

International Agricultural Research Centers (IARCs)

Preliminary Draft Proceedings of the
**Workshop on
Farming Systems Research**

17-21 February 1986
ICRISAT Center, India



ICRISAT

International Crops Research Institute for the Semi-Arid Tropics
Patancheru, Andhra Pradesh 502324, India
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Workshop Objectives

- To develop an understanding of the relevance and approaches to Farming Systems Research (FSR) in International Agricultural Research Centers (IARCs),
- To indicate the roles of international and national research agencies in FSR,
- To harmonize the recommendations of previous reviews on FSR into an IARC framework,
- To discuss the results of case studies to assist in assessing the relevance and priority of such research for creating an impact on national systems, and
- To outline the future of FSR in the CG System.

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Session 1: Review, Philosophy, and Concept
of Farming Systems Research

Review of Concepts of Farming Systems Research:
the What, Why, and How

Donald L. Plucknett¹, John L. Dillon², and Guy J. Vallaeys³

Introduction

During the 1977 "Stripe Review" of farming systems research at four International Agricultural Research Centers (IARCs), we found several worrying things: (1) in general, terminology being used was not very specific, nor standardized; new terms were being invented; (2) although scientists working in FSR seemed to know instinctively what they were doing and why, often they could not explain their program in any meaningful way; and (3) because of these two reasons and the newness of such research, some donors were becoming concerned about the investment in, and direction of, FSR in the IARCs. In consequence, we found it necessary to lay out a conceptual framework for FSR as an aid to existing programs as well as to provide a basis for evaluation of the work in progress at the four IARCs.

Since 1977 much has happened in FSR. The term has become common in the literature. Numerous, often very well-funded, projects and programs exist with most or a significant portion of their activities devoted to FSR. The literature is full of articles on FSR, its methods, conduct, philosophy, and expected benefits. All should be rosy in FSR.

But we see worrying signs reappearing, many of them the same concerns that were expressed in 1977. Chief among these are: a confusing array of terminology; a seeming lack of consistency in approach; the often fuzzy and seemingly all-embracing nature of many programs; the often extravagant claims for FSR; mutterings in the donor community (and elsewhere) about whether FSR is worth all the expense and effort being put into it; and--above all--just what, really, is FSR and should the IARCs be involved in it? A no less worrying question often raised is: does FSR in the IARCs or of itself provide anything useful to national agricultural research systems (NARS) in developing countries? And--a related question--is all the talk and ferment and lack of commonality of approach just creating confusion in the NARS?

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Considerable developments have occurred since 1977 in both the legitimation and implementation of FSR. In this, IARCs have played a significant role in the development of methodology, often in partnership with national programs, and have provided strong support to NARS in their initiation and implementation of FSR. Much important literature on FSR has been published, and more will be, as ongoing FSR studies are analyzed and documented.

Concepts and Principles

As an approach, FSR has a strong philosophical basis; viz, that research conducted in close contact--sometimes in partnership--with the farmer can provide better understanding of farmer circumstances and help to ensure that new technology will be appropriate to farm conditions and farmer needs.

In her important paper Deborah Merrill-Sands recommended that the term FSR be replaced by the new generic term RFSP. We recognize that the term FSR has become something of a buzzword and has somewhat fallen into disrepute, but we consider that it encapsulates too important a concept to just abandon. What is important is to recognize that agricultural research for development should be geared to the needs of developing-country farmers, and that it should therefore be carried out within a farming systems perspective. This does not mean that all researchers must be FSR specialists, nor does it mean that FSR must be carried out within a special unit.

FSR scientists have done themselves and their efforts a disservice by continually coining unnecessary new terms for their work, often, it seems, not because of scientific need but because of poetic fancy or a desire for institutional trademarking. Though not unexpected in a relatively new field, FSR jargon has caused serious misunderstandings of what FSR is and does.

There is a serious need for clarification and standardization of FSR terms, and the coinage of new terms should be avoided. We hope this workshop will provide the opportunity for further progress towards agreement on FSR terminology. If complete standardization cannot be achieved, then at minimum every effort should be made to establish where equivalent terms or concepts exist.

A major misconception today is that FSR is synonymous with, and indeed limited to, on-farm research (OFR). While recognizing the importance of on-farm research, we want to correct this misconception--just as, at the other extreme, we also want to correct the misconception that FSR is an approach encompassing all aspects of agricultural development.

A Conceptual Framework for FSR

FSR should aim to meet the following interrelated objectives:

1. To understand the physical and socioeconomic environment within which agricultural production takes place.
2. To gain an understanding of the farmer in terms of his or her skills, constraints, preferences, and aspirations.
3. To comprehend and evaluate existing important farming systems, in particular, the practice and performance of these systems.
4. To improve the identification of problems and opportunities for change in existing farming systems and thereby better focus research on specific key aspects.
5. To enhance the capacity of research organizations to conduct research on priority problems.
6. To conduct research on new or improved practices or principles and to evaluate these for possible testing on farms.
7. To evaluate new or improved systems, or system components, on farms in major production areas under normal farm conditions.
8. To assist the extension, monitor the adoption, and assess the benefits of improved farming systems.

We believe that the above eight objectives of FSR can be met within the context of three interlocked multidisciplinary "activity areas"--base data analysis, research station studies, and on-farm studies--which provide a basis for focus of research. All three activities are necessary, whether the aim be the adjustment of existing systems, their revision, or the development of new systems. We would argue that if, over time, a particular program did not involve all three of these activity areas, then it should not be seen as FSR.

Base-data analysis (BDA) involves the collection, collation, and analysis of data on the many factors characterizing the environment and farming systems of a region.

Research-station studies (RSS) involve a focused research program aimed at the development of components for the improvement of existing systems or for the putting together of new systems.

On-farm studies (OFS) involve studies of existing systems, on-farm experimentation, studies of technology adoption, and assessment of the impact of new technology--all in relation to the farm household. Probably no other aspect of FSR has received as much attention in the literature as OFS.

In the Stripe Review we introduced the concepts of upstream and downstream activities as a way of emphasizing the continuum of FSR from, on the one hand, problem identification on the farm and solution of specific problems requiring component or disciplinary research on the station (upstream) to, on the other hand, the testing and modification of technology on the farm (downstream). We consider that the terms are apparently confusing, have been misunderstood, and should be abandoned.

Another problem we see is that FSR programs commonly describe their work via some kind of flow diagram, usually including a diagnostic stage, a design or experimental stage, a testing stage, and an extension-cum-monitoring stage. When other scientists are shown this conceptual approach, the reaction of most is: "So what is new about that? I follow that approach in most of my work all the time."

We agree that these four stages of diagnosing, designing, testing, and monitoring are important, but in truth the stages usually take place across the three activity areas of BDA, RSS, and OFS. Doing the work within that interlinked framework, and with a farming systems perspective, is what is different and distinguishes FSR from conventional commodity or disciplinary research.

Need for Farming Systems Research

There are basically two strategies to follow in agricultural research.

1. The most common and familiar one is the commodity strategy, which selects a crop or a livestock enterprise, and then moves along with the efforts required to maintain or expand production of that commodity. The parameters of the research are set by the commodity of interest, the type of land, and other resources it employs. We are quite good at commodity work, and this is where most research resources go. The commodity approach, however, takes for granted the relevance of the commodity being researched. It largely assumes the availability of a suitable resource base in terms of land, climate, and infrastructure. In essence, it is directed to nonmarginal lands.

2. The other research strategy is resource-base oriented, and its parameters are set by what the resource base will allow. Here the resource endowment, or lack of it, determines the direction of the research, and commodity selection--either singly or in combination--is recognized as being determined by the strengths and weaknesses of the resource base. We are not as yet very good at the land capability strategy--first, because it calls for an integration of ideas from several disciplines; and, secondly, because it does not take commodity choice as

predetermined but recognizes that the problem is to find a production system that can best use the available resource base either as is or as ameliorated through research. This is a broader and far more challenging research task than that taken up by the commodity approach. The resource-base strategy is the one that brings us most forcefully to dealing with marginal land situations. Obviously, the more difficult the resource base, the greater the need for a resource-base strategy in research.

FSR is needed in both strategies, but it receives its greatest challenge--and perhaps its greatest potential benefits for resource-poor producers--in the resource-base strategy. Here BDA techniques must be used more wisely and ingeniously for better characterization of the environment as well as of farmers' resources and objectives. RSS, especially those related to management of the resource base, and to design of new farming systems suited to the limitations of marginal lands, must play a major role, in combination with substantial OFS as an early and integral part of the research process. We will return to the commodity and resource-based approaches later.

We consider FSR to be very important in providing a scientific approach to problem identification and technology development aimed at improving agricultural production systems.

The goal for FSR remains the improvement of human welfare through increased but sustainable agricultural productivity.

Specific conditions presently exist that are unlikely to be adequately accommodated, if at all, by a commodity research approach of the traditional type that implies the necessity for a farming systems perspective. Among these conditions are:

- the significant increases in population, particularly in the tropical and subtropical areas of the world, which creates an immediate and ongoing need for increasing food supplies;
- the increased use of marginal lands with resource constraints that do not respond to high-yielding varieties bred for nonmarginal conditions and the threat of irreversible environmental degradation through misuse of these lands;
- the fact that most farmers in developing countries do not have the power or the means to identify and communicate their needs to research agencies and policymakers;
- the acknowledgment that there are wide gaps between results achieved in research stations and those obtainable by farmers; and
- the increasing awareness that women are major contributors to the world's food supply, particularly in developing countries, and the recognition that agricultural research has seldom considered women's roles.

In responding to these needs and deficiencies, the IARCs should not become involved in location-specific FSR unless there are strong reasons for doing so. Sufficient reasons might involve methodological or training requirements or, in some circumstances, the weakness of national programs. The IARCs do, however, have a comparative advantage and thus a case for working in the following areas or aspects of FSR:

1. Developing FSR methodology with wide application based on a holistic approach and using a multidisciplinary team.
2. Defining broad agroclimatic zones to provide basic information and feedback for plant and livestock breeders and other contributors to the design of improved farming systems.
3. Organizing workshops on FSR in the Third World. Such workshops would bring together FSR and related workers from international centers and national programs to focus on common problems and learn from each other's successes and failures.
4. Providing leadership in FSR networks. Networks are often outgrowths of workshops; they can have an important role in FSR, particularly in regions sharing broad agroclimatic features. Networks need strong leadership, particularly at an early stage, and IARC scientists are likely to provide effective guidance.
5. Printing and disseminating information on FSR. Most IARCs have high-quality printing facilities and mechanisms to keep cooperators and other researchers informed of developments.
6. Providing library resources. Most IARCs have libraries, and some provide bibliographic services and copying of material for scientists in the Third World.
7. Assisting NARS in the institutionalization of FSR. Particularly, this lies in the capacity of ISNAR.
8. Providing training in FSR. Short courses in FSR are currently offered by IRRI, ICRISAT, IITA, and CIMMYT. More Centers could offer similar, and perhaps expanded, courses (though some degree of standardization in terminology and approach to FSR would be necessary to avoid confusion).
9. Developing new farming systems of broad potential. For some environments, particularly on marginal lands, completely new production systems may be called for. Because it will demand more basic RSS, and because its relevance may cross national boundaries, such prototype technology R&D is best conducted by IARCs working in collaboration with national programs.
10. Backstopping, when necessary, for FSR workers in national programs. For countries with weak agricultural research and extension programs, this service is especially valuable.

11. Serving as a clearinghouse for FSR expertise. IARCs could compile rosters of competent specialists in FSR for their mandated commodities and regions. As necessary, teams could then be assembled to help national programs.

Current Status

Significant progress has been made in FSR; however, problem areas remain.

Two major problem areas of FSR

FSR faces two major problems, in our opinion. One, of course, is the whole range of conceptual problems. We consider that most of the conceptual framework for FSR does exist, but the understanding of that framework is, as yet, inadequate. Much more thought needs to be given to the way the conceptual framework can be applied more effectively in the conduct of FSR.

The other major area of concern is operational: how do we put the concepts of FSR into operation? FSR can be very expensive, being very demanding of both human and financial resources. Also, the number of potential areas of inquiry are very broad and encompassing, and there is always the possibility of trying to include too much in an FSR program. Problem identification and problem choice therefore become serious matters; FSR efforts should be kept to an "effective minimum," otherwise they may overwhelm a research institution, both financially and from a manpower standpoint, without a concomitant improvement in research output.

