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The Identification of Farmers' Production Problems in Indonesia

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The production problems that farmers face are always interrelated. Attempts to solve a specific technical problem may create new problems if the whole complex of farmers' constraints is not understood.

By training and temperament, scientists like to simplify. A common scientific technique is to isolate for study one aspect of a larger system while holding other factors constant. This technique is a powerful analytical tool that has extended the boundaries of scientific knowledge. Agricultural research in developed countries is usually organized along these lines and concentrates on a particular crop or animal. This specialization permits in-depth study of the components of a farming system. When carried to an extreme, however, this approach becomes counterproductive and the research irrelevant. It is therefore fortunate when agricultural extension workers and farmers are able to incorporate certain useful aspects of the research in the existing farm setting.

Even in developed countries, however, scientists are beginning to devote more time and effort to systems research that addresses the complex and immediate problems of farmers. This approach is similar to the one used in the early days of agricultural research and is appropriate in many situations in developing countries today. Unfortunately, this interdisciplinary, integrated, and holistic approach to farm research sounds complicated and is not easily carried out. The approach does not fit the conventional, narrow scientific method that is still commonly taught in colleges and universities. Expanding the horizons of traditional research costs a lot of money and takes considerable time and institutional and individual commitment. It is difficult to mobilize and maintain the interest of scientists because of the need to establish one's identity, either personal or scientific, in this kind of research.

But, for those who empathize with farmers and their problems, this kind of research is highly rewarding—not in a monetary sense nor necessarily in the quantity or even quality of scientific papers published, but in the realization that one is identifying problems that affect farmers' daily lives and is directly meeting the needs of rural people. There is also the reward of working with colleagues from other disciplines such as economics, rural sociology, anthropology, and agricultural extension. Moreover, there is the fascination of understanding how families cope with problems and situations that we as scientists tend to shy away from.

In addition to relevant, problem-focused research, agricultural scientists should provide the technology and ideas for future agricultural development activities. Of course, these scientists need to do the research before they can provide the answers requested. The stimulus for agricultural development should come more from researchers than from planners because researchers working in the systems approach know best the whole farming environment and its exigencies. In this way agricultural scientists will be able to serve their country better, bring credit to themselves, and gain greater support for their research institutions.

Background of Agricultural Research in Indonesia

Most Indonesian farmers own a small piece of land. This is true even of farmers in Java and Bali, Indonesia's most populous islands. The average smallholding is 0.5 hectares per farm family. Lowland areas are dominated by rice farming, wherever water is available. Rice is usually grown twice a year in fully irrigated land, but only one crop is grown on lands with only five to seven months of irrigation. Such lands are kept fallow when irrigation water is insufficient for a second rice crop.

The greatest potential for an immediate increase in food crop production exists in these lowland areas, which usually have enough infrastructure in place to support efforts in intensified agricultural production. Even under the best circumstances, where considerable irrigation and drainage efforts have been made, there is still scope to increase the existing cropping intensity, and thus to increase food and rice production as well as farmers' incomes.

The strategies used to accomplish this goal have included the introduction of early-maturing and improved crop varieties, direct seeding of rice, reduction in turnaround time between successive crops, and improved crop management techniques. To facilitate field research and to direct research to more location-specific issues, these land areas were usually partitioned, according to water availability, into the following categories for study:

- Irrigated lowlands
  - Full irrigation—for ten months or more
  - Partial (or no) irrigation—for seven to nine months, for five to seven months, or not at all
- Rainfed uplands
  - Drought-prone areas
  - Humid areas.

Starting in 1972, on-site research was carried out in six sites in western Java, Lampung (southern Sumatra), and Madura (eastern Java).

Irrigated Lowland Areas

Inspection indicated that usually only two rice crops were grown in the areas fully irrigated and those irrigated for seven to nine months. Usually one crop of rice was successfully grown in the areas with less than full irrigation (if a second crop was planted, water shortages drastically reduced yields).

