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Key Macro-Policy, Technical, and Socio-Economic Issues in Agricultural Inputs and Credit

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I. INTRODUCTION AND SUMMARY

A. Conceptual Background

Social scientists for some 40 years have studied the processes through which farmers learn about and adopt new agricultural technology and associated services. While no single, clear-cut theory, capable of explaining and predicting farmer behavior in all situations has emerged, scientists have advanced useful hypotheses. Knowledge of at least one set of these hypotheses may help provide perspective for the impact evaluations.

Two concepts are basic to farmer use of any technology or service: availability and accessibility. It is not sufficient that a service such as seed, fertilizer, pesticide, machinery, or credit actually exist (is available) although this is basic. The farmer must have ready, easy, and timely access to it. The input/service must be available at the right place, at the appropriate time, and in a form easy to transport and use. The farmer may not be able to gain access to it because of various constraints he may face--lack of funds, credit, transportation, or knowledge about the input/service or how to use it. A product or service can be physically, financially, or socially unavailable or inaccessible, or both. This paper focusses on the availability and accessibility by farmers to the assigned inputs/services.

Determining whether farmers actually do access the inputs/services made available requires consideration of a different set of variables. Social scientists have shown that at least seven characteristics of most innovations determine whether and how rapidly a farmer accepts and con-

tinues to use new technology or services.[1/] The relation of these seven to such issues as seeds, fertilizer, and pesticides is readily apparent but less so with respect to machines and credit. The first three, being consumables, must be replaced or renewed annually or with each crop. Machinery represents a one-time investment and commitment, although there is a continuing need for maintenance, a factor frequently overlooked. And credit, in most cases, provides access to the other four elements.

Each of the following characteristics bears varying degrees of relevance for the agricultural services of concern here:

Same as #5 below?

1. Relative Advantage. This is the degree to which a farmer perceives that the "service" (seed, fertilizer, etc.) will raise benefits, or lower costs, as compared with the benefits, or costs, associated with his current practice. Usually interpreted as profitability, relative advantage may take the form of a difference in effort, risk, prestige, or social approval.

2. Reliability. This is the degree to which a farmer perceives that use of the service will consistently produce the minimum crop needed to feed his family and provide the income normally received from sales.

3. Simplicity. This is the degree to which the farmer perceives the service is easy to use.

4. Compatibility. This is the degree to which a service is consistent with his needs, values, past experience, and farming siutation. Problems of compatibility arise frequently although they may not be recognized as such.

5. Visibility. This is the degree to which a farmer can see the results of using the service, and how apparent the results are to others.

1/ See Everett M. Rogers and Floyd E. Shoemaker. Communication of Innovations 2nd Edition, New York, Free Press, 1971.

While important throughout the growth cycle, visible differences are most important at harvest.

6. Divisibility. This is the degree to which a farmer perceives or knows that he can try the service on a limited basis. Seed, for example, has a distinct advantage over some other services in that a farmer can limit his initial trials to a small portion of his land.

7. Independence. This is the degree to which a farmer perceives he can try and adopt a service without consulting others. Here characteristics of farmers, themselves, become an issue. Owner operators are more independent, for example, than sharecroppers.

Given the above, it is possible to consider to what extent and how specific agricultural services projects took into account one or more of these characteristics, and, if so, with what effect on impact. Chapter 6 of Successful Seed Programs (see Seeds chapter) provides specific examples of these hypotheses in relation to programs to introduce and promote the use of improved seeds. More detailed discussions of the underlying themes, principles, and studies are presented in Everett M. Rogers and Floyd F. Shoemaker, Communication of Innovations.

Determination of the impact of agricultural services at the farm level necessitates surveys of farmers. This is not the focus of the current AID evaluation of agricultural input/services projects. Those interested in studies of farmer impact will find much literature available, both theoretical and empirical. Useful insights are provided by Arthur T. Mosher in An Introduction to Agricultural Extension. Agricultural Development Council, 1978.

In discussing agricultural inputs, Mosher has identified five essential characteristics that seeds, fertilizers, pesticides, and equipment must

have for farmers to be willing to use them. These, in certain respects, are related to the characteristics described earlier in Communication of Innovations.

These should have been integrated with #s 1-7 above

1. Technically effective: Given the farmers' soil and climatic conditions, cropping patterns, etc., will the input really make a difference?

2. Dependable quality: Can the farmer depend on the distribution system to deliver consistently high quality inputs that perform as expected?

3. Appropriately priced: Is the input priced in relation to output prices so as to make its use profitable?

4. Locally available precisely when needed: Is the distribution system sufficiently decentralized so that inputs are readily available and on hand at the appropriate season?

5. Packaged in appropriate sizes and amounts: Can farmers buy quantities that fit their cropping requirements without season to season storage?

For more detailed discussion of these points, see A. T. Mosher, Getting Agriculture Moving, Praeger, 1966, pp. 92-96.

B. The Framework

There are common components related to availability and farmer access for all five of the agricultural inputs/services under consideration. Some components take on greater significance for particular inputs or services. The most obvious common component is an effective delivery system, one that will make services available at the "end-of-the-line" where small farmers tend to predominate. Transport and storage are essential to an effective delivery system. Transport becomes particularly important for an input

like fertilizer because of its bulk. Reversing the input delivery system is also important, i.e., local markets to accept and handle increased agricultural production.

Delivering inputs must be profitable to deliverers or middlemen. Input prices and/or margins at each step of the delivery process become critical--for suppliers, wholesalers, retailers, and farmers. Output price must provide incentives to farmers. Pricing of credit services is just as critical as for inputs. The use, or misuse, of subsidies becomes a factor for consideration, both for inputs and outputs.

Quality of the inputs must be assured, usually requiring government regulatory/control programs. Seed, fertilizer, pesticides, and machinery must perform as designed if farmers are to benefit. Pesticides have the additional factor of safety.

Farmers are induced to use particular input services through information/education processes; either through government agricultural extension services and/or by the final deliverer of the service--the local retailer. Recommendations to farmers regarding use of inputs must be supported by research and tested at local levels to assure applicability to the farmers physical and biological situation. Credit is a common component of agricultural input projects. It is not an input in and of itself, but facilitates farmers access to inputs by providing him command over real resources.

C. The Process

The assignment has been approached by looking at each of the assigned inputs/services in terms of the essential components for providing farmer

access to that particular service. The issues then become whether or not a particular component is functioning as planned. The importance of various components, and therefore issues, will depend on the specific objectives of the project being evaluated.

There is a separate chapter on each input/service, although a high degree of complementarity exists among the inputs. For example, it is not usually profitable to use pesticides until high yielding seeds and fertilizer are being used and the incidence of disease or infestation is at a level which significantly will reduce yields. Fertilizer can be wasted unless seeds are of responsive varieties and water is assured. Complementarities are noted in each chapter.

Procedurally, the assignment involved an in-house conference to identify key individuals and literature. These individuals were contacted, either directly or by long distance telephone, for (1) their views regarding the key issues, (2) their suggestions regarding relevant literature, and (3) names of other knowledgeable individuals. This process led to personal interviews, primarily in the Washington area, and/or phone interviews with approximately 25 scientists/administrators.

Studies and syntheses reviewed are listed at the end of each chapter. They are divided into "most useful" and "other." "Most useful" was determined in the review process. The "other" references also were reviewed, for the most part, but some are included on the basis of recommendations of individuals interviewed.

Senior World Bank officials report that, except for credit, formal Bank policy statements do not exist for the other agricultural services. To document the Bank's guidelines for mechanization, pesticides, fertilizer, and seed would require an analysis of individual project documentation for

a number of projects in each region of the world. Such a task is not within the scope of this paper.

D. Summary of Key Issues

The key issues to guide evaluation of each of the inputs/services are selected from the text and reproduced below. The numbers are not consecutive as some minor or less important issues are not included here. The issues are cast in rather absolute terms, when in fact evaluators in the field will be dealing in matters of "degree" or "extent" in project performance.

GENERAL ISSUES

To the extent the agricultural services are related to agricultural technology (varieties and cultural practices), then certain issues are common to most services. Among these would be:

ISSUE #1. Were technologies or technological packages actually available to farmers that are capable of substantially increasing output over current practices?

