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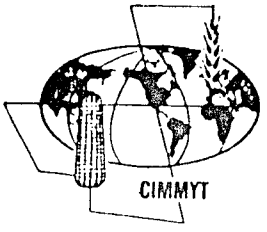

INTERNATIONAL MAIZE AND WHEAT IMPROVEMENT CENTRE

REPORT OF A NETWORKSHOP OF EASTERN AND SOUTHERN AFRICAN SENIOR AGRICULTURAL ADMINISTRATORS ON ISSUES IN SYSTEMS BASED ON FARM RESEARCH

Maseru, Lesotho, November 24-28, 1985

Networking Workshops: Report No. 8

CIMMYT Eastern and Southern Africa Economics Programme
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The material in this report does not necessarily reflect the views of the International Maize and Wheat Improvement Center (CIMMYT).

INTRODUCTION

This was the third meeting of Eastern and Southern African Senior Agricultural Research and Extension personnel to discuss systems based On Farm Research. It follows previous meetings in Nairobi in 1983 and Eldoret, Kenya in 1984 in the context of the informal network on OFR in the region organised by CIMMYT. The programme (Annex A) for the meeting was developed by consultation with senior agricultural administrators over the previous twelve months. It contained a significant training element and with this in mind senior representatives from five universities, including three of the largest agricultural faculties in the region, were good enough to attend. This report is a record of the proceedings of the meeting.

One or two aspects of the programme deserve comments. During 1984/85 several research and extension directors in the region asked for evidence of the effectiveness of a systems based approach to On Farm Research. Seven countries were asked for country papers giving the history, achievements and problems of systems based OFR in their countries. These papers, the questions they raised and the responses to the questions are found in Part I of the report. As can be seen from the papers the institutionalisation of systems based OFR in the research and extension services of the region is a phenominon of the last three or four years. Building effective research capacity is a long process and probably a ten year horizon is realistic once a country has opted for institutionalisation and resources are forthcoming to fund OFR programs. In any evaluation it is imperative to assess whether the concepts are getting an opportunity to prove their worth.

Even though the 1984 meeting in Kenya (held jointly with World Bank, USAID, EEC and other donors) focussed on OFR as a research/extension linkage device, many research and extension administrators continued to raise issues on linkage; with technical research, with extension and with planners and policy makers. CIMMYT prepared a set of briefs on these linkages issues and circulated them to participants a month before the meeting. Group discussions on these issues made up Tuesdays programme, the briefs and summaries of the discussions make up Part II of this report. Finally invited speakers addressed three other areas in which administrators had expressed interest. Training for OFR with particular reference to the role of the universities, Networking in OFR in the Eastern and Southern African region, including information exchange, and the role of the International Agricultural Research Centres in OFR. These papers, with the question they prompted, make up Part III of this report.

Both CIMMYT and the participants at the Maseru meeting owe a debt to the Ministry of Agriculture, Lesotho in general and to Winston Nts'ekhe, Director of Technical Services in the Ministry, and Musi Matli, Deputy Director Research, in particular. Their enthusiasm and help with the organisation and logistics were indispensable to the success of the meeting. We owe a special debt to the Hon. Minister of Agriculture Hon. L.T. Matsepe, for his time and kind words in opening the networkshop, and for his emphasis on the importance of the topic of OFR.

Dr Ronald Cantrell, the Director of CIMMYT's Maize Programme, welcomed participants on behalf of CIMMYT and gave an address emphasising the dependence of CIMMYT on strong National Agricultural Research Services. This is reproduced below.

MANAGING MAIZE RESEARCH WITH LIMITED RESOURCES

by

Dr R.P. Cantrell, Director, CIMMYT Maize Programme*

In this paper I address an issue about which we at CIMMYT have not spoken very much and have written even less. That issue is the management of national maize research with limited resources. We have been more or less silent on this topic because we are still in school learning some basic lessons ourselves, not because the subject lacks importance.

The skill with which managers of national agricultural research allocate scarce resources has acquired special significance for us at CIMMYT as we have come to understand more fully our interdependent relationships with national programs. What we have realized is that the cost-effectiveness of our own work in developing agricultural technology hinges upon how well national programs apply their own resources in adapting and applying that technology.

The literature on this subject is rich and varied. Numerous studies have been done on the organizational structure and cost-effectiveness of both national and international research. The relation between the two received much attention in a study recently conducted by the CGIAR on the impact of the international agricultural research system, including both the centers and their cooperators in national programs. Many other studies propose decision making models, some of them very elaborate, for allocating resources to national and international agricultural research.

One of these models may be of interest to you. It is outlined in a paper entitled "Investment in Agricultural Research: Some Economic Principles", which was prepared for CIMMYT by economist Grant Scobie. He suggests several practical steps that can be taken to determine, first, how much should be invested in research and, second, how the research budget should be allocated. For distributing funds among zones, commodities, or projects, Scobie says that the simplest and most useful initial step is to consider the "size of the industry". In the case of a commodity, this would mean its share in the total value of agricultural output. Scobie goes on to point out that this criterion is seldom enough by itself and that various tradeoffs have to be made. To assist in this fairly subjective process, he supplies 10 additional criteria, such as the amount of calories and protein supplied by the commodity.

My own comments about managing scarce resources for maize research will be of a different nature from those of Scobie and other economists. I am assuming that a certain amount of funds has already been allocated to the national maize program and that this amount is inadequate or just barely sufficient. I would like to share some of my own experience in the public and private sectors and some views this experience has given me on the role of national program research and the management of its scarce resources.

As I mentioned earlier, there is an interdependent relationship between national and international research. International institutes and regional programs were established to strengthen, support, and complement the work of national researchers, who remain primarily responsible for developing and transferring improved

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*Director, CIMMYT Maize Improvement Program, El Batan, Mexico

agricultural technology to farmers. International research can never serve as a substitute for national programs and, on the contrary, depends for its own effectiveness on the success of those programs.

Let's look at a couple of maize research activities in which it is evident that certain functions can be carried out only by the national maize research programs. First, germplasm development. The improved maize germplasm developed and distributed by CIMMYT is an intermediate research product suitable for large areas, which we term "mega-environments." These encompass many smaller maize growing niches that are distinct but similar in characteristics such as elevation. Because these areas are so numerous, it would be impossible for us to produce all the final products, the finished varieties, that are needed for every developing country.

The vital task of making these raw materials into final products is the exclusive responsibility of national researchers. They are in a far better position than we are to know what characteristics must be incorporated into CIMMYT varieties, in addition to the broad adaptive traits these varieties already possess, to make them acceptable to farmers in a particular area. We can provide various types of support in this process of fine tuning varieties, such as training and research techniques. But we cannot carry out this task ourselves. If it were not done by national programs, then our intermediate research products would remain on the shelf benefitting no one.

The same goes for the other goods and services that we provide, such as on-farm research procedures and other approaches that can be used in dealing with crop production problems. These sorts of problems, which are site-specific, can best be resolved by national researchers who are familiar with local circumstances that have some bearing on the problems, not by an international center or regional programs.

Agronomists in our regional programs are busy enough already keeping up with the work of as many as a dozen or 15 national programs. They do not have time to conduct by themselves the research required to solve an agronomic problem in, say, Zambia. We in Mexico are in an even less likely position to address the problem adequately. The levels of mechanization, availability of chemical fertilizer, and other factors vary too widely between one country and another to permit such a long-distance approach. Any solutions that we propose would be fully applicable only to the area in which we developed them.

The fact that we do not conduct this type of research at our headquarters in Mexico is a source of bewilderment to many CIMMYT visitors. After having made the rounds of our experiment stations and seen our germplasm development work, they often ask, "Well, where is your agronomy program?"

The answer is that, although we have agronomists on our headquarters and regional staff, we do not have or even need an agronomy program. This research is already being carried out by those who are in a better position to conduct it -- namely the agronomists in national programs. Why should we try to do in Mexico work that is best left to a national researcher in Malawi? Our own time and resources are better spent in supporting the efforts of those in the national program. We can do so by assisting with economic surveys that pinpoint agronomic and other problems, by providing in-country and in-service training in techniques for investigating and solving those problems, and by consulting with national researchers as they attempt to integrate and move forward with their experiment station and on-farm research programs.

What I have tried to describe is a division of labor in which CIMMYT supplies intermediate research products and national programs develop and deliver the final products to farmers. We consider this the most effective way of apportioning research responsibilities and scarce resources with which to fulfill them.

I would also like to say in passing that at this time neither of us has any business becoming involved in some of the more basic research, such as biotechnology. This work is very far removed from our respective responsibilities and extremely expensive besides. In CIMMYT's maize program, basic research is limited to some work on wide crosses. In addition, we will try to stay abreast of developments in biotechnology at the universities and other institutions in which this work is being done. We will apply the newly developed tools where they are applicable. But we will not conduct research on the tools themselves.

Another issue that comes up in deciding how to apportion research tasks and resources is the division of labor among national programs within a region. However this issue is resolved in detail, it is probably not wise for a single national program to abandon completely any major research activity. This is especially true of long-term projects such as plant breeding, which can be expensive and time consuming to initiate. It is particularly wasteful of resources if a breeding program is abandoned and then revived later. Not only do you pay the starting costs twice, but you lose much of what was gained before the first breeding program was cut. Circumstances will often dictate reductions in a program, and opportunities may arise for satisfying the need being met by that program more cheaply through cooperation with another national institute in the region. Even so, a remnant of that program should probably be kept on so as to maintain some continuity in the research and staffing, and in case a change of circumstances makes it necessary to restore that program to full strength.

The degree to which the requirements of maize research and production can be satisfied through regional cooperation varies widely according to the activity. In some types of research, almost no cooperation is possible, while in others national programs can be almost completely interdependent. For example, several programs in a region should be able to take advantage of research on maize utilization or storage methods. But there will be a definite limit to the number of countries that can benefit from their neighbours' inbred development programs, the products of which will be restricted in their adaptation. An even more extreme example would be a good hybrid combination developed by a national program. Rather than being shared throughout the region, this valuable resource should be guarded jealously (as private companies do with their hybrids) and sold at a profit that will help cover the cost of national research. Another example that occupies the middle ground between interdependence and no cooperation is regional variety and hybrid testing. Many countries stand to gain from this type of cooperation (researchers in Tanzania, for example, can readily benefit from the experience of their colleagues in Kenya). But regional networks can never substitute entirely for a national program's own breeding effort.

The brief reference I just made to the practice of private sector agricultural research brings me to my next point. For five years I worked as a plant breeder for one of the large private seed companies in the U.S. More recently, I have had the chance to get to know and work with scientists in many public research organizations around the world. One difference between these two types of organizations has always struck me as peculiar. Oddly enough, it is most often the resource-rich private companies that tend to manage their resources most effectively, not the national research institutions operating on meagre public funds. The opposite should be true. Scarce funding ought to be a strong incentive for administrators of public-funded research to be adept in allocating their resources. This incentive should be at least as strong as the profit motive that partially explains the efficiency of the private companies.

The difference in motivation, by itself, is a weak explanation for the greater efficiency of many private companies in managing resources. A much stronger one is the approach these companies take in planning their research and in documenting their research plans. The decisions of these companies about priorities and allocation of resources are almost always based on well-defined research objectives or products. In contrast, most national programs I have observed develop and document their research plans according to topics such as germplasm improvement, agronomy, pathology and so forth.

The weakness of this approach is that, although it might add something to scientific knowledge, it does not lead to rapid progress in solving problems that limit the productivity of farmers' resources. Rather than bring together the various specialists needed to solve these problems, this approach encourages researchers to continue working within the confines of their own academic disciplines. As a result, their work lacks the sharp focus it must have to achieve definite objectives that justify the investment in that work.

Let us suppose that a national program decides to abandon the topical approach in research planning and to organize its work more according to research objectives and products. What will this mean in practice for the administrator of a maize breeding program, for example? Such a decision will, first of all, require that program staff members, from the leader of the crop program down to the individual researchers, reevaluate their priorities according to specific product needs. Their aim should not be just to develop improved germplasm, but to produce a specific number of varieties over a certain period. These should fit a well-defined description that includes grain type, disease resistance, and other characteristics that the country's farmers require.

The example of a maize improvement program is probably not the most appropriate since many national programs have already done a good job of identifying the product needs that must be met by their maize breeders. But this example is the simplest one for illustrating how the product orientation can be applied.

Having defined product needs, the researchers' next step is to work backwards from those objectives in organizing the resources that will be required to reach them. It will undoubtedly at that point be necessary to make some difficult, but extremely important, priority decisions. Work that does not contribute to meeting the product needs will have to be discarded and personnel shifted to more urgent tasks. These decisions ought to be made by the scientists who are engaged in identifying objectives and conducting the research to fulfill them, and should then be passed up to research administrators for review. The process of apportioning resources should thus operate from the bottom to the top of the organization and not vice versa.

This approach may at first seem odd to many of us who were trained as researchers, primarily, I think, because of some deficiencies in our training. I was taught to deliver research products, but no one told me how to decide what those products should be. And yet researchers must assume responsibility for defining product needs if the product orientation in managing resources is to work smoothly.

In the case of a breeding program, the international centers can be especially helpful at this stage by providing germplasm and some assistance in the use of that material. For example, if researchers in an African national program decide that their most urgent germplasm need is a streak resistant variety, they need not go to the trouble and expense of screening for streak resistance. They can obtain resistant materials from the CIMMYT/IITA Maize Program in Nigeria and then direct their resources toward developing a final product from the unfinished resistant germplasm.