Cropping systems research successfully showed how these systems could be further intensified through the use of earlier-maturing crop varieties, the use of directly seeded rice (*gogo rancah*) in partly irrigated and rainfed areas, and a reduction in turnaround time. Component research developed more appropriate rates and methods of fertilizer application, insect control measures, and techniques of weed management.

The pattern of lowland rice-lowland rice-legume was successfully and profitably grown in the full seven-to-nine-month irrigation categories. A combination of directly seeded lowland rice (gogo rancah) and lowland rice—in the pattern gogo rancah-lowland rice-cowpea—permitted the production of three crops a year in the other categories (five months' or no irrigation) where previously only one crop had been grown.

Rainfed Upland Areas

The second major target area for cropping as well as farming systems research was the rainfed uplands being used for transmigration program development in Sumatra, Kalimantan, and Sulawesi. In general, these areas receive rainfall that is sufficient and adequately well distributed for year-round crop production, but management constraints have prevented stable and sustainable food crop production. There also have been soil management, pest and disease, and socioeconomic problems that transmigrant farmers have not easily been able to overcome by themselves.

Initial research showed that the existing cropping patterns could be simplified and made more productive by growing crops in rows, using moderate rates of fertilizer application, and returning crop residues to the soil directly or as manure. The technology developed in central Lampung has been found to be applicable, with some modifications, to the humid areas of western upland Indonesia, where the rainfall is greater than 2,000 millimeters a year and where there is no distinct dry season. The basic pattern recommended is corn plus upland rice interplanted with cassava.

Research-Extension Linkage

The linkage of research and extension has been instrumental in furthering the developments mentioned above. In Indonesia this linkage is effected by:

- Transferring research results through publications, research reports, leaflets, and brochures
- Inviting the agricultural extension workers and subject matter specialists (SMSs) to attend monthly seminars, usually held by the research institutes
- Inviting the researchers to attend meetings, usually convened three to four times a year, of the agricultural extension staff to discuss the "impact points" in seasonal extension programs for the area or province selected
- Conducting a cropping/farming systems workshop (especially to support the transmigration program) handled by a farming systems working group and attended by staff from agricultural extension, from the Directorate-General for Transmigration, and from universities
- Hosting annual field days, usually done by the research institute, to show extension staff and key farmers what has been done, what is being done, and what is going to be done in the near future in location-specific agricultural research
- Training by researchers, at the request of agricultural extension, of the trainers of the SMSs (in several disciplines, commodities as well as cropping/farming systems).

Present State of Farming Systems Research

Cropping systems research in Indonesia started in 1972. The cropping systems research program has developed a methodology and a core of personnel capable of designing and carrying out on-farm research. Linkages with other commodity research groups and government agencies have been forged through the program. Gradually since 1980, a holistic farming systems research capability has evolved, especially in support of the transmigration program. To conduct research efficiently and effectively, however, it is still appropriate to identify and conduct research on specific issues that involve only two or three commodity groups or components.

In the upland rainfed areas, for example, food crop agriculture is necessary but usually is limited to only a part of the land owned by a farmer. The upland farmer finds it difficult to use more than 0.75 hectare of land for food crop production if only family labor is available. More extensive cultivation is highly risky because the soil is sensitive to erosion. In this situation, growing specific perennial and estate crops is quite feasible. Animal husbandry is equally feasible—not only for producing protein and increasing income, but also for providing animal power and manure to increase soil productivity.

Although the emphasis is on crops, integrated agricultural research in Indonesia considers all farm-related activities—from field preparation (including family labor, animal resources, and so on) to marketing of farm output. In the integrated research strategy, initial research concentrates on food crop production for the farmers' subsistence. Concurrent with this objective, constraints to increasing production or land use are identified.

For example, it was found that in upland areas of Indonesia family labor using hand tools can cultivate only about 0.6 hectares of land in a year. There is a shortage of machine power to make use of the remaining land resources. Animal power may be the solution. If so, the upland farmer will need animal-drawn farm machinery and forage for feed. Consequently, the farmer may be able to cultivate more land with this additional power and make use of even more area by putting some land into forage crops. Animal manure and excess forage for green manure can be used to improve the soil fertility. Additional land may be profitably used for the production of perennial crops for spices, food, fiber, and fuel. Furthermore, it is possible to develop structures for upland water control and soil conservation that can be used to impound water for family use, fish, and animals.