ISSUE #2. Was information about the new technolgies being effectively transmitted to farmers?

Another issue general to most agricultural inputs is the distribution system. Roads, bridges, canals, docks, and other transportation and storage facilities are essential for inputs to be received, moved, stored, and delivered to users. Lack of such constitutes a major obstacle to encouraging private sector participation. Thus:

ISSUE #3. Did government provide adequate infrastructure (roads, canals, docks, etc.) to facilitate transportation of inputs? Were public or private storage facilities available?

MACHINERY AND EQUIPMENT

ISSUE #3. Did the changes in farming operations claimed for the mechanization project actually take place?

ISSUE #4. Was the machinery and equipment selected for the project appropriate for achieving the intended result?

ISSUE #5. Did farmer participants in the project have ready access to maintenance and repair facilities and spare parts?

ISSUE #7. Did the manufacturer develop as an enterprise capable of meeting project objectives? Have sales, maintenance, and repair facilities and spare parts been decentralized into the market area?

PESTICIDES

ISSUE #1. Were the proper information, education, training, regulatory, and other activities that will assure safe handling and use of pesticides incorporated into the project?

ISSUE #2. Was there a domestic research capability for work on pesticides. If not, was the staff strengthened so as to be able to test imported material?

ISSUE #3. Did the distribution system provide adequate access to pesticides for the target population?

FERTILIZER

ISSUE #1. Were host government options regarding fertilizer pricing and subsidies analyzed and rational choices made on the basis of this analysis?

ISSUE #3. Was fertilizer made available in the right kind, in the right amount, appropriately packaged, and at the right time for the target population of the project?

ISSUE #4. Did the research establishment issue useful fertilizer recommendations and did these recommendations get to farmers through the extension service and/or the fertilizer dealer network?

ISSUE #7. Were marketing margins and other essential services and programs conducive to private sector involvement in fertilizer distribution?

SEEDS

ISSUE #3. Were desirable varieties available for the seed program, either domestic or imported?

ISSUE #4. Was basic seed multiplied in adequate quantities for the seed program?

ISSUE #5. The evaluation team should include a seed technician familiar with the vast array of technical factors involved, which are only highlighted in the text, for adequate assessment of performance in seed production, processing and storage. The primary factors to be looked at will be the appropriateness of equipment and facilities selected, adequacy of maintenance program, numbers and quality of staff assembled, and adequacy of the financial resources committed to the program.

ISSUE #6. Did the seed enterprises, either public or private, effectively extend into remote areas predominated by small farmers?

ISSUE #7. Were the quality and control and informational components of the seed project in place and effectively supporting the seed program?

ISSUE #8. Did input supply programs, credit and trade policies, and pricing policies effectively support the seed project?

ISSUE #9. To what extent did governmental policies encourage private sector involvement?

CREDIT

ISSUE #3. Were inputs necessary to the new technology readily available to farmers?

ISSUE #4. Were local markets adequate to handle increased output?

ISSUE #8. Was the capacity of the credit program adequate to serve a large number of small clients at low cost?

ISSUE #9. Were low interest rates undesirably influencing the credit program?

ISSUE #10. Were delinquency and default rates undesirably influencing the credit program?

ISSUE #11. Did the lack of an effective rural savings mobilization program adversely affect the credit program?

ISSUE #12. Who had access to the available credit? Small farmers? Women? Landless farmers?

ISSUE #13. Were indigeneous or traditional sources of credit available? How did they compare with the more formal sources? In what ways: Access? Cost?

II. MACHINERY AND EQUIPMENT

A. Macro-economic Aspects of Farm Mechanization

Generalized conclusions regarding macro-economic aspects of farm mechanization are provided by Binswanger (1) based on a historical comparison of the growth in mechanization in developed and underdeveloped countries. His research supports the following generalizations:

1. "The rate and pattern of invention and adoption of agricultural machinery are governed to a substantial degree by an economy's land and labor endowments, by the non-agricultural demand for labor, and by conditions of demand for final agricultural products."

2. "Mechanization leads to direct yield increases only in exceptional cases such as the application of seeds, pesticides, or fertilizer. Thus, higher levels of mechanization usually substitute for labor, or--where they are already in use--for animals."

3. "Mechanization is most profitable and contributes most to growth where land is abundant, where labor is scarce relative to land, and/or where labor is being rapidly absorbed into the non-agricultural sector."

4. "High capital costs (relative to labor) retard mechanization, and lead to selective emphasis on power intensive operations. Machinery design adjusts to high capital costs by lack of convenience features, simplicity and reduced durability."

5. "Mechanization is the key facilitator of farm size growth."

6. "Large farms adopt new forms of mechanization considerably faster than small farms."

7. "Farm sizes play a much less important role in determining optimal machine sizes for operations where rental markets are fairly easy to establish."

These generalizations suggest that there are probably few AID assisted countries where mechanization (other than pumps and power for pumping irrigation water) will have the desired impact on AID target groups of small farmers. Most AID assisted countries have high labor to land ratios (some AFR and LA countries may be exceptions) and low agricultural wage rates.

The non-agricultural sectors are not making strong demands on the labor force. The elasticity of demand for final products may be favorable, however, particularly in countries emphasizing export crops.

Mechanization is generally not yield-increasing and, unless land is abundant, increasing mechanization will displace labor. Typically, the labor displaced is at the lower end of the economic scale and can have only lower alternative opportunities thus further worsening the equity situation. Since large farms mechanize faster than small farms, there is a further deleterious effect on equity. This latter effect may not be as serious in countries or regions within countries where custom hire markets for machinery have developed as in Thailand (4).

Binswanger's ((1) p. 17) concludes that subsidization of mechanization can speed up mechanization, but this will not increase yields and, unless the mechanization is driven by labor scarcity and high wage rates, cost of production reductions cannot be expected and the output effects of the subsidies cannot be large. However, reductions in labor use can be large with harmful effects on the agricultural laborers.

ISSUE #1. Did the project's economic, social, and techncial analysis adequately assess the project's expected impact on output, employment, income, and equity of those impacted?

B. Patterns of Mechanization

A uniform pattern of evolvement of mechanization appears to be borne out in the historical record of developed and developing countries. (See (1) pp. 18-28).

The first processes to be mechanized have been power-intensive processing and pumping--milling, threshing, chopping, sugarcane crushing, pumping

of water, etc. frequently with stationary power sources. For the most part, these machines serve many customers and have been adopted despite low wage rates.

Primary tillage, the first operation in land preparation, is the next to be mechanized but depends on the availability of mobile power resources. As new power sources become available, they are first used for primary tillage, with secondary tillage continuing to be performed by the old power source for a considerable period. Transport, another power-intensive operation, is quickly shifted to new sources of power.

Mechanization of harvesting comes next but depends on the nature of the crop. Some, such as root crops, are highly power-intensive. Some, such as apples and some other fruits, have not been satisfactorily mechanized. Mechanization of harvesting depends on the amount of labor required and wage rates and is not profitable in most low wage countries ((1), p. 25).

Seeding and planting are among the few agricultural operations where machines give greater precision than hand labor. Small grain seed drills, maize drills, cotton seeders, and fertilizer drills are used because they result in yield increases, save seed, and facilitate interculture (weeding, primarily). In addition, these tools usually reduce significantly the time required for planting, except in those cases in which the seed is broadcast by hand.

Weeding and interculture of crops, fields, and orchards are shifted to new power sources only after tillage, transport, threshing, and seeding have been shifted.

Fertilizer placement is improved by equipment and results in higher yields from the same amount of fertilizer. Application of pesticides

requires sprayers and dusters which evolve as pesticide materials become available and are used even in situations of low wage rates.

ISSUE #2. Was the mechanization project being evaluated consistent with the country's or region's stage of mechanization?

C. On-farm Mechanization Programs

Typically, on-farm mechanization programs involve tractors, tillers, harvesters, threshers, dryers, motorized pumps, or other specialized machines. Improved hand tools or improved ox or buffalo drawn equipment may be included.

Improved mechanical devices are justified on one or more of the following changes in farm operations.

1. Increased intensity and diversity of farming operations, i.e., machine power permits more timely harvest and seedbed preparation and makes double or triple cropping possible. Diversification in cropping patterns also may be feasible.