FSR methodology

During the Stripe Review in 1977, we were struck by the inadequate development of methodology for FSR, particularly for on-farm studies and base-data analysis, and, to a lesser degree, for research station studies, especially when two or more crops were grown together. Basic research designs for multidisciplinary work, statistical analyses, handling of masses of data relating to socioeconomic as well as biological and physical factors, dealing with masses of secondary data so as to sharpen knowledge about target regions or systems, all of these required much more work.

On-farm research. Our perception today--and this is largely supported by the responses we have had from the Centers--is that research methodology for OFR is much improved. Most Centers are confident that the methods being used are adequate for their

purposes. ILCA is an exception, in that it considers livestock research efforts on small farms to present some daunting problems. It is probable that ICARDA would also agree with that.

We are not entirely convinced that research designs for on-farm research are adequate. Questions of number and size of plots, suitable replication, degree of involvement of researchers and farmer, and so on, may be confusing for national programs. Are there ways that the experiences of the Centers could be distilled in such a way that the national programs could benefit?

From a survey made by Barker and Lightfoot--including responses from four IARCs of the CGIAR--it would appear that operational problems of OFR may be more limiting than conceptual problems. Operational problems mentioned included judging the correct number of replications and plot size, selection of farmers, making farmers partners in the decision-making process, "over-extension" or too ambitious a work plan, inadequate logistical support (inputs, transportation, too few resources for the area to be covered, and so on), and lack of trained manpower. Another major problem was with data analysis, particularly in projects "awash with data."

In the same survey, it would appear the major conceptual problems encountered were: whether the OFR had as its purpose technology generation (usually researcher-managed), technology verification (usually jointly managed by researcher and farmer), or technology extension (usually farmer-managed).

Base-data analysis. In our opinion, this is an area where effective methodologies are still largely lacking. Most FSR programs do not appear to make good use of secondary data in planning and targeting their research.

FSR and Strategies of Research in Agriculture

The land capability strategy presents much greater difficulties for FSR. It requires much better use of base-data analysis of soil, climatic, ecological, and socioeconomic data, for example, than the commodity strategy. On-farm research is also more difficult, in part because the choice of target areas of farmers is much more difficult, but also because the mixes of crops or enterprises are more varied and complex. Also, by its nature, the land capability strategy requires more effort to be expanded on new farming systems development, since few models exist that can be followed. Indeed, the land capability strategy is usually followed in resource-limited situations, where serious problems exist for many crops. Research station studies also are more daunting because operational research methodologies for the land resource strategy are less well developed and usually much more complex.

Part of our conceptual problems in FSR can be solved by understanding more clearly what research strategy each Center may be following. We believe there are great differences in FSR concepts and--by inference--methodologies, between the commodity and land capability strategies.

By our definition above, CIMMYT, CIP, IRRI, and WARDA follow the commodity strategy. No Center follows a strictly resource or land capability strategy. However, CIAT, ICARDA, IITA, ICRISAT, and ILCA follow both a commodity and a land capability strategy; consequently they may suffer a type of "research schizophrenia," in which their commodity responsibilities can and do conflict with their land resource (agroecological zone) responsibilities, and--complicating their lives even more--in designing their research, they may well be mixing FSR methods best suited for one or the other of the strategies.

We are concerned about the problems a farming systems research program may have in one of the schizophrenic (from an FSR sense) Centers. How can one FSR program do an adequate job of handling the challenging, and difficult, problems of the semi-arid tropics (or the humid tropics, or the low-rainfall areas of the West Asia, or the acid savannas of Latin America) if it also has to satisfy the FSR or cropping systems research needs of the commodity programs? We suggest that the responsibilities of a Center for a land resource mandate and for commodity mandates should be clearly defined and understood so that both areas of responsibility--as well as the methodological difficulties--can be handled satisfactorily and effectively. Perhaps some of the unrest and questioning of FSR at the dual-responsibility Centers could be alleviated if such a clear distinction as to purpose and conduct of FSR, in given situations, was made before a research program was initiated.

Conceptual Aspects of FSR

FSR has made considerable gains conceptually since 1977. A major advance has been the development and field testing of on-farm research methods and ideas. The concept that FSR work should begin and end with the farmer has been useful and, we believe, is of value to national programs in planning and executing their own FSR.

Two papers on concepts have recently been completed by N.W. Simmonds and D. Merrill-Sands. One idea that was especially useful in Simmonds' paper was the separation of new farming systems development (NFSD). We consider this to be very appropriate and helpful, in particular for the IARCs that have a major responsibility for a particular agroecological zone or where resources are limited and where NFSD will be required.

Sands listed several key concepts in FSR: "(i) FSR is farmer-oriented, (ii) FSR is systems-oriented, (iii) FSR is a problem-solving approach, (iv) FSR is interdisciplinary, (v) FSR complements mainstream commodity and disciplinary agricultural research; it does not replace it, (vi) FSR tests technology in on-farm trials, and (vii) FSR provides feedback from farmers."

We agree with these concepts and commend them as key ideas to follow in organizing and conducting FSR.

The concept of recommendation domain has been useful as a way of delimiting the level of specificity to be followed in FSR. Using base-data analysis more reliably and effectively to define recommendation domains would be an important innovation.

The concept held by some that FSR is synonymous with on-farm research is unacceptable, because it does not emphasize the two other vital areas of FSR, base-data analysis and research station studies.

We like the concept of research with a farming systems perspective (FSP). Indeed, we consider that good agricultural research must take such an approach.

Session 1: Review, Philosophy, and Concept
of Farming Systems Research

Reviewer's Comments

N.W. Simmonds¹

It is good to have this paper from the same three authors of the TAC (1978) Stripe Review, the document that, so to speak, got FSR on the road. There is much in it with which I agree but also some points of disagreement.

First, I agree with the authors' conclusion that a farming systems perspective (FSP) is the crucial element and that very substantial progress has been made in developing this. Given FSP, FSR becomes a mode, a style or an approach to doing research and defining objectives, whether on a commodity basis or on the problems of a particular farm sector. I believe that much progress has been made and that the CIMMYT/IRRI methods of OFR/FSP have sufficiently defined the necessary practical procedures. From now on, it seems clear, FSP must and will underlie much, or perhaps all, research aimed at making local stepwise changes.

Secondly, I also agree with the authors in their insistence that the IARCs, having helped greatly to clarify the place of FSP, should now go wider, leave the practice of OFR/FSP to NARS and should themselves reduce strictly locally oriented activities. Increasingly, their function must surely lie in training and in the broader, yet unexplored and more difficult, area of NFSD.

Thirdly, I also agree with the authors in their insistence upon considering more carefully the place of women when framing research objectives; a closely related question, to which Dr Dillon referred, is of firewood gathering and the potential of agroforestry to lighten the fearsome burden often placed upon women in this connection.

However, I part company with the authors in several matters. They inveigh against Simmonds and Sands for their terminological endeavors, yet themselves preserve the old and (dare I say it?) confused terminology, and even adding some new terms; to the rubber man RSS means 'rib-smoked sheet'! A coherent terminology is necessary and I believe that we have seen, in this meeting, the beginning of agreement on the matter; but only a beginning, alas.

Secondly, the authors recognize the necessity for new

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farming systems development (NFSD), yet hardly, it seems to me, appreciate the urgency of the need, especially in the low, wet tropics on poor soils.

Thirdly, the authors are, I personally believe, mistaken in attributing as much importance as they do to FSR(SS). Collective experience now, it seems to me, indicates that relatively superficial analysis suffices for OFR/FSP. There may be exceptions (if some kind of NFSD were contemplated perhaps) but practicability must in general surely rule.

Fourthly, and finally, the authors look to the IARCs for further technical development of the practice of OFR/FSP. I rather doubt this. It seems to me that there will still be a need for minor changes and elaborations but that, in general, the technique/methodology is plain enough, once it is recognized that the CIMMYT/IRRI approaches are effectively identical. The suggestions, raised elsewhere in the meeting, to the effect that FSR courses for NARS students could, with advantage, be staffed by teachers from more than one Center should surely help in establishing the identity; it would not only be good for the teaching but would surely contribute to understanding between Centers.

In conclusion, I welcome this useful paper and hope that the observations set out above will be useful in placing it in the general context of the meeting and of likely future developments of this important subject.

Session 1: Review, Philosophy, and Concept
of Farming Systems Research

Chairperson's Summary

E.T. York, Jr¹

The opening session was devoted to a presentation and discussion of the workshop's keynote paper by Plucknett, Dillon, and Vallaeys. The paper constituted, in effect, an updating of the report of the comprehensive Stripe Review on Farming Systems by the authors in 1978.

The authors are to be commended for the thorough and perceptive treatment of the subject. The paper unquestionably served its intended purposes of identifying and considering key issues and concepts as a basis for stimulating discussion during the course of the workshop.

There was, indeed, a lively discussion of the paper, with the expression of many concurring and dissenting views to those set forth in the paper. Let me refer to some of the key issues.

The authors reaffirmed their earlier position that FSR should be considered an approach to research--not a new science or discipline. Most of the workshop participants seem to be supportive of this concept and I believe it should be strongly emphasized in the workshop proceedings.

The authors recognized the imprecise and ambiguous manner in which the term FSR has been used and the confusion resulting thereupon.

The paper emphasized the need for a clarification and standardization of FSR terms and suggested that "willy-nilly" coinage of new terms be avoided. The authors continued to advocate the terms, to classify FSR-related "activity areas" which had been used in the Stripe Review.

There was general accord among the workshop participants that clarification of terms was needed, but some felt that it would be more desirable to focus on major areas of program emphasis or thrusts rather than on where the research is centered (i.e., on- or off-station). Actually, the classification used in the paper is a combination of the two approaches. Some slight modification of this classification scheme seems desirable--perhaps more along the lines proposed by Simmonds.

The authors correctly emphasized that "FSR" and "On-farm

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Research" should not be considered as synonymous terms and urged that such misuse of the terms be discontinued.

In keeping with the concept of farming systems as an approach or a method for conducting research rather than a science, the authors very appropriately stressed that all researchers should not be considered farming systems specialists and that FSR not be carried out within a special FSR unit." In this regard, I would underscore one key point made by the authors, which I consider very basic--"The FSR approach should be argued as a necessary and normal part of the agricultural research process."

The authors proposed one departure from their Stripe Review paper by advocating the abandonment of the "upstream-downstream" terminology in relation to FSR. This suggestion was well received by the participants.

The keynote paper suggested two strategies to follow in agricultural research--one commodity-based and the other resource-based. The ensuing discussion reflected considerable uncertainty with respect to how or why such a strategy might be applied. The ultimate goal of our efforts is to produce sustainable levels of commodities--recognizing that the nature of the resource base will affect greatly the choice of those commodities to be produced in given locations as well as the management practices to be applied. At some point the two strategies must come together. My personal opinion would be to focus on commodities, recognizing that the nature of the resource base will influence what commodities can be grown and how they should be managed.

This is not to say, however, that there would not be resource base-related basic and strategic research conducted that would be independent of commodity considerations. This is a method which, I believe, warrants further discussion.

The authors seemed to be a bit ambivalent in their treatment of what this farming systems enterprise might be called. In one part of the paper, the authors voiced some reluctance to give up the old term, FSR, while in another instance they appeared to be supportive of using the term "Research with a Farming System Perspective" to characterize activities primarily included under the FSR label. There seemed to be general support among the participants for the use of the latter term. I believe the adoption and use of such a term would be very desirable and is consistent with the position already taken by TAC.

One issue which, in my opinion, was not adequately addressed in the keynote paper or in the subsequent discussion is whether there should be a distinction between on-farm trials to evaluate genotype x environment interactions and the type of on-farm/farmer-related research we talked about under the rubric of FSR in the workshop. One speaker pointed to the fact that genetic material on-station performed in a markedly different way

from the way it does on-farm, and used that as a basis for advocating an FSR approach. We all recognize such differential behavior. However, is it not the breeders' responsibility to try to test his material under a wide range of environmental conditions to determine broad areas of adoptability? Some of this obviously can and should be done on farms. However, isn't this a different type of activity from what we are treating as FSR? I believe some further clarification of this point is needed.