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Cropping systems research, it must be stressed, is an integrated research—not only because it deals with several crops (rice-cereals-legumes/vegetables), but also because it encompasses disciplines such as insect management, plant spacing, and the amount and method of fertilizer application within the particular cropping system. Farming systems research amplifies research into cropping patterns by considering not only food crops but also other commodities (such as perennial or estate crops, livestock, and fishery) as components of the farming system.

In Indonesia, integrated cropping systems research has evolved into farming systems research—which is broader, in that it views the farm as an integral socioeconomic entity encompassing more than purely agronomic variables—but this approach has been systematic and hence manageable.

The terminology "food-crops-based farming system research" accurately describes the kind of agricultural research that has been conducted in Indonesia. The research is carried out by a coordinated, interdisciplinary group of scientists integrated among different government agencies and activities (such as extension, local government, irrigation, and national production programs). It is focused on specific target areas and is limited in scope to make more efficient use of research staff and funds. The methodology and staff that have developed in Indonesia are sufficiently strong to continue this research orientation. But renewed efforts, through long-term research projects, are needed to stabilize the gains that have been made. Although production of food crops sufficient for subsistence has been and will continue to be the primary focus in the development of farming systems research for small Indonesian farm operations, greater effort will have to be made to study and improve all production aspects of these operations.

Problem Identification

In Indonesia, farmers' production problems are identified by cropping systems/farming systems research teams who conduct a quick agroeconomic profile study for this purpose. The team usually comprises an agronomist, a soil scientist, a plant protection specialist, a specialist in animal husbandry (if needed), and two specialists in socio- or agroeconomics. The team usually is coordinated by the researcher specializing in socio- or agroeconomics. Whatever his specialty, the team coordinator should have some capability in linking the biophysical and socioeconomic aspects to be analyzed in the survey report.

The objective of an agroeconomic profile study is to gain an understanding of:

- The ongoing cropping and farming systems practiced by farmers and the reasons for these systems
- The biophysical and socioeconomic constraints to production—soil, climate (amount and distribution of rainfall), water availability, crops and varietal use, yield performance, inputs and output, labor profile (both potential productivity and current allocation of labor), markets for input and produce, infrastructure, and the like
- The researchable issues and priorities that can be suggested to the farming systems working group.

This study or survey is usually done over a period of not more than three months: one month is devoted to conducting the field survey (collection of primary data), one month to data tabulation and analysis, and one month to compiling the profile report.

Inventory of Resources

In addition to undertaking traditional commodity- and discipline-oriented research activities in Indonesia, we need to develop a systematic way of arriving at priorities for adaptive agricultural research for all disciplines within the Agency for Agricultural Research and Development (AARD). It is the view of AARD that agricultural research should precede agricultural development projects and even provide the initiative for such projects.

The first priority at the national level is to prepare an inventory of natural resources and of the present agricultural situation. The final stage in the process usually consists of developing a "land use capability

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map." Such maps have been developed for Indonesia and are useful. But for researchers the information needed for the development of such maps may be more valuable than the final product. A series of overlays presenting a sequence—from the edaphological classification of land, through the physical determinants, and finally to the land uses for individual food crops and farming systems—would be more useful. Such a sequence would help researchers orient themselves and determine what research topics might have more relevance for all the disciplines involved in the research effort.

EDAPHOLOGICAL CLASSIFICATION OF LAND. This classification attempts to delineate land areas that differ in the chemical and physical characteristics of the soil and in the water environment. Areas are classified without reference to climate or other overlapping factors such as slope or land form. As a first approximation, on the basis of experience and data available, Indonesia is classified by region according to upland, lowland (with various categories of irrigation), swamp, tidal, and mangrove areas.