In part because international and regional assistance to crop breeding is relatively abundant, it is very tempting for national programs to devote more resources to meeting germplasm objectives than is really necessary. This, I think, is a very common misallocation of resources, with serious consequences for maize research programs. Over emphasis on maize improvement can be very damaging to the achievement of other objectives -- effective agronomic research, for example -- without which the improve germplasm may never confer any benefit on farmers.

Already, the products of most national maize improvement programs in Africa are at a more advanced stage than those of their agronomy research. This situation is exactly the opposite of that in which American farmers found themselves during the 1940s. Their crop production practices were fairly sophisticated, but they lacked germplasm that could take advantage of good management. Not until the new hybrids became widely available were these farmers able to lift their maize yields off the plateau that had been reached.

In Africa it is the crop production problems that are more limiting to maize production, not a lack of germplasm. For that reason it is essential that the notable achievements of national maize breeders on this continent be balanced by equal progress in the formulation of appropriate crop production practices. I am convinced that only then will national programs be able to make a real impact on maize production.

Correcting the imbalance that now exists will require maize research administrators to reapportion resources between crop improvement and agronomic research, channelling substantially more funds into the latter than it now receives. They will also need to subject their agronomic research to the same process I have already described, in relation to crop improvement programs, of reevaluating priorities according to specific product needs. Although I will return to the subject of on-farm research later, I should mention here that it is no accident that the programs having the best balance between crop improvement and agronomy also tend to be those with active on-farm programs.

Since the products of agronomy research (information) are less tangible than the germplasm developed through plant breeding, defining the agronomy program's product needs will tend to be more difficult. Nevetheless, this task can be done in very much the same way as with a crop improvement program. For both types of work, you can imagine the process of setting priorities and choosing objectives as being like a pyramid. At its peak are the program's objectives, which in the case of an agronomy program will be a set of improved production practices designed for specific farmer circumstances. The broad base of the pyramid represents the numerous options open to researchers in the investigation of maize production problems.

As with real pyramids, getting from the base to the peak is the tricky part. What happens in many national programs is that researchers work separately on various aspects of agronomy (soil science, weed control, and so forth), each following his own route toward the peak. Though all may reach the objective (information on soil fertility, plant density or herbicide recommendations), the research products do not necessarily bear any relation to one another. What should happen is that the various specialists ought to set out from the base together, making joint decisions in selecting research options and apportioning resources. That way when their paths converge at the peak of the pyramid, the result will be an integrated "package" of agronomic practices for farmers.

Once national researchers have established definite product goals that are within their program's capacity and divided up the resources available for achieving those goals, program staff should next carefully document their research plans. This step, which I consider an essential one, offers a number of advantages that far outweigh the expenditure of time required.

First, carefully documented research plans better enable research administrators to evaluate the way in which priorities have been established and resources apportioned. A second benefit is that in the numerous projects that require a well-coordinated multidisciplinary effort, detailed research plans can greatly facilitate cooperation between researchers of various disciplines. A third point is that these plans become a useful part of the national program's historical record, a resource that can be extremely useful to future researchers. Without this information it is difficult for the national program to maintain continuity, especially during periods of high staff turnover.

All of the steps I have outlined so far -- priority setting, allocation of resources, and documentation of research plans -- require an ample stock of accurate information. Researchers and administrators cannot make sound decisions unless they have a clear picture of farmers' needs and circumstances. They must also be well informed about the characteristics and performance of research products that might meet farmers' needs. The best and in most cases the only source for some of this information is on-farm research.

This is hardly a point on which anyone here needs convincing. Nor is there much new that I can tell this group about how to organize and carry out an on-farm research program. I would simply like to stress the aspects of on-farm research that could contribute to the process of priority setting and resource allocation.

One of its functions could be to set limits within which researchers and administrators establish their goals and manage resources for reaching them. These limits could be set through a series of on-farm trials comparing the local variety under farmer management with the best variety (a single-cross hybrid, for example) under exceptionally good management.

In a developing country where most farmers are still many years away from science-based farming, it might seem like a waste of resources to test hybrids under management that farmers cannot possibly provide. But in my view this use of resources is well worth the gains to research management. By establishing both present and potential maize production and the breadth of the gap between them, results from the kind of trial I have in mind could better enable researchers and administrators to define short, medium, and long term goals. In many cases almost all of a national maize program's resources will be devoted to the short term goal of gradually lifting yields above the lower limit. But it will still be useful for this program to have a clear idea of its more distant objectives.

Thinking about upper and lower limits brings to mind an experience I had as a young man growing up on a farm in West Texas. My friends and I spent a good part of our time riding horses. In racing up and down the road, we often passed by an old man, a neighbor, riding his mule. We made jokes about him, and he knew it. One day he challenged all of us to a race but reserved the right to choose the track. His choice was a dried-up, sandy river bed. On the smooth, straight road where we always raced, there is no question that we would have won. But on the old man's turf, we never had a chance. As the mule ambled off into the distance with its rider, we remained behind, our horses still floundering at the starting line, knee deep in sand. The speed of the horses didnt count; what mattered in this case was the speed of the track.

Most farmers in developing countries are like that man and his mule. They know that on their land and with their own management, they can always count on the local variety and that under the same conditions a single-cross hybrid doesnt stand a chance. The researcher's first responsibility in this situation is not only to know the speed of the track -- to understand what level of production farmers are capable of now -- but to imagine what the speed of the track, or level of production, might be in the future.

Having established these upper and lower limits, researchers can then set priorities for balanced crop improvement and agronomic research, and establish objectives according to definite product needs. This, I am convinced, is the most efficient way of managing scarce resources for maize research, and the one that will ultimately enable farmers to move from the river bed to the race track and exchange mules for thoroughbreds.

DISCUSSIONS ON DR CANTRELL'S PAPER

Dr Ndimande (Zimbabwe)

Disagreed that germplasm research is in advance of agronomic research in all cases. For some countries, short on research staff, little germplasm development work has been done on major crops for marginal areas or on minor crops.

Response

There is a contrast with the US situation of the 1940's. Their yields were at a plateau with available varieties. In Africa today variety trials on research stations commonly, give 2-3 times national average yields.

Dr M. Avila (Zimbabwe)

On the subject of national versus international research responsibilities, does the CIMMYT breeding programme have ways of taking account of the need to breed varieties suitable for farmers who for example are interested in stover as well as grain yield or who want maize varieties suitable for legume intercropping.

Response

The approach adopted is to get material into on-farm trials under farmer candidates as soon as possible. Can breed for characteristics such as canopy or stover production but not directly for intercropping (ie. select under intercropping conditions).

Dr Debele (Ethiopia)
Mr Nts'ekhe (Lesotho)

Agree with comment that management is more limiting in general than germplasm in our countries. What national programmes look for from IARC's is guidance and general principles of research methodology to address the agronomy and management problem.

Dr Ndimande (Zimbabwe)

Staff shortages are a characteristics of national programmes. What do you advise under such staff shortage situations?

Response

This is a common problem. It points to the need to force researchers to work on integrated programmes. Administrators should evaluate researchers' work on the basis of how well integrated a product is generated by researchers. Thus the generation of information on soil fertility is not enough. It should also be related to a complementary set of cultural practices.

Mr Tsododo (Zimbabwe)
Dr Dafalla (Sudan)

Even with indigenous varieties there is potential for improved yields. Why there is such a difference between research managed and farmer managed yields is a major question that needs answering. It may be an extension problem, a resource problem or a technology problem.

Response

This is a major argument for OFR. OFR should identify where the real problems lie and this should direct trial activity. It should be stressed that deciding what to do research on, should be a major responsibility of researchers. A useful start to this is to identify the upper and lower limits of yields so that specific short and long term goals can be set in a research programme.

Mr M. Ngwenya (Swaziland)

A problem in attempting to develop an integrated research programme in many countries is the lack of research staff. This means that research programmes get started if and when appropriate staff are available.

Mr S. Kean (Zambia)

Training of agronomists to take an integrated perspective is important. Current training stresses excellence within disciplines, more training needs to be given on appreciation of integrating research to produce specific products rather than to work on discipline topics.

Response

Administrators can contribute by insisting on the adoption of an integrated approach by their research staff. The development of well documented research plans based on specific products is a way of doing this.

PART I: COUNTRY PAPERS ON PROGRESS IN OFR

INTRODUCTION AND GUIDELINES FOR COUNTRY PAPERS

As noted in the Introduction to the report there is only a short history of systems based On Farm Research (OFR/FSP) in countries of the Eastern and Southern African region. Nevertheless there is strong interest in its evaluation as a new tool in agricultural research. With this in mind seven countries were invited to prepare papers for the networkshop and guidelines were provided to try to ensure questions being raised in the region were answered and that country situations could be compared. The guidelines offered to Botswana, Lesotho, Malawi, Sudan, Swaziland, Zambia and Zimbabwe are reproduced here as an introduction to the country papers and the questions raised on them.

GUIDELINES

These guidelines are provided for countries which are being asked to review their experience with a systems based approach to on farm research. The intention is to provide a common framework for country reviews. Some countries are being asked to review results with only two seasons of on farm experiments completed yet it is clear that a realistic time frame for building national capacity to implement this new approach is at least 10 years. This will be spelled out to participants in the opening session. What is sought from these reviews, and requested by several research directors, is to see if evidence can be documented to confirm the potential of a systems based on farm research approach.

We do not ask for an elaborate paper, more for brief case studies, to identify both achievements and problems, and to document the time frame experienced in introducing OFR/FSP. We suggest a three part paper:

(1) A calendar of progress in implementing OFR/FSP in country

(2) Evidence of its usefulness

(3) Identification of problems in its use.

Content for these three parts is elaborated below:

Calendar of Progress in Implementation of OFR/FSP

We suggest a calendared list of events in the history of OFR/FSP in country. The list might include the following and other events in this or a different order:

- Identification/awareness of a problem of farmer adoption of research output.
- Awareness of a systems based approach to on farm research.
- Decision to try out OFR/FSP.
- Donor project requested.
- Decision to build a national capacity in OFR/FSP.
- Recruit national staff.
- Training programme initiated.

- First surveys
- First experiments
- Start to organise working relationships between OFR/FSP and station research.
- Start to organise working relationships between OFR/FSP and extension.
- Linkages and operating procedures working smoothly.
- First useful results from OFR/FSP.

Most countries will not yet have taken all the steps on this list. Some countries will have steps they see as more important than those listed. Feel free to adapt the idea of the calendar list to your own circumstances, but please make out the list from a country, rather than single project perspective.

Evidence of the Usefulness of OFR/FSP

The bottom line for OFR/FSP is that farmers rapidly adopt technologies developed using the approach. Given its short history in the region examples of this which can be documented will be few. Various intermediate measures of usefulness can be listed and should feature in this section:

- Documented evidence of farmers adopting technologies developed through OFR/FSP.
- Farmers assessments of technologies being developed through OFR/FSP.
- New recommendations drawn up and issued as a result of OFR/FSP.
- On Farm Experimental thrusts identified as particularly relevant to specific groups of farmers by the diagnostic phase of OFR/FSP.
- Understanding through OFR/FSP diagnosis why current recommendations are not being widely adopted by farmers.
- Technical, station based research thrusts, identified as important to farmers and guided in design by OFR/FSP.
- Input supply and credit decision mechanisms re-geared to locally appropriate technologies developed by OFR/FSP.

Problems with OFR/FSP

Of course there are many difficulties with OFR/FSP. It is based on concepts not widely taught in the course of higher agricultural education and therefore not well understood. There is no 'well tried' operational model for its implementation. There is significant resistance to change among bureaucracies. Research institutions and educational establishments are often particularly conservative in this respect. In this section of the paper we would ask country reviewers to try to pinpoint the factors they feel have most inhibited the performance of OFR/FSP in their own country situations. Some examples are listed below:

- Concepts dont seem to fit the facts of your country situation.
- Confusion on the role, approach and methods of OFR/FSP.
- Donor programmes do not seem to have national capacity in OFR/FSP as a major objectives.

- Technical assistance staff not well versed with the concepts and methods of OFR/FSP.

- Training not readily available for building national capacity in OFR/FSP.

- Difficulties in getting qualified national staff for OFR/FSP teams.

- Low staff salaries fail to motivate researchers to try new ways.

- Recurrent budget difficulties inhibit heavy field work required by OFR/FSP.

- Confusion on OFR/FSP relationships with station research and with extension.

It is not easy to discuss failings of efforts in ones own country, indeed it is often difficult to get them in perspective. For this kind of network meeting however a frank discussion of such difficulties can be very useful to others embarking on a similar path. As we would like to carry the texts in our report on the networkshop, the papers should be cleared for this kind of limited circulation publication.

PROGRESS AND NEEDS IN ON-FARM RESEARCH IN BOTSWANA

by

Curtis Trent, Tshekiso Monyatsi and Elijah Modiagotla/*

On-farm research with a farming systems perspective is not new to Botswana. Projects containing most elements of the farming systems approach have been operating for almost a decade. Currently, farming systems programs are active in four geographic regions of the country.

Hunter and Farrington (1985) have outlined and documented the development of the Farming Systems movement in Botswana, beginning with the awareness on the part of the Ministry of Agriculture of the problem of farmer adoption of research findings in the early 1970's.

According to Hunter and Farrington (1985), the Ministry of Agriculture in the early 1970's expressed the opinion that there was in existence a body of research knowledge which, if applied by a large number of farmers, would significantly increase the nation's food production. If such a body of knowledge did exist, it was not being communicated to farmers or else it was proving to be unacceptable to them. The Ministry was also at a loss to explain the differences in yields between research plots and farmers' fields, when apparently the same technology was being utilized.