While agreeing with much of the paper, let me express mild disappointment with one aspect of the paper and, indeed, with the treatment of this issue throughout the week. Very little attention has been given to the role of extension in this enterprise we call FSR. To be most successful and productive, I think there must be heavy involvement of extension in FSR activities--helping to shape the research activities, monitoring the work, and extending the results to the broader farmer community. In my opinion, one reason FSR has generated so much interest is that in many developing countries--especially Africa--extension programs are very weak or essentially nonexistent. FSR has, in part, filled a void.

The presence of strong, effective extension programs, especially those having good subject-matter specialists, closely linked to research, would serve many of the functions now being addressed in FSR--by keeping researchers constantly abreast of farmers' problems and needs and helping the researcher evaluate the acceptability to farmers of the technological products of their research.

As developing country extension services improve, I foresee a changing role for researchers in on-farm research endeavors. This should be reflected in the IARCs' work on methodology and training.

There are many other important issues discussed in the keynote paper--all of which have contributed greatly to setting the stage for a most productive workshop.

The report of the Stripe Review made a tremendous contribution to our knowledge and understanding of FSR in the earlier stage of its development. As Dr Simmonds put it, "It got FSR on the road." The current paper, I believe, will help to keep FSR on the right road as it guides us to a more rational, meaningful, and productive approach to the application of this useful concept.

Session 2: Area-based Farming Systems Research

Reviewer's Comments

Norman Hudson¹

I shall try to highlight some of the similarities and differences between the FSR programs of the three area-based Centers--ICRISAT, IITA, and ICARDA--from which we have received papers, but which also do commodity-based FSR.

The objective of all three programs is stated as being to increase productivity. I would like to point out that there may be other objectives, such as to increase the reliability of production, or to reduce the labor requirement, or to increase the efficiency of the labor force, or even to increase production of cash crops to generate foreign exchange.

We have had several references to land capability and soil conservation. A common constraint is the lack of a coherent national policy for land use and resource development. The IARCs will not wish to become embroiled in national politics, but this constraint is not going to go away, and should be recognized.

In Session 1, Plucknett and Dillon suggested separate mandates for the commodity-based and resource-based programs, and the three papers suggest that this is a valid point. In all three, it is not clear how the FSR programs will interact with the other programs. The descriptions of the process, for example, "we will cooperate with" or "in close liaison with," are too vague.

Similarly, all three papers talk of working with national programs, but do not explain just how this will happen. So I support the suggestion by Dr Castillo that this matter should be given more attention.

Another aspect that is given inadequate attention in all three papers is the forward planning of FSR. There should be defined targets against defined time scales.

We have had discussions on terminology. If one accepts the concept that "it's not science until it can be (a) defined and (b) measured," then FSR has a long way to go on both counts. The confusion of terminology does not worry me, for it is only jargon--a shorthand used by specialists when talking to each other. The problem arises when, as in this case, the specialists find they cannot communicate with nonspecialists without using the jargon, which the nonspecialists do not understand. This is

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the problem of FSR at the moment and it does require attention. (What would be more serious would be if excessive jargon were used to cover up lack of precision in the thinking.)

On the suggested "harmonization" of the IARCs' FSR programs, I agree with Dr Castillo (Session 1), that there is no need for this. The papers in Session 2 show that the IARCs are all doing different jobs, in different conditions, and I think it is right and proper that they should each develop their own approach to FSR, their own style (even their own jargon if they wish).

Some of the differences between the three Centers are as follows.

- a. The rates of change they are seeking. ICARDA is looking for step-by-step improvements, whereas ICRISAT and IITA are closer to NFSD; but Lal (ICARDA) argued that NFSD can also be stepwise, so perhaps the difference is not important.
- b. The degree and manner of cooperation between IARCs and NARS varies a great deal, and this is to be expected, since the capacity of national programs also varies greatly.
- c. IARCs with FSR programs have to allocate resources to the various parts of the program. The ICRISAT paper shows in Table 1 the number of personnel engaged on each part in 1978 and 1985. It would be useful if (i) this could also include a projection of the expected allocation in 5 years time to further demonstrate the trend, and (ii) the same data could be supplied from other IARCs.

The ICRISAT paper highlighted the problem of transferring technology after it has been developed and validated. This is an important point which could be given attention by the other IARCs.

Session 2: Area-based Farming Systems Research

Chairperson's Summary

N.W. Simmonds¹

The three programs (ICRISAT, IITA, and ICARDA) represent three strongly contrasted approaches to FSR. Collectively, they illustrate very well the observation of the TAC Stripe Review (echoed by later writers) that IARC approaches are diverse by reason of mandates, histories, and local agricultural interests.

Broadly, the following generalizations seem justified (admittedly with some simplification).

ICRISAT has a long-established program that is essentially ecologically and technically oriented, is systems-based, has had a relatively small economic input, and started its OFR work relatively late. (But extensive village studies were conducted in parallel early in the life of the program.)

IITA has a long-established program that is component-based, the intention being that components of land management, weeding, small-scale mechanization, new varieties, etc., should be fitted together stepwise into new or adjusted farming systems in the wetter tropics. Thus far, the economic input and OFR activities have been relatively small, but the latter, we heard from Dr Lal, were developing strongly.

ICARDA initially stimulated several studies of Mediterranean agriculture that were essentially of an FSR(SS) nature but later moved towards a strong OFR/FSP orientation. Indeed, Dr Somel explained that ICARDA does far more work on-farm than on-station.

Additional information given in the ICRISAT paper shows that, in recent developments of its work in Africa, it has moved strongly towards an OFR/FSP approach. Dr Virmani explained this as being due to the Center's belief that this was appropriate to the African circumstance, whereas, in India, there was a strong national system in place and ready and eager to undertake the on-farm exploitation of ICRISAT findings. He explained that the national system was at the point of large-scale exploitation of watershed management systems for black soils. He added that the ICRISAT program is soon to be reconstructed as the Resource Management Program, to include a closely integrated economics component.

In retrospect, I think it is fairly clear that the three Centers were largely constrained by mandate and location to adopt

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the lines of work that they did: ICRISAT to enhancing the productive potential of the black soils, IITA to the local realities of poor lands increasingly stressed by over-exploitation, ICARDA to the dominance of migrant sheep in very dry places.

In retrospect, also, one wonders what would have been the effect if ICRISAT had begun its studies on-farm earlier: perhaps the toolbar technology would have been modified? One wonders also what will be the outcome for the ICARDA plant breeders of OFR studies of new varieties: given the overriding fact of irremediable drought, what can plant breeders do if there is little or even no scope to exploit genotype x environment interactions? And, again, one wonders which elements of the IITA component studies will prove to be exploitable in agricultural practice? Alley cropping looks likely, but will farmers adopt it and in what contexts?

At risk of being told that I am riding a hobby-horse, I now refer to New Farming Systems Development (NFSD). The need for fundamental change in shifting/fallow systems in the lowland wet tropics figures in the IITA mandate, yet the available components (some of which seem potentially very promising) have yet to be synthesized into any semblance of an NFSD. Bold acts of imagination are required; but where are they to come from? Scientists, governments, and institutions will all have to be involved. Dr Lal argued that stepwise adoption of components will be feasible; with respect, I doubt it. I believe that any effective NFSD for these circumstances must involve the extensive use of tree crops for food, an annual-perennial swing so to speak. Yet we are essentially ignorant of tree food crops. The point emerges elsewhere in this meeting (Session 5) and I personally hope that one result of our discussion will be to direct TAC/CG attention to the neglect of perennials. Bananas, it is true, are just starting to emerge from ill-deserved obscurity, but the food trees are still terra incognita to most tropical agricultural research (with honorable exceptions such as CATIE and some NARS).

Session 3: Commodity/Input-based Farming Systems Research

Reviewer's Comments (A)

Arturo A. Gomez¹

My comments are organized into three main topics: (1) similarities and differences in FSR activities among the three Centers, IRRI, CIAT, and IITA; (2) opportunities for harmonizing FSR activities among Centers; and (3) other issues. The first two topics have a direct bearing on the objectives of this workshop, while the third allows me to comment on some issues that are of special interest.

Similarities and Differences Among the FSR Activities of IRRI, CIAT, and IITA

The FSR activities in the three Centers have major similarities both in their objectives and their implementing strategies. There are, however, some differences in emphases. All three Centers recognize the development of improved technologies as a major objective. However, the objectives of developing research methodologies as well as assisting national research centers is prominently highlighted by IRRI and CIAT but is not formally stated in the IITA paper.

In terms of implementation, all three Centers conduct base-data analyses, on-station research (OSR) and on-farm research (OFR). However, there are major differences in emphasis. CIAT places major emphasis on OFR, to the extent of almost equating this activity to FSR; IITA, on the other hand, has very little OFR; while, IRRI is somewhere in between.

The three Centers operate their FSR through a fairly diverse organizational setup. IRRI has two separate departments whose primary responsibility is to conduct FSR; CIAT incorporates its FSR activities into existing commodity programs; and IITA lumps all activities apart from breeding into farming systems (see the flowchart in the IITA paper).

Opportunities for Harmonizing FSR Activities in the IARCs

While there is room for diversity among the various IARC programs on FSR, I also see the need to identify some key concepts or features that can truly justify a common label for all these

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programs. It would even be more useful if these key concepts can help harmonize the objectives as well as the organizational structures required to implement the programs. In this context, I see a major opportunity in the suggestion made by the concept paper of Plucknett, Dillon, and Vallaeys that farming systems research be looked upon as an approach to or a style of conducting research that gives prime importance to the farmers' perspective and requirements in developing new technologies. That is, research to develop new varieties or new fertilizer or pest management must be designed to solve existing farm problems and constraints rather than to achieve theoretical perceptions of potential productivity.

In this context, I see the existing strength of FSR in diagnostic base-data analysis as well as in the conduct of on-farm trials as an important and powerful tool in orienting and guiding the existing OSR in plant breeding or soils, say, to address existing and priority farm problems and constraints.

If this notion is accepted, then the existing FSR programs should look forward to the following.

- a. That the FSR perspective will be so successfully incorporated in all aspects of IARC research that separate FSR programs will be redundant.
- b. That OFR will be an integral part of all IARC research in order to continuously remind the various on-station researchers of their FSR perspective.

Other Comments

On farmers' participation. Farmers' participation in OFR continues to be vaguely defined. This participation can take any one or a combination of the following forms:

- the farmer as part of the farm environment;
- the farmer as a judge who impartially watches the researcher conduct the experiment on his farm;
- the farmer as implementor of some specified activities in the research plot;
- the farmer as decisionmaker in planning the research;
- the farmer as decisionmaker in implementing the research.

Note that the level of farmer participation progresses from the first item to the last. Also note that the procedure for incorporating farmer participation increases with the level of his participation. Furthermore, the level of farmer participation may imply and even specify the focus of the

experiment. Thus, it is very necessary that the type of farmer participation be clearly specified before the experiment starts.

G x E interaction and the need for varietal improvement in farmers' fields. A significant genotype x environment interaction for trials conducted on-station and on-farm does not immediately justify the transfer of breeding work from station to farm. The size of this interaction and its relative magnitude with respect to the main effect of genotype and environment is important. The balance between on-station and on-farm evaluation as it relates to the relative magnitude of the various sources of variation has been published elsewhere.

Need for NARS to have a farming systems perspective. The NARS, who are mandated to solve existing farm problems, need the FS perspective much more urgently than the IARCs. How does the IARC help bring this about? Do we preach it? Do we show it? Can we now give some guidelines from the collective experience of IARCs? I think the decision of the various IARCs on the suggestion to identify key concepts in FSR will greatly influence what the NARS will do.

I also feel that the emphases of the IARCs on OFR have greatly influenced the NARS. There is no question in my mind that the OFR now being conducted in various NARS is of substantial value in incorporating the farming systems perspective into their research programs.

Session 3: Commodity/Input-based Farming Systems Research

Reviewer's Comments (B)

M.H. Arnold¹

I found the papers from CIMMYT and CIP very interesting. Here we have two Centers starting from somewhat different premises but arriving at remarkably similar operational procedures.

This may be an oversimplification, but CIMMYT seems to have started its OFR from a farming systems approach and narrowed it down to something more easily translated into action. CIP appears to have started with a commodity approach and broadened it to include the perceptions of farming systems.

CIMMYT stresses that, because farmers tend to make few changes at one time, it concentrates in its OFR on only one enterprise at a time, but also recognizes the complementary relationships and interactions with other enterprises.

CIP says essentially the same thing in a different way. The focus is on potatoes (the commodity) and primarily, but not exclusively, on the producer. But the commodity focus is broadened to include the food system of which the potato forms a part.