ENVIRONMENTAL DETERMINANTS. This section of the inventory is based on the most important environmental factors that determine the suitability of land for crop production and that will modify the edaphological map. The key factors are soil, rainfall, elevation, and slope.

PRESENT LAND USE. For the development of land or research objectives within an area, the most significant information on present land use and on cultivation practices is obtained from farmers. Research-extension linkages allow the information to flow upward from the farmers to the regional extension workers, to the provincial extension workers, and then to the researchers; in some cases, researchers obtain the information directly from farmers. The linkages are:

- Surveys of farmers and studies done by researchers and the extension workers in selected areas
- Seminars, workshops, technical meetings, and agricultural meetings attended by farmers, extension workers, and researchers
- Field days conducted by the research institutes (these usually take place once a year and focus on food crops), at which extension agents and key farmers discuss their technical problems and constraints on production with researchers
- Communications from extension workers and key farmers to researchers—at the institutes, at research stations, and at outreach sites in farmers' fields—who are always willing to discuss agricultural questions.

On a national scale, the following land use classifications may be useful:

- Upland food crops
- Lowland rice (including *gogo rancah*, swamp, and *pasang surut* rice)
- Mixed *alang-alang* (*Imperata cylindrica* grass) and brush
- Forest (primary and secondary)
- Perennial estate crops
- Pasture.

The land use information delineated in preparing the land use capability map can be valuable in two ways. First, it is useful to relate land use for distinctly different crops or vegetation with different ecological needs to a physical setting that can be characterized. Further breakdown by crop or species of plant provides the "standards" for evaluating land capability and gives a basis for modifying present land use or for extrapolating a particular kind of land use to new areas having similar agroclimatic conditions. Second, production figures for different food crop commodities from different areas of the country provide a basis for comparison. If production figures for areas with similar agroclimatic conditions differ greatly, there is an ideal opportunity for analyzing the yield gap through relevant basic and applied research projects. Land use information classified in this way provides a rational basis for clarifying research priorities.

Table 7-1. Research-Extension Interface in Different Phases of a Cropping Systems Research Program in Indonesia

Target area selected	*Phase I Site selection and description*	*Phase II Biological and economic evaluation*	*Phase III Design and testing of cropping patterns*	*Phase IV Preproduction testing*	*Phase V Implementation*	*Technology transfer*
CSWG	CSWG	CSWG	CSWG	CSWG	CSWG	CSWG
Extension Local government National government	Extension Local government	Extension Farmers Local government Bureau of Statistics	Extension Farmers Local government	Extension Farmers Directorate of Food Production Local government	Extension Farmers National production program Local government	Extension Other National government agencies

CSWG: Cropping systems working group, the multidisciplinary research group that coordinates and carries out the plans of cropping systems research programs in a target area.

Note: This schematic represents the research-extension workload distribution and interaction with farmers and other government agencies in different phases of cropping systems research and implementation.

Selection of Target Areas for Applying Integrated Research

Integrated research is a coordinated and cohesive effort to develop technology that will enable farmers to increase production. The technology eventually recommended must be acceptable to the farmers who will use it. In some cases it may be desirable to identify and remove constraints to increased production through government programs. Production may be increased if present farming systems are better managed, an extra crop (or crops) or form of husbandry is introduced each year (intensification), or agricultural activities are expanded into newly opened or underused land areas (extensification).

The integrated research is carried out by a coordinated, interdisciplinary group of scientists. It concentrates on specific target areas to make more efficient use of limited research staff and funds. The target areas for applying integrated research must be carefully selected.

The Indonesian research program emphasizes the following criteria for the selection of target areas

- The area should have government priority for the production of food crops.
- In the case of large areas, soils and climate should not vary markedly.
- Prior evidence should indicate the feasibility of intensifying cropping patterns and farming systems.
- Markets and infrastructure should be available.

A diagram of cropping systems research in Indonesia (table 7-1) shows five distinct phases and research activities (and the groups of people associated with each) that occur after the target area has been selected and before the improved technology can be transferred.