As a result of these concerns, two projects were initiated in 1975-1976. Their initial mandate, among other things, specifically included the testing of technology interventions at the farm level.

EFSAIP (Evaluation of Farming Systems and Agricultural Implements Project), started at Sebele in 1976, was the first multidisciplinary project specifically designed to test agricultural technologies on farmers' fields in Botswana. It was attached to the Department of Agricultural Research. During the first years of the project it was not perceived as a farming systems project. Efforts were concentrated on component research. The original objective of the project was to test under farm conditions the use of a multi-purpose tool carrier developed at Sebele. The failure of the tool bar to reduce draft power inputs when used under farmer conditions resulted in a modification of the project objective. Emphasis was switched to the development and testing of alternative machines and cultivation practices compatible with the standard row cropping system recommended by the Ministry of Agriculture. At this stage, system description/diagnosis became an important project activity.

Continued contact with the farming community eventually led EFSAIP to have a broadly focused technology improvement program, although some emphasis on reducing animal draft requirements continued. The broad focus of the program stemmed from a conclusion that diversity of endogenous farmer circumstances is sufficient to warrant a need for a large number of approaches to overcome restraints--one or a few solutions may not be generally applicable even if technical problems facing farmers are similar.

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EFSAIP had no institutional ties with extension, but it pioneered the use of the extension service in the dissemination phase of its program.

The second project, IFPP (Integrated Farming Pilot Project), initially had two aims: 1) to test under on-farm conditions new systems of cultivation developed by research, and 2) to pilot an integrated approach to rural development. Unlike other FS projects, it was institutionally located within the Department of Agricultural Field Services with headquarters at Pelotshetlha.

During phase I, IFPP was closely linked with EFSAIP. IFPP provided the extension situation under which farmers tried out recommended cultivation practices, planting techniques, and new implements.

The original intention was to test both arable and livestock recommendations. A team consisting of three specialists (an Extension and Land Use officer, an Animal Production officer and a Farm Management officer) together with an Agricultural Supervisor and six Extension workers was located in a communal area, selected for its apparent representation of the Botswana farming situation. The pilot nature of the project underpinned the hope that the evaluation of a tested arable package, in particular, adopted through a community extension approach could then be transferred elsewhere in Botswana as a basis for reducing the risks associated with arable farming, increasing incomes, and increasing the nation's food supply.

Although IFPP's initial mandate specifically included the testing of technology interventions at the farm level, it was soon discovered that such testing would require a thorough understanding of all the constraints facing farmers. Consequently, the mandate was broadened to include the development of a much more detailed and wider based investigation into farmer problems and attitudes.

ADNP (Agricultural Development for Ngamiland Project) was started in 1979 and was the first project in Botswana to be established as farming systems project. Its major objectives were: 1) to design, develop and promote appropriate agricultural technological packages for different socio-economic farmer groups, paying particular attention to resource poor farmers, and 2) to provide useful information about circumstances of farmers in particular areas which could be of vital importance to other agencies.

Phase I was oriented toward system description and diagnosis. Phase II, which started in 1982, focussed on technology development and dissemination. Phase I of the project was based in Maun, but it was decided that Phase II would be located at Gomare and would concentrate on the Communal First Development Area (CFDA) which covers three villages in Ngamiland West. Integration of ADNP into an existing government development program framework is a distinctive feature of the project.

ADNP deals with two distinct farming systems: melapo farming and dryland farming. Unlike farming systems elsewhere in Botswana, farming in Ngamiland is dominated by maize, and many farmers rely on crop production as their primary livelihood.

Phase II is scheduled to end in 1986, and phase III is being negotiated.

ATIP (Agricultural Technology Improvement Project) was started in 1982 with the explicit goal of improving the capacity of the Ministry of Agriculture's research and extension departments to develop and effectively extend farming systems recommendations.

The core of the project is two Farming Systems teams - one located at Mahalapye and the other at Francistown. During the first two years considerable emphasis was placed by the two teams on description and diagnosis to provide an in-depth understanding of the technical and human environment. However, because of the substantial body of knowledge supplied by other Farming Systems projects, ATIP was able to initiate a limited number of technology design and testing activities during the first year.

ATIP is institutionally attached to the Department of Agricultural Research, although it is formally linked with the Department of Field Services and the Division of Planning and Statistics through secondment of officers to ATIP. It is linked also to extension through the Research Extension Liaison Officer who is attached to the Department of Field Services.

ATIP, along with the other FS projects, is actively seeking an appropriate model for Farming Systems work in Botswana. Before the scheduled end of the current phase of the project in 1987, it is hoped that an approach can be identified and pre-tested which will incorporate promising elements from all four FS projects.

USEFULNESS OF FS WORK

Given the short history of the farming systems approach in Botswana, it is difficult to predict the long-term benefits that may accrue; however, several results to date are worthy of mention.

Through the description and diagnosis stages of the FS approach, much has been learned about traditional farming practices, how farming decisions are made, relationships among family members, traditions, culture, attitudes, sources of income, and household practices.

Feedback from on-farm tests related to the suitability of research recommendations (autumn cultivation, row planting, use of fertilizers and improved seed, good weed and pest control, crop rotation, minimum tillage and soil/water conservation) as a total package based on the multi-purpose tool bar showed that the package was inappropriate for use by the limited resource farmer. However, the feedback process did encourage the improvement of some of the individual components of the package, e.g. row planting technology. On the livestock side, it was very quickly found that the management recommendations produced under APRU range conditions could not be applied to the situation of the communal area farmer. All this has helped to focus research efforts into a much wider range of farmer problems.

Resulting from this program, there has been a better recognition of the need to move away from blanket recommendations with more emphasis being placed on the need for flexibility.

Growing experiences in identifying farmer constraints has had a very strong influence on the Arable Lands Development Project (ALDEP), a program that has been institutionalised within the Ministry of Agriculture. The ALDEP packages covering animal drawn implements, water catchment tanks, fencing, and the use of donkeys as a source of draught power were based on early farming systems investigations.

Several promising technologies have emerged as a result of FS work, one is double plowing. Results in Mahalapye and Francistown, for instance, have shown some significant benefits from double plowing over the past three years, under drought conditions. It will be interesting to see what results can be obtained during years when rainfall is more adequate.

One of the fruits of FS has been the identification of areas needing investigation. These include risk reducing strategies in crop production; livestock, crop and non-farm linkages; relationships between research results and extension recommendations; the place of small stock in the farm enterprise; animal traction; early plowing and double plowing; deep-ripping; broadcast-plowing; post-establishment interventions for broadcast sorghum; alternative planting methods; relationships between cattle posts and land enterprises; value of mineral supplements for goats and donkeys; dairy feasibility; poultry feasibility; hand planting techniques applicable to low resource farmers; utilization of crop residues; and production and use of forage crops.

Another contribution of FS programs has been the bringing together of research and extension staff at the field level. This has assisted in the identification of constraints and the development of solutions. The interaction of research and extension staff during all phases of the program ensures a mutual awareness of both technology and farmer circumstances and should greatly enhance the rate of adoption.

FACTORS INHIBITING PROGRESS

Environment

Physical Environment - One of the greatest deterrents to the success of FS work in Botswana is the environment itself. Coupled with low and erratic rainfall and poor soils, the possibilities of subtantial and/or reliable improvements in agricultural productivity are low at best. It is unlikely that any one precise general recommendation will hold at all times and the optimum strategy may well be very different in years of rainfall above and below the average.

Technology Development

Importance of Arable Agriculture - In contrast to many developing countries, Botswana farmers do not depend upon arable agriculture as their main source of income. Whenever possible, farmers pursue other activities which have higher or at least more certain returns to resources such as keeping livestock and working at off-farm jobs. Thus, it is important to take into account the practice of buffering which makes crop technology development difficult.

Available Technology - in Botswana there are relatively few tested technologies available applicable to both wet and dry years, which can be readily adopted by farmers. The lack of these technologies means delays in achieving the purposes of FS.

Lack of Options - Because of the unpredictable climatic conditions in Botswana, it would seem that a concerted effort should be made toward the development of as many practical options as possible for farmers to choose from as the unpredictable season unfolds.

Lack of Flexibility - Unlike the situation which exists in many countries, Farming Systems in Botswana are forced to develop strategies that will break constraints rather than have the luxury of exploiting flexibility. This implies more finely tuned technologies and more radical changes on the part of farmers. Thus, there is greater reluctance to change, and slower progress results.

Support Systems

Lack of an influential Link with Policy and Support Systems - There are two components to improving productivity: 1) Improving technology and 2) developing policy support systems. Both are needed in determining what types of technology are likely to be relevant. For example, fertilizer recommendations would be inappropriate in areas where there was no source of supply available to farmers.

Administrative Support - There is a reluctance on the part of MOA field staff to become involved with FS work when top administrators appear to exhibit little or no interest in the activity.

Credibility

Poor Credibility - Poor credibility can be partially attributed to the difficulty of achieving quick relevant results in the harsh unstable climate of the country. Lack of credibility has limited the support for institutionalization in the upper echelons of the Ministry.

Expectations of Quick Results - The pressures from donor agencies and government officials for "quick results", whether real or imagined, result in frustrations for FS teams.

Personnel

Trained Manpower - The lack of trained indigenous manpower is a major constraint to FS progress. Expatriates occupy most of the top research positions, and they change often. Most nationals involved in FS work have diplomas in agriculture. Expatriates working in the country consider formal training to the M.Sc. a prerequisite, given the formidable challenge from the environment. Only the latest two FS projects have had funds for substantial training of nationals.

Lack of Incentives - Work undertaken by FS teams involves subtantial field work, often under difficult circumstances. It involves considerable amounts of travelling and often requires living in isolated areas. The lack of suitable incentives often precludes the identification and participation of qualified national staff.

Liaison - Communications between research and extension have improved over the past few years, but much work needs to be done to strengthen relationships. There exists a wide gulf between extension specialists and researchers with regard to position, status, and level of formal training.

Evaluation

Lack of Relevant Evaluation Criteria - Traditionally, research has been geared towards an objective of increasing yield per unit area or per animal. There is often the implicit assumption that farmer motivation is cash oriented and that the farmer has reasonable access and control over available resources. This does not hold true for the average low-resource farmer in Botswana. Evaluation needs to be based on criteria relevant to goals adopted by and resources controlled by farm families. For example, in the Botswana situation the returns per unit of labor during "bottle-neck" periods are likely to be more relevant than returns per unit area or per animal. Evaluation criteria different from yields per unit area can be difficult to incorporate satisfactorily into research program undertaken on experiment stations.

BOTSWANA: QUESTIONS ON COUNTRY PAPERS

Mr J. Gatheru (Kenya)

Is FSR a success or failure in Botswana? FSR in Botswana is still facing problems of staff/acceptability/resources after five years of operation.

Response

Good question! FS projects have contributed a good deal to the identification of areas needing investigation. In Ngamiland, FSR has been incorporated into an ongoing governmental program. One positive aspect of the programme has been 13-14 nationals on degree programmes which will help build up national capacity.

Mr J. Gatheru (Kenya)

Question not answered. Problems shown in Botswana paper are typical of any developing country. Options available to farmer for success are few and does experience with FSR in Botswana show that the options are widened.

Response

1. Livestock is primary activity in Botswana and therefore arable agriculture will be a subsidiary activity. However, government policy is for national food self-sufficiency and thus research must address arable issues as well.

2. Have made some progress on moisture conserving practices which show promise.

Dr M. Boateng (Somalia)

Botswana paper deals with many problems that are outside researchers control e.g rainfall. What problems were identified as researcher controllable during diagnosis and what strategy was used to address these?

Response

Exogenous problems are dominant in Botswana. One endogenous problem was to conserve moisture - Some emphasis on early ploughing etc. However many farmers do not have cattle and therefore this is not an appropriate recommendation.

Dr M.P. Collinson (CIMMYT)

Comment - if store of component research was not being picked up, then why expand component research without appropriate diagnosis.

Prof A.N. Mpuru (Tanzania)

1. One major technology has been double ploughing. Can small farmers afford this technology.

2. There is confusion between integrated rural development and research diagnosis.

Response

Double ploughing has been shown to be effective in conserving moisture, controlling weeds, improving stands and increasing yields. Costs can be calculated. Double ploughing is not a recommended practice in Botswana. Further work needs to be done. It shows some promise.

Prof A.N. Mphuru

One problem mentioned was lack of incentives. FSR should not be treated as a special entity - Shouldnt FSR projects be adapted to operate within existing structure rather than try and change system.

Response

The difficulty is in keeping people in the field and in the public sector. We do not have any answer to this. Problem is compounded by lack of institutionalisation so staff are uncertain of their future.

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ON-FARM RESEARCH ON LESOTHO

A. Historical

In the late 1970's the MOA decided that a new approach to Agricultural Development was needed. Results from research conducted on the research station at Maseru was not reaching farmers and production projects often had little lasting impact. A system that involved farmers, recognized their constraints and problems, and most importantly one that they would feel a part of was identified as being needed. The concept of on-farm research was carried through the planning phase and in April, 1979, the Farming Systems Research Project was initiated. Its goal was to improve the quality of rural life in Lesotho through increasing incomes of Basotho farmers. To attain that goal it had the following objectives:

1. Find the most appropriate means of transferring knowledge and gaining farmers' acceptance of recommended technology.

2. Collect and further analyze the findings of research previously undertaken by the MOA and other donor projects as well as undertake current research and adapt results of all projects to the real world of the Basotho farmers.

3. Institutionalize a farming systems research unit within the MOA Research Unit to continue development and nationwide replication of farming systems technology after the project ends.

