FARMING SYSTEMS RESEARCH AND EXTENSION: ACHIEVEMENTS AND FUTURE

H.G. Zandstra

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At this, the sixth farming systems research and extension symposium, I am most grateful for the opportunity to return to Kansas State University's lovely campus. I am especially grateful for the opportunity to meet with so many colleagues active in farming systems work.

This symposium and the pre-symposium workshops show the extent to which FSR/E has captured the hearts and minds of agricultural scientists. For, finally, here is a clear route to our ultimate goal: increasing food production and bettering the living conditions of low-resource farmers, particularly those in the Third World. The key to that goal is the installation of research on the farm, not dramatic demonstrations of new technology in the rarefied atmosphere of the research station.

Successful installation of research requires a different approach, a community-based approach that is at once ecological -- dealing with problems within their agricultural, social and political milieu -- and also eclectic -- drawing from a cross-section of disciplines. An examination of the origins and achievements of more than 20 years of progressive research shows the path we have taken to farming systems research and extension today.

The Beginnings

Though it's difficult to trace the genesis of FSR/E with a great deal of precision, everyone probably agrees that, by the late 1960s, the notion of inefficient resource use causing low productivity was put to rest by such economists as Hopper (1957) and Chennareddy (1967). Their work supported Shultz's contention that poor farmers were actually quite efficient.

It was then, too, that we began to realize the limits of technology transfer from Western to Third-World systems. In fact, the industrialized countries' research-extension system itself produced few measurable results in developing countries (Rice, 1971).

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2. Director of the Agriculture, Food and Nutrition Sciences Division, International Development Research Centre, Ottawa, Canada. The views expressed in this paper are those of the author and not necessarily those of IDRC. The assistance of Chris Mercer of IDRC and Louise Fresco of University of Wageningen is gratefully acknowledged.

But there was good news. Beginning with such pioneers as Comilla (1959) in what is now Bangladesh, CADU in Ethiopia (1967), Puebla in Mexico (1967), and Caqueza in Colombia (1970), researchers sought ways of allowing rural communities to capture the economic gains implicit in new technologies. From this "biological soup" of integrated rural development projects evolved many techniques for on-farm evaluations. For instance, over a very short time the Puebla project evolved from a commodity-based maize program to one that recognized the validity of local farmers' multi-cropping techniques. It increasingly focused on the whole farm family. The Caqueza project, too, emphasized multi-cropping and included livestock in its research scenarios.

Over time, a greater integration of social and biological sciences was achieved. A strong emphasis on diagnosis and continuing evaluation of farmers' reactions to projects led to such techniques as adoption studies, risk-sharing plans for introducing high-input technology (Zandstra et al, 1975), farm monitoring, and rapid appraisal, which recognized land types and production systems (Cobos and Gongora, 1977). These developments and others spawned ICTA's (the Institute of Agricultural Science and Technology in Guatemala) agricultural research model. The ICTA model shows the importance of farmer participation and the use of community organizations in research, and contributed greatly to the wider use of rapid-appraisal techniques (Hildebrand, 1981).

Early FSR-like activities ranged from predominantly descriptive to strictly experimental (Gilbert et al, 1980, and Whyte, 1981). However, there was considerable sharing of experiences. In the early years, information sharing and training by the Puebla project's Antonio Turrent, Leonardo Jimenez and Reggie Laird boosted Latin American on-farm research. In 1975, the first Asian Cropping Systems Working Group brought together influences from African farming systems work at Amadu Bella University, Asian multi-cropping work from the International Rice Research Institute (IRRI), and the Latin American Puebla and Caqueza projects.

At the same time, researchers were contributing to classification systems (Ruthenberg, 1980), and understanding the ecological and socio-economic determinants within and between different farming activities (Norman, 1974). Bradfield and Hardwood's Asian work on multiple cropping and intensified cropping led to many of the agronomy and crop physiology concepts now used and confirmed FSR's strong orientation toward technological change.

Towards a Consensus on Farming Systems Approaches ?

By 1980, FSR approaches began to converge. A major contribution towards this was the "Stripe Review" commissioned by the Technical Advisory Committee of the CGIAR (Consultative Group for International Agricultural Research) (Dillon et al, 1978). The US-AID funded Farming Systems Support project greatly increased communication among researchers and encouraged a greater understanding of similarities and differences. This may also have spawned recent papers on FSR nomenclature: Fresco (1984), Simmonds (1985), Sands (1985), and Stoop (1986). These were discussed in further detail at the TAC sponsored Intercenter Workshop on Farming Systems Research (ICRISAT, February 1986) where a somewhat delicate concensus was reached along the following lines (Arnold, 1986):

FSR, as a generic term, would refer to research with a "Farming Systems Perspective" or a "Farming Systems Approach". The latter two terms were preferred. There was a general, be it not uniform, desire to adopt the following three terms for further differentiation of concepts and work related to them:

"Farming Systems Analyses" (FSA) would be used to describe the deep analysis of existing farming systems, including all the socio-economic aspects. It would be limited to on-farm studies and data analysis.