Table 7-1 can also be viewed as a general description of the activities and intentions of farming systems research. It illustrates how research is integrated with other government agencies, with farmers, and with private enterprise in all phases of research and development—a linkage that is vital for the identification of research problems and for the subsequent implementation of results. In specific target areas, different research activities and approaches will need to be emphasized because of the varying natural conditions, stages of development, and availability of technology.

CONCEPTS FOR THE DESIGN OF CROPPING SYSTEMS. In some instances, crop or cropping systems research simply amounts to testing crop sequences in the farmers' fields under different environmental conditions. The approach in Indonesia has been to test different categories of patterns that depend on the level of technology sought or available.

When the Indonesian program started in 1975, three cropping patterns were tested in each category (items 1, 2, and 4 of table 7-2) for each target area. Each trial was replicated by three farmers. The cropping sequences tested in each category were not necessarily the same but were chosen on the basis of the same criteria. The categories and the rationale for each are presented in table 7-2.

The use of these categories for the design of cropping patterns has been successful. It has allowed researchers to be objective and has prevented them from becoming bogged down in evaluating small differences in results from using different species of legumes or varieties of rice while they are testing many different cropping sequences. Such refinements are necessary but are the kind of component studies that are never finished.

In our studies, however, we have been aware of the severe economic stress faced by many Indonesian farmers. They simply do not have the money for material inputs or, if they do have the money, they are afraid to take the risk. This is particularly true of farmers who have seldom worked with the extension service. It was therefore necessary to develop cropping patterns that could be adopted at low cost and with little risk. If the technology is good and shows evidence of being profitable, poor farmers will accept it and gradually learn how to use additional inputs.

For this reason we added category 3 to the design process (table 7-2). It has helped us find ways to make more efficient use of the tremendous energy, land, water, and labor resources in Indonesia and to induce farmers to adopt the technology developed.

The Rationale for Farming Systems Research

The physiological, agronomic, and technical aspects of agricultural research may be studied in the laboratories and research stations. The potential for increasing total production is evident from this kind of conventional research, even if many times the technology used is inappropriate for adoption by small farmers in the developing countries of the tropics. The contrasting situations of the developed and less developed areas of the world must be recognized even at the risk of oversimplification. In developed countries, where farmers are likely to be well educated and economically strong, published and disseminated research information may be sufficient to meet the farmers' needs. Farmers are able to apply the technology, assume the risk, and readily evaluate the technology within their context. In developing countries, however, farmers in general are undereducated, financially weak, and may often be afraid to assume the financial risk and peer pressures associated with change. In this case, technology must be developed and tested systematically and extended to farmers in a simplified form, in line with the constraints they face and the ability to remove those constraints.

Production programs have been developed and financed to solve some of these problems. Technological packages were made available to farmers with credit facilities through such programs as MASAGANA 99 in the Philippines and BIMAS[1] in Indonesia that increased production of individual crop commodities. Although these steps forward were successful, many farmers did not greatly benefit from the efforts and did not continue to participate. The basic problems of development and adoption of appropriate technology by farmers were not solved by these early production programs.

Before programs for crop commodities and cropping systems reach the stage of implementation, they must be preceded by research conducted under conditions approximating those of the farmers to be served. The research and implementation must be target-area specific. The first step, as has been described earlier, is to conduct preliminary research in the farmers' fields under the researcher's management to get some idea of crop performances and production potential within a target area. If this looks promising, the cropping patterns that have been designed should be further tested, as much as possible, under prevailing conditions in farmers' fields.

Methodology Used for Research on Farmers' Fields

In western Java, Lampung, South Kalimantan, and Southeast Sulawesi, the Indonesian cropping systems program has been effective in developing and implementing research in farmers' fields with the following methodology.