CIMMYT says that a narrowing of focus raises the chances of formulating improvements that will be widely adopted, but notes the disadvantage that potentially valuable improvements based on multiple changes might be missed.

CIP comments that holism (a major premise of FSR) has its positive side but it also has its operational problems. The emphasis in CIP's case is therefore to focus on the most important activities and then investigate the interactions by placing the changes in progressively wider contexts.

The two approaches, therefore, have a great deal of common ground.

Both also stress the need to eliminate irrelevant solutions early in the process, and following that the general methodologies adopted are essentially similar.

CIMMYT uses a five-stage approach in which the whole process is iterative. CIP's farmer-back-to-farmer model is also obviously iterative but only four formal stages are recognized. Looking at the detail, however, the differences do not appear to

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be substantive and I would have thought that the two approaches could easily be thought of as one.

Regarding national programs, CIMMYT stresses the role of OFR in strengthening national research systems and regards them as having the primary responsibility for generating improved technology. The importance of involving national scientists and extension workers in OFR is also stressed.

CIP makes similar points but has gone further in some of its programs, notably in Rwanda and Burundi. When national programs have been in need of intensive support, CIP has established country programs in each of which a CIP scientist is based to work full-time with national scientists. This strategy contrasts with some of the views expressed already at this workshop and is bound to generate further discussion in the CGIAR. My own view is that there are some circumstances, i.e., where you have very weak national programs, in which it is entirely justified. One point made by CIP, about flexibility, perhaps requires further thought. "National scientists" according to CIP, "should not be trained in or feel compelled to follow a rigid set of procedures on how to do on-farm research." Although the idea of flexibility is readily acceptable, one wonders how flexible--when flexibility results in major differences that militate against a common approach across Centers for training purposes.

Reference was made at the beginning of this workshop to some criticisms in recent years that have been leveled at FSR. This was epitomized during the second review of the CGIAR system when one donor exclaimed to the study team: "Why is it that when we now work on farmers' fields we have to call it FSR?" (the implication being that this was somewhat esoteric). "Why," he added "can we not get back to some honest-to-goodness old-fashioned production research on farmers' fields?"

I suggest that what we are seeing in these two papers is what has evolved from old-fashioned production research. The primary focus is still on the producer and mainly on the single enterprise or commodity, but it also incorporates or takes into account other enterprises and other considerations that might be neglected if it relied solely on inputs from a bunch of scientists, be they national scientists or social scientists. I conclude, therefore, that for both CIMMYT and CIP the proper taxonomic classification (in the Simmonds mode) should be OFRWFP, i.e., on-farm research, with farmer participation!

Session 3: Commodity/Input-based Farming Systems Research

Chairperson's Summary

P.R.N. Chigaru¹

FSR activities in all the seven Centers covered in this session have major similarities in their objectives as well as in implementing strategies. There are, however, some differences in emphasis. The methodologies of IRRI, CIAT, CIMMYT, CIP, and ILCA are somewhat similar in that they do emphasize the need for refining FSR approaches as well as assisting NARS in carrying out FSR. IITA and IFDC, on the other hand, did not highlight this aspect formally in their papers.

In describing the experience they gained with FSR, ILCA was the only Center prepared to admit to both successes and failures and in identifying its comparative advantage as an IARC. CIP also gave more of an insight into some of the problems the program has faced in the field, such as with small NARS as typified by Rwanda.

With respect to implementation activities, all Centers appear to conduct base-data analysis and are agreed that FSR is best incorporated through a research continuance that includes on-station research supported by strong on-farm research programs. The emphasis on on-farm research varies between Centers, however, and CIAT, CIMMYT, CIP, and IRRI place major emphasis on OFR through NARS. ILCA conducts its own OFR at its field sites, with limited participation by NARS; IITA has very little OFR which it tests at its headquarters. IFDC appears to work more directly with other IARCs than with NARS, although OFR activities are described as an important element of IFDC's research programs. In the case of IITA, which has an area-based and a commodity/input-based mandate on FSR, it is recognized that IITA is engaged mainly in attempting to achieve major alterations to the existing farming systems in the humid tropics of Africa with the objectives of increasing food production on a sustainable basis.

Most of the differences noted above derive from the diversity of the mandates of the Centers and are to be expected. During the discussion, however, there was a feeling that Centers should explore opportunities for harmonizing their activities. There is a need for them to identify some key concepts or features of FSR that can justify a common label for their programs. In this respect IARCs should collaborate more closely and should not desist from criticizing each other's methods.

1. Research and Support Services Department, Ministry of Agriculture, Harare, Zimbabwe.

They should seek joint approaches to NARS and conduct joint training programs.

With respect to their interaction with NARS, it was not clear from the presentation how IARCs deal with NARS of different size and institutional development and the level at which they pitch their training activities. Perhaps this is an area in which ISNAR could assist the other IARCs since they have, over the past 5 years, reviewed NARS of different sizes and complexity. On the question of training, it was felt that all Centers should develop manuals and attempt to achieve some harmony in such manuals so that these can be used not only by the IARCs themselves but also by NARS during in-country workshops.

One important point made during the discussion was the question of land tenure systems and how these affect FSR. It was suggested that, as a general rule, Centers should not become involved with issues of a national/political nature, since even NARS also always try to work under given sociopolitical conditions, irrespective of whether or not this reduces their effectiveness.

Session 4: Evaluations and Policy Implications

Chairperson's Summary

J.L. Dillon¹

This session was something of a pet forum, with four papers each on a distinctive topic, the title of the session being somewhat a misnomer since evaluation was not considered (though it was considered briefly in the Plucknett paper).

Stoop's paper hypothesized on the best course of organizational development for a NARS in its implementation of RFSP. His not surprising conclusion was that the organizational development of RFSP in NARS should be a staged process and take place in a balanced way relative to the stage of development and capacity of the NARS itself, and that such development should be on a program rather than a project basis, and should be sustainable in the long term. Supplementing Stoops' paper, Sands outlined an ISNAR project which is just now getting under way, aimed at comparative analysis of a number of NARS' implementation arrangements for RFSP; such an analysis would provide information on the pros and cons of alternative organizational arrangements for the institutionalization of RFSP in national programs.

Zandstra's paper argued the need for better inter-Center coordination of RFSP activities by the IARCs, on a regional basis, with particular emphasis on the coordination of IARC approaches to national programs. Avenues for facilitating such harmonization of approaches would be through network arrangements involving NARS and IARCs, and through training activities.

Anderson's paper was concerned with the policy issues of agricultural research ranging from research and management policy within IARCs and NARS to the implications of RFSP for government policy in the agricultural sector.

Wessel showed in his paper how the concepts of RFSP are used in the ICRA training program with its emphasis on giving its trainees an understanding of the farmer's perspective.

Lively discussion ensued but more in terms of expansion of matters raised in the papers rather than in terms of any significant disagreement with the papers.

Perhaps the major issues raised in the wide-ranging discussion related to the following.

- Training needs and the desirability of the IARCs jointly

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organizing training courses and materials.

- Internal IARC policy implications of RFSP in terms of reward structures.
- The need for a farm household and community focus rather than simply a farm production system focus.
- The integration of OFS and RSS and the involvement of station-based scientists in OFR.

Session 5: Integration of Crop/Livestock/Agroforestry
and other Land-use Systems

Chairperson's Summary

H.G. Zandstra¹

The papers presented by Drs Hart and Raintree cover many methodological concepts and considerations for implementation. It is not possible to do justice to all of these, and this summary will comment on only a selected few, because of their importance to the overall objectives of the workshop.

The paper by Dr Hart introduces a hierarchy of agricultural systems including the "crop population, ecosystem, farm systems, and regional system." The type of technological intervention, the inclusion of trees and livestock as means for improving land use, and the extent to which community-level resources and marketing and price policies are considered, are given as factors that determine the systems level(s) to be covered by research and development. A good case is made for including all levels at the description and analysis stage ("Optional Systems Emphasis"), as a means to identify the most productive intervention points for technology (or policy?) design and evaluation. The importance of higher-level systems for the policy and marketing aspects is stressed--a view also present in the concern for the food system expressed by Rhoades in his description of the CIP approach.

Hart also presents an interesting view of the evolution of the overall international research system (national, regional, and international levels) that would be needed to accommodate agricultural research and development strategies that reflect a systems approach. At the national level, he emphasizes the need for a strong linkage between research and development institutions, and, at the regional level, he points out the increasing number of multicountry networks such as the Asian Farming Systems Network, the Latin American Animal Production Network, and the CARDI coordinated farming systems projects in the Caribbean. Hart finds that there is a critical need to allow national institutions to select their own farming systems approaches to research and pleads for less insistence by IARCs on the use of approaches developed for their own mandates. He indicates that regional (multicountry) networks are needed that can accommodate crop, livestock, and tree components of production systems, and feels that a common approach to farming systems research by IARCs will do much to obtain this.

The ICRAF approach to agroforestry research in a farming systems perspective was developed later than that of most CG

1. International Development Research Centre, Ottawa, Canada.

Centers. The authors feel that this has allowed them to "eliminate idiosyncratic elements" and to be more explicit about "certain aspects of the underlying logic." As has been the case with several IARC centers it has led to additional terminology. ICRAF's approach as presented in this paper fails to satisfy the description of FSR presented by the keynote paper for this workshop--it lacks on-farm evaluation of designed alternative production systems and the development of component technologies (see Table 1 for the "D & D discovery procedure"). In fairness, the author does indicate that collaborating national programs will conduct this research. This approach probably fits the nature of ICRAF as a council.

The paper correctly states that ICRAF places more emphasis on diagnosis than most other Centers, but this reviewer is not convinced that the scope is wider. The claims made by the authors about more of a focus on the land user, a "variable scale of diagnosis," a more elaborate technology design step, and a more iterative "basic D & D process" are in comparison with "the general FSR approach"--something this workshop with all its good intentions could not clearly define. These differences were not substantiated in the paper and do not agree with what this reviewer has seen in other IARCs and national programs. As a case in point, the contention that the design stage in other IARCs refers to experimental design is at variance with a substantial chapter in IRRI's methodology, the FSR approach described by Chigaru and Avila in this meeting, and a report of a workshop on Technology Design and Ex-Ante Analyses of the Latin American Animal Production Systems Research Network.

Neither paper provided details about the added methodological complexities caused by considering livestock (particularly bovine) and trees in addition to annual crops in FSR. These were raised during the discussion period. Discussants felt that there was a great shortage of techniques for measuring the performance of crop/livestock/tree-based systems. It was, however, widely recognized that the major measurement problem continues to be primary (vegetative) productivity, and that livestock responses to changes in primary productivity were fairly predictable. Problems of interactions between trees, crops, and livestock continue to be difficult to document sufficiently.

The discussion also raised the danger of researchers placing too much trust in farmer's perceptions of technology performance, an aspect that may ignore the long-term effects of land degradation and other social costs.

A particularly effective plea was made for a greater consideration of food trees such as peach, palm, breadfruit, and plantains as the basis for a major component of land-use systems for the lowland humid tropics.

In conclusion, the tree and livestock component of farming systems can provide important additional tools to researchers for the development of improved stable production systems. Cross-Center development of low-cost FSAR research methodologies suitable for national research programs would appear to be a high priority. Such developments should be conducted in close collaboration with national programs, possibly through inter-Center regional networks.

Session 6: Viewpoint on FSR Country Programs

Chairperson's Summary

J.K. Coulter¹

Four papers were presented at this session: Indonesia, India, Ecuador, and Zimbabwe (with an African slant). The paper on Indonesia described how an FSR perspective had been incorporated in the national research program. In doing this there had been substantial collaboration with the IARCs, particularly IRRI. Three points were emphasized: the national program set the priorities; the extension system was involved from an early stage in the on-farm work; and the importance of involving policy-makers in the early stages was recognized.

The paper on India described the national agricultural development objectives, including the need to increase the productivity of dryland agriculture to meet the projected population increase in the country. India has a substantial number of programs designed to evaluate the acceptance and impact of new technologies in the farmers' fields. These include operational research projects, lab-to-land programs, adaptive research programs, agricultural science centers, minikit trials, model agronomy trials, etc. It was suggested that the IARCs could help the Indian national program through supply of new ideas and information on new technology as well as guidance on program planning.

