are these households distributed in terms of major agro-economic farm types?
- What are the major demographic, economic, and social characteristics of the households? What are the characteristics of household composition, organization and division of labor; of the levels, importance, variability, and seasonality of off-farm and nonfarm income sources and employment histories; of health, mortality and education; and of agricultural experience?
- What are the households' food and energy consumption patterns, particularly intrahousehold food consumption levels? What are the variabilities in consumption? What are the effects of variabilities in food and energy consumption on health, savings and the maintenance of household integrity and welfare? How and from what sources are consumption demands supplied and what are the main variabilities in these supply systems? What, if anything, are households doing to smooth supply and consumption variabilities?
- What are the characteristics of the communities where limited-resource farm households live, in terms of: infrastructure and administrative services; ethnic, occupational, and income diversity; demographic change (in particular, levels of in-migration, dependency ratios, and household formation rates)?

2. *What are the characteristics of farm enterprises?*

- What characterizes the household's security of access to land it cultivates? How was access acquired? How is access for children and heirs provided?
- What are the production levels, variabilities and disposition patterns for crops and animals raised?
- What is the current status of resource management practices including community, reciprocal, hired and family labor allocation, land-use patterns and intensity, and crop and variety choices? Have these practices changed in recent years? If so, how and why?
- What is the current status of environmental and ecological characteristics of lands utilized for agriculture? Are there problems? If so, what are the problems, and what measures are being taken to manage and control the problems? Have the number, identity, or seriousness of problems changed in recent years? If so, how and why? If measures to manage and control environmental and ecological problems have changed in recent years, how and why?
- What are the characteristics of farm infrastructure such as equipment, tools, erosion control and water impoundment structures, and on-farm storage facilities?
- What characterizes patterns of accessibility to, and availability of, agricultural support services, such as markets; mills, storage, and processing facilities; and input supplies, technical services, and credit?
- What forms of local area coordination in resource management exist? How and when do these function? What are their effects? How, when, to what degree and with what costs and benefits does any particular household participate in such arrangements?

3. *What are existing problems?*

- What is the frequency of problems in relation to important agricultural and family life cycles? In relation to community resource management practices?
- What are the locations of problems in relation to crop growth and utilization patterns, land management practices, soil and land forms, and proximity to houselots?
- How can problems be characterized in terms of levels and variations?
- What are the primary explanations for the levels, variabilities, frequency, duration, and location of problems?

4. *What strategies are chosen to confront these problems?*

- What are the major types of responses to problems? How do these relate to resource management practices? What, if any, extraordinary demands do any of these responses make on land-use, family or community labor, etc.?
- How are the types and levels of responses phased? When are responses initiated? What are the durations? How are responses related to other resource management functions?
- How were different resource management strategies learned? From whom? When? Where? Are other practices known and not currently used? If so, why not? If other methods were previously used and discontinued, why?

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