Expected results were:

1. Establishment of a farming systems program to develop alternative technologies and management practices in three test areas of varying physical environments.

2. Development of alternative strategies for reaching farmers to ensure that effective means are found to communicate with farmers and encourage their acceptance of recommended practices.

3. Trained Basotho personnel who will establish an ongoing research capability within the MOA.

4. A research and information data base from which research results can be drawn.

5. An agricultural library to support research efforts.

6. An appropriate farming systems and related rural enterprises, developed by the research effort, tested and in use by at least five percent of the farm households in the pilot areas.

During 1979/80 one prototype area was identified in each of the three (3) ecological zone in Lesotho, Molumong in the mountains, Nyakosoba in the foothills, and Siloe in the southern lowlands. During 1981 a baseline survey was conducted in all three prototype areas to gain information about sociological parameters of rural residents, economic resources and restraints, to identify legible methods of providing information to farmers, provide Research Division personnel with on-the-job training in field survey methodology and to better understand farmer-used methodology.

In addition, smaller specific surveys of limited scope were conducted to provide direction to the technically oriented research programs. During mid-1981 Village Agricultural Committee, (VAC) were formed and the first training session held. This was followed by a second farmers' training school in the spring of 1982. These schools were organized by the Extension Section of the Research Division and held in Farmers' training Centers at Mokhotlong, Matela and Mohale's Hoek. Approximately 30 farmers from each prototype area participated. Subjects covered included responsibilities of VAC, and technical training in Agronomy, Plant Protection, Farm Machinery, Horticulture, and Animal Science (nutrition). The schools were evaluated by questionnaires and discussions with the participants. To reinforce Extension and Research cooperation and to facilitate on-farm trials buildings were constructed at each prototype area to house Research Extension Agents (EAs assigned to work with Research) and to provide housing for researchers when in the field. An office and laboratory building was also constructed at the Maseru Station to house the increased number of Research Division personnel. This new building included space for an agricultural library. An important objective of the FSR project was training of nationals in degree programme, and the use of short term training courses, to improve the capability of Research Division Personnel. This activity was started soon after the project was initiated and has continued to the present.

The goal of maintaining a FSR unit within the Research Division proved to be unfeasible and in 1981 on-farm research was adopted by the Research Division as a guiding policy for its programs. Expatriate advisors are assigned to appropriate sections and work with national counterparts in their specific disciplines. In 1982 the MOA was decentralized and many personnel moved from Maseru to the 10 agricultural districts in the country. At the request of the MOA the Research Division's Extension Section conducted training courses for field-based personnel during 1983/84 and 1984/85. The first year extension methods were taught and in 1984/85 training in subjects such as agronomy, pest management, horticulture, marketing, soils, range management, land conservation, animal nutrition, and farm structures was offered.

On-farm trials in the prototype areas were started in the early years of the project and have continued since. The REA is the contact between the farmer and the researcher and is a key person in identifying cooperators. The trials have involved crops such as maize, sorghum, wheat, beans, peas, vegetables, especially cabbage, forages, and livestock. Studies of fertilizer rates, seedbed preparation, different livestock management practices, adaptability of varieties, and plant populations have been major program activities. Economic evaluation of existing and proposed production methods has been an important part of the project as has the study of the impact of input availability and marketing systems.

Livestock is one of Lesotho's principle sources of income and the extensive rangelands are a major national resource. Overstocking has led to rapid deterioration of ranges and lowering of quantity and quality of livestock products. Communal grazing of ranges and traditional practices in management and the lack of alternative investment opportunities for livestock owners have hindered attempts to reduce animal numbers. A Land Conservation and Range Development Project (LCRD) was started in 1981 and operates on 30,720 ha in south-eastern Lesotho. An educational program was undertaken with the area's residents and an executive committee was formed with elected representatives from each of the villages in the range management unit. A grazing association became legally recognized in January, 1983. The objectives of the project, and association are to improve rangeland conditions and improve livestock quality. Unlike earlier attempts to improve rangeland and control animal numbers, the LCRD project has involved livestock owners from the beginning and through an educational program is attempting to help them understand the advantages of adopting improved management practices. A sociological study to determine the attitudes and desires of livestock owners in an important part of the project.

B. Evaluation

The success of development projects must be measured not in the adoption of a particular technology but rather in the change of attitudes of farmers, extension personnel and researchers that result in continuing advances being made over a long time span. How well has this been achieved in Lesotho cannot be ascertained at this time but some encouraging results indicate the process has been initiated. These include:

1. The use of fertilizer in the prototype areas has increased from virtually none to several thousand kg/yr.

2. Two of the three (3) Village Agriculture Committees have progressed to being cooperatives with purchasing and marketing authority.

3. In spite of drought, farmers that followed recommended practices were able to produce a crop. Five of six farmers who cooperated on a total farm enterprise basis had positive returns over costs.

4. Vegetable production in all three prototype areas increased in the 1984/85 season to the point farmers required help in marketing their produce.

5. Sixty farmers in the Siloe prototype area formed a forage association and have used their resources to plant forage crops this year. Farmer in other prototype areas are also producing more forage.

6. A survey of the 194 farmers that have attended in Extension sponsored training schools for the past four (4) years was made. Preliminary findings of the schools impact indicate 80% have better nutrition for their families, 65% report increased yields, 39% have higher incomes, and each participants has told or shown improved technology to 11 or 10 other farmers.

7. An improved ox-drawn planter was developed by modification of an existing model in wide use in Lesotho. The modified parts are produced by a local firm and are in demand by farmers.

8. The introduction of Pinto beans was a success from both agronomic and consumer standpoints. The lack of seed is the major hinderance to its adoption by farmers, but production is increasing yearly.

9. Both the Research Division and LCRD project efforts have resulted in an increased awareness of livestock owners of the need to shift animals to various locations on the range. Rotational grazing systems are used on the LCRD project near Sehlabathebe and at a site in the Nyakosoba prototype area. The use of improved sires is also practiced.

10. The number of farmers practicing winter plowing has increased from few or none to approximately one-fourth of the prototype farmers.

Other advances that are not directly related to on-farm trials, but which have a temendous impact on development efforts are:

1. The establishment of a viable research unit with 23 individuals either through or engaged in degree programs. A similar number has attended short courses on a variety of subjects.

2. A constant interaction between Research and Extension in the form of field days, demonstrations, and training courses for field personnel.

3. A tour of the US by 60 chiefs from the LCRD range management area so they could see firsthand improved range management and production practices.

4. Interaction among Research and Production divisions and Coop Lesotho has resulted in an improved availability of inputs such as seed, fertilizer, and pesticides.

5. The development of cropping guidelines that summarize recommended seeding rates, varieties, and fertilizer rates for various sections of Lesotho. This publication is reviewed annually by personnel from all Divisions of the MOA and is distributed to all ten (10) districts.

C. Problems

The problems encountered during the past seven (7) years are undoubtedly similar to those experienced by other development projects. The weather has been anything but cooperative with drought during 82/83 and 83/84 growing seasons and frost on December 6, 24, and March 6 during 84/85. Aside from the weather, problems encountered were:

1. Start-up time for the FSR project was longer than anticipated.

2. Technical data needed for on-farm trials was not as available as originally believed.

3. Communication and transport to and from the widely seperated prototype areas created, and still creates problems at times.

4. Turn over of REAs has disrupted the desired continuity at the prototype areas.

5. Sending Research Division personnel out of the country on long-term training programs depleted the organization's capability in the short term.

6. The number of research field staff was minimal and sometimes was not able to meet needs at times of peak demands.

7. Instructions to field staff were not always as complete as they should have been. This sometimes resulted in trials not being conducted as the scientist in charge desired.

8. Livestock owners excluded from ranges set aside for the grazing association resent it greatly and trespass of unauthorized animals is a problem. At times physical violence occurs over grazing rights.

These are some of the problems that have occurred with the on-farm research programs in Lesotho. They have had varying degrees of impact on the research efforts and most have been corrected to the extent possible with available resources. It is doubtful if any of these are unique to Lesotho and the Research Division personnel would welcome discussion of problems and how they were solved in other countries.

Discussion of Lesotho Presentation

Dr Debele (Ethiopia)

Is there a separate extension service or do FSR teams act as extension workers.

Response

Both - FSR extensionists and Ministry of Agriculture extensionists work very closely together. FSR extensionists act partly as extension/researcher linkage in project areas. FSR teams undertake direct extension.

Question

Where does FSR sit in Ministry and are linkages informal or structured.

Response

FSR sits in the Research Division of the Ministry of Agriculture as an integral part of that division. The horizontal linkages between research or FSR and extension are informal but strongly urged by higher-ups. Top level of the Ministry, the relation is structured. At the middle, formal joint research/ extension planning land co-ordinating committee has been established.

Question

How are messages to the farmer coordinated from FSR teams and extension services.

Response

In prototype areas, only FSR team operate. Outside prototype areas only MOA extension staff operate. Put another way, FSR has the extension service built into the FSR system.

Dr B. Ndimande (Zimbabwe)

How successful have you been in getting commodity researchers to cooperate with FSR teams.

Response

This was a slow process achieved mostly through discussions and persuassion. Finally, most commodity researchers have voluntarily agreed to support FSR teams. The majority of commodity researchers currently see themselves as part of FSR teams that are research station based. Lately they are proud to announce that they are not only researchers but sound extension agents and educationists.

A REVIEW OF RESULTS OF A SYSTEMS BASED ON FARM RESEARCH APPROACH IN MALAWI

by

F.M. Nyirenda[1], H.K. Mwandemere[2], and G.Y. Mkamanga[1]

Introduction

The need to conduct On Farm Research with a Farming Systems Perspective (OFR/FSP) in Malawi was realised in the early fifties when the Department of Agricultural Research started to run District trials on maize, groundnuts and cotton in farmers' fields in addition to on-station trials. In the early seventies when the major Agricultural Development Projects (Karonga, Lilongwe, Salima and Chikwawa) were launched the need for OFR/FSP was even greater. The project staff wanted site specific recommendations for farmers in their project areas. But as in the previous years the recommendations derived from the results obtained from district trials were not readily adopted by local farmers. Despite this problem considerable achievements were made in increasing agricultural production and in raising the standard of living of the people in the projects.

In 1977 the concept of the National rural development programme (NRDP) emerged in order to extend to other areas in Malawi some of the benefits which were experienced with the major Agricultural Projects. The country was then divided into eight Agricultural Development Divisions. The following are the aims of the NRDP:

(a) To increase the general level of Malawi smallholder agricultural production, in particular the production of cash crops for export and for the countries Agro-industries, and the production of food crops to sustain self-sufficiency and for feeding the growing urban population.

(b) To provide the inputs and services necessary to enable increases in smallholder agricultural production with particular emphasis on increasing productivity per unit area.

(c) To preserve and maintain the natural resources by encouraging high standards of crop husbandry combined with soil conservation. To conserve the key watershed areas and maintain the forests through replanting trees in reserves, on customary and estate land.

In order to cope with the demand for site specific recommendations the Department of Agricultural Research has been reorganised into Commodity Research Teams and Adaptive Research Teams (see Fig. 1). The Commodity Research Teams are responsible for technology development on research stations, whereas the Adaptive Research Teams are the link between the Commodity Research and extension staff and farmers. The Adaptive Research Teams have the following roles to play in the generation and linkage of research to extension and farmers:

(1) From the range of available technical research results, select and, if necessary adapt, components identified as appropriate to the immediate needs and conditions of local specific groups of farmers.

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(2) Feed back unsolved technical problems identified as important for local farmer development to the appropriate commodity teams for their attention.

(3) Link research closely and continually to extension, drawing extension staff and farmers into the technology development process.

The purpose of this paper is to discuss the calendar of progress in the implementation of OFR/FSP, the evidence of the usefulness of OFR/FSP and to highlight some of the problems experienced in Malawi with the OFR/FSP.