2. Increased crop yields by increased precision of farming operations e.g. deeper plowing permits more effective use of fertilizer and precise placement of seed and fertilizer increases yields; and by better control of weeds, insects, and diseases.

3. Reduced harvest and post-harvest losses of crops through the use of improved harvesters, threshers, and dryers.

4. Increase in labor productivity because of greater capacity of mechanical devices, resulting in increased size of farm operation where available land is not a constraint.

5. Off-farm uses through hiring out of equipment for non-farm uses such as transport of goods and people by mechanical rolling stock.

ISSUE #3. Did the changes in farming operations claimed for the mechanization project actually take place?

Accurately assessing these changes may require pre-evaluation surveys or studies.

Appropriateness, particularly relating to size, will depend on an individual farmer's operation and management plan--whether he plans to do custom work or can fully use the machine in his own farming operation.

ISSUE #4. Was the machinery and equipment selected for the project appropriate for achieving the intended result?

Machines are a useless investment unless they can be kept in use. Depending on the size of the project area, a repair and maintenance system can involve a rather substantial investment and require managerial talent to keep it functioning. If these facilities have not been built into project costs, there is a strong presumption that repair, maintenance, and the availability of spare parts will be found inadequate.

ISSUE #5. Did farmer participants in the project have ready access to maintenance and repair facilities and spare parts?

Labor displacement is the most frequently voiced objection to mechanization. Available evidence is clear, at least for South Asia, that use of tractors replaces labor. Binswanger (2), analyzing a large number of comparable tractor surveys in India, Pakistan, and Nepal, noted:

> "The other main conclusion of the surveys related to the labor-saving nature of the tractor investments. That tractor farms generally do not show much less labor use per hectare than do bullock farms does not imply that they are not labor displacing. What counts is, first, that the frequently higher levels of output on tractor farms (on account of their better capitalization) are generally produced by equal amounts or even less labor. Second, even if the tractor investment left employment unaffected, we must count the foregone employment of not investing the additional capital required for tractors into employment-creating irrigation or even non-agricultural investments as an employment cost of tractors."

The complexity of the analysis by Binswanger, and the magnitude of scientific staff work involved in the 20-odd farm surveys which he studied, suggests that the employment issue cannot be addressed in a conventional impact evaluation. It would be better to see that this issue is addressed to the extent possible, in project design.

Factors that will minimize the impact of mechanization on employment will be to assure that machinery and equipment included in a project is properly priced. Properly, in this sense, means that it is not subsidized by the project nor by the government through exchange rate policies or subsidized credit. If machine owners bear the full cost of this innovation, then any labor displacement is an adjustment that must be accommodated in the interests of overall agricultural and economic growth in the country.

ISSUE #6. To what extent has mechanization supported under the project had an undesirable effect on employment?

In another synthesis of rice mechanization studies in Asia, Herdt (3) found that power tillers had minor positive effects on output (a 10 percent increase in intensity of cultivation), but neither tillers nor threshers had any clear effect on yields either through timeliness of operations or shortening turnaround time (time between harvest and seeding the next crop). Herdt notes that machines substitute for labor, but the studies reviewed do not quantify this. He concludes that

> "the actual impact on laborers of any reduction in the demand for labor depends on the proportion of their incomes that derive from operations that are mechanized and the opportunities for alternative earnings. This varies from place to place making the need for a careful assessment of the likely impact of mechanization that much more important." ((3) p. 19).

D. Machinery and Equipment Manufacture

Domestic manufacture of machinery and equipment usually is justified (a) on the basis of foreign exchange savings from not having to import, (b) on having machinery and equipment better suited to the needs of the country, and (c) increasing industrial employment.

Manufacture of farm machinery and equipment may be taken up by well-established firms, or new enterprises may be created. In the latter case, a major institution building task may be at hand. The managerial and administrative capacity of the organization must be developed to the point where dependable quality products are being produced. This frequently will require training in management as well as in technical or engineering aspects.

A key factor in a successful manufacturing operation will be to establish a sales and support organization in the market area to be served. This must include a maintenance and repair capability and a stock of spare parts.

ISSUE #7. Did the manufacturer develop as an entity capable of meeting project objectives? Have sales, maintenance, and repair facilities and spare parts been decentralized into the market area?

Subsidies, through credit or otherwise, are frequently provided to facilitate the establishment of a new enterprise. So long as these subsidies are used on establishment and development costs and do not result in lower than market prices for the machinery and equipment, there should be no uneconomic impact on employment.

ISSUE #8. Did the project analysis take into account the pricing and subsidy question in enough detail to understand what was supposed to happen in project implementation?

References

Most Useful

(1) Binswanger, Hans P. "Agricultural Mechanization: A Comparitive Historical Perspective," Agricultural and Rural Development Department, World Bank, October 4, 1982. Memeographed.

(2) Binswanger, Hans P. The Economics of Tractors in South Asia--An Analytical Review, Agricultural Development Council, New York and International Crops Research Institute for the Semi-Arid Tropics, Hyderabad, India.

(3) Herdt, Robert W. "Mechanization of Rice Production in Developing Asian Countries: Perspective, Evidence, and Issues," International Rice Research Institute, September 1981, Memeographed.

(4) Wattanutchariya, Sarun, "Economic Analysis of Farm Machine Industry and Tractor Contractor Business in Thailand," Kasetsart University, September 1981. Memeographed.

Other

A large number of micro studies in Asia on the consequences of mechanization are being conducted under a project supported by AGR/S&T/AID. These papers may be useful depending on the specific countries in which mechanization projects are evaluated.

Two large farm mechanization conferences were held in Asia under sponsorship of the Agricultural Development Council (A/D/C). The papers were edited by Herman Southworth and Milton Barnett and published by A/D/C.

Farm Mechanization in East Asia, A/D/C, 1972.

Farm Mechanization in South East Asia, A/D/C, 1974.

III. PESTICIDES

The nature of pesticides sets them apart from other agricultural inputs. Because of their toxicity there is the issue of human and environmental safety. In addition, the agricultural use of pesticides results in the build up of resistance in insects with possible undesirable side effects, e.g. mosquito vector resistance to malaria control efforts.

Pesticide issues can be best viewed from two inter-related aspects--pest management and pesticide management. The former deals with the farmers use of pesticides as part of a pest control program for increasing agricultural production. The latter deals with the creation, delivery, and use of pesticides in a safe, effective manner.

The use of pesticides in agricultural production typically follows the adoption of other improved practices. For example, if high yielding varieties are being used, along with fertilizer, then crop yields are probably large enough to warrant protection. This is the role of pesticides--to protect a crop created with other inputs from damage that can result from insect or disease attacks. And, weed infestations are compounded by the use of fertilizer and irrigation water, creating a demand for herbicides.

There are two general approaches to pesticide application--prophylactic or selective. In the former, a schedule of application for a particular crop is adopted and applications are made according to this schedule irrespective to actual crop damage. This approach generally is not recommended, but may have to be used if applicable research results are insufficient to support the selective approach.

The selective approach involves developing a procedure that will signal farmers that it is time to apply pesticides. For example, this could be a procedure where farmers count insects or other manifestations of the presence of insects. When a certain number per unit area is reached, the farmer knows that timely application of a particular pesticide is warranted. This method is much preferred but it requires research to establish the indicators and training to teach extension workers and farmers the assessment techniques.

A. Safety - Human and Environmental

Pesticides are chemical compounds intended to be toxic to some specific disease or insect. This toxicity also may be harmful to those handling pesticides, to the environment, or both. Safety precautions are necessary.

Pesticide experts recommend selection of a pesticide that is no more toxic than necessary for the task intended. Then farmers must be trained to use the material safely, and to store or dispose safely the left-over chemicals and containers.

Disposal of pesticide containers and out dated stocks is difficult and potentially dangerous. Instructions on disposal should be included in the training and information aspects of the project and on pesticide container labels.

Pesticides, particularly if over-applied, can create environmental problems. Many pesticides are persistent and accumulate in the environment where applied. Runoff from pesticide-treated areas may contaminate drinking water. Rice/fish culture can be subjected to hazards from use of pesticides. Here again, selection is the key to minimizing undesirable side effects.