The paper from Ecuador reviewed the location and agroclimatic conditions of Ecuador, the range of crops that can be grown and the impact on agriculture of its oil production. The author described the commodity-based approach as illustrated by the work on potato and the resource-based approach that served new crops such as soybean--a crop that had developed rapidly in the last two decades. For traditional cropping systems, e.g., those with maize and beans, the farmers activities have to be analyzed and a system-cum-resource based approach is needed.

The author emphasized that FSR cannot exist as a separate program and should be part of the regular research system. Farming systems research was not new in Ecuador but it needed to be supported and it was essential to develop an attitude that was concerned with the practical aspects of agricultural development in both the educational system and in the public employee sector.

Continuing involvement of the IARCs was needed and should be utilized in a coordinated fashion. The continuing dissemination of information was an important role.

1. The World Bank, Washington, DC, USA.

The paper from Zimbabwe described the activities of on-farm research in the region. It pointed out that on-farm research had a long history in the commercial farming sector but not in the communal lands. The paper emphasized the problems of countries where trained staff were in short supply and where there was a large gulf between what happened on research stations and what happened on farmers' fields. A large number of workshops, initiated by donors or IARCs, made heavy demands on staff time; the design of research programs was often too ambitious for the resources of those concerned to undertake. There was a need for better techniques of data collection and statistical evaluation.

The discussant, Ms Fresco, pointed out that national programs seemed to encounter fewer difficulties in integrating their FSR programs into the overall research programs; donors and IARCs seemed more intent on preserving a separate identity for FSR programs. There was a need to obtain a clearer picture of what national programs expected IARCs to deliver and for IARCs to see what they could learn from national programs. Furthermore, the national programs needed better information on what was on offer from each of the Centers.

The discussant raised the question of the homogeneity of recommendation domains. In Indonesia, for example, well defined agroecological regimes were used, but, clearly, both small and large farmers must exist in such domains; how were the problems of these addressed? The question of cropping systems as components of the overall farm and household activity was raised in the context of research approaches. Such whole systems clearly involved such considerations as labor allocation. Finally, it was pointed out that linkages between FSR and extension, for example, posed some difficult institutional problems that needed political intervention for their solution.

In the discussion that followed, five topics were considered:

1. Institutional issues, including relationships with extension systems.
2. Inter-IARC relationships and the developing country views on these and on IARC-country relationships.
3. The role of recommendation domains.
4. Evaluation of FSR programs.
5. Relationships between subcomponents, e.g., cropping systems and the whole-farm activity.

In the discussion on institutional issues, it was clear that capacity and maturity of national research programs determined many of the institutional parameters. In some programs, the extension workers were closely involved in identification of farmers' problems and in doing on-farm trials. In others, all of

the on-farm trials were done by the research system. How to integrate an FSR team into the research system and whether it should be commodity-based or run as a separate unit was a recurrent topic, the conclusion being to consider it on a case-by-case basis. The caliber of the staff doing on-farm research was regarded as important. Often junior staff were detailed to do on-farm trials, while senior staff remained behind on their stations, sometimes because they felt that they had little to offer the farmers. The result was that the feedback to the station researchers was inadequate.

In the discussion on inter-Center and Center-country relationships, it was pointed that on-farm research was basically a national responsibility; the role of the IARCs was to support them in two major areas--training and the supply of information. Both implied strong Center cooperation. However, it was also pointed out that some countries did not have the capacity to do on-farm research and that they therefore needed, at least for the time being, the intervention and help of IARCs. It was generally agreed that the IARCs had to act in harmony in their relations with national programs, i.e., they should not be seen to be giving conflicting advice, but, on the other hand, it would be undesirable to develop a single approach to the problems. Clearly, the diversity of the Centers' approaches, their ability to do some things well and others not so well, provided an opportunity for the national programs to be selective.

A further factor concerning IARCs and national program activities was the growing number of networks. These seemed to proliferate, overloading the national programs. On the other hand, asking a specific network to do too many things overloaded the network and lowered its efficiency. Nevertheless, increasing the efficiency of networks was a topic needing further examination.

On the question of recommendation domains there was discussion on how the specific objectives influenced their design. Where there was a specific crop orientation there might be one particular design, but this need not necessarily suit other purposes well. There was obviously a desire to delineate homogeneous domains, for these could also be used for specific recommendation by, for example, the extension system.

On evaluation and impact, it was generally agreed that this was a difficult but necessary undertaking. Little progress had been achieved so far, although there was a great deal of discussion by donors on the need to evaluate this aspect of farming systems research.

Work on subcomponents within the total farm system is an area where several IARCs and other international research organizations are likely to be involved, and there was obviously need for close cooperation of the IARCs involved. However, there were few examples so far of such programs actually in action. The IARCs were cooperating at the cropping systems level and

there were a few examples of where crop- and animal-based systems were involved, but there was little activity at this stage in actual on-farm work.

Session 7: Formation of Discussion Groups

Chairperson's Summary

M.H. Arnold¹

In Session 7, the workshop divided into three groups to discuss:

1. The conceptual framework of FSR.
2. Commonality of approach to FSR by the IARCs.
3. Interaction between NARS and IARCs.

Each group convenor reported to the workshop in plenary session and, after discussion, consensus was reached on the following points (except where otherwise indicated).

Conceptual Framework

There was considerable sympathy with the view that what really mattered was what was actually done in farmers' fields as a consequence of farming systems research. Nevertheless, the workshop generally accepted the need for some further classification of the underlying conceptual framework.

Most speakers saw farming systems as an approach, rather than as a distinct research discipline. It was recognized, however, that because the term "FSR" has now been widely disseminated, it would probably continue to be used. But the workshop considered that some of the misconceptions about work on farming systems could be avoided if the term FSR were replaced, at least in the literature, by the term "Farming Systems Perspective" or "Farming Systems Approach." The generic term would then probably be abbreviated to read simply "Farming Systems," for example, as a budget head, and perhaps this might be acceptable to everyone.

Within the farming systems approach, the workshop recognized that two research thrusts had evolved. Although both were directed towards similar goals, they were conceptually different. One sought to devise novel systems of managing natural resources for eventual translation into farming practice; the other sought to understand the circumstances of the resource-poor farmer in order to identify possibilities for improved technologies that might readily be integrated into an existing farming system.

The workshop discussed the various terms that had already been used to describe these two basic concepts and work related

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to them. In the interests of simplicity and clarity, there was a general desire--not shared by every participant--to move towards the adoption of the following three terms:

Farming Systems Analysis--FSA,
Farming Systems Adaptive Research--FSAR,
New Farming Systems Development--NFSD.

FSA would be used to describe the deep analysis of existing farming systems, including all the socioeconomic aspects. It would be limited to on-farm studies and data analysis.

FSAR would include elements of FSA but would also involve on-farm and on-station research. Feedback from on-farm research would be used as an input for the design of on-station experiments in order to develop technology closely adapted to the existing farming systems.

NFSD would eventually encompass aspects of both FSA and FSAR but would be based initially on on-station experiments aimed at devising novel production systems, including agroforestry.

Commonality of Approach

In Centers with commodity mandates, research with a farming systems perspective is similar. Differences were noted, however, among those Centers with agroecological mandates.

Linkages between on-farm research and on-station research are being developed by all Centers. Problems have been encountered by all Centers in working with those commodities that are not included in the mandate of an existing Center. If appropriate expertise could not be found in the national systems, it has proved necessary to request support from other organizations.

The workshop supported the idea of nominating regional liaison scientists from the Centers to foster collaboration and avoid duplication of effort. These positions could rotate among Centers. In addition, each Center should nominate an individual who could be contacted in order to obtain, or be supplied with, relevant information.

In socioeconomic research there had been a common trend to move away from post mortem evaluation towards ex ante evaluation, as well as towards a greater involvement in the diagnosis and design stages of adaptive research. In this connection, the workshop noted that NARS were frequently lacking in a comparable capability.

There is also a common recognition among Centers of the desirability of working closely with the extension services from the earliest stages of adaptive research, but adequate mechanisms

for accomplishing this do not always exist.

In order to eliminate undesirable differences in training, the workshop agreed that countries should freely exchange training material. The idea of exchanging training staff for short periods was also suggested as worthy of serious consideration.

The workshop noted that ICRAF has an approach that is similar to that of farming systems. It has elements of NFSD as well as similarities with the commodity focus in that the tree is common to agroforestry systems. In general, however, the needs for developing agroforestry systems are more complex than those for farming systems, and, for agroforestry to be incorporated in center programs of FSAR, further development of methodology would be required.

The workshop noted that the exchange of information among Centers on farming systems had started with the 1984 meeting on systems-based on-farm research, during which similarities and differences in methodology were identified. The workshop considered that the summary of this meeting contained valuable information that should be brought to the attention of all IARCs.

Interaction between NARS and IARCs

While recognizing that NARS and IARCs are interdependent, the workshop stressed that the success of the Centers was entirely dependent on the NARS that constituted their most important client group. This relationship relies on mutual understanding and respect that needs to be reinforced.

The extent of interaction between Centers and NARS is mainly dependent on two factors:

- the level of development of the NARS, and
- the stage of refinement of new technology available from the Centers.

By defining more precisely what they require from Centers, NARS could have an important role in helping to harmonize the activities of different Centers in a single region. Consideration should be given to whether or not adequate institutional mechanisms in all regions for these influences to be effective. In this connection, the role of ISNAR in helping certain NARS to define their priorities was noted, but the work of ISNAR alone should not be expected to give a complete solution to the problem.

With respect to training, the workshop identified a need for screening existing training material, with a view to developing more effective packages or modules, which could be used in

national systems. In order to accomplish this, a small task force would be required, possibly comprising staff from both IARCs and NARS. This idea was commended to TAC for further consideration.

The workshop reiterated the importance of in-country training and workshops (as distinct from workshops convened at IARCs). There was also a need for management training in FSAR. Interest was expressed in the approach to training developed by ICRA, whose expert input should also be tapped to help in classifying the training needs of NARS.

Regarding information, the workshop identified a need to improve the availability of literature on FSAR as many of the existing publications had limited circulation, were not reported in abstracting journals, and were not included in computerized information services. Regional networks had a role in this respect as well as in addressing other problems relating to efficiency in on-farm research, such as the availability of appropriate seed stocks.

In addition to assisting with training and the dissemination of information, the workshop recognized the role of IARCs in mobilizing political support for research with a farming systems perspective. Furthermore, there must be occasions when Centers should give direct support to NARS by posting staff to work with them in specific programs. Clearly IARCs also had a role in collaborating with NARS to monitor the impact of farming systems research.

Session 8: Synthesis and Future of FSR in the CG System

Farming Systems and the International Agricultural Research Centers: A Workshop Synthesis

L.D. Swindale¹

Introduction

Let me commence this summary by recalling the purpose for which this workshop has been held. The subject of farming systems research has become quite popular in recent years, particularly within the International Agricultural Research Centers (IARCs) and in many of the developing countries with which the Centers work. The popularity of the subject matter has led to some confusion about the meaning of the term "farming systems research," the scope of research undertaken in its name, and, to a lesser extent, the effectiveness and relevance to agricultural development of what is being done.

The Technical Advisory Committee (TAC) to the CGIAR in its 1985 priorities paper indicates a need for increased attention by the Centers to the wise use and management of natural resources and the development of sustainable agricultural production. TAC also believes that on-farm research is an area of work done by national agricultural research systems, presumably because of its location specificity, and hence believes that input by the IARCs should decline in importance.

In 1977 TAC, finding some confusion about the nature of farming systems research and its implementation in the IARCs, requested a Stripe Review Team of John Dillon, Don Plucknett, and Guy Vallaeys to make a review and indicate what were the essential features of the subject, at least in the Centers. They came up with an excellent report (in 1978), but some confusion about farming systems technology still or again exists. The Stripe Review Team have presented in the keynote address at this workshop an update of their earlier report, which deals in part with this problem.

Farming Systems Related Research

I believe this workshop has been successful in illustrating what the IARCs and some national programs are doing in farming systems research. Virtually all Centers are involved, including two that

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do no biological research. The research is both commodity-based, and area-based, as indicated in the titles of two sessions of the workshop, and almost all of it can be conveniently and quite simply classified into three subject-matter areas as developed at this conference, and similar to those defined by Simmonds in his 1984 review. These are:

1. farming systems analysis, i.e., the study of farming systems as they exist,
2. farming systems adaptive research, i.e., on-farm research with a farming systems perspective, and
3. new farming systems development.