Calendar of Progress in the Implementation of OFR/FSP

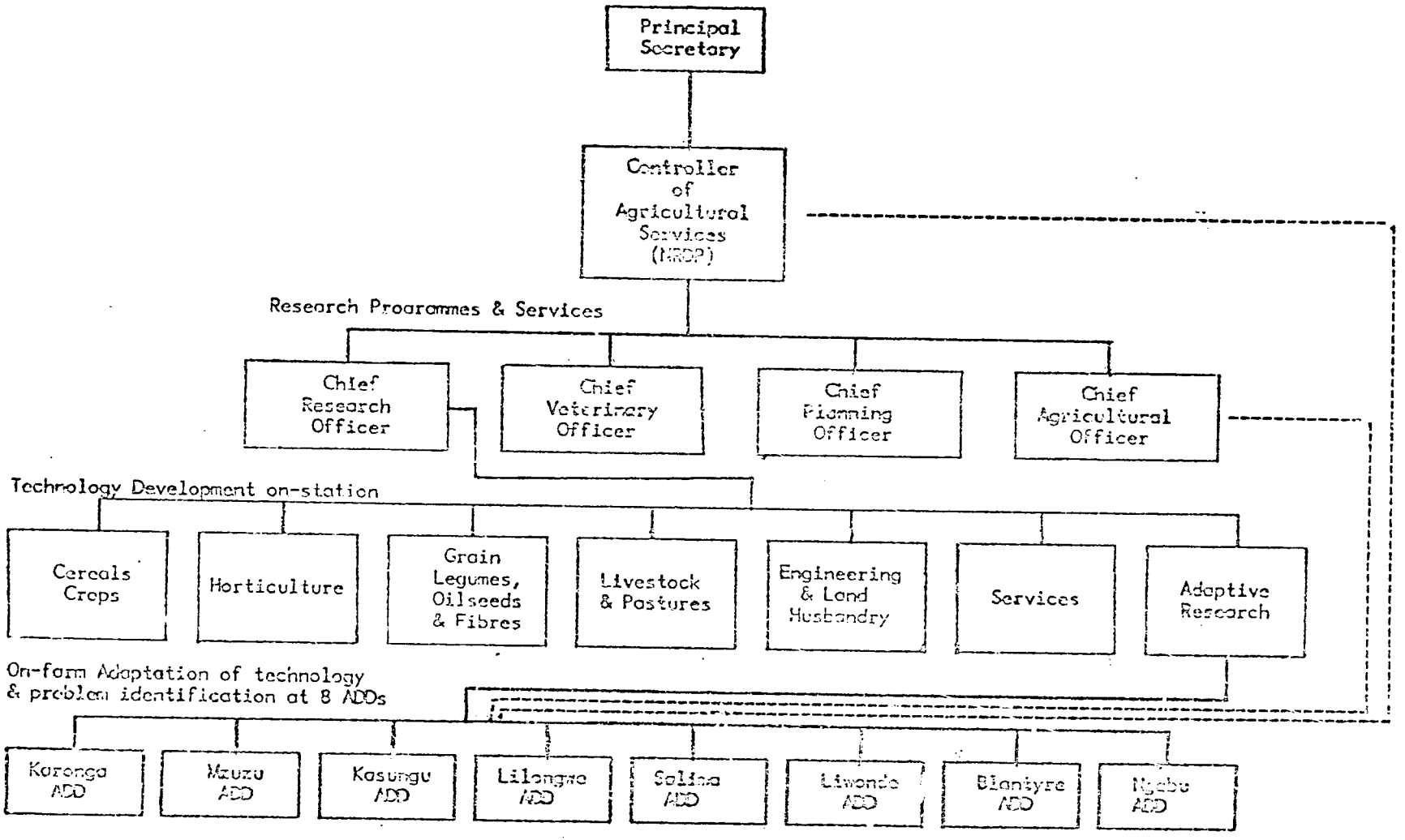
In 1981 a Farming Systems Analysis (FAS) section was instituted under the University of Florida/United States Agency for International Development (UF/USAID) contract and within the Malawi Agricultural Research Project which AID funded. The main objective of the FSA was to establish a farming systems research program. This was done with the appointment of five FSA staff and an office was set up at Chitedze Research Station. Some diagnostic surveys were completed in four ADDs between April and June, 1981 and on farm trials were designed and carried out in 1981/82 in Blantyre (Phalombe), Lilongwe and Liwonde ADDs. The results of these on farm trials were analysed and written up in several FSA section publications. Thus, at the end of the 1981/82 harvest the FSA section and various ADDs had progressed through the diagnostic and experimental phases of OFR/FSR. However, due to some misunderstanding and friction between the FSA section and other complimentary scientists e.g agronomists within the DAR, the programme was put to a temporary stop until the issue of how other technical scientists were to be involved in the FSR effort was officially resolved. Consequently there were no follow-up on farm trials during the 1982/83 season.

During the 1983/84 crop season and indeed towards the end of the Malawi Agricultural Research Project, FSR resumed under the name of Adaptive Research and in response to the need to ensure that smallholder farmer's problems are addressed by research and that results of this research are better transferred to farmers by strengthening linkages between research and extension. The Adaptive Research Programme (ARP) has been organised as a collaborative effort of the CIMMYT Farming System Programme in Africa, the DAR, Department of Agriculture and UF/USAID Malawi Agricultural Development Project. Initial financial assistance was provided by the World Bank and the institutionalised with the reorganised DAR under the new National Agricultural Research Project which is funded by the World Bank and AID.

In order to build up the national manpower capabilities in OFR/FSP approach, CIMMYT was invited to undertake an in country training programme at Chitedze Research Station for staff which DAR identified to form 3 to 4 Adaptive Research Teams (ARTs). It was necessary to keep all the teams together at Chitedze for the first year so that they could meet jointly for teaching and discussion on mutual problems. CIMMYT started with an orientation seminar in August 1983 which drew DAR and DOA staff together. The purpose of the seminar was to familiarize research and ADD officers with the Adaptive Research philosophy and methodology. This was followed by seven periodic series of workshops, the last of which was conducted in June, 1985.

There are now four ARTs deployed in four ADDs. The Kasungu and Lilongwe ADD - ARTs were deployed in the middle of 1984, the Blantyre ADD - ART was deployed in September, 1984 and Liwonde - ART was deployed in 1985. In addition to this, there is an Adaptive Research Coordinating Unit which is based at Chitedze Research Station. In both cases each team is composed of an Agricultural Scientist and a Socio Economist. It is planned that trained staff from the present teams will be used to expand the number of ARTs in the remaining four ADDs in the future.

Fig. 1: Organisation Chart for the Ministry of Agriculture



During the 1983/84 crop season, a crash programme of on farm trials was formulated in the Lilongwe (Thiwi/Lifidzi and Ntcheu RDPs) and Kasungu (Dowa West RDP) ADDs based on a review of secondary data and informal surveys only. The OFR/FSP process was hastened so that at least a few on farm trials could be available for the CIMMYT in country training exercises. For each of the above RDPs, the farming system was described and priority problems areas were identified. For each of the identified problem areas a number of alternative ways of addressing each problem were listed as can be seen in Table 1 The potential technical interventions were discussed with applied Researchers and Extension officers from the respective ADDs to determine whether sufficient technical information existed to support their inclusion in adaptive on farm trials. The accepted interventions were then screened for profitability, systems compatibility and risk to select the most appropriate ones for the initial on farm trials. Table 1 also shows a summary of the results of the discussions. Five on farm trials emerged out of this exercise e.g.

1. Lilongwe A.D.D.

   (a) Thiwi/Lifidzi RDP

      i. MH12 time of planting and stalk bending trial
      ii. Groundnut time of planting and spacing trial

   (b) Ntcheu RDP

      i. Effect of intercropping maize and beans on the yield of maize and beans.

2. Kasungu

   (a) Dowa West RDP

      i. Groundnut time of planting and spacing trial
      ii. Effect of fertilizer on yield of local maize
      iii. MH12 time of planting and stalk bending trial
      iv. Effect of chopping and soaking maize stover on the performance of stall feeders.

All the above trials except "Effect of chopping and soaking maize stover on the performance of stall feeders trial" were repeated during the 1984/85 crop season. However, in the light of the results obtained in the 1983/84, season, the local maize trial was modified to include Khola manure and the Groundnut trial to include ridge spacing. Also there were two additional trials viz Pasture undersowing in maize and effect of Furadan (to control Hilda) on yield of groundnuts proposed for Kasungu and Lilongwe ADD, respectively.

In addition to the on farm trials conducted during the 1984/85 season, a lot of time and effort was devoted to the diagnostic surveys which were conducted in Kasungu, Mchinji and Dowa East RDPs of Kasungu ADD, Dedza Hills and Lilongwe North East of Lilongwe ADD and Chiradzu RDP of Blantyre ADD. These surveys which were planned, designed and executed by the ARTs in collaboration with the ADD staff formed the basis for part of the on farm trials scheduled for 1985/86 season.

The first half of 1985 has also seen intensified interaction between the ARTs and Applied Researchers on one hand and ADD (Extension) on the other. This has been mainly through commodity team and group meetings whereby past seasons trial results and following seasons trial proposals were discussed and a consensus was reached on the Adaptive Research on farm trial content for 1985/86 crop season. It is worthy noting that this year's ART meetings were held at

Table .1 Problems and Screening of Possible Solutions for A Rural Development Project

Enterprises	Problem/Cause	Intervention	Reject/Refer	Monitor	Accept
Local maize	Stalk borer	Early planting	Not effective Dimba infestation		
		Dipterex		Check Farmer use and local herb	
	Witch weed	Herbicide Fertilization Early planting Rotation	Check DAR data No evidence System Incompatible	Monitor Incidence Check feasibility	Trial
	Low fertility	Fertilization Manuring Legume intercropping	Short supply Data from Bunda	Check availability	Trial
MH12 Hybrid	Cob/rot/low yield	time of planting Time of harvest Stalk bending	System incompatible	Incidence Trial data	Trial
	Non optimal Fertilizing	Time and rate of fertilizer application Variety	Breeders	what and why	Trial
Tobacco	Nematode	Seed bed fumigation FBD in field	TRA TRA		
	Bushy top	Early planting Destruction of residues	TRA TRA		
Groundnuts	Rosette	Time of planting Plant spacing & time of plant	System incompatible	Incidence	
	Hilda Pops	Time of planting Phosphate application	Lack of data Check Groundnut Agronomist	Incidence	Trial
		Time of planting	Check DAR Data		
Wheat	Relay planting Bird damage	Planting times Bird scaring Paper hanging	LADD Data Institutional Problems	Check practices	
	Threshing loss Harvest loss	Improve methods Improve methods	DAR DAR Data		
Irish Potatoes	Blight	Dithane spray Clean seed	Not available	Current Use	
	Nematode	Rotation Varieties	Bvumbe	Land resting	
Fruit trees	Fruit quality	Dithane Spray Improved handling	Bvumbwe Bvumbwe		Trial Trial
	Pruning	Equipment Training	Institutional Training Problems		Trial
	Varieties	Better supply	Bvumbwe		
Beans	Disease	Certified seed Rotations Spraying	Bunda Bunda Bunda	Diaba Gardens	
	Varieties	Credit/Knowledge	Institution		
Stall feeding	Lack of feed Feed quality	Ha/silage Treatment of Crop residues		Farmer Practice	Trial
Dairying	Feed supply Feed quality	Fodder conservation Improved pastures	Few farmers Few farmers		
Cattle	Long Calving Interval	Bull Introduction	Institutional		
	Inbreeding	Performance Tested Bulls	Institutional		
	Liver fluk	Deworming	Institutional		

Lilongwe A.D.D.

(a) Thiwi/Lifidzi RDP

i. MH12 time of planting and stalk bending trial
ii. Groundnut time of planting and spacing trial

(b) Ntcheu RDP

i. Effect of intercropping maize and beans on the yield of maize and beans.

the ADD headquarters, thus bringing both Adaptive and Applied Research closer to Extension and fostering linkages between the two parties.

At the ADD headquarters, the ARTs operate as part of the ADD staff, in terms of day-to-day operations, and part of the DAR interms of technical back-up. The budget for their operations is allocated by the DAR to the ADD. Administratively each ART is responsible to the ADD Programme Manager and forms a section within the ADD structure. The ART leader j as the existing ADD Management Team, which comprises all section heads and plans and implements the ADD work program. This gives the ARTs opportunity for regular and substantive discussions with other ADD staff.

Evidence of the Usefulness of OFR/FSP

It is probably too early to assess the usefulness of OFR/FSP in Malawi. During the past seasons most of the time has been spent on training the ARTs in the philosophy and methodology of the approach and in establishing the present ARTs in their respective ADDS. Nevertheless, there are some indications of the usefulness of OFR/FSP. Through OFR/FSP diagnosis and socio-economic analysis of on farm trials priority production constraints are being identified, setbacks to current recommendations adoption are being uncovered and available technical solutions to identified priority farmers problems are being adopted or if lacking are referred to the applied research commodity teams. The following examples represent some supporting evidence of the usefulness of OFR/FSP in Malawi:

1. Most of the diagnostic surveys conducted by the ARTs have indicated that more than 50% of cultivated maize and land is put to local maize and almost all smallholder farmers grow some local maize each season. This has revealed the importance of local maize in the farming system. However low fertility and high intensity of intercropping in some areas are among the factors which reduce maize yields. The ARTs are testing fertilizer packages which include both khola manure and inorganic fertilizers in order to reduce costs of inorganic fertilizers.

2. Most of the fertilizer trial work done in Malawi was on pure stands of crops. However in areas such as Chiradzulu RDP of Blantyre ADD where mixed cropping is most common such fertilizer packages are inappropriate. Fertilizer response data on soils under typical intercropping are clearly needed and the ARTs are looking into this.

3. Where land is the most limiting resource, mixed cropping is inevitable. The ARTs especially in Blantyre ADD have established the types of crops and ranked the dominant crop combinations to test and adapt the most profitable and agronomically sound mixture and pattern.

4. There is a clear indication from the results obtained from on farm trials that the problem of cobrot of MH12 resulting from continued rainfall after maturity when farmers plant early is not as serious as perceived by the farmers and extension staff. MH12 has good sheath coverage and will drop naturally after maturity and rain water falling on the cobs will automatically drip off.

5. Experience from diagnostic surveys and some of the on farm trials conducted already indicates that labour intensive crops which will mature at the same time should not be planted at the same time unless, labour saving techniques for some of the operations are available. Otherwise one or more crops are bound to be lost to weeds, rotting etc., depending upon the priority the farmer puts on the crops. In a maize/beans mixed cropping trial in Kasungu ADD, the beans matured at the same time with the tobacco; the farmers priority was on the tobacco and so he concentrated on harvesting the tobacco and left the beans to rot in the field.

6. Several technical and institutional issues and problems arising from the diagnostic surveys and on farm trials have been identified as important to smallholder farmers have been discussed and referred to Applied Researchers or ADD Management for their action. These include:

   (a) The Maize Commodity Team should select maize varieties which will be compatible and yield well in an intercropping and relay cropping regimes. The present improved varieties are bred for pure stands and have been found to smother the intercrop of beans or cowpeas

   (b) Low fertility/fertilizer management is a widerspread problem in the areas surveyed so far. However, most farmers with small fields are reluctant to purchase fertilizer or take credit for it on account of the risk of not being able to repay or because they are short of cash. This suggests that organic manuring ie. green manuring or, on the smallest fields, composting may be an appropriate research area.