Proper packaging and labeling also is emphasized so that dangers from accidental use are minimized. Farmers should be able to buy materials in packages that approximate their requirements, and with detailed instructions as to their use rather than provided a "coke bottle" full from a much larger container.

The manufacture and import of pesticide chemicals should be regulated by government. Legislation and regulations should provide for testing materials to make sure they meet manufacturers claims, and so that appropriate safety measures can be devised. Such testing should be done in public laboratories having scientific staff and equipment capable of running the necessary tests to determine environmental behavior, persistence, hazards, and residues of pesticides. Regulations should also prescribe required labeling of pesticides which deal with contents, hazards, and use instructions ((1) Chapter 16) and other matters necessary to regulate pesticide use.

Other than the regulatory aspects, the brunt of the effort to achieve a safe pesticide management program will fall on the educational, informational, and training activities built into the project. The general public, farmers, dealers, manufacturers, and others dealing with pesticides have different levels of involvement, and knowledge requirements will vary. Specialized educational/training programs for farmers and wholesale and retail dealers are particularly critical.

ISSUE #1. Were proper information, education, training, regulatory, and other activities that will assure safe handling and use of pesticides incorporated into the project.

B. Research

Pesticides should be as insect or disease and crop specific as possible to provide good control and to avoid undesirable side effects. This creates the need for a large number of different pesticides, particularly in areas of diversified cropping. As pesticides are used, insects and diseases adapt, thereby creating the necessity for continually developing and disseminating new pesticides.

Because of these continually changing requirements for pesticides, a heavy burden is placed on the public research system as well as on pesticide manufacturers to develop and test new materials. To be most effective, pesticides must be applied at a specific stage of plant growth or at a particular stage in the life cycle of the insect. Effectiveness also varies with variety, season, and cultural practices. Therefore, relatively sophisticated physical and biological research is needed to support a pesticide program. This will not likely be available in most developing countries, and scientists there should concentrate on testing imported pesticides and on developing local recommendations for their use.

In addition, the changing requirements for pesticides make training farmers and dealers in the distribution system a continuous issue. This is in contrast to fertilizer training which can generally be thought of as "once over" for a particular farm and cropping pattern.

In addition to the relatively sophisticated physical and biological research requirements, careful economic evaluation of the pests and the pesticides is required. Visible pest damage does not necessarily justify

pesticide application. An economic evaluation takes into account the probable damage from pests and the costs, considering effectiveness, of treatment. Economic evaluation is not possible without the results produced by physical and biological research.

ISSUE #2. Was there a domestic research capability for work on pesticides. If not, was staff strengthened so as to be able to test imported material?

C. Distribution

The distribution network required for pesticides is not materially different than that needed for fertilizer, seeds, or other purchased inputs, except of course, the more stringent safety requirements. The distribution system must be broad-based so that farmers in all geographic areas needing pesticides have access. Safety measures must be taken at each step in the system, and the system must be staffed with people conscious of the safety hazards and trained to cope with them. Dealers, wholesalers, and anyone else in the distribution system will require training in handling, storing, and packaging of pesticides.

As indicated earlier, it is important for retailers to package or repackage pesticides so that farmers know what they have bought and have detailed information on how to use it.

ISSUE #3. Did the distribution system provide adequate access to pesticides for the target population?

D. Integrated Pest Management

Integrated pest management involves the use of resistant varieties, steps to increase insect predators, and careful tillage practices along with

the judicious use of chemicals. Farmers will be able to reduce the use of highly toxic chemicals as more resistant varieties are developed, as more specific chemicals are developed, and as scientists find out more about the vulnerable stages in the life cycles of harmful insects.

Primarily because of the fact that not enough research has been done, fully integrated pest management programs for most countries still are not available. Farmers must continue to use present and newly developed chemicals (4). However, where any aspect of pest management has been adequately researched, e.g. resistant variety, it should be incorporated into the program. A long range goal would be a fully integrated pest management program.

References

Most Useful

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(2) Ennis, W. B. Introduction to Crop Protection, American Society of Agronomy, 1979.

(3) Metcalf, Robert L. and Luckmann, William. Introduction to Insect Pest Management, 2nd edition, John Wiley, 1982.

(4) Bottrell, Dale G. "Integrated Pest Management," Council on Environmental Quality, December 1979.

Other

(5) Pest Management Strategies in Crop Protection, Volume 1, Congress of the United States, Office of Technology Assessment, 1979.

(6) Apple, J. Laurence and Smith, Ray F. (Editors). Integrated Pest Management, Plenum Press, 1976.

(7) Proceedings of a Seminar Workshop on Pests and Pest Management in the Caribbean, CICP and AID, 3 Volumes, 1981.

(8) Bottrell, Dale G. and Smith, Ray F. "Integrated Pest Management," Environmental Science and Technology, Volume 16, pp. 282-288, 1982.

IV. FERTILIZER

Discussion of fertilizer here is confined to distribution and use, either from imported or domestic sources. Plant manufacture is not covered.

A. Contribution of Fertilizer to Farm Production

Nitrogen, phosphate, and potash, as well as many minor elements, are required for plant growth. These nutrients are available to varying extents in the soil. Additions can be made by incorporating plant and animal residues or growing legumes which fix nitrogen in the soil. In intensive agriculture, however, or on low fertility soils, these sources must be supplemented by chemical fertilizers to achieve high crop yields.

It is difficult to determine the precise impact of fertilizers on crop yield, primarily because of the high complementarity of associated inputs--varieties, irrigation, pesticides, herbicides, labor, etc. The primary interest of the farmer is what happens as the result of using the package of inputs. A number of attempts to isolate the influence of fertilizer on crop production have shown that it accounted for about one third of past increases in grain production in Asia, but only one fifth in Africa. The impact of fertilizer is on yields. Fertilizer usage was responsible for about 85 percent of improved yields in the Near East, about 65 percent in Latin America, and 43-49 percent in the Far East. (See (1) pp. 152-58). These, and other studies ((2) Herdt and Barker (1975)) show that fertilizer is a highly important factor in increasing food production in developing countries.

Another measure typically used to assess fertilizer response is that one kg. of fertilizer applied to grain crops results in 10 kg. increase in grain output. This figure will vary by country and within a country, but has, nevertheless, become a useful and widely used standard.

B. Factors Influencing Fertilizer Use

Fertilizer use is determined primarily by fertilizer/product price ratios, agronomic response of crops to fertilizer, and the number and extent of constraints farmers face.

1. Prices and Subsidies

Farmers are responsive to changes in fertilizer prices and to the price of fertilizer in relation to product prices. The price elasticity of demand for fertilizers in many developing countries is reported in (1) p. 161 to be between 0.5 to 1.0 in the short run and 1.0 to 2.0 in the long run. Thus, governments could expect a 10 percent reduction in the price (usually through subsidy) of fertilizer to result in a 5 to 10 percent increase in fertilizer consumed. Utilizing the standard measure described above of 1 to 10, fertilizer input to grain output, it is easy to see why governments in desperate need of food grain turn to fertilizer subsidies.

Because farmers are responsive, governments can expect an output effect but should also expect to suffer a relatively heavy drain on the national treasury. Governments must balance this cost against other ways of getting needed food grains--investment in extension, research, irrigation, improved seeds, etc. With the exception of extension, the gestation

period for these investments to influence output significantly is 5 to 10 years.

Or governments can import food. Another option is to raise the price of food grains to farmers (again requiring a subsidy unless consumers are expected to pay) thus influencing the other half of the fertilizer/output price ratio. This option has more wide ranging effects on the economy--food consumption and nutrition levels of the poorer in the population, creating imbalances in the agricultural industry, etc.--than fertilizer subsidies.

Another option available to governments to obviate the need for subsidies is to reduce the cost of producing, importing and/or distributing fertilizer. FAO (3) has prepared a convenient bulletin covering a myriad of factors that bear on the final cost of fertilizer to farmers.

If a government decision to subsidize fertilizer prices is based on a careful analysis of all the consequences, an impact evaluation should probably turn to determining whether or not the subsidy program is working the way it was intended.

Because of high risk aversion, particularly by small, subsistence farmers, subsidies may be used effectively to introduce fertilizer to farmers for the first time. Later purchases may not need to be subsidized.