"Farming Systems Adaptive Research" (FSAR) would include elements of FSA but would also involve on-farm and on-station research. Feedback from on-farm research would contribute to the design of on-station experiments, thereby developing technology closely adapted to existing farming systems.

"New Farming Systems Development" (NFSD) would eventually encompass all aspects of both FSA and FSAR but would be based initially on on-station experiments aimed at devising novel production systems, including agro-forestry."

I will resist the temptation to comment on the merits of this nomenclature, except to say that it is the most recent (I think).

Concluding, it is clear that development of FSR approaches has been gradual and in response to regional, institutional and disciplinary influences. Perhaps I can help set the stage for this week's discussions by reviewing some of the issues of incorporating the FS approach into national researech structures, the experience with livestock, the relation to commodity research, and others which continue to affect FSR approaches and which presage the future evolution of farming systems research.

Farmer Participation

FSAR practitioners have always stressed the importance of farmers' participation. The introduction of research teams in villages requires careful community briefing about the objectives and approaches of FSAR. To do so, meetings are held in each village and with farmers' groups involved in the diagnosis and testing phases.

Increasingly, farmers contribute to the design phase, as is the case in Latin American livestock systems research projects. In Asia, farmers are confronted with research designs and hypotheses, and are asked whether they would prefer to modify treatment methods and evaluation criteria.

Farmer-managed trials have played an important role in FSAR. The extent to which farmers apply treatments or participate in research designs or in the choice of research objectives still varies greatly. It often depends on the expertise available, the farmers' level of education, and on the complexity of the procedures. In some cases, the desire to increase farmer participation has led to a diminished emphasis on experimental techniques that allow confident comparisons between alternatives. This, of course, leads to a compounding of uncertainties, certain to render the research inconclusive. Careful experimental design and execution are no less a requirement with farmer participation than without it.

The shift towards farmer participation should continue to receive emphasis. The increased use of rapid-appraisal techniques, which feed research team interpretations back to farmer and key informant groups, is encouraging.

Gender and group interests should receive more attention in the design and ex-ante performance and impact analyses of alternative technology. This means that appraisal and monitoring must provide gender and community group differentiated information about resource use and benefits. These methodological changes are taking place, but there are still few cases where research objectives and technological or policy choices have been changed as a result.

As part FSAR's commitment to community-based research, greater attempts should also be made to employ field assistants from the community. The inclusion of community extension workers on FSAR teams can help pave the way for a stronger community base. The location of the research team within the farm community is also an effective means to increase interaction and acceptance.

Though farmer participation is essential, the farming systems approach cannot depend solely on what farmers already know. There must be a combination of the experiential knowledge of the farm community (in particular its technological history and environmental insights) with the biological and technical knowledge of the researchers. One has only to think of the frequent success of lateral transfer of farming technologies -- even across oceans -- to recognize the importance of new technological insights. It is often the knowledge of what is possible and what alternatives are available that is limited in the farm community.

Developing a Strong Research Capability

The FSAR perspective should be integrated with existing national research systems, but this is often easier said than done. Stoop (1986) treats the difficulties associated with the introduction of a farming systems approach into national research and extension systems. He concludes that a policy gradually introducing on-farm research with a systems perspective is more likely to succeed than using large, externally funded farming systems units that are not integrated into the existing structures.

In this respect, the use of one to three small research teams composed of BSc-level research and extension staff from the research site has been effective. These teams could be coordinated at a national level. At that level, contacts with commodity research groups and support from social scientists and soil and climatological research groups can be established. These can be formalized as part-time participants in the national FSAR team, or as a technical advisory unit to the FSAR project.

Experience in Asia and several African countries shows that research teams should have limited responsibility in terms of the target area or agrological production zone. As much as possible, the FSAR teams must have a reasonable degree of independence in their day-to-day activities. They should be responsible for the design of their research (appraisal, monitoring and trials) and for conducting analyses of research results. The location of initial FSAR teams should allow access by supporting scientific staff (for example, from a nearby research station).

While the FSAR approach should be implemented by line agencies for agricultural research and extension, other organizations can make important contributions. A wider coverage and greater decentralization can be achieved when national NGO's and universities participate. These linkages should extend to contacts with credit and marketing institutions and groups active in post-production research, so that the opportunities for removing institutional constraints can be more realistically assessed.