   (c) The groundnut pop problem is still common in some areas of Malawi e.g. EPA 1 and 2 of Kasungu and Mchinji RDPs extending into South Mzimba also Chitipa Plain. This is attributed to erratic rains and low calcium and phosphate levels in the soil. Application of gypsum and phosphate have proved to be uneconomical. Small seeded groundnut varieties which give higher shelling percentages than the large seeded ones would be recommended in these areas.

   (d) Long term effects of high rates of manure on soil properties and yield of various crops should be investigated. Some farmers feel that groundnuts grown on previously heavily manured soils have excessive vegetation with low kernel yield.

   (e) The improved post harvest structures are weak and have small capacity and cannot contain most of the farmer's produce. Extension staff as well as farmers, feel that these structures lack stability due to the high ground to base clearance (1 m) and hence adoption by farmers is minimal. The Crop Storage Team has been requested to improve on structural stability.

7. Proximity of Agricultural Development and Marketing Corporation (ADMARC) markets for farm inputs, spread of dip tanks for cattle, roads, prices of farm inputs and produce are among some institutional problems that have been revealed by the diagnostic surveys as hindering farmer adoption of some technologies in some RDPs.

Problems with OFR/FSP

This section attempts to highlight some of the problems that have been observed in Malawi with OFR/FSP since its inception two crop seasons ago. The observations are very preliminary and tentative and should therefore be looked at with caution.

1. Problems with interdisciplinary team work - For interdisciplinary team work to operate smoothly, there is need for matual respect for each others discipline amongst Research Scientists, Socio-Economists and Extension Workers. Members of the team should function as equal partners with joint responsibility for the final product of their on-farm research. Experience with the ARTs in Malawi is beginning to show that it is not easy to marry Biological Scientists with Social Economists who are compatible enough to work together constructively. Frequently one observes the Biological Scientist working in isolation of the Socio-Economist and vice versa and yet they are supposed to work as a team throughout the OFR/FSP process. It also takes a lot of time for all parties to reach agreement on technical issues sometimes just on the basis that they

belong to different disciplines. This problem appears less pronounced where the ART is composed of scientists of about the same calibre and experience; a rare combination to find at the current age of OFR/FSR.

2. Problems with Extension, Adaptive Research and Commodity Group Linkages. The set-up of ARTs being responsible to programme management administratively and DAR technically has sometimes been misunderstood by partners in the Research-Extension linkage. There is already some indication that some ADDs would rather have the ARTs completely managed and controlled by the ADD management unit. While this atmosphere would be conductive to getting full participation from the Extension Technical Assistants in executing on farm trials, it would leave the Adaptive Research work isolated from the DAR and uncoordinated to station based research resulting in duplication of research efforts.

In spite of its institutionalisation, OFR/FSP seems not popular amongst some applied researchers. Some commodity teams have been naive and negligent in availing to the ARTs the necessary technical solutions to identified farmer problems. Others are not just in sympathy with OFR/FSP, irrespective of its future benefits. It is important to popularize OFR/FSP amongst applied researchers because these are the banks of technologies that may be adapted. Although this observation appears individualistic, several reasons for the resentment can be put forward as follows:

(a) Most on farm researchers in the OFR/FSP are fresh agricultural graduates with a first degree and little experience in the field of research. As such the applied researchers with their long experience in research and post graduate training do not want to receive directives from the ARPT as regards to the priority farmer problems which require their station based research attention. This observation emphasises the urgent need for post graduate training for the ARTs so that they can be at equal educational setting with their colleagues. The ARTs also need to be upgraded to equal status/rank to Commodity teams and ADD extension so that they can also attract respect within their community of work.

(b) Applied researchers suspect that OFR/FSP in encroaching in their jurisdiction. The case in Malawi whereby multilocation trials commonly called District Trials on farmers fields have been restricted to research station and trials sites have aggravated these notions of tension and competition between the Adaptive and Applied researchers.

(c) The Adaptive Research Programme being a new pilot programme, is currently receiving more financial, logistical and moral support than the commodity teams, most of which are already established.

(d) Is OFR/FSP a scientific discipline?

3. Problems with rules of statistics - Where research statistical methods within disciplines are firmly established and widely accepted, they cannot all apply to OFR/FSP. For example, OFR/FSP, by its nature of operating under uncontrolled and variable conditions, cannot stick to 5% or less probability level for significance otherwise very few technologies will ever prove statistically viable under prevailing smallholder circumstances. The point is while rules of statistics need to be complied with if analysed data and inferences drawn from it are to be accepted internationally, a decision should be made as to which statistical tools are most effective and suited to the circumstances under which OFR/FSP operates.

4. Problems with workload - The amount of workload that each ART can manage in a cropping season has to be carefully established. Experience in Malawi has shown that the ARTs have tended to spread too much in their diagnostic surveys and even on farm trials that the quality of their work has sometimes been affected. The volume of on farm trials proposed has in some cases been unmanageable and consequently it has not been uncommon to write off some trials or sites. Heavy demands and unrealistic expectations from the ARTs by ADD management have sometimes forced this spread. Alternatively, is an ART of two professionals big enough for an ADD? Can additional women home economists and human nutritionists based at Chitedze Research Station take care of women matters in farming system to improve the situation?

5. Problems with Livestock based OFR/FSP - The OFR/FSR has often been criticised for not paying attention to livestock production. There is a general feeling in Malawi that the approach does not cater very well for livestock based on farm research especially when it comes to prioritising the enterprises of a farming system.

6. Problems with diagnostic surveys - Reliability and validity of information obtained from the farmer during informal surveys has sometimes been questionable. Under the political and socio-economic influences, the respondent farmer is likely to tell the government policy rather than what he or she actually does and sees on the farm. Worse still, the response may not be consistent each day he is interviewed.

7. Problems with recommendations approval - One aspect of the move to establish ARTs in each ADD is to decentralize decision making with respect of recommendations that are adapted to the location specific requirements of farmers within each ADD. However it would appear that this process of decentralised decision making, with respect to the role and function of the ARTs to develop specific recommendation, is not clearly understood and fostered within all part of the Ministry of Agriculture.

OFR/FSP in Malawi is planned in such as way that policy makers should be appraised through the right channels and protocol, of any information obtained by the ARTs that may require their attention, consideration or action for formulation of Agricultural development policies. It is important and necessary to institutionalise this objective of OFR/FSP so that policy makers can recognise the information submitted to them as one which can direct them in policy making.

8. Problems with University teaching of OFR/FSP - Bunda College of Agriculture has not been seriously involved with OFR/FSP. It is necessary that the college should include courses on OFR/FSP so that graduating students joining the Adaptive Research Programme are aware of the approach before doing so.

SUMMARY

The need to conduct On-Farm Research with a Farming Systems Perspective to ensure that the technologies generated by the commodity research teams are adopted by the smallholder farmers is not new in Malawi. The institutionlisation of OFR/FSP and the Adaptive Research Teams are an effective way of fostering linkages between the commodity researchers and the extension/farmers. Although it is too early to assess the usefulness of OFR/FSP in Malawi, use of OFR/FSP diagnosis and socio-economic analysis of on farm trials has given more effective means of identifying production constraints, setbacks in current recommendations, and farmers priorities. However, several problems have been recognized in implementing OFR/FSP in Malawi. The major problems are lack of interdisciplinary team spirit among biological scientists and socio-economist; lack of good linkage among Extension, Adaptive and Commodity researchers; lack of formal training in OFR/FSP; and failure to address livestock production in the OFR/FSP.

ACKNOWLEDGMENTS

We would like to acknowledge with thanks the financial support provided by CIMMYT which enabled us to attend the workshop and the Malawi Government for granting us the ten days study tour.

QUESTIONS

Ir D. Hockstra

Is livestock included in the diagnostic and experimentation?

Response:

Yes, it is included - we have some problems identified with livestock and some experiments.

Prof A. Mphuru

What is OFR. Is the technology already available?

Response

It is identifying useful technology for local specific groups of farmers. If none available, back to commodity teams.

Dr Seme Debela

Why are local specific recommendations difficult?

Response

Because the national mechanism for making recommendations is difficult for local specific groups and does not fit with local ART recommendations.

Dr M. Boateng

Where does the technology come from?

Response

It is drawn down from past research results, to finish the product under particular local circumstances.

THE WESTERN SUDAN AGRICULTURAL RESEARCH PROJECT

An Experiment In Farming Systems Research

by

Dafalla Ahmed Dafalla[1]

INTRODUCTION

The Western Sudan Agricultural Research Project (W.S.A.R.P.), sponsored by the Government of the Sudan, The United States Agency for International Development, and The World Bank, is the major research activity of the Agricultural Research Corporation (A.R.C.) for the traditional rainfed production sector of Western Sudan. Moreover, the W.S.A.R.P. represents a departure from the traditional mode of conducting research in the Sudan in that it has adopted a farming systems approach for the development and implementation of its research program. Consequently, the W.S.A.R.P. itself is an experiment. An experiment being undertaken by the Government of the Sudan and the A.R.C. to see if such a research mode can effectively compliment and contribute to existing national agricultural research programs and measurably improve the level of productivity and standard of living of traditional producers in the western regions of the country.

In the discussion which follows I would briefly like to share our experiences during the evolution of this farming systems project. Our research program has been operational for less than three complete cropping seasons. Consequently, it is too early to make a final assessment on either the short - and long-term impact of the W.S.A.R.P. on the production enterprises of its clientele or on the suitability of an "On-Farm Research with a Farming System's Perspective (OFR/FSP) "research philosophy for implementing a sustainable agricultural research program under the production conditions which exist in Western Sudan. What does seem apparent at this juncture, however, is that OFR/FSP programs can be very effective in increasing producer awareness to available production-increasing/cost decreasing technologies, but that such a program cannot, single-handedly, address all the various facets of a comprehensive research program for rainfed producers. The applied and adaptive focus of OFR/FSP research programs necessitates that these programs have available to them new technologies which are generally the result of discipline/commodity oriented research efforts. OFR/FSP program can then use theese new technologies to address the production constraints facing their clientele.

THE GENESIS OF THE W.S.A.R.P.

In 1975 the Ministry of Agriculture, Food, and Natural Resources requested the Ford Foundation to assist the Government of the Sudan on a study of selected crop and discipline research capabilities in the country and to

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1/ Presently Director of the Western Sudan Agricultural Research Project.

suggest the ways and means of strengthening Sudan's agricultural research and related services. This study was carried out by a group of expatriate consultants and Sudanese scientists and administrators. An intergrated summary of these reports was prepared and discussed at an International Workshop on Agricultural Research and Development in the Sudan, held at Khartoum in November, 1976. As a result of this workshop, the Government of the Sudan and the Ford Foundation agreed that the reports should be integrated into a master plan for strengthening agricultural research capabilities, with a focus on strengthening the A.R.C.

The International Agricultural Development Service, Incorporated, U.S.A., was invited to develop this master plan in collaboration with senior scientists from the A.R.C. This Joint Team undertook its review of agricultural research on a national level but excluded the western regions of Darfur and Kordofan, which were being reviewed concurrently by the World Bank. The reports from both these review teams indicated that Sudan's agricultural development strategy, as defined in the Government's Six-Year Plan, 1977-1983, needed to fully utilize existing resources and at the same time correct the wide variance in productivity and income between the commercial, irrigated, and rainfed, mechanized production sectors and traditonal sector. As part of this strategy, the Government placed a high priority on implementing development programs for traditional cultivators and pastoralists in the Western Regions.

The Joint Team Report of November, 1977, made a number of recommendations for reorganizing and/or re-orienting research activities of the A.R.C. Central to these suggestions was that research programs should begin to shift away from traditional, discipline orientation, to one which was commodity and problem factor oriented. Moreover, efforts should be made to restructure the organization of the A.R.C. so as to better implement and co-ordinate a multi-discipline team approach to research. The report also recommend the development of a national network of research stations that would give priority support to those areas of the Sudan that did not have access to improved, adapted technologies.

The 1978 World Bank study of the western regions, Darfur and Kordofan, indicated a need for developing an agricultural research capability. In support of this plan, the Government of the Sudan requested the IDA to develop and help finance an agricultural research project for the rainfed, arid and semi-arid areas of Western Sudan.

In their appraisal of the research needs for the western regions, the World Bank emphasized the necessity of implementing an integrated crop/livestock research approach, identifying the Savannah Belt as climatically the most suitable area in the Sudan for the expansion of rainfed agriculture. Such development, the report went on to say, should be targeted for increased production of sorghum, groundnuts, sesame, and an improved level of integration of crop and livestock production.

Because of the desired scope of the development activities for agricultural research in the West, and the inability of the IDA-GOS agreement to meet all the emerging needs of those activities, the U.S.A.I.D. designed and had approved a companion project which was fully integrated with and complimentary to the IDA-GOS project. Thus, the Western Sudan Agricultural Research Project became a reality.

The objectives of this project, as outlined in the planning documents from both the World Bank and USAID, were to develop and institutionalize an effective system for conducting agricultural research in the West. Specifically, the project was mandated to develop and test improved production systems for livestock and crop production, to improve the management and rehabilitate the natural resource base, and to improve the quality of life of traditional farmers and pastoralists in the arid and semi-arid areas of the West. Also emphasized in project documents was the desirability of utilizing an integrated cropping/ livestock production system in the design and implementation of research activities.