ISSUE #1. Were host government options regarding fertilizer pricing and subsidies analyzed and rational choices made on the basis of this analysis? Was crop insurance considered or made part of the project? Another approach is to provide some farm or crop insurance, especially within the project for participating farmers.

2. Agronomic Factors

Experience has shown that the yield difference between a farmer's current practices and that resulting from fertilizer adoption must be significant if farmers are to change practices (see (4) pp. 45-46). Factors involved in the agronomic response to fertilizer are: soil; climate; irrigation;

plant variety; prevalence of insects and disease; type of fertilizer and method of application; nutrient balance; and timeliness of application. The influence of these factors is determined through research and provided to farmers in the form of recommended fertilizer use for particular situations.

Availability of high-yielding, fertilizer-responsive varieties is a critical factor in determining whether to fertilize a crop and the rate of application. Irrigation is highly significant as it shifts the response curve upward and provides stability of results. Research can help farmers to adjust to soil, climate, and rainfall factors. As noted earlier in the mechanization discussion, method, precision, and timeliness of fertilizer application were yield increasing.

Government policy impacts on these response variables through investment in research and extension, and, particularly, in irrigation facilities.

ISSUE #2. Did government create the institutional (research and extension) and physical (irrigation facilities) infrastructure to support a fertilizer program?

C. Constraints to Fertilizer Use

1. Unavailability of Fertilizer

It is necessary not only to have sufficent fertilizer in country to meet farmers demands but to have it at the right location at the right time. This is primarily a function of the fertilizer distribution mechanism. Typically, this mechanism, whether public or private, fails to make fertilizers available in remote--physically and economically--areas of a country. This affects most heavily small farmers who tend to predominate in the more

remote areas. Thus, the distribution system can become an absolute constraint on fertilizer use in areas not served. In a survey of 46 developing countries, FAO found that the use of fertilizers was seriously hampered in 75 percent of the countries because of local unavailability. (Reported in (1) p. 170).

Failure of the distribution mechanism can be related to institutional inefficiency, the fact that these markets may be uneconomical to serve, poor transport facilities limiting access, lack of adequate storage facilities, or a lack of interest in providing service to remote areas. Private distributors appropriately do not serve uneconomic areas. Public distributors will have to be subsidized to serve these areas or the price of fertilizer to farmers may be prohibitive.

The physical infrastructure, primarily transport and storage, is a critical part of the distribution system. Fertilizer cannot be distributed widely without roads and trucks. Primary distribution from plants or ports usually relies on rail transport. Regional and local storage facilities are essential because of the seasonal nature of fertilizer use.

If a country depends on imports for its fertilizer, the competition for foreign exchange may limit the amount of fertilizer imported. In which case some rationing mechanism must be evolved with even less likelihood that farmers in remote areas will be served.

ISSUE #3. Was fertilizer made available in the right kind; in the right amount, appropriately packaged; and at the right time for the target population of the project?

2. Lack of Knowledge

Farmers, extension agents, and fertilizer dealers frequently are ill informed about the kind and quantity of fertilizer to use and how and when to apply it. In most developing countries, governments generate and dis-

seminate information about fertilizer. Response to fertilizer is location specific and influenced by many factors (See B.2. above). Research and on-farm testing are required to tailor recommendations on fertilizer use to specific farming situations. Cooperation among farmers, extension agents, and research workers will produce useful results. This kind of testing frequently is not done, and government agencies issue generalized fertilizer recommendations. These only yield optimum results by accident.

The fertilizer dealer is a key person in fertilizer distribution, particularly through his interaction with farmers in the sales transaction. Dealers who have current, accurate information about fertilizer use recommendations for their service areas contribute greatly to a successful fertilizer program. This suggests that more consideration be given to providing technical training, refresher courses, and up-to-date informational materials to individuals engaged in the supply and sales of agricultural inputs to farmers.

ISSUE #4. Did the research establishment create useful fertilizer recommendations and did these recommendations get to farmers through the extension service and/or the fertilizer dealer network?

3. Risk and Uncertainty

"Uncertainty regarding yields and fear of heavy loss due to crop failure is the major reason behind non-adoption of fertilizers by farmers in dryland areas." ((4) p. 53). Uncertain yields result primarily from uncertain rainfall and attacks of pest and disease. This kind of uncertainty can be mitigated by government policies that facilitate the use of pesticides or resistant varieties, and the development of irrigation facilities.

Market risks are related primarily to crop prices at harvest. Fertilizer use will be lower in areas of uncertain or widely fluctuating crop prices and higher where governments stabilize prices.

ISSUE #5. Did government policies and programs mitigate the impact of natural and market factors on the risks and uncertainties farmers face?

4. Lack of Credit

Lack of credit is the reason farmers give most frequently for not adopting, or increasing use of, fertilizer. Despite this, little research on fertilizer and credit use supports this attestation by farmers (See (4) p. 50). Other factors such as risk and uncertainty, lack of knowledge, or even the unavailability of fertilizers, may be the real reasons why credit is not obtained and used for fertilizer (see (7) pp. 29-30). Nevertheless, it would appear that the availability of credit for purchase of fertilizer would influence fertilizer use positively.

Credit frequently is available to farmers and to importers but infrequently to the rest of the distribution channel--wholesalers and retailers. This can severely constrain efficient private sector involvement in a fertilizer program.

5. Land Tenure

The effect of land tenure depends on the tenancy arrangements. If tenants and landlords share input costs equally, or a fixed rent is paid, tenancy has no economic influence on fertilizer use. If the tenant is responsible for all inputs and must share some of the crop with the landlord, however, lower fertilizer inputs will be more economic for the tenant.

D. Complementarity of Inputs

It has been emphasized throughout that it is the entire package of modern practices farmers need--improved varieties, irrigation, pesticides, herbicides, and other improved practices, in addition to fertilizer.

A well-designed, financed, and implemented comprehensive agricultural development program will achieve the best results. Where fertilizer is a constraint in this overall package, it should be emphasized. The same is true for other inputs.

ISSUE #6. Was the fertilizer project part of a larger agricultural program designed to bring balanced availability of all inputs to farmers?

E. Private Sector Involvement

The key to private sector involvement in fertilizer distribution is adequate, i.e. profitable, margins at each stage of the distribution process--retailer, and one or more sets of wholesalers. Where government does not control fertilizer prices, margins should be adequate. Over development of the distribution network leading to intense competition among dealers may temporarily reduce margins below profitable levels, as has been reported in Thailand. Time will sort this out in a free market (See (5) pp. 22-24). Problems manifested under government controlled prices are discussed for Nigeria in (6), Chapter 8.

The availability of other public or private services, such as credit, particularly for holding fertilizer inventory, will facilitate private involvement in fertilizer distribution. Access to adequate storage facilities throughout the distribution network is essential because of the seasonal nature of fertilizer demand. Information made available to retailers on fertilizer recommendations for their service areas will permit them to do a better job. Provision of adequate transportation facilities for fertilizer requires cooperation and interaction between government and the private sector. Availability of roads makes it possible for private dealers to move and distribute fertilizer by trucks.

Another important factor facilitating private sector involvement is consistency in government policy and reliability in the performance of related programs. If government sets targets for production of specific crops in specific areas, fertilizer dealers will plan accordingly. Failure to achieve targets, for whatever reason, is likely to result in unprofitable dealer operations. If this happens regularly, dealers will cut back to some safe level of operation and raise prices and margins, if not controlled, on a smaller volume of business. Dealer confidence in operation of the rest of the system is essential for efficient dealer involvement.

ISSUE #7. Were marketing margins and other essential services and programs conducive to private sector involvement in fertilizer distribution?

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V. SEEDS

A. Prerequisites to a Successful Seed Project

A successful seed industry development project must be consistent with a country's stage of agricultural development and its current status of seed activities. Douglas (1) defines four possible stages of seed activities:

"In stage 1, agricultural research and development are ineffective, limited, or just getting under way. Most varieties of basic food crops are traditional, as are production practices. Nearly all farmers save their own seed, but a plant breeding department may be distributing small quantities of improved varieties of some crops.