All have to do with the efficient development of new innovations and their testing; innovations as simple as a new crop variety or as complex as new farming systems for recently settled nomads.

Most Centers are undertaking studies of existing farming systems as an adjunct to and prior to their subsequent research. For this purpose they may be able to rely upon data from other sources, supplemented by additional rapid surveys. But in some cases it has proved necessary to undertake intensive and lengthy base-line studies.

The commodity-based Centers are involved in on-farm research with a farming systems perspective, i.e., on-farm research that tries to study and understand the broader implications, including policy implications, of the innovation being tested. We have had at this workshop examples of this approach from CIMMYT, CIP, IRRI, and the Bean Program at CIAT. All use rather similar methods. A similar approach is used by commodity programs at Centers that are also involved with area-based farming systems research. Examples given at our workshop are the root and tuber program of IITA and ICRISAT's sorghum program in West Africa.

Farming systems related research at the area-based Centers is primarily concerned with the development of new or improved farming systems. This applies to IITA, ICARDA, ILCA, and ICRISAT. CIAT, although predominantly a commodity-based Center, has adopted a similar approach in its tropical pastures program. Much of the farming systems development research is done at the research station, but on-farm testing of these more complex innovations is also considered necessary. CIAT has referred to the value of undertaking even the technology development in on-farm situations as well as the testing and verification.

The national agricultural research programs in Ecuador, Indonesia, and Zimbabwe undertake baseline studies and on-farm, commodity-based research and have working relations with relevant Centers, CIMMYT, CIP, and IRRI in particular. These programs are aimed at bringing production improvements into the hands of the smaller farmers and, to some extent, are extension-replacement operations. Linkages with extension services, where they

existed, became something of a problem and, as one reviewer noted, the programs have a rather narrow production focus.

India has a large national research program involved in area-based and commodity-based systems. It takes administrative and legislative policies into account as well as production-oriented problems.

All the activities seem to fit satisfactorily into the classification developed at this workshop. A few activities discussed here, that are part of the work of farming systems programs at a couple of Centers, remain outside our classification. Plucknett, Dillon, and Vallaeys (in their keynote paper) have questioned the wisdom of retaining separate farming systems units or programs. By definition, any research carried out by a farming systems program is presumably farming systems research, whether it fits the classification or not. An example might be the bacterial survey of soils being carried out by ICARDA. I have no doubts that ICARDA has good reason for carrying out this research. The problem is not the research but the name of the program in which the bacteriologists work.

But we should not strive to classify all our work in FSR into a few categories. Simmonds reminds us that too much standardization and coordination stifles creativity. The problems we are dealing with are not easy; they will require innovative solutions.

Although this synthesis, so far, has emphasized the classification of farming systems research activities, few of the Centers showed much interest in these taxonomic details. They have concentrated on explaining what they were doing and the types of results obtained. This has been much to our advantage and has enabled us to learn from each other's experience. All of us will do better farming systems related research in the future as a result of the papers that have been read and discussed here.

The Nature of Farming Systems Research

The 1978 Stripe Review report pointed out that a farming system is not simply a collection of crops and animals to which one can apply this input or that and expect immediate results. Rather, it was "a complicated, interwoven mesh of soils, plants, animals, implements, workers, other inputs and environmental influences, with the strands held and manipulated by a person called the farmer who, given his preferences and aspirations, attempts to produce output from the inputs in technology available to him. It is the farmer's unique understanding of his immediate environment, both natural and socioeconomic, that results in his farming system."

If crops research is research about crops then farming systems research, similarly, is research about farming systems. The keynote paper describes it as an approach to research that has eight interrelated objectives.

1. To understand the physical and socioeconomic environment within which agricultural production takes place.
2. To gain an understanding of the farmer in terms of his or her skills, constraints, preferences, and aspirations.
3. To comprehend and evaluate existing important farming systems, in particular the practice and performance of these systems.
4. To improve the identification of problems and opportunities for change in existing farming systems and thereby focus research on specific key aspects that limit production or farm income and their sustainability.
5. To enhance the capacity of research organizations to conduct research on priority problems of farming systems.
6. To conduct research on new or improved practices, principles, system components or subsystems within a FSR context, and to evaluate these for possible testing on farms.
7. To evaluate new or improved systems, or system components, on farms in major production areas under normal farm conditions.
8. To assist the extension, monitor the adoption, and assess the benefits of improved farming systems.

This list seems adequate to our purpose and relates well to what we have said we are doing. We freely acknowledge that in many cases we are focusing our efforts on farming subsystems, including cropping systems, rather than the system as a whole.

Farming systems research clearly requires the measurement of numerous variables, not all of which can be controlled. The statistical requirements have been touched upon only in a few papers. It is an important subject, not only to help us reduce to an essential minimum the magnitude, and hence the cost, of farming systems research, but even more importantly, to help us determine whether we are really doing research or not.

It is easy enough to find in the workshop papers the use of the common scientific method of setting up and testing hypotheses. The general hypothesis is that the innovation being tested will succeed in solving the identified constraints. The examples used by the participants to illustrate their approach to farming systems research all give positive answers. This is not surprising with the illustrative and explanatory papers that have been developed for this workshop. But I think that there is indeed some cause for concern, both because the complex mix of

parameters and variables in which we are interested are not always all easy to measure, and because of the value-driven nature of so much of farming systems research. The ICRISAT paper mentions that there is some scope for improvement in our on-farm methodology. I hope you would all agree. It is something that we should work on both individually and together--and it has been suggested that we have additional seminars and workshops.

The Necessity of Farming Systems Research

Is farming systems research necessary? I believe it is true that present-day agriculture has been developed without it. Why use it now? Our simple answer is that too much research is being done that does not benefit the target group. I do not know whether this statement is more true today than it was in the past, or than it is more true in agriculture than in industry, medicine, or space. Research is a risky business. The chances of producing useful results are fairly small. It is justified because successes, though small as a percentage of the total effort, are still numerous, and many give very high rates of return on the investment made. So should we do farming systems research? Our workshop answer is a resounding "yes".

Virtually all our Centers have farming systems research activities, as do a growing number of national agricultural research programs. The list of objectives given by Plucknett, Dillon, and Vallaeys for farming systems research is also its justification, but we have several additional reasons. Firstly, and prominently, we believe that the use of a farming systems approach will benefit the more disadvantaged farmers, farmers on marginal lands, poorly endowed farmers, small farmers and women farmers, more effectively than conventional research; i.e., there is a large equity issue involved in using the farming systems approach. CIMMYT also points out that a farming systems approach helps a farmer make short-term improvements that are preferable to longer-term improvements because of the high discount rates on investments in agricultural research. Many farmers, particularly in the rainfed and marginal areas where resource constraints tend to be more severe, are reluctant to adopt complex packages of practices; a farming systems approach can help overcome these barriers to adoption--although we must emphasize that the time scale will still be long.

Technologies that increase the productivity and sustainability of low-input agriculture tend to increase management input by the farmer himself and labor requirements. Such technologies are better promoted through the farming systems approach. Standard procedures of extension are largely limited to extending innovations to more progressive farmers in sole cropping, using manufactured inputs. The promotion of innovations in intercropping, double cropping, residue management, and some forms of land management need the farming systems approach.

We are not entirely agreed on whether FSR is a science or an approach to research but we know, at least, that it is not a new paradigm, i.e., it does not represent the way in which all agricultural research will be done in the future. It is an approach used to provide greater benefits to certain target groups and for propagating certain types of innovations. It does not substitute for, but supplements, the conventional approach.

And it is not without its problems. It requires a commitment to multidisciplinary activities by scientists from different disciplines, which is not always easy to obtain. ICRA is unique among our participants in concentrating its work on baseline and diagnostic studies. It has provided a number of insights into the difficulties and weaknesses involved in the farming systems approach. Poor communication and the lack of mutual respect among scientists from different disciplines are two that ICRA highlights. It has been suggested that ICRA can help us to improve our skill in using the farming systems approach.

ICRA and CIMMYT both point out, as has Michael Lipton in an earlier paper, that a farming systems approach is conservative and tends to be constrained by what the farmer already knows or can perceive. We have been reminded of this several times. The microcomputer probably would never have been developed had scientists been limited to public perceptions of what was needed in communications 40 years ago. Farming systems research also tends to make the assumption that the farmer knows best. That is not always true. The world concern for the problem of desertification reminds us also that the farmer, particularly in the poorest developing countries, but not only there, can be in conflict with the larger needs of society. ICRA and Anderson remind us that the farmer can also be in conflict with his labor. Farming systems research, concentrating narrowly on farmers' values or on production alone, has a tendency to overlook some exogenous and endogenous constraints. On the other hand, it can get too broad to be useful.

Farming systems research is probably more costly than the conventional means of disseminating research innovations in agriculture. ISNAR proposes a "minimum" farming systems program as a means of containing the costs and also highlights the difficulties of managing farming systems activities, and mentions the disappointing impact of some farming systems programs.

These difficulties notwithstanding, our workshop is clearly in favor of continuing research with a farming systems perspective. The positive results achieved by each Center seem to speak for themselves. The Centers are engaged in these activities because they clearly see their value and have every expectation that they will continue to do so. If CIMMYT is correct in believing that the adoption of new technology is mostly a question of assuring that recommendations fit farmers' conditions, farming systems research--particularly on-farm research--is the way to ensure that this will happen. We believe

that agricultural research for development should have a farming systems perspective. We must recognize, nevertheless, a real need to analyze the cost and effectiveness of the farming systems approach.

The Framework for Farming Systems Research

The keynote paper by Plucknett, Dillon, and Vallaeys advocates a conceptual framework for farming systems related research comprising three major elements: base-data analysis, research station studies, and on-farm studies. All are part of the system. All must be conducted, although not necessarily by the same institute and certainly not necessarily all at the same time. Indeed, there is an implication of a sequence, of moving from one step to the next and from the last back to the first.

This is the same framework these authors advocated in their 1978 Stripe Review report. ICARDA, ICRISAT, IITA, and ILCA, the Centers that have spoken about area-based farming systems research, all use it in their work. It can apply equally well to commodity-based farming systems research. Crop improvement research fits into research station and on-farm studies but, clearly, not all the crop research of our Centers can be or needs to be considered as part of farming systems research. Crop improvement research is part of the farming systems cycle if, and perhaps only if, it fits into the framework; that is, if it is undertaken as a consequence of baseline studies or of previous on-farm experiments, and if the improved cultivars are tested in on-farm situations. CIAT, IRRI, and the IITA paper on root and tuber crops appear to be in consonance with this idea.

The framework might be made more useful if one additional element dealing with technology design were added. As ICRA has pointed out, and as we in ICRISAT know full well, the effective utilization of baseline studies in determining the nature of research station studies is the greatest real weakness in farming systems research. There is need for a special place in this framework for the use of mathematical models and other forms of ex ante analysis, as has been pointed out by both ILCA and ICRAF.

Particularly in rainfed agriculture, ICARDA and ICRISAT find that operational research at the research station is necessary to learn the probabilities of success in relation to climatic variability. It is difficult to obtain this information on-farm, because of the many uncontrolled variables, and because it is generally difficult to maintain a program of on-farm research on the same farm or even in the same village for more than 2 or 3 years. Also, as ICRA and ICARDA point out, it may be very costly to develop technology for a single recommendation domain, if the latter is defined with any degree of rigor. Ecuador has produced a description of a recommendation domain that mentions a large "homogeneous" group of farmers; but the impression remains that we are talking about relatively small numbers in each domain. A

research institute, and particularly an international research institute, must work at a higher level of generalization, which requires the development of some form of agroclimatic or agroecological stratification and, perhaps, the use of benchmark sites.

The Role of the IARCs

IARCs contribute only a small part of the total agricultural research effort, even in developing countries. Few of them spend more than 20% of their total funds on farming systems related research. Thus, they can play only a small role in this field, and it should be carefully chosen. The keynote paper lists 11 areas where IARCs could be involved, if or when the national agricultural systems need our help.

New farming systems development is one area in which the Centers have a comparative advantage that is shared by only a few national agricultural research centers. The new systems can include cash crops and other commodities important to the farmer, and should not be thought of as the exclusive province of the Centers with geographic or climatic mandates. Comparative advantage also applies in the agroclimatic studies needed to relate new systems to their most probable recommendation domains. On-farm research is also needed to test the technologies as they are being developed and when available for utilization. The Centers should also be involved with national agricultural research systems in developing methodologies for farming systems research because these are transferable and will lead to improvements in performance, scientific validity, and cost-effectiveness. Present methods are not satisfactory; we should encourage methodological research.