THE WSARP EXPERIENCE

The Challenge

Rainfed agriculture is a critical production sector for Sudan's national economy. The country has painfully learned that the rainfed sector has a greater impact on both domestic supplies and export earnings than does the irrigated sector. In 1982/83, when the drought resulted in a 24 percent decline in the value of rainfed production, real GDP dropped over 2 percent, while a 7 percent increase in the value of irrigated products had little counter balancing effect. In fact, the irrigated sector's impact on net foreign exchange earnings declined substantially once the country began to import agricultural inputs at the bank rate for foreign exchange. The irrigated sector's impact on net foreign exchange earnings declined substantially once the country began to import agricultural inputs at the bank rate for foreign exchange. The irrigated sub-sector accounted for just 19 percent of net agricultural foreign exchange earnings in 1982, down from 43 percent in 1980. However, the rainfed sector's contribution to net agricultural foreign exchange earnings grew from 57 percent to 81 percent over the same period.

Rainfed agriculture is also critical to Sudan's food security. Mechanized, rainfed agriculture produce on the average, 55 percent of Sudan's sorghum. Traditional rainfed agriculture produces another 35 percent, as well as 100 percent of the millet, 75 percent of the peanuts, 70 percent of the sesame, and virtually all of the livestock. Overall, rainfed agriculture is the key producer in Sudan's economy, accounting for 65 percent of the country's foreign exchange earnings in 1982. In fact, the top net foreign exchange earning crops per unit of local currency invested are rainfed sorghum, sesame, and groundnuts. Sudan also has a strong comparative advantage over several neighbouring countries in livestock (Egypt, Gulf States) production, an activity which takes place exclusively in the traditional, rainfed sector.

The target area of the W.S.A.R.P. is the two regions of Darfur and Kordofan. These regions comprise a total land area of approximately 850,000 Kms (approximately 35% of Sudan's total land area) and contain a population of approximately 5 million, a quarter of Sudan's total. In terms of national agricultural production, the area produces 90% of the millet, 52 % of the sesame, 46 % of the groundnuts, 17% of the sorghum, and 90 % of the gum arabic. Livestock resources of the regions account for 45% of the cattle, 37 % of the sheep, 32 % of the goats, and 65 % of the camels. The vast majority of production in the area is in the hands of traditional producers who operate under production constraints which limit output that could generate more cash sales and keep most farmers in a state of relative poverty. Insufficient resources such as the limited availability of labor during peak work periods, inefficient tools for cultural practices, poor access to credit, and fertilizer, and poorly developed roads and markets, impose limited production alternatives and incentives. The absence of clear land-use policies and land tenure systems are important factors leading to low productivity in livestock production systems and conservationally unsound management of the natural resources by both crop and livestock producers, a situation commonly found where no land use policies are enforced.

It is within this ecological and production environment that the W.S.A.R.P. was mandated to implement an agricultural research program which would stabilize and improve the existing systems of crop and livestock production for traditional producers.

The strategy

In an effort to complement the already well established commodity research program of the A.R.C. and to provide the project's clientele with the most relevant research results appropriate under the unique circumstances of their farming enterprises, the W.S.A.R.P. undertook to implement a farming systems research program. This programmatic philosophy was already embodied in most of the project planning documents referred to earlier in this paper, and reflected, by-and-large, in the recommendations of the Joint Team Report for the reorienting research priorities of the A.R.C. Farming Systems Research programs represented a new concept of research program implementation within the established agricultural research system in Sudan.

Thus in 1979, a major research efforts was launched which focussed on the traditional producers in Western Sudan. This pre-project planning stage took approximately four years, beginning in 1975 with the recognition by the Government of the importance of prioritizing development support for traditional producers in the rainfed sector to 1979 when the Government and the World Bank and USAID actually signed the agreement to implement the W.S.A.R.P.

The first task addressed by the project was the establishment of the infrastructure necessary to support an applied research program. This effort, which began in 1980, initially concentrated on the construction of the physical facilities necessary for program implementation. Project documents had already established that research stations would be established at four sites, one in each north/south region of Darfur and Kordofan. Initially, construction was prioritized for those sites with some pre-existing facilities, the objective being to complete station facilities and commence implementation of the research program in as short a time as possible. As a consequence, one station was completed approximately on schedule, late-1982, while continual delays, resulting from logistical and material supply problems, have resulted in the failure to complete the other three stations up to this time. Recent estimates place completion of all stations before mid-1986. Thus, the construction program alone, has, or will have taken approximately 5 years, while delays in the completion of facilities have had important implications regarding the recruitment of staff.

Delays in the construction program have resulted in delays in the recruitment of project staff and as a consequence, delays in designing an integrated, project - wide research program. In addition, the training of Sudanese scientists in formal, overseas degree programs, has prevented many from activity participating in research programs design and implementation activities. Nevertheless, a scientific staff was recruited for one station, including both Sudanese and United States nationals, and a research program was designed and initiated, in the hope that it would provide a model and learning experience for undertaking similar activities at the other stations when facilities were completed. Thus, during the project's 6-year lifetime one research station has been fully functional for about three cropping seasons, and the provision of temporary facilities has allowed for the initiation of limited research activities at another station for one cropping season.

Research program development was undertaken on several levels. Because the W.S.A.R.P. is, administratively, a research arm of the A.R.C., senior administrators from this organization were appointed members of several project research planning committees. The primary purpose of the committees are to plan, on an integrated project-wide basis, research programs and to ensure that these programs are compatible with national and regional development goals and objectives while

complimenting other, on-going national research activities. In addition, committee membership provided A.R.C. staff with "hands-on" experience in the management of a farming systems research program. Such an experience was expected to provide A.R.C. staff with a better understanding of farming systems research (FSR) and begin to engender and institutionalize FSR methodologies as a compoment of national agricultural research planning.

On an internal level, the project developed and initiated a research management infrastructure which aimed to integrate all individual research station programs into a complementary and integrated, project-wide research effort. Programmatic emphasis at the research station level focused on the design and development of potentially adoptable, production-increasing technologies which addressed important production constraints of the research station's clientele. The establishment of such a programmatic emphasis clearly identified the initial stages required to implement station research programs, which involved;
(1) an identification of important, potentially solvable production constraints;
(2) identification of technologies which might overcome these constraints;
(3) the testing and adaption of selected technologies to producer conditions; and
(4) dissemination of adoptable technologies to consumer groups.

Implementation of research activities for the predominate cropping systems of research stations target areas conformed to well established guidelines for FSR programs. These involved the initiation of reconnaissance surveys, zoning of production systems into recommendation domains, diagnostic surveys to identify production constraints which would serve as an initial focus of research efforts, and on-station, and on-farm, researcher and farmer-managed trials. The nature of the technology being tested, the production constraints being addressed, determined the sequence of steps followed in research trials, but the over-riding considerations were (1) to provide farmers with adoptable technologies in the shortest period of time; and (2) to minimize any risk associated with technology adoption, on both a short and long-term basis.

Previous experience with farming systems programs for livestock production systems was much more limited, and guidelines for implementing such programs not as clearly established as for cropping systems. Accordingly, the project found itself developing its own methodologies and guidelines for research programs addressing the production problems associated with pastoral systems. Some of the primary functional differences between cropping and livestock production systems were; (1) the longer time frame for achieving marketable products in livestock systems; (2) the ease of maintaining livestock units year after year which was associated with the traditional investments potential commonly associated with livestock; and (3) the fact that pastoralis : exercised much less control over the management of their natural resource base than sedentary cultivators. Collectively, these factors required that the project implement and focus research efforts for pastoralists differently than that used for cultivators.

The establishment of information networks and linkages with other projects, organizations, and consumer groups was recognized as a very important activity. Project management realized that efficient and effective research had to provide scientific staff with information necessary to (1) make knowledgeable decisions concerning technology selection, adaption, and testing; and (2) provide the mechanism necessary to disseminate adoptable research results to the largest possible number of consumers. The W.S.A.R.P. has attempted to initiate such networks by establishing formal and informal linkages and collaborative research activities with other local development and research organizations, international development agencies, and the International Agricultural Research Centres such as ICRISAT, ICARDA, ILCA, IITA, and CIMMYT. In addition, the project is undertaking to establish a project information service consisting of research station libraries, a publication/documentation service, and the formation of linkages with extension service personnel and consumer groups through the efforts of research station production specialists.

SOME ACCOMPLISHMENTS OF W.S.A.R.P. PROGRAM

One of the immediate advantages the project experienced from the OFR/FSP research approach was the establishment of dialogue with producers. As a consequence, research staff became aware and began to appreciate and understand some of the problems, constraints, and environmental limitations within which farmers undertook their production activities and research programs began to practically address some of the perceived needs of producers. As a result of this adaptive technological orientation, however, it has also been apparent that farming systems programs are rather dependent on technological packages resulting from disciplinary and commodity oriented research programs. Such research programs are necessary to generate basic technologies which farming systems programs can then select from for on-farm, adaptive research trials.

Although the W.S.A.R.P. research program in Southern Kordofan has only been functional for three years, and that in Northern Kordofan for one year, the farming system approach has provided the project with some evidence of early sucess, for example:

1. Initial horticultural trials looking at improved cultural practises were undertaken on farmer's fields during the first cropping season. Consequently, by the end of the first growing season, many of the farmers had adopted a ridge-furrow planting technique used by research staff because it substantially reduced the amount of water required for irrigation, and thereby the amount of expensive fuel used for pumping water from deep wells.

2. Collaborative work with an animal traction project in Southern Kordofan and producers indicated that the low rate of adoption of traction technology was partly the result of inappropriate designed equipment which was not suitable for the heavy soils of the area. However, most producers were very interested in using the animals for transport purposes. Renewed interest in animal draft has encouraged the re-design of implements, has provided farmers to learn about animal handling, care, and training, and has revitalized efforts to introduce animal traction.

3. In-herd/on-range trials with sentinel herds has provided research staff with an opportunity to initiate diagnostic studies and to plan, design, and implement researcher-managed trials with producer animals. In addition, such herds have enabled researchers to familiarize pastoralists with research methodologies while acquainting researchers some of the constraints facing pastoralists.

4. On-farm trials have provided continual feedback to the research station which has been used in formulating successive research programs. For example, early diagnostic surveys indicated that the expansion of food and forage legumes in the existing intercropping system would have a much greater chance of adoption, and therefore a greater impact on maintaining soil fertility than a crop rotation system previously designed by research staff.

5. Diagnostic surveys indicated the importance of house-gardens in providing nutrition for households during the hunger period. As a result, an on-farm program designed to test new and improved short-maturing varieties of commonly grown housegarden crops was met with enthusiastic support from local producers.

W.S.A.R.P. has many examples where on-farm and in-herd trials have provided scientists with important information on which to base future research studies. In addition, continual dialogue with producers has provided research staff with insights as to why recommended practises may not have been followed by producers, for example, due to the lack of improved seeds and fertilizer, lack of credit, and policy decisions which may limit input channel development and credit availability, as well as cultural constraints which may impact on technology adoption.

SOME PROBLEMS OF THE W.S.A.R.P. PROGRAM

Implementation of a farming systems research program by W.S.A.R.P. has not been without its problems. During the early stages of project implementation it was necessary to assure national program administrators that FSR programs could be complimentary with existing discipline and commodity research programs and were not designed to replaced them. Quite on the contrary, farming systems programs are dependent on technology generated by such programs for use in their own adaptive and applied research efforts. However, in the developing country setting, where resources for the support of agricultural research are often very limited, competition among programs becomes inevitable, and then the decision must be made on striking a balance between disciplinary/commodity research programs and applied/adaptive research programs. Compounding this problem of making effective decisions regarding the complexion of national efforts is the frequent confusion which may exist over the role, approach, methodology, and previous successes of farming systems programs, in part a result of the relatively short time FSR programs have been operational. Accordingly, however, it is often difficult to clearly demonstrate the complimentarity and potential benefits FSR programs can make to national research program goals and objectives.

The emphasis of farming systems research programs on the producers and on implementing on-farm trials presents some unique problems not commonly found in more traditional research programs. The implementation of experimental trials under on-farm, producer conditions presents difficulties in terms of the the control of experimental variables and in the interpretation of trial results. Such problems are generally manifest in terms of the proper conduct of experimental trials and in the perception of what constitutes professionally recognizable research results. In general, national scientists must view an opportunity to work on farming systems program in the context of whether or not such a commitment will contribute to their own professional advancement. To be acceptable to national professional staff, such programs must strive for scientific excellence, encourage the publication of research results, and provide a research environment where scientists can establish professional credibility and achieve professional recognition.

The W.S.A.R.P. has addressed these issues by; (1) establishing a project publication series where scientific reports are formally documented and circulated to other interested individuals and organizations; and (2) encouraging scientific staff to attend national and international meetings and workshops where research results are presented or training is undertaken. Such meetings are selected to emphasize not only farming systems activities but also discipline oriented research. Programmatically, the W.S.A.R.P. has adopted the view that farming system research basically constitutes an integrated program of professionally sound, multi-disciplinary research activities which are ultimately analysed and evaluated within a producer context. In fact, it could be argued that as such, farming systems research programs strive for an additional dimensions of professional sophistication than is often found in more traditional research programs in that they seek technological simplicity and adaptability.

As regards the training of scientific staff for farming systems programs, the W.S.A.R.P. has adopted the philosophy that a sound technical/scientific background is the most desirable type of training for scientists who will be implementing such programs. The engendering of an attitude which views agricultural research in the context of multi-disciplinary teams undertaking off-station research trials which are addressing producer-perceived production problems, will in large part be determined by the emphasis and professional opportunities national programs give to such research efforts. Presently, professional opportunities in farming systems research programs are being provided by international donor agencies and research centres through the implementation of projects such as the W.S.A.R.P. In the future, however these incentives will have to be provided by the national research organizations themselves.