In stage 2, agricultural research and development are under way. Improved varieties of basic food crops are being developed and are beginning to replace traditional varieties. Use of production inputs, such as fertilizer, is limited but improving. A few farmers and seed production units are multiplying seed. The limited quantities of seed available are a constraint upon improvements in crop production.

In stage 3, agricultural research and development are well established and productive. High-yielding varieties of basic food crops are rapidly replacing traditional varieties in the most productive areas of the country. Production inputs are widely used, although usually not at the most efficient levels. Many components of a seed program exist, and the supply of seed ranges from fair to adequate. Seed quality may be poor, distribution remains relatively inefficient, and farmers use much less seed than is available for distribution. Some private seed enterprises are being formed.

In stage 4, the agricultural sector is well advanced. The national seed policy is reexamined, special attention is given to developing and strengthening commercial seed production and marketing, a seed law is in force, and links are established with related and supporting institutions and groups.

Douglas notes that there are far too many attempts to establish stage 3 and 4 programs when a country is only able to handle stage 1 or 2.

ISSUE #1. Is the seed project being evaluated consistent with the country's stage of agricultural and seed development?

Another prerequisite is a strong government commitment to seed industry development. An overall agricultural development strategy must exist with a clear role for improved seeds in this strategy. This would sanction and facilitate subsequent stages of evolution of the seed program, including the appropriate commitment of personnel and financial resources. A high level decision should also be taken regarding the institutional form for implementing the seed program, specifically the respective roles of public and private enterprises.

ISSUE #2. Was there a strong government commitment to the seed program, including adequate funds and personnel?

B. Components of a Seed Program

1. Operational Components

a. Crop Breeding Research

A successful seed program requires the development of crop varieties that meet the needs of farmers--high yields, insect and disease resistance, early maturity or other agronomic features, and grain quality acceptable to consumers. A country's agricultural research establishment should have the capacity to create a continuing stream of varieties that increase farmers' potential for increased income. If the research establishment does not have this capacity, the seed program must depend on importing and testing seed of varieties introduced from outside the country.

ISSUE #3. Were desirable varieties available for the seed program, either domestic or imported?

b. Basic Seed Multiplication

After an improved variety has been created it must be maintained and multiplied as the next step in getting improved seed to farmers. Organiza-

tionally, this can be done in many ways. Countries in stage 1 may make the plant breeder responsible for maintaining and multiplying the new varieties he creates. But this detracts from his primary function of creating new varieties. A specialized group or a basic seed enterprise may be established to handle seed maintenance and multiplication in collaboration with the plant breeder. This generally will be a public enterprise.

A key issue at this point is the government's policy on use of the basic seed. If basic seed is supplied only to public farms or seed units for increase and distribution to farmers, an opportunity will have been missed to involve the private sector. The critical point here is the nature of the crop for which seed is to be produced. If the crop is self-pollinating, then many farmers will save seeds from one harvest to plant the next crop. They are more likely to buy seed of open-pollinated crops from suppliers, and in the case of hybrids, it is necessary to buy seed for each planting. Thus the private sector tends to focus on the production and sale of hybrids.

ISSUE #4. Was basic seed multiplied in adequate quantities for the seed program?

c. Seed Production, Processing, Storage and Marketing

These activities require organization, staffing, equipping, and financing for successful operations. (See (1) Chapters 4, 6, 7, and 8 for details). Appropriate buildings; land; drying, laboratory, processing, and field equipment; seed storage facilities; and vehicles must be obtained and maintained. Managerial, technical, and support staff must be assembled and trained for the functions they are to perform. Financial resources must be assured for physical facilities and for direct operating costs, including staff, interest, seed production costs, transportation, drying, processing, storage, equipment maintenance, seed losses, and marketing costs.

Seed production, processing, storage, and marketing involves a complex set of technical, managerial, and organizational factors that are usually best handled by the private sector in what Douglas ((1) pp. 83-94) calls a "seed enterprise." The key elements in seed production are covered in (1) at pp. 100-3; processing and storage at pp. 103-4, and marketing at pp. 159-75.

(1) Seed production requires careful planning. The kind and quantity of seed must be planned several years in advance since three or four multiplications may be required to produce the amount of seed needed to meet expected demands and to allow for losses during production, processing, and distribution. Suitable seed growing areas must be selected--these to have proper soil and climatic conditions for the crops being produced, low weed and disease incidences, assured water and power supplies, ready access by road, and good communications. Seed growers must be assured fertilizers, pesticides and herbicides, along with seed stock for efficient seed production. A key technical requirement is maintaining trueness-to-variety. This requires proper isolation of seed fields and care in all cultivation operations. Prompt harvesting with properly cleaned and adjusted equipment at the right stage of maturity is essential to obtain high quality seed. Depending on climatic conditions, artificial drying may be required to protect seed from damage. Seed growers need the latest technical information on growing high quality seeds and must be provided with appropriate incentives.

(2) At the processing plant, inert material and alien seeds are removed; the seed is sized if necessary; seed may be treated with fungicides or insecticides, and properly packaged. A key factor is to see that

all equipment is properly maintained and adjusted so that its full capacity can be utilized. Seed storage must maintain the viability of the seed to be planted during the current year, seed to be held for the following year, and seed stock held for multiplication in following years.

ISSUE #5. The evaluation team should include a seed technician familiar with the vast array of technical factors involved, which are only highlighted above, for adequate assessment of performance in seed production, processing and storage. The primary factors to be looked at will be the appropriateness of equipment and facilities selected, adequacy of maintenance program, numbers and quality of staff assembled, and adequacy of the financial resources committed to the program.

(3) Seed marketing requires (a) an accurate assessment of the demand for seed, (b) accumulation of seed to meet the demand, (c) effective promotion and public relations to sell the seed, and (d) an effective and efficient, widely dispersed distribution system with full supplies of seeds and information for farmers in their most profitable use.

ISSUE #6. Did the seed enterprises, either public or private, effectively extend seed into remote areas predominated by small farmers?

2. Service Components

a. Quality Control

Seed quality control is essential if the seed is to perform as expected for farmers. There are various elements of a seed quality control program which will only be listed here. They are discussed in detail in (1) pp. 109-144. The elements are (1) a seed certification program that assures farmers seed of specified quality; (2) a seed testing program that supports the seed certification program, permits enforcement of legislation requiring seed of specific quality, and services farmer seed producers; and (3) seed legislation that codifies and controls the whole seed industry. Seed legislation is not recommended by Dougherty until stage 3 or 4 in seed industry development has been reached.

b. Education and Information Services

Spreading knowledge about new seeds must be an integral part of the total system for educating farmers, researchers, bankers, merchants, government officials, and the general public about agricultural development. Organizationally, this will include the agricultural extension service, seed growers, seed enterprises, marketing groups, and seed sellers.

Functionally, such promotional activities are frequently embodied in an intensified crop production program which involves (1) setting goals--increase production, improve diets, reduce imports, earn foreign exchange, or raise farmer incomes; and (2) organizing a promotional and educational campaign directed at the various groups that make up the total production, processing, marketing, and consumption system. On-farm demonstrations, production kits, short courses, and workshops have been used not only to teach farmers about new varieties, but also to inform landlords, input suppliers, bankers and credit agencies, civic leaders, and farm radio broadcasters. The general public can be informed through radio, newspapers, magazines, television, posters, and leaflets.

ISSUE #7. Were the quality control and informational components of the seed project in place and effectively supporting the seed program?

3. Complementary Components

The successful performance of a new variety will depend, not only on the availability of the variety itself, but on the availability of fertilizers, pesticides, herbicides, water, and other production inputs.

Credit will be required for all component stages of the seed industry outlined above. Policies that restrict the free flow of grains or other commodities within countries should exclude seeds. In the best interests

of overall agricultural development, seed industry development should not depend on import or export restrictions.

Pricing has a crucial impact at several component stages of seed industry development. Most important is the margin structure at the various steps. Farmers should pay prices for improved varieties that cover costs and reasonable profit margins for seed marketers, processors, and producers. The seed literature generally reflects the view that subsidized prices for seeds are not critical in obtaining their adoption. ((1) (4)) Outstanding performance is the basic criterion. Profitable margins will be an incentive for private sector activity in seed enterprises.