The Centers can play a major role in training for farming systems research, recognizing that there are others such as ICRA and the Farming Systems Support Program at the University of Florida that are also involved. There would be value in exchanging training materials and in understanding each other's training goals and objectives. A seminar on Training in Farming Systems Research would be worth considering.

On-farm research with a farming systems perspective, even to test simple commodity innovations, can be conducted only in a few places by each international Center, as is pointed out by IRRI. Regional networks of countries and locations are utilized by several Centers to spread their contributions in the widest possible manner. Inter-Center, multiple-country networks merit some consideration. It is accepted that the national agricultural research systems must do most of the on-farm research, both because of its location specificity and because it is often as much demonstration as it is research. But, in some parts of the developing world, particularly in Africa, the current capacity of national systems to do on-farm research and

participate in networks is limited, and Centers and other agencies need to assist. Some Centers feel it necessary to assume this national role until such time as farming systems can be institutionalized in the national agricultural research systems. As ISNAR points out, however, even the national systems should put only a portion of their research effort into this form of adaptive research.

In some parts of the world several Centers are involved in on-farm research in the same countries and there is an obvious need for coordination and the formation of inter-Center teams and networks. Most Centers participated in a coordination workshop on on-farm research in eastern Africa in 1984. The proposals for coordination among the Centers and with the national agricultural research systems given in the report of that workshop merit wide circulation. Ecuador reminds us, however, that coordination of agricultural research efforts within a country is the responsibility of the country itself. We agree, and ask them to exercise their right with vigor and good judgment.

I have referred in the early part of this synthesis to the classification, following Simmonds, developed by this workshop, which satisfactorily includes virtually all the farming systems related research we have heard about and discussed. I have also referred to the conceptual framework given by Plucknett, Dillon, and Vallaeys. To me these two serve different purposes and we can gratefully accept both. The first, to tell TAC and our donors what we are doing under the heading "farming systems research"; and the second, to remind us of the steps that we must follow for the research to be done well. As Dr Gomez has put it, our strategies may differ, but our conceptual framework is the same.

I would like to take this opportunity to express my gratitude to the Chairman of TAC, who first suggested the possibility of this workshop. I believe it has given him, his colleagues in TAC, our donors, and our partners in the national agricultural research systems the information that they need to know about our farming systems research. I thank the participants for their valuable contributions, and my colleagues in ICRISAT led by Drs Kanwar, von Oppen, and Virmani, for the considerable efforts they have made to organize and conduct this workshop for us all.

Session 8: Synthesis and Future of FSR in the CG System

Reviewer's Comments

E.T. York, Jr¹

This workshop has been particularly helpful to me in providing a better appreciation of what FSR is all about. My association with this subject is probably quite different from that of any other workshop participant. And that difference may provide a perspective that might be relevant to this discussion. Let me explain.

During the decade of the 1970s, I was involved, almost full-time, in wrestling with the bureaucracy of higher education administration--totally removed from the agricultural research arena. In the early 1980s, I decided to get out of academic administration and devote essentially full time to my primary interests--international agricultural development, with particular emphasis on agricultural research and education.

Upon making this change, I immediately began to sense some of the feelings Rip Van Winkle must have experienced upon emerging from his long sleep. I found that in the preceding 10 years something which appeared to be new and different had emerged on the international agricultural research scene--something I had barely heard of before.

I discovered that FSR was the "in" theme with much of the donor community. USAID, for example, was pouring millions of dollars into new FSR projects, and it was obviously an area of major emphasis within the CG System.

I immediately began to try to learn more about this "new" effort, but I had considerable difficulty in understanding what was so new and different about it all. The basic concepts and approaches seemed to be little different from those that were being used a generation ago in the USA and, I suspect, elsewhere. Let me pursue this point for a moment because I think it is quite relevant to our deliberations.

In the early 1950s, I joined the faculty of North Carolina State University and assumed the leadership of a research program to increase the yield levels of groundnuts--yield levels that had been stagnant for as long as accurate records were available.

We put together a research program that, in retrospect, incorporated all the key concepts involved in FSR as set forth in the Sands paper, and as endorsed by Dillon, Plucknett, and

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Vallaey's in their keynote paper. Specifically, the program was clearly

- both farmer- and systems-oriented;
- it involved problem-solving approaches;
- it was interdisciplinary, involving agronomy, plant breeders, plant pathologists, entomologists, economists, engineers, and others;
- it involved extensive on-farm trials; and
- it provided both input from farmers in planning research and feedback to farmers following its completion.

But, before beginning the research program, we spent several months in the field visiting with extension personnel, farmers, and others, observing farming operations, getting familiar with farmers' practices, cropping patterns, etc. All of this was an attempt to better understand the problems and constraints that limited production. At the same time, we collected climatological and soils data as well as other environmental or ecological information that might have a bearing on our efforts.

Today, I assume such activities would be classified in farming systems jargon as farming systems analysis or base-data analysis. I should add, however, that these efforts involved no separate formal projects. We looked upon such work as an integral part of the planning of a research program, little different from a thorough search of the literature. It essentially involved an assessment of the environment in which we planned to conduct our research--dealing with factors that might have an impact on the research effort.

I should add that our research program also included a new farming systems development component (using the Simmonds terminology). This was in the form of a major crop systems experiment, involving various cropping sequences and a variety of management practices.

At the time the research program began, the university had no groundnut extension specialist, and research personnel, of necessity, were involved with extensive interactions with farmers. Two years later, the research results looked so promising that we employed a full-time extension groundnut specialist. He began to function as an integral part of an interdisciplinary, research/extension team, assuming increasing responsibility for maintaining continuing contacts with extension field personnel and farmers, and feeding back information to the research team on farmers' problems and needs.

Twenty years after the work had begun, average state groundnut yields had increased more than threefold with the increases directly attributable to the results of the research and extension effort.

In my opinion, what I have described was truly "research with a farming systems perspective," as we are using that term today.

I use this personal experience to illustrate a point. However, I should emphasize that in the last 30 to 35 years there have been similar experiences all over the USA, with essentially every commodity of economic importance. Such work has contributed to yield increases in the post-World War II era of some two-, three-, or fourfold with most agricultural commodities. Furthermore, I am sure there have been similar experiences in Canada, Western Europe, and other more developed regions.

In the USA today, extension programs, closely integrated with research efforts, frequently assume much responsibility for on-farm testing and adaptive research efforts. Furthermore, with close linkages between research and extension, along with established feedback mechanisms, extension helps to insure that research continues to be "farm-oriented with a farming systems perspective." In that respect, such extension programs perform some of the functions considered to be an integral part of FSR.

Given this vital role that extension should play in this process, I have been somewhat surprised that this function has received so little attention in our discussion. As the extension function in developing countries is strengthened, especially with the addition of well trained subject-matter specialists, there will likely be a changing role for research personnel in terms of on-farm research. Such considerations need to be factored in to how the IARCs approach this subject--especially in methodology development and training.

I am not an authority on Indian agriculture, but I am tremendously impressed with the advances that have been made in India over the past two to three decades. These advances have included a seven- to eightfold increase in wheat production, a threefold increase in rice production, and somewhat comparable improvements in a number of other commodities. This has been done without a major farming systems effort as such. I suspect a significant reason for this is that the strong research program in India has been complemented by an excellent extension organization with a close integration of the two functions.

Coming back to the issue of research with a farming systems perspective in the more developed nations, I was intrigued by Jock Anderson's suggestion that this was an approach that the more developed nations should adopt. It is obvious that research of this nature has been under way for many decades in some parts of the world. This was confirmed by Dr Jha of IFPRI earlier this week, when he indicated that IFPRI had found "a prevalence of research with a farming systems perspective in the earlier days of industrialized countries."

This was obviously not called FSR. But the concept or philosophy has been an integral part of the agricultural research effort in these countries for many years.

One big difference in the early efforts to which I referred, and what is being done today under the label of FSR, is that the early work had a much lower level of involvement of economists and other social scientists. I recognize fully that much more might have been accomplished had there not been that deficiency--had there been a better balance between economics and other disciplines such as agronomy. Despite this deficiency, however, the results have been quite impressive--by any measure.

In this regard, I would differ somewhat from Dr Swindale's suggestion that much of the past improvement in agriculture has been achieved without the use of FSR. It is true the FSR term or label has not been used, but the basic concepts have been employed and have made significant contributions to the advances made.

This brings me to what I think is one of the most significant points emerging from this workshop--specifically, that research with a farming systems perspective is not a new science or discipline, but rather it is a concept, an approach, a method for making research more relevant and meaningful.

I agree fully with Dr Gomez that, if we accept this concept, at least some of what we call FSR (particularly on-farm research) should become such an integral part of ongoing agricultural research efforts that it would lose its label or identity--just as these concepts or approaches have never acquired such an identity in many developed countries.

The obvious question, however, and the one I have been wrestling with, is this: If farming systems is not a new or radically different concept--and I don't think it is--why has it emerged so prominently in IARC and developing-country strategies? Why is it being evangelized by some as a new religion or wave of the future?

First, let me respond by saying without equivocation that it is indeed an important concept. Furthermore, it may indeed represent a new concept or approach to many Third World countries and to the IARCs that have a responsibility for serving these countries. I think there are two basic differences in the situations applying in developed and developing countries that have an impact on this issue.

First is the absence of effective extension programs in many developing countries, especially in Africa. Of course, there is no extension dimension in the IARCs. Their research programs have to fill a void created by the absence of close, effective extension linkages and functions.

Another reason why special attention must be given to FSR in the IARCs and national research programs of developing countries was alluded to by Dr Wessel earlier this week. He pointed to the fact that so many agricultural scientists today have little or no background in production agriculture or experience with farmers. Furthermore, their training is often in more highly specialized disciplinary areas rather than in the more applied agricultural sciences.

One reason why this is not a major concern or limitation among earlier generations of agricultural scientists is that most such scientists grew up on farms--many of them were from "resource-poor farms"--and were acutely aware of farmers' problems and needs and took these fully into account in planning and executing our research efforts.

Much of what I have said reinforces or expands on points made in Dr Swindale's synthesis paper. I am also impressed by the extent to which TAC's position on the subject, as stated in its 1985 Priorities paper, so closely parallels the general consensus that seems to be emerging from this workshop.

Let me review briefly some of the key elements of TAC's treatment of the subject.

TAC's paper points out that multidisciplinary research, centered on specific commodities but aimed at improving whole production systems, has been and should continue to be the central thrust of the CGIAR. While focusing on commodities, TAC recognized that agroecological and farming systems approaches are also important elements of the programs of some Centers. Now let me quote specifically from the TAC report:

Various types of research on farming systems have also proved to be valuable as complementary approaches to commodity research. Such research is closely related to multidisciplinary commodity research but is broader in perspective. It aims at increasing the sustainable productivity of whole-farm systems, rather than that of a commodity as a specific element within a production system.

In the CG system, research on farming systems has incorporated three basic and quite distinct activities: (1) baseline data analysis for characterizing major types of farming systems with agroecological zones; (2) research station activities directed towards the development of new farming systems; and (3) farming systems adaptive research which incorporated on-farm research and the testing and fine-tuning of technologies to specific environmental and farm management conditions.

TAC considers that research with a farming systems perspective will continue to be useful and relevant to the Centers' work over the short to medium term. Centers are encouraged to maintain an active dialogue aimed at

evaluating, improving, and harmonizing their respective approaches to farming systems research. In the long term (25 years), however, TAC considers that the respective roles of the three primary aspects of research on farming systems will vary in the System.

TAC considers that baseline data collection and analysis should continue to be used in the International Centers until an adequate knowledge base is created. At greater levels of specificity, however, the responsibilities for this type of research should be taken over by national or regional research institutions.

The Centers should also continue to work on developing new farming systems for major agroecological zones, particularly where physical resource limitations are great and where new concepts of resource management are necessary to achieve a breakthrough in productivity as, for example, in the humid tropics. TAC sees this approach as complementing the multidisciplinary commodity approach, rather than becoming a substitute for it. TAC believes that, since farming systems adaptive research or on-farm research is highly location-specific, it is more appropriate to the level of national, rather than international, agricultural research. The CG System should, therefore, limit its activity in this area to strengthening national systems' capacities. Centers should continue to concentrate their effort on developing research methodologies in FSAR, training national scientists in on-farm research methods, and stimulating awareness of the benefits of this research approach which integrates the farmers' needs, priorities, and knowledge into the process of technology development. In all cases, Centers should maintain active linkages with FSAR programs in collaborating national systems as a means to channel critical feedback to the Centers' scientists in the performance of their technologies and recommended management strategies.