A great limitation to widespread adoption of FSAR is the lack of trained field staff. The demand for training at the regional level (for coordinating staff and trainers) and at the national level (for field staff) far exceeds the installed capacity. International centres should consolidate and strengthen their training efforts, and more in-country training of the sort offered by the FFSP in West Africa and by the CIMMYT group in East and southern Africa should be encouraged.

Where absolutely needed and requested, foreign specialists can be added to the advisory unit. One or two should be sufficient and they should report to national program leaders. Their function should be limited to training and advice; institutional and managerial decisions should be left with the national program leaders.

Commodity Research and FSAR

The growing interdependence of FSAR and commodity programs testifies to the importance of maintaining good links between the two research activities. FSAR depends greatly on the availability of a wide range of genetic materials. The FSAR perspective helps commodity researchers to understand the demands that will be placed on their materials.

It is not coincidental that CIMMYT's maize program developed a strong FSAR approach. They needed more information about site-specific and systems-conditioned demands on maize varieties. The association of IRRI's systems programs with rainfed lowland and upland rice-growing regions did not arise because IRRI badly wanted to work with non-rice crops. It was because these were the environments in which the performance of rice varieties (and thereby varietal requirements) were strongly conditioned by land type, growing season, and other crops in the rotation.

There is no doubt that national agricultural research systems require an overall land/resource-based FSAR approach (as explained by Chigaru and Avila, 1986) -- not a commodity or input-constrained approach to making the most of resources. This approach deals effectively with multi-cropped mixed farms and is pretty well necessary if research is to consider policy implications. Much of farming systems research takes place on marginal land. Those studying new farming systems for the humid tropics of highly eroded tropical highlands are well aware of the importance of sustainability of production systems. Research on ways to regenerate lost production potentials of marginal land is better served by an overall resource-based approach. It could even be argued that a strong commodity orientation risks a neglect of environmental concerns.

To make the most of both commodity research and FSAR, we need a well-developed feedback system. Communicating FSAR insights from diagnostic work, on-farm testing, and project monitoring helps commodity researchers to refine their product specifications. Eventually, such specifications as breeding objectives will reflect on-farm limitations and potential more clearly.

In return, FSAR/commodity cooperation will help define screening conditions (seasons, type of land preparation, input levels, land type, and so forth) for component technology evaluation.

A good illustration of the values of such cooperation is in the workshop proceedings on "Crop improvement in Eastern and Southern Africa: Research Objectives and On-farm Testing". Here, Kirkby (1984) analyzes the relationship between types of research and deals with the views of commodity program leaders on the subject.

It is indeed encouraging to note commodity program leaders' increased interest in participating in the research design of FSAR programs. Several national research systems now have FSAR advisory or coordinating teams to which related commodity program leaders belong.

Crop improvement programs should not necessarily depend on the FSAR activities of others to provide the feedback they need. On-farm evaluation with participation of farmers or farmers' groups, taking into consideration socio-economic factors, should be part and parcel of commodity improvement programs. Obviously, there is a lot to be gained if such research can be conducted at FSAR research sites and in coordination with FSAR activities.

Livestock in FSAR

Our symposium theme, "Food and Feed" is a good illustration of the interdependence, not just of commodity research and FSAR, but also of the different disciplines within FSAR. Though many FSAR activities concentrate on either livestock or crop components, some treat both. Examples of livestock-based programs include the Centre for Research and Training in Tropical Agriculture (CATIE, Turrialba, Costa Rica); the International Livestock Centre for Africa (ILCA) and a wide range of projects supported by WINROCK International.

Much experience has been accumulated, particularly in Latin America, where a formal collaborative research network has grown out of the CATIE and IDRC support to livestock production systems research (Li Pun and Ruiz, 1984). The Asian Farming Systems Research Network has since 1983 included a small number of crop-livestock research projects. Papers from these groups will be presented at this symposium.

Because of the predominance of mixed farms in small holder agriculture, it's tempting to assume that all FSAR projects should intervene in both crop and livestock components of mixed farms. It is true that the diagnostic stage and farming systems analyses must lead to an understanding of the roles and transfer relationships between the two. However, beyond this, it is quite feasible to concentrate on the sector in which your institution has expertise.

Because the major constraint to livestock productivity is the lack of a reliable year-round supply of quality feed, the search for better feedstuffs has led to improved use of by-products, intercropping, hedgerow cropping of fodder crops and trees, and increasing forage yields and/or quality from food-crop production. It is therefore important that livestock researchers exploit opportunities for intervention in the crop sub-system. Most of these interventions can be dealt with using FSAR techniques from cropping systems research, although the use of tree species presents special difficulties (Nitis et al, 1985).

Where interventions involve substantial changes in herd management or require evaluating several technologies, whole-farm evaluation appears the only approach. In some projects, this is achieved by using researcher- or farmer-executed model farms. However, for interactive and realistic results, it's necessary to introduce the changes gradually to a number of farms. These can then be compared to carefully paired check farms that have been monitored in the same way.