Table 7-2. Categories for the Design of Cropping Systems

Category of cropping pattern	*Rationale*
1. Farmer's present cropping pattern (monitored)	To establish a baseline for comparison
2. Cropping pattern farmer would choose if input and market constraints were removed	To evaluate the farmer's pattern in the absence of constraints, to evaluate the farmer's level of competence and managerial skill, and perhaps to uncover hidden socioeconomic constraints
3. Introduced pattern with low-cost inputs	To induce the farmer to try new technology gradually
4. Introduced pattern with input and market constraints removed and technical assistance provided	To determine production and economic potential and the ability of research to remove constraints

1. In the BIMAS program the government provides farmers with credit for seeds, fertilizer, and insecticides, while the extension service instructs them in the application of fertilizer and water, the use of insect controls, and soil management to grow the recommended varieties of rice. The BIMAS program could be successful only if farmers could be assured of a good market for their rice. Unfortunately, the price of rice has gone down in the peak harvest season, so that farmers have not increased their incomes even though they have increased rice production to reach national goals. Sustained adoption thus depends on an assurance that the additional investment will be more than compensated by significant additional returns.

A team (cropping systems working group, or CSWG) comprising a coordinator, agronomist, plant protection specialist, and socioeconomist was stationed in each target area. A team leader and field assistants for agronomy and economics were put in charge of the fieldwork and the collection of input-output data within each site in the target area. A system for collecting daily farm records for all buying and selling activities was implemented in cooperation with farmers (about thirty) in each target area to obtain a larger base for socioeconomic evaluation—especially to determine whether the technology is culturally acceptable and manageable within the community.

Our experience is that the organization of the research and of the research team should be as simple and self-contained as possible. The team coordinator should have the flexibility to implement the research once the general guidelines for trials, patterns, organization, and staffing have been decided. He should have mobility so that he can visit the sites and research plots frequently, talk with the farmer cooperators, and develop linkages with the extension service and local government officials. He should assume the responsibility for summarizing and preparing a draft report of the research results. Above all, he should, in consultation with his staff, critically analyze the research in progress and prepare a tentative project proposal for the following year. The involvement of those close to the field research activities is the key to successful and relevant research and staff development.

The Indonesian program has usually replicated the field trials in the fields of different types of farmers. This has been successful primarily because the target area had been partitioned into categories. For each cropping pattern tested, three farmers within a category were randomly selected as cooperators after screening by criteria relating to land tenure, size of farm, cropping system, location, and desire to cooperate. Each farmer agreed to permit 0.1 hectare of land to be used for the research. He provided the labor, and the project provided the necessary inputs. The farmer was compensated for any losses and extra labor caused by the project. All data concerning labor and input costs were collected. The cash flows of the farmers cooperating in the agronomic test group and of those cooperating in the economic test group were monitored. The data were reported in terms of yields, gross returns, labor costs, material costs, and net returns for each pattern in each category. The data from farmers cooperating in the economic test were summarized in the same way to establish more precisely the economics of the farmers' cropping patterns and to understand their farm operations.

The Flow of Research Information: What Private and Public Sectors Should Do

In our experience, the smooth and continuous flow of agricultural research information between the source and the user is always a problem. Even in the most developed countries there is usually a feeling that the dissemination process could be made more efficient and the feedback more relevant. There is a common feeling among researchers, on the one hand, that the extension agents do not see the broader issues and that extension workers should not only transfer information but also adapt the available information to meet the users' needs. Extension workers, on the other hand, feel that much research is not relevant to the needs of their clientele and that researchers are so far removed from the farm that they do not appreciate the farmers' problems.

There is some truth in both views. The important thing to remember, however, is that both research and extension workers are equally concerned about doing a good job and that more frequent formal and informal work contacts can do much to solve communication and linkage problems.

In general, the institutional linkages between research and extension are about the same in developed and developing countries. Yet linkage seems to be a bigger problem in developing countries.

The difference lies not in the official linkages but in the lack or scarcity of informal means of communication. Much of the dissemination and extension of research findings in many of the developed countries is done through commerical publications, agribusinesses, and credit institutions. Commercial publications are usually much faster in communicating new findings from public and private research institutions than are the official dissemination sources. Agribusinesses such as fertilizer and seed suppliers are equally fast

and effective in disseminating technology and information through personal contacts and publications. Most banks and loan agencies also have field agents who work hard to see that credit is used wisely and effectively Consequently, the public research and extension agencies in the developed countries are complemented by privately funded activities that provide good linkages between the two groups, the developers and users of technology. The technology flow and feedback is effective, even though the linkages are not rigidly institutionalized.