Let me say in closing that I have heard nothing this week that would suggest the basis for any major departures from the position taken in the TAC paper.

It seems to me that, in the final analysis, we are focusing on two major types of activities: (1) on-farm adaptive research and (2) research dealing with the development of new or improved farming systems.

I do not discount the importance of base-data analyses. But such research efforts could be looked upon as being complementary to, if not integral parts of, the other two major thrusts.

IARCs will obviously continue to be involved in on-farm research, but, given the location-specific nature of such efforts, the primary role of IARCs in this area appear to lie in working with the national programs in the development of methodology and in training. The latter role will become

tremendously important.

The remaining major efforts or functions are in the area of new farming systems development. I share fully Dr Simmonds' enthusiasm for this area of activity--because such approaches do involve potentials for significant improvements, if not revolutionary advances.

I am impressed with the fact that most Centers are actively involved in research to develop new and improved farming systems. I think that, in the long term, this is an area that offers great promise and should be actively pursued.

Again let me congratulate you for an excellent workshop and thank you for the opportunity to participate.

Session 8: Synthesis and Future of FSR in the CG System

Chairperson's Summary

D.L. Plucknett¹

I am going to be brief in my summing up.

I think we all agree that finding ways to make science more effective at the farmer's level, and to involve the farmer in that process, is a very important matter.

Secondly, one of the things that farming systems research has been accused of is being strong on good intentions but weak on analysis. Our analysis of basic information does not appear to be as good as it should be, and we are perhaps not as innovative as we might be. I think we have to stress the need for analysis, because this type of work helps IARCs to plan their research programs more efficiently, and it widens national programs' perceptions about farmers in their own communities.

Thirdly, I think effective cooperation between IARCs and national programs is a major area of concern. We have had some examples of its beneficial effects this week, supported by expressions of approval about some of the results achieved.

Fourthly, I think we need to recognize that more OFR needs to be done, not so much as a recipe but as a concept. However, this aspect of our work, or this approach to research, has always been hard to explain, not only to administrators but even to colleagues. And we should perhaps reflect that any activity that has difficulty in explaining itself to others will not long survive, or will at least be called into question. Therefore we need to define on-farm research more clearly. This week I think we have made a move towards clarification--not to put a straightjacket on anyone, but to insure that our concepts are correct. I believe we can now explain to others why it is that one Center does a lot of basic resource work while another focuses its research on-farm.

OFR, however, has attendant problems. If it is done badly, it may leave scars on a farming community for years. Mistakes on experiment stations may be redeemable; but real mistakes with farmers can leave many residual difficulties. I think we therefore need to organize ourselves conceptually so that we know what it is we want to do, and then go about that work in such a way that farmers are clearly involved.

1. Consultative Group on International Agricultural Research, Washington, DC, USA.

Fifthly, the question of cost has been raised. It seems to me that OFR can be very costly, even though some have said it need not be expensive. One has to consider on how many sites one can operate, because each site costs something. In many countries access is difficult, and transport or local support may not be available. Enumerators may need training in research procedures, and there is the related question of quality control. I endorse the idea of an "effective minimum", in which costs are balanced against the operational demands that have to be met if the work is to be done efficiently.

I think the discussions this week have been excellent and I thank each of the chairpersons of each of the sessions. I enjoyed Dr Swindale's synthesis paper and the discussion that followed; there were a lot of cogent and incisive thoughts in it that stimulated a wide-ranging discussion. Finally, I feel that this has been a successful workshop, and I am pleased to have been involved in it.

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Program

MONDAY, 17 Feb 1986

0830-0930	Registrations, Lobby, Building 212	
0930-1000	INAUGURAL SESSION	
0930-0945	Welcome address, and orientation to ICRISAT	L.D. Swindale
0945-1000	Workshop objectives, scope, and organization	J.S. Kanwar
1000-1030	Coffee Tea	
1030-1300	WORKSHOP SESSION I Review, Philosophy, and Concept of Farming Systems Research	
	Chairperson: E.T. York, Jr. Rapporteurs: D. Byerlee, CIMMYT/S.M. Virmani, ICRISAT Reviewers: N.W. Simmonds, and G.T. Castillo	
1030-1040	Introductory remarks by Chairperson	E.T. York, Jr.
1040-1110	Review of Concepts of FSR - The What, Why, and How	J.L. Dillon
1110-1200	Comments by Reviewers	N.W. Simmonds G.T. Castillo
1200-1250	Discussion	
1250-1300	Summing Up	E.T. York, Jr.
1300-1400	Lunch - Recess	
1400-1700	WORKSHOP SESSION II Area-based Farming Systems Research	
	Chairperson: N.W. Simmonds Rapporteurs: R.A. Morris, IRRI/J.R. Burford, ICRISAT Reviewer: N. Hudson	
1400-1410	Introductory remarks by Chairperson	N.W. Simmonds
1410-1430	Farming Systems Research Relevant in the Humid Tropics with Special Reference to Tropical Africa	R. Lal
1430-1450	Farming Systems Research at ICRISAT	S.M. Virmani/ M. von Oppen

1450-1510	Farming Systems Research at ICARDA	K. Somel
1510-1530	Comments by Reviewer	N. Hudson
1530-1600	Coffee/Tea	
1600-1650	Discussion	
1650-1700	Summing Up	N.W. Simmonds
1830	Cocktails hosted by Dr. J.S. Kanwar, 204 Snack Bar	

TUESDAY, 18 Feb 1986

0830-1300	WORKSHOP SESSION III(a) Commodity/Input-based Farming Systems Research	
	Chairperson: N.S. Randhawa Rapporteurs: K. Somel, ICARDA/R.A.E. Mueller, ICRISAT Reviewer: A.A. Gomez	
0830-0840	Introductory remarks by Chairperson	N.S. Randhawa
0840-0900	The Cropping Systems Research Program of the International Rice Research Institute	R.A. Morris
0900-0920	The CIAT Bean Program's Approach to Systems-Based Research	J. Woolley
0920-0940	Root Crops Based Farming Systems Research at IITA	H.C. Ezumah
0940-0950	Comments by Reviewer	A.A. Gomez
0950-1000	Summing Up	N.S. Randhawa
1000-1030	Coffee/Tea	
	WORKSHOP SESSION III(b) Commodity/Input-based Farming Systems Research	
	Chairperson: P.R.N. Chigaru Rapporteurs: M. Upadhya, CIP/K.B. Laryea, ICRISAT Reviewers: M.H. Arnold, and J.G. Ryan	
1030-1040	Introductory Remarks by Chairperson	P.R.N. Chigaru
1040-1055	CIMMYT's Approach to Systems-Based Research	D. Byerlee
1055-1110	Generating Appropriate Technologies with Small Farmers: The CIP Approach	R.E. Rhoades
1110-1120	Comments by Reviewer	M.H. Arnold
1120-1135	Farming Systems Research at ILCA	J. McIntire

1135-1150	Farming Systems Research and the International Fertilizer Development Center	K.A. Dvorak
1150-1200	Comments by Reviewer	J.G. Ryan
1200-1250	Discussion	
1250-1300	Summing Up	P.R.N. Chigaru
1300-1400	Lunch - Recess	
1400-1530	Free for arranging return journey, travel claims, etc	
1530-1600	Coffee/Tea	
1600-1700	Group picture (assemble near main lobby at 1600 hrs sharp!) followed by slide show and guided tour of ICRISAT Center. Buses for tour will depart from near main entrance.	

WEDNESDAY, 19 Feb 1986

0830-1300 **WORKSHOP SESSION IV** **Evaluations and Policy Implications**

Chairperson: J.L. Dillon
Rapporteurs: R. Lal, IITA/T.S. Walker, ICRISAT
Reviewers: E.H. Gilbert and C.O. Andrew

0830-0840	Introductory remarks by Chairperson	J.L. Dillon
0840-0900	Organization and Managerial Implications of a "Farming Systems Approach" for NARS	W.A. Stoop
0900-0920	Inter-Center Coordination of FSR Activities on a Regional Basis	H.G. Zandstra
0920-0940	Policy Issues of Farming Systems Research	J.R. Anderson
0940-1000	Farming Systems Research as an Analytical Framework and a Tool for Training	M. Wessel
1000-1030	Coffee/Tea	
1030-1100	Comments by Reviewers	E.H. Gilbert/ C.O. Andrew
1100-1250	Discussion	
1250-1300	Summing Up	J.L. Dillon
1300-1400	Lunch - Recess	

1400-1700 **WORKSHOP SESSION V** **Integration of Crop/Livestock/Agroforestry/ and other Land Use Systems**

Chairperson: H.G. Zandstra
Rapporteurs: W.A. Stoop, ISNAR/C.K. Ong, ICRISAT
Reviewer: J.S. Maini, E.A. Luna

1400-1410	Introductory remarks by Chairperson	H.G. Zandstra
1410-1430	R and D Strategies to Improve Integrated Crops, Livestock, and Tree Systems	R. Hart
1430-1450	Agroforestry Research in Farming Systems Perspective: The ICRAF Approach	J.B. Raintree
1450-1530	Comments by Reviewers	J.S. Maini/ E.A. Luna
1530-1600	Coffee/Tea	
1600-1650	Discussion	
1650-1700	Summing Up	H.G. Zandstra
1930	Drinks and dinner hosted by Dr. L.D. Swindale, at Kaliva	

THURSDAY, 20 Feb 1986

0830-1300 **WORKSHOP SESSION VI** **Viewpoint on FSR Country Programs**

Chairperson: J.K. Coulter
Rapporteurs: J. McIntire, ILCA/D. Sharma, ICRISAT
Reviewers: L. Fresco, and P.R.N. Chigaru

0830-0840	Introductory remarks by Chairperson	J.K. Coulter
0840-0900	Farming Systems Research and Development in Indonesia and its Relations to International Agricultural Research Centers	A. Syarifuddin Karama
0900-0920	Farming Systems Research - Indian Experience	N.S. Randhawa
0920-0940	On-Farm Research in Ecuador: Current Status and Future Projections	A. Francisco Munoz

0940-1000	Comments by Reviewers	L. Fresco/ P.R.N. Chigaru
1000-1030	Coffee/Tea	
1030-1250	Discussion	
1250-1300	Summing Up	J.K. Coulter
1300-1400	Lunch - Recess	
1700	WORKSHOP SESSION VII	
	Formation of Discussion Groups	
	(Concurrent Meetings)	
1400-1530	Chairperson: M.H. Arnold Convenors: D. Merrill-Sands, G.T. Castillo, and L. Fresco [Convenors to identify members of discussion groups]	
	Themes:	
	(a) Conceptual Framework and Priorities for FSR at the IARC's: Its Role in Conducting Research on Low-Input Sustainable Systems Convenor: D. Merrill-Sands	
	(b) Commonality of Approach and Methodologies in Existing FSR in the IARC's: Identification of Areas of Further Cooperative Research, Exchange of Information on Methodologies Convenor: G.T. Castillo	
	(c) Interaction between National Programs and IARCs conducting FSR Convenor: L. Fresco	
1530-1600	Coffee/Tea	
1600-1630	Presentation of Consensus Statements by Convenors Sands, Castillo, and Fresco	
1630-1650	Discussion	
1650-1700	Summing Up	G.J. Vallaeys
1700	Adjourn	

FRIDAY, 21 Feb 1986

0830-1300	WORKSHOP SESSION VIII	
	Synthesis and Future of FSR in the CG System	
	Chairperson: D.L. Plucknett	
	Rapporteurs: J. Woolley, CIAT/M. von Oppen, ICRISAT	
	Reviewer: E.T. York, Jr.	
0830-0930	Presentation of Summary Reports by Chairpersons of Sessions I to VII	
0930-1000	Synthesis Paper	L.D. Swindale
1000-1030	Coffee/Tea	
1030-1045	Comments by Reviewer	E.T. York, Jr.
1045-1240	General Discussion	
1240-1250	Summing Up	D.L. Plucknett
1250-1300	Vote of Thanks	J.S. Kanwar
1300-1400	Lunch - Recess	
1400	Departures, sightseeing, shopping, etc.	