Most projects using whole-farm testing use interdisciplinary teams in the diagnosis, design of alternatives (generally one or two only) and ex-ante analysis. Several have used simulation models for ex-ante analysis and design activities, and all seek reactions from farmers and extension workers several times during the design process. The increased emphasis on systems simulation and ex-ante analysis to compare potential interventions is an understandable adjustment, given the costs and complexities of evaluating whole-farm crop-livestock alternatives. It places, however, greater demands on the research system and can limit the ability of non-specialized staff to participate in decisions about research directions.

How should livestock production research be included in national research systems? This naturally varies greatly from country to country. In general, different research organizations are responsible for crop and livestock research. It may then be best to encourage independent activities and to seek collaboration on selected research sites. Where both components reside in the same organization, there is merit in combining the livestock and crop capability at the national level. This has been achieved effectively in Zimbabwe, where the farming systems unit consists of two livestock scientists, two agronomists, one agricultural economist, and support staff. The research is conducted at two research sites, each managed by a small field team (Chigaru and Avila, 1986).

Agricultural Policy Support

Canadian farmers know how important agricultural policy support is to their livelihood. Instead of ensuring farmers a fair return on their investment, agricultural policies have abandoned them to an international marketplace marked by low prices and subsidized competition.

In the Third World, political support for new agricultural technologies is equally important. However, our methods of attracting and building this support need refinement. FSAR usually promotes policy changes through highly visible demonstrations of potential benefits using pilot production projects. This then leads to special projects that provide the necessary additional credit, input and marketing supports. Although many of these institutional changes were confined to the project area, and were sometimes of a temporary nature, the use of improved technology as an instrument for policy change merits greater attention.

Even when projects attempt to foster such support, it is not always forthcoming. This has led to lost production and income on many occasions (Zandstra et al, 1975). To get away from the problem of transient support, more formal links between FSAR coordinating groups and policy planners are required. This will allow the presentation of carefully documented findings in non-threatening ways. The possibility of policy makers and planners participating in national-level committees or units should be more aggressively pursued.

The close association with the rural community of those conducting FSAR places them in an excellent position to predict or document the impact of technological and policy changes on different groups. To contribute effectively to the policy-making process, FSAR teams need, however, to take store of their usual methods of data collection and presentation. These should give greater recognition to the institutional costs of recommended changes, and to area-based estimates of input requirements, production changes, market interventions, and employment and income effects. For most national FSAR activities, this will require a considerable strengthening of analytical and communication capabilities.

Conclusion

Agricultural research has never been more important. Not only because food availability and incomes of smallholders in the Third World need to be increased, but more and more because the world must protect or even improve the future production capacity of its agricultural land.

The farming systems approach continues to evolve and become more clearly defined. Future directions that merit attention are:

- A greater emphasis on long-term sustainability and thereby closer links between the development of new farming systems and their early on-farm evaluation.

- Better participation by farming families and different beneficiary groups (e.g. gender or tenancy specified) in the design and execution of research plans.

- Increased consideration of the relationship between agricultural policy and technological change.

- Broader participation of commodity and disciplinary (soil, engineering, etc.) research groups in technology design. This should allow a more complete scan of possibilities, such as food and fodder, trees, non-food crops, and land or water-based livestock.

The farming systems approach has become widely accepted in the last ten years. There are some promising institutional implementations of FSAR to attest to this. Despite this, the main constraint to the adoption of improved strategies for sustainable rural resource use continues to be the lack of national research capacities to exploit the technical and policy opportunities in specific rural regions. There is therefore, first and foremost, a need for continued support for training and institutional implementation of FSAR.

Implementation of FSAR should normally be gradual. The use of, initially, a few multidisciplinary field teams is advised. These should be composed of BSc level research and extension workers from the region and trained field staff from the villages in the work area. Strong national level suport is required from systems research specialists who can provide methodological inputs. A national FSR coordinating group or committee has proven a most useful means for ensuring close collaboration with policy-makers and leaders of commodity programs. Commodity programs should increase on-farm research, where possible in close collaboration with FSAR teams. After three or four years' work on two to three locations, national or state programs are in a better position to estimate the eventual level of investment in FSAR teams and their coordination that is required and can be sustained.

Finally, it cannot be overstated that the implementation of farming systems research is a long-term process. The initiatives by International Agricultural Research Centers and donor agencies have been instrumental in bringing about its wider implementation. The Farming Systems Support Program has resulted in an important consolidation of research methods and experiences and strong support for in-country training. I sincerely hope that this determination to support FSAR will continue, as it is sorely needed if we are to make available the benefits of research to resource-poor farmers.

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