Developing countries, however, do not have a strong private sector. Therefore it is important that public institutions in these countries make a greater effort to see that mechanisms for the flow of technology and feedback are more highly developed and institutionalized. In this way, the problem of communication between institutions can be solved.

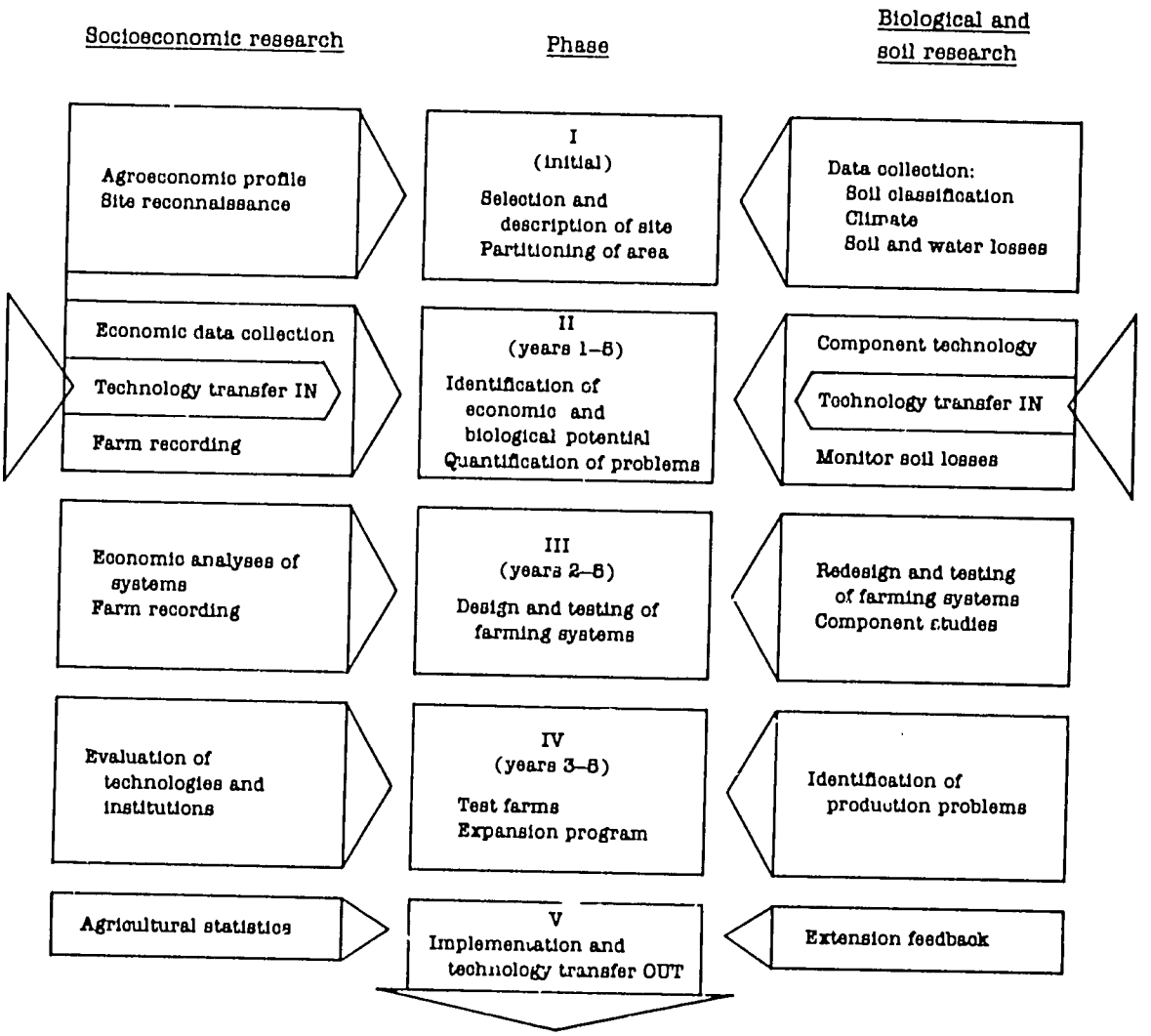
Table 7-3. Research-Extension-Institutional Linkages in Cropping Systems Research and Development for Selected Target Areas, Bogor, Indonesia, 1979