Markets for increased agricultural production at the local level and remunerative farm prices are essential.

ISSUE #8. Did input supply programs, credit and trade policies, and pricing policies effectively support the seed project?

C. Private Sector Involvement

In summary, the following factors would tend to encourage private sector involvement in seed industry development. First, a strong government policy commitment favoring private sector involvement and including a clear statement of public and private responsibilities in seed industry development. Second, since in nearly all developing countries, crop research and the multiplication of basic seed is a public responsibility, a government decision to provide the private sector with access to basic seed on a reliable and continuing basis is probably the most important factor affecting private involvement. Third, profitable margins are essential. Fourth, other facilitating arrangements can be provided by government including access

to credit for seed industry development, inspection and quality control measures that support good performers, and an overall policy framework that facilitates seed industry development.

ISSUE #9. To what extent did governmental policies encourage private sector involvement?

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An excellent, two volume draft report on the "Seed Program/Industry" was prepared by the Seed Technology Laboratory at Mississippi State University under AID contract no. AID/csd-1203, June and October, 1969. Part I discusses requisites, planning organization, and components of a seed program. Part II discusses problems associated with establishing a seed program/industry. It also discusses conditions fostering indigenous private sector involvement in the seed industry. U.S. seed industry involvement overseas is presented, based on surveys and interviews of U.S. seedsmen. These drafts are recommended for their additional detail. The basic points are covered in Chapter V of this report.

VI. CREDIT

The organization and presentation of agricultural credit issues draws heavily on the AID Spring Review of Small Farmer Credit. The "Summary Papers," Volume XX, June 1973, treats recommended agricultural credit issues thoroughly and concisely. The "Analytical Papers," Volume XIX are also drawn on rather extensively.

The major categories for treating the issues are: (a) credit program objectives; (b) institutional issues; and (c) the policy framework.

A. Credit Program Objectives

1. The literature reviewed and experts consulted clearly establish that the primary objective of a credit program should be to finance improved technology that will increase farm output and income.

ISSUE #1. Were technologies or technological packages actually available to farmers that are capable of substantially increasing output over current practices?

For this to be the case, the countries research establishment must have created such technologies and tested them at local enough levels to make them relevant to farmers in the credit program who must cope with varying soils, climatic, and socio-economic conditions. A further requirement is that the research be ongoing, yielding a stream of new technology.

Transmission of research results usually is the responsibility of the agricultural extension service, working in effective collaboration with the credit agency. This collaboration is effected through a policy decision taken at the appropriate level of government, and implemented through

administrative and procedural arrangements established for that purpose, and, most of all, the willing collaboration of both the credit and extension agencies at all levels.

Alternatively, the agency handling the credit program may have its own extension capability as part of an integrated area rural development program. Conceptually, coordination should be easier with this form of organization, but experience has shown that it still must be developed.

ISSUE #2. Was information about the new technologies being effectively transmitted to farmers?

Most new technologies depend on modern inputs of one sort or another--fertilizer, pesticides, improved seeds, irrigation water, improved livestock feeds, veterinary services, machinery or equipment, and so on. Evaluation should determine whether, in fact, these inputs are available to farmers participating in the credit program and whether they are reasonably priced. Reasonable in this context is whether prices are consistent with budgets developed in the financial analysis for the project design.

ISSUE #3. Were inputs necessary to the new technology readily available to farmers?

Local markets must be adequate to handle increased output. Generally, this will not be a problem for staple commodities--food or cash--well established in an area. If a new crop or new livestock enterprise is being introduced into an area, market development needs special attention. Again, output prices should be consistent with project budgets.

ISSUE #4. Were local markets adequate to handle increased output?

2. Achieving the prime objective requires the establishment of selection criteria for farmer participants.

Loans to increase output and income can only be made successfully to farmers with a size of business large enough to absorb the loan financed

inputs and create the increased output. Depending on the enterprises being financed, there will be a lower limit to farm size below which a loan would not be viable. If this limit has been set too low in the project design analysis, one could expect rather heavy delinquency/default rates. (See (1) Appendix D, p. 2 and fn. 7). An upper limit to farm size is commonly set also since large farmers have access to private capital sources and need not be supported by public credit programs.

But size alone is not an adequate criterion. Ownership also needs to be considered. The owner-operator of a small, well-managed enterprise may be a better credit risk than the tenant who farms a larger area.

Another selection criteria should be a farmer's willingness to adopt the new technology and follow program guidelines.

ISSUE #5. Were farm size and other parameters appropriately set?

3. Credit program objectives must fit into and support broader national policy goals for agricultural and rural development.

ISSUE #6. Were credit program objectives consistent with overall agricultural development goals?

4. Productivity/equity objectives.

The above discussion has focussed on productivity objectives. The literature generally condemns the use of credit programs to address equity problems. Lower than market interest rates and dealing gently with loan delinquency in credit programs are the practices usually justified on equity grounds. The arguments against using these two practices in this way are that it damages both the credit program and the credit agency. These two issues are dealt with in more detail in the policy section.

ISSUE #7. Were equity objectives included in the credit program?

B. Institutional Issues

There are three factors to investigate if the number of clients is small and costs are high: (1) administrative skills of the credit institution; (2) whether delivery, supervision, and collection methods are low cost; and (3) whether there is access to large supplies of funds.

At the project design stage, administrative skills can be tackled by the selection of an implementing institution that already has widely dispersed field operations and established organizational and administrative skills. By evaluation time this decision will have been made. If a new organization has been created to handle the credit program, patience will be required since experience has shown that it may take a decade or more before the organization becomes effective. In this situation look at staffing and personnel policies, training provided for staff at all levels, and incentives for staff performance.

Administrative costs of credit programs can be reduced and their effectiveness increased by (a) decentralizing elementary decisions on client selection, loan amounts, and enforcement techniques to the lowest possible echelon in the organization (note exception in INVIERNO program where computers expedite decision making from headquarters level (4)); (b) grouping clients for supervision and for joint liability; (c) simplifying the paperwork; and (d) using repayment capacity of the loan and/or crop liens for repayment security rather than land mortgage or other collateral difficult to document.

For comparison with projects being evaluated, the World Bank notes that the administrative costs of a well run credit program for small farmers should be in the range of 7 to 10 percent. (See (5), pp. 43-45).

Available funds can be increased by getting access to private institutional money markets or building a savings program into the credit project. The latter is discussed later.

ISSUE #8. Was the capacity of the credit program adequate to serve a large number of small clients at low cost?

Institutional form does not appear to be an issue in credit projects. (See (1) p. 15). What is critical are the policies and powers the institution has to carry out its work, its leadership, basic economic factors, and the socio-cultural milieu in which the institution operates. Again, at the evaluation stage the choice of institutional form will have been made. The factors mentioned above are discussed at various places throughout this chapter.

C. Policy Framework[1/]

The most widely discussed issues in credit policy are interest rate levels, delinquency and default rates, and to a lesser extent, rural savings mobilization. These factors all relate to the viability of the credit institution to continue its mission.

Interest rates set in most credit programs are below market rates. The economic arguments against such low rates are formidable. (See (2), Gonzales-Vega, pp. 337-372 and Adams, pp. 311-333). In summary, such rates distort capital markets resulting in less capital available in rural areas, do not cover the costs of doing business, a rationing mechanism must be devised to allocate credit, rural savings mobilization is impaired, informal

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1/ Credit policy guidelines for the World Bank are summarized in Appendix A.

lenders cannot compete, loan funds are diverted to consumption, lenders place more emphasis on collateral requirements, lenders tend to focus on larger farmers, loan recipients relend funds in the informal market, and incentives to "graduate" farmers from the program are reduced.

But there are arguments supporting low interest rates (See (2) Long, pp. 275-6). In summary, these arguments are that low interest rates offset the higher costs and inconvenience associated with public credit, offset other macro policy elements that tend to bias the terms of trade against agriculture, where credit goes to smaller farmers a subsidized interest rate can be justified as shifting resources in an equitable manner, and it is not clear that higher interest rates would mobilize a significant quantity of savings for rural areas.

The above points miss probably the most significant reason why LDC policy makers insist on low interest rates to farmers--they represent 60 to 80 percent of the electorate in most LDC's. Under these circumstances, economic logic is not likely to bring about higher interest rates.