Components Activity	*Phase I Site selection and description*	*Phase II Biological and economic evaluation*	*Phase III[a] Design and testing of cropping patterns*	*Phase IV Preproduction testing*	*Phase V Implementation*
Activity	Physical Soil taxonomy Rainfall distribution Irrigation Other climatic data	Sequential agronomic testing on small plots Varieties Fertilizer response Crop combinations Other component technology	Partition of target area Water availability Soil capability Market accessibility	Research managed plots on 3–4 Increase visibility and demonstrate potential	BIMAS[b] type of program for cropping patterns, *not* commodities
	Economic Agroeconomic profile	Economic farm recording Income Labor Market price	Pattern design Farmers' design—monitor only Farmers' design—optimum management Improved design—low input Improved design—optimum management	Village level Identify biological and institutional constraints to large scale production	
		Problem-focused survey	Testing—1,000-square-meter plots[c]		
Methodology	Data collection and survey	Secondary data and small plots	Agroeconomic evaluation in farmers' fields	Field-level evaluation	Production program
Responsibility	Research and extension	Research	Research	All relevant agencies	All agencies
Time frame	Initial	Years 1–2	Years 1–3	Years 3–5	

a. In this and succeeding phases, all planning must be coordinated by the Provincial Planning Agency (BAPPEDA).
b. Production program for lowland rice.
c. Standardized data collection, data handling, data processing, and reporting.
Source: Central Research Institute for Agriculture (Bogor, Indonesia), July 1979.

There is still, however, a problem of communicating with the farmer and learning his needs. In many instances this requires on-site research. One of the purposes of cropping and farming systems research is to solve these problems of research and research dissemination. Table 7-3 illustrates the phases of a cropping system research project in a selected target area. Linkages are established among farmers, research, extension, and other government agencies as each group carries out its responsibilities within the project activities. The relative proportions of the workload distribution between research groups (CSWG) and the other responsible groups are illustrated in table 7-1. The important point that needs to be emphasized with respect to linkages is that closed and more constant contacts are necessary if farmers' needs are to be communicated to researchers and other government institutions and if technology is to be effectively transferred from researchers through extension to farmers.

Figure 7-1. Parallel Biological and Socioeconomic Activities Required for the Five Research and Implementation Phases of a Farming Systems Program



Note: The program is designed both for little inflow and for significant inflow of technology from research to farmers. With a significant transfer of technology, the research time in a target area may be reduced by two or more years.

Technology Transfer

There are two effective ways to improve the efficiency of the development and use of agricultural technology.

Research Coordination

This term has been used many times and will be used again to emphasize the importance of providing a format by which researchers have some feeling of research priorities but are not constrained by rigid boundaries of inquiry. Coordination can provide the framework that encourages collaboration not only among researchers but between them and extensionists and farmers. It discourages repetition of preliminary and shallow research yet provides a mechanism for the transfer of technology among scientists.

Site Description and Technology Transfer

Systematic socioeconomic, soil, and biological descriptions of research sites provide the basis for technology transfer to target areas with similar conditions. Figure 7-1 illustrates the mechanism and time frame for this kind of technology transfer. It is not necessary to repeat all the research phases of a farming systems project in each target area. It is important, especially in Indonesia and other developing countries, to make efficient use of research funds by laying out a series of observation trials on farmers' fields that can be used quickly to adapt information gathered over a longer time in a similar agroecological zone.