ISSUE #9. Were low interest rates undesirably influencing the credit program?

If delinquency and default rates are unusually high, evaluators should look at factors which fall into three categories: (a) political attitudes, (b) overwhelming natural events which have widespread impact, and (3) individual management difficulties which may be widespread among small borrowers (See (2) Ekhaus, pp. 393-397 and (5) pp. 40-43).

In addition to political attitudes that affect the outcome of elections which have an obvious relationship to defaulting by the electorate, there is the political sociology of the local community. One of the major sources of default is that borrowers do not believe the loans are seriously

intended to be repaid. First, this attitude is fostered in the village where large farmers with political influence are known to have high delinquency/default rates. Therefore, repayment depends on political and economic power and not on laws or regulations. Second, weakly staffed credit offices without the capability to assess a borrower's repayment capacity, or to demand payment, signal to the borrower that the credit agency is not to be taken seriously. Achieving income redistribution objectives through the credit programs undoubtedly would inhibit the vigorous pursuit of defaulters.

Overwhelming natural events such as flood, drouth, or insect infestation cannot be coped with by the individual farmer and usually not his government. In such circumstances "loan forgiveness" is a superior alternative to forced collection. The Bank suggests that in areas where output is highly variable, credit agencies might experiment with "share cropping" rather than fixed amount payments ((5) p. 43.)

Individual management difficulties such as sickness or death in the family, a loan based on unrealistically favorable assumptions, or loans poorly suited for the purpose, e.g. short-term loan for medium-term activities, result in delinquency. Resolution of such situations can only be on a case-by-case basis.

Probably most important regarding delinquency and default, however, is to look at the technology being supported by the credit program to make sure it is productive enough to make repayment possible.

ISSUE #10. Were delinquency and default rates undesirably influencing the credit program?

The World Bank colloquium (3) focused on rural financial markets. Several papers dealt with rural savings mobilization. Through the 1960's

it was generally believed that small farmers and rural areas, generally, did not have excess resources to save in financial institutions. However, research since the AID Spring Review has convinced a number of the researchers at least, that there are savings in rural areas that can be mobilized through rural financial institutions. An AID project in Peru which did mobilize substantial rural savings is described ((3) Discussion Paper No. 6, Robert C. Vogel, "Savings Mobilization: The Forgotten Half of Rural Finance.")

However, rural savings mobilization requires eliminating the low interest rate policies of most developing countries. According to Vogel, attractive (market) rates on savings deposits and higher loan rates (savings rate plus administrative costs) should result in (a) improved income distribution; (b) more efficient resource allocation; (c) assured viability of financial institutions; and (d) appropriate incentives and discipline for rural financial markets and institutions, and for governments.

The pros and cons of the interest rate issue are discussed above. Unless high interest rates have been adopted, there is little likelihood of a savings mobilization program existing.

ISSUE #11. Did the lack of an effective rural savings mobilization program adversely affect the credit program?

D. References

Most Useful

(1) "AID Spring Review of Small Farmer Credit: Summary Papers," Vol. XX, June 1973. No. SR 120.

(2) "AID Spring Review of Small Farmer Credit: Analytical Papers," Vol. XIX, June 1973. No. SR 119.

Other

(3) Economic Development Institute, World Bank, Colloquium on Rural Finance, September 1981. There were five Background Papers and 10 Discussion Papers. These papers are now in the process of being published.

(4) Gonzales-Vega, Claudio and Tinnermeier, Ronald L., "INVIERNO: Innovation in Credit and in Rural Development," Occasional Paper #8, Economics and Sector Planning Division, Development Support Bureau, AID, July 1979.

(5) "Agricultural Credit: Sector Policy Paper," World Bank, May 1975.

(6) "Use and Abuse of Rural Financial Markets in Low-Income Countries." Edited by J.D. Von Pishke, Dale W. Adams, and Gordon Donald, World Bank, 1981.

(7) Donald, Gordon, Credit for Small Farmers in Developing Countries, Westview Press, Boulder, 1976.

Appendix A

The following World Bank guidelines for agricultural credit programs is quoted directly from (5) pp. 18-20.

Guidelines for the World Bank

1. The World Bank will continue to expand its efforts to help meet the credit needs of small farmers. Increased attention to small farmers should not, however, obscure the need for additional significant increases in aid to other groups, especially medium-scale farmers. To reach large numbers of small farmers in low-income countries with credit at the farm level; will require a substantial volume of Bank and IDA lending. During the next five years, the Bank proposes to allocate $1,300 million for rural credit, almost half of this sum being for small farmers.

2. The expansion of rural credit will be on a selective basis, related to conditions which will lead to an increase in rural productivity. Credit is not normally the appropriate instrument for transferring income to low-income producers or the rural poor. An expansion of rural credit programs may reach large numbers of small, potentially productive farmers. But a great number of low-income persons in rural areas, such as the landless and those with holdings too small to be viable, will seldom benefit from them. They will have to be aided by other means.

3. In the initial stages of the transition to a more productive agriculture, access to short-term credit for purchasing fertilizer, improved seeds, pesticides, etc., is often of greater importance for small farmers than long-term credit. Accordingly, in the credit programs for small farmers, emphasis will be placed on short-term seasonal credit in the context of overall on-farm development planning. World Bank lending could provide a permanent working capital fund for this prupose which is rolled over and reused from year to year. As the Bank loan or IDA credit is repaid, domestic sources of credit and capital can gradually replace external funds.

4. In loan decisions, the emphasis will be on the productive capacity of small farmers rather than on collateral. For long-term credit to large farmers, land mortgages are in order. In addition, more use will be made of chattel mortgages or liens on crops as security for short- and medium-term loans. In general, further experimentation with simplified arrangements and procedures to secure credit will be encouraged.

5. Preference usually will be given to a single institution handling all types of credit needed by farmers: short-term credit for production and for living expenses in the lean period, as well as medium- and long-term credit for on-farm development. This would benefit the recipient and

enable the institution to oversee his performance and protect its loan. Credit to farmers should be veiwed as an integral part of a continuing process to help farmers adopt changing technologies.

6. With regard to small farmers, preference will be given to projects in which credit is designed as an element of a reasonably low-cost package that provides the necessary additional services--as in integrated area or crop development projects.

7. The World Bank will encourage appropriate adjustments to the general structure and level of interest rates so that rates in the agriculture sector are in harmony with those in other sectors of the economy. In general there is no simple answer to the question of what is an appropriate interest rate on a Bank-assisted agricultural credit project. The Bank will work toward the long-run objective of an interest rate that reflects the costs of capital and of providing the capital. An intermediate objective might be to cover at least the opportunity cost of capital. Subsidies should, in general, be limited to cases where they can be justified and are likely to be effective in view of the pattern of farming in the project areas. The issue of interest rates, however, should always be seen as one component in a project. The extent to which a project is likely to achieve the overall objectives of World Bank policy should influence the attitude toward interest rates.

8. The World Bank will encourage governments to develop systems of lending through cooperatives and/or groups of small farmers. This approach seems to be the most promising for reaching large numbers at low cost. The nature of the groups will vary according to the culture of different societies. At the same time, it should be recognized that cooperatives perform poorly in most developing countries and ways need to be found to strengthen them.

9. The Bank will continue to support special project authorities, such as those created in limited areas of Africa, as instruments to draw farmers from subsistence to commercial agriculture. At the same time, the Bank will encourage the development of apex institutions which can promote, oversee and service such enclaves within national programs.

10. The Bank will give increasing attention to building and strengthening financial institutions as agricultural credit channels, particularly to orient their efforts toward the small farmers.

The World Bank needs to know a great deal more about the performance of credit programs for small farmers (including nongovernmental programs) in improving productivity and incomes, and about the costs involved in providing such credit. Accordingly, the Bank should, in future, insist that a reporting system be incorporated, at least in major projects, to provide information, from the farm level, on the situation before the project was initiated, and the progress made and the problems that emerged thereafter. In the meantime, the Bank has initiated a study of the administrative and other costs inherent in credit programs for small farmers. This study includes considerations relating to the effectiveness of cooperatives and other group activities as a means of providing low-cost credit.