CONCLUSION

The Western Sudan Agricultural Research Project represents Sudan's major research effort which is addressing the production, marketing, and socio-economic constraints faced by traditional producers in the rainfed sector. As such, it becomes responsible for providing producers with production-increasing/cost-reducing technologies which will increase their productivity and standard of living while significantly contributing to the national economy. As outlined in this brief overview, the project's research orientation has been on applied, adaptive research efforts. However, such efforts alone cannot hope to provide the technological break throughs to provide for sustained production which will be required in the future from the rainfed sector. Significant efforts must be undertaken in basic technology development. Whether these basic research efforts are undertaken by existing national research organizations or new programs, or whether formal linkages should be established with appropriate international agricultural research centers and research organization in other countries, depends on the availability of resources and the potential economic benefits such activities could have on national economies. In any event, applied and adaptive research programs will likely form a very important dimension to national agricultural research efforts. Such programs function as an interface between national development efforts and producers, and such can provide important policy alternatives for prioritizing research activities and resources to meet current and future needs of producers. Research programs such as the W.S.A.R.P. can play an important role in adapting technology to local ecological conditions and to the production constraints of producers. In addition, to providing iterative inputs on technology development, projects such as the W.S.A.R.P. can provide input to policy-makers regarding infrastructural and economic issues which limits productivity. Research programs such as that being implemented by the W.S.A.R.P. can also provide formal linkages between national agricultural research efforts and national extensions programs, strengthening the ability of extension personnel to provide producers with the most recent and accurate recommendations for improving their productivity.

W.S.A.R.P. has provided an institutional framework in Western Sudan which has provided direct linkages between rainfed sectors producers, researchers, policy-makers, and international organizations. This has provided a forum for the exchange of information and ideas focusing on those constraints which are limiting productivity of the major agricultural sector in the Sudan. The continuing challenge is for the W.S.A.R.P. to promote appropriate, adaptable interventions to stimulate producer interest and national policy-makers awareness.

QUESTIONS

Dr M. Avila (Zimbabwe)

Do you work on Crop/Livestock interactions and at what stage of research are you?

Response

It is more complicated in that we have three major farming system types, pastoral, transhumant sedentary as well as crop/livestock interactions within the transhumant and sedentary systems, there are significant crop livestock interactions between them.

Mr A. Okech (Kenya)

Is FSR really more sophisticated than traditional research?

Response

In the sense that there is direct contact with the producer and a less mechanistic way through research - yes.

Mr M. Mekuria (Ethiopia)

Will this experiment be replicated elsewhere in Sudan?

Response: We cannot say, so far.

ON-FARM RESEARCH IN SWAZILAND: BACKGROUND AND PERSPECTIVES

by

C. Seubert and C. Nkwanyana*

A. Introduction

The present Research Division of the Ministry of Agriculture and Cooperatives was initiated in 1959 by the establishment of a central research station at Malkerns. Four sub-stations were later added. This extensive coverage of such a small country is necessitated by the widely divergent soil and climatic zones within Swaziland.

In 1971 the responsibility for the Research Division was transferred to the University of Botswana, Lesotho and Swaziland to strengthen the university presence in the country and formalize ties between the Faculty of Agriculture and the Research Division. This association continued officially until 1978; but the 1977/78 season was dominated by staff losses at all levels. Serious research activities began again in the 1981/82 season with the recruitment of an agronomist. The expansion of the research effort has been assisted by the Cropping Systems Research and Extension Training Project; a cooperative effort between USAID, the Ministry of Agriculture and Cooperatives, the Pennsylvania State University and Tennessee State University.

B. Background

One of the important elements in the revitalization of agricultural research has been its reorientation towards the small farmer. While the tendency to repeat previous research strategies remains, and the tendency of the researchers towards a more traditional discipline oriented on-station research approach remains, an on-farm research component with a systems perspective remains a strong factor in the research equation in Swaziland.

While several people have, over the years, pointed out the need for a more systems oriented approach to agricultural research in Swaziland, two individuals M.J. Jones (1979) and F. Saunders (1982), have made noteworthy comments which have helped to lay the foundation for the present farming systems research effort. Jones stated that 'There is a great need for a broad, general, descriptive account of the whole farming system, integrating the cropping system with other aspects of the system..'. Saunders, in referring to the traditional farming sector stated that: 'Because they fall into the low income group, they should not be expected by those in the higher levels to produce for nationalistic or idealistic reasons. Sound economic advice and the institutional support of government in credit, marketing, availability of inputs and similar services, without excessive bureaucracy, are their right..'. The seeds sown by these individuals, and the efforts of the Ministry of Agriculture to foster the Farming Systems Research effort have resulted in the ongoing USAID project entitled Swaziland Cropping Systems Research and Extension Training Project.

A large amount of background information covering the physical, economic and human resources of Swaziland has become available over the last decade. These studies and reports have been of considerable assistance to the farming systems research effort in Swaziland.

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Publications, such as those by Black-Michaud and Simelane (1982), Russell (1982), and de Vletter (1983) have served to improve our understanding of the Swazi Nation land social setting. A better understanding of the economic and labor situations on SNL farms has been provided in studies by Low (1985) and the Farm Management Surveys (1977-79). Additionally, numerous survey and censuses covering the period from 1976 to the present provide us with a considerable amount of information about SNL farmers yields, inputs, production, crop mixtures and resources (Central Statistics Office, 1976-1985, RDA Monitoring Unit, 1977-79, and RDA Management Unit; 1982, 1983, and 1985).

Several organizations had conducted research on farmers fields prior to the coming of the Cropping Systems Research and Extension Training Project. The earliest efforts at on-farm trials may well have been the District Soil Fertility Trials conducted at several hundred locations between about 1968 and 1974 in all of the major agro-ecological zones of Swaziland (Faculty of Agriculture, 1972, 1973). Some of the fertiliser levels used in these trials were a bit beyond many farmers, and the field plot techniques were not appropriate for on-farm research. While the grain yield and soils data were collected and tabulated, from the records it does not appear that any final reports or summaries of this work were ever produced.

A more recent on-farm effort has been that of the Intercropping Project funded by the International Development and Research Centre of Canada and managed by the Faculty of Agriculture of the University of Swaziland (Faculty of Agriculture, 1982). This group has done some very good work and has produced a good report. But the work, while carried out on farmers fields, did not reflect the farmers management practices and use of resources. The design and methods used in these trials did not take into account the farmers constraints and perspective.

The Seed Multiplication Project conducted on-farm maize variety trials for three seasons from 1982 to 1985 (Simelane and van den Burg, 1983, and van den Burg, 1985). These trials were conducted under farmers conditions and have been well summarized; in fact, they have been of assistance in formulating the current variety recommendations for maize in Swaziland. Because many farmers in Swaziland plant with an SAFIM ox-drawn planter, it has been difficult to establish on-farm trials, using different varieties of maize, that closely approximate farmers conditions. Nonetheless this program has continued to improve its on-farm focus over the years.

The Soil Testing and Lime Demonstration Unit of the Extension Service have been conducting an on-farm demonstration program since about 1975. While the organization has been focussed primarily on demonstrations of the effects of lime and fertiliser, their work has been done on farmers fields, though not always under farmer conditions. Recent cooperation with the Cropping Systems Project has changed their on-farm program towards operating closer to the farmers conditions and resources.

With this background and history to draw from the Cropping Systems Research and Extension Training Project has been able build on past efforts to adopt a systems approach. As a result, an interdisciplinary team composed, at various points in time, of agricultural economists, agronomists, rural sociologists, horticulturalists, and irrigation specialists have been able to supervise an ongoing team effort that conducts more than 100 on-farm research and observation trials annually. With assistance and training from CIMMYT informal and formal diagnostic surveys have been completed in seven of the ten areas where OFR work will take place. At present personnel are stationed at ten sites, representing all three agro-ecological zones of Swaziland. Interdisciplinary team research in socio-economics horticulture, irrigation and rainfed agronomy involving all of the major crops grown in Swaziland is being conducted at all of these sites.

C. First Results from the On-Farm Research Program

One of the first, and probably the most important benefits of an on-farm research program has been an increase in contact with the Swazi Nation Land farmer. This repeated contact, supported by the information gathered in informal and formal diagnostic surveys and on-farm trial observation and monitoring, has led to a better understanding of the farmers resources, and strategies. Researchers who have visited farmers, and see what's going on in their fields, think more than the farmers point of view than researchers who are not in contact with their clientele. This is starting to show in some of the research conducted at the Malkerns Research Station. We do have a way to go to eliminate some of the narrow discipline focus of past years, but there is progress.

The on-farm research program has also generated interest and cooperation between research and extension. While, the FSR program has not been able to formalize a cooperative relationship by itself, it has succeeded in getting researchers involved together with extension workers in field days on farmers fields. Also, several extension workers have cooperated informally in putting out on-farm trials along with the OFR field staff.

The on-station research program has not yet initiated any formal interaction between on-farm and on-station research programs. However, the on-station and on-farm researchers attend numerous meetings and have discussions together about the direction and focus of research programs. The general attitude of cooperation between the two research orientations is readily evident. Part of this attitude is due to the small number of professional staff at the Malkerns Research Station. The process of getting a clearer understanding of the roles and scope of on-farm and on-station programs is underway.

The weed control research program, with some funding from SADCC, has oriented several on-station trials towards providing more information about practical problems faced by small farmers with regard to the use of herbicides for weed control in both maize and cotton. The weeds agronomist and on-farm agronomist, who observed weed conditions and herbicide use together on farmers fields, have collaborated together in designing multi-locational on-station experiments which will serve to identify and pre-test herbicide strategies under controlled experimental conditions before taking them to farmers through the on-farm research programme.

During the 1984/85 cropping season the on-farm research program cooperated with the cotton entomologists in testing a new type of cotton insecticide sprayer, called the Electrodyne Sprayer. This sprayer, which is soon to be introduced commercially in Swaziland, was tested by 10 cooperating farmers on their cotton fields for the entire season. The initial thinking was that the electrodyne would save a large amount of the labour needed for spraying cotton. During the cropping season weekly visits were made to each farmer to assess the amount of time and inputs being used on each field for each type of farming operation. From the survey data it was readily apparent that the time spent weeding far exceeded the time spent spraying, regardless of the type of insecticide spray system used.

It seems that we were misled in the informal and formal surveys. We incorrectly interpreted the farmers concern about recent increases in the cost of insecticides as a general concern about cotton pest control; thus we gave the whole issue a higher priority than it merited in the farmers overall management strategy. As a direct result of findings from the weekly visit surveys a program for commercialization of the Electrodyne has been given lower priority. Additionally, the on-station work is expanding its efforts in the area of cotton herbicides and is pre-testing a herbicide strategy suitable for small farmers.

At the request of the Home Economics Unit of the Ministry of Agriculture and Cooperatives the Cropping Systems Team initiated a program of introducing soybean cultivation to small farmers. The emphasis in this program has been on the nutritional value of soybean and its potential as a dietary supplement rather than as a cash crop for oil. As a direct result of the interdisciplinary nature of a team approach the work with soybeans has emphasized the non-agronomic aspects of production and use; such as: cooking, nutritional value, and appropriateness for the cropping system. As a result, the Home Economics Unit is emphasizing the educational aspects of soybean use and preparation for cooking; rather than a large scale promotional effort to get farmers to grow soybeans.

The on-farm research program cooperated with the Seed Multiplication Project in comparing the dry bean seed that they were multiplying to the seed being used by the farmers. These trials included seed source, nitrogen topdress and row spacing as variables. While the Seed Multiplication Unit seed was as good as the farmers seed in disease resistance and pod set (yield potential), it was about 3 to 5 weeks longer in maturing than most of the varieties being used by farmers. Because of the problem of cattle being released into the cropping areas late in the season, this late maturing variety is not favored by farmers. As a result, the Seed Multiplication Unit is giving more attention to maturity date in their varietal testing and selection work and are using planting dates more closely approximating those of farmers.

In the last six months Swaziland has begun to adopt the Training and Visit approach as their basic extension methodology. The T&V supervisory staff responsible for the development of the training messages have met with the on-station and on-farm agronomists at the Malkerns Research Station. The experiences of the on-farm research program provided useful information for adapting the T&V messages to be more suited to a wider range of farmers. It remains to be seen if the T&V message can be adapted to the diversity and complexity of the farming systems in Swaziland.

Following a partial budget and statistical analysis of their on-farm demonstrations the Soil Testing and Lime Demonstration Unit of the extension service has changed the focus of their research work. Their previous focus was towards encouraging farmers to adopt a profit maximizing liming strategy which assumed high input levels and management abilities for farmers growing maize. The present on-farm effort has been shifted away from this demonstration mode to a research mode which looks at several liming strategies at farmer levels of management and inputs.

The on-farm research program has performed a number of on-farm and on-station trials to test improvements to the SAFIM ox-drawn planter. This has resulted in several extension recommendations regarding the use and calibration of the ox-planter. Additionally, oxen have been used at the Malkerns Research Station for the first time in many years and plans are underway to expand their use. This is slowly leading to a broader program which tests and improves equipment commonly used by small farmers. Also, the use of draft animals and small scale equipment on station allows researchers to pre-test experiments and become familiar with the operation of the equipment.

D. Problems

One of the objectives of the Cropping Systems Project has is to train extension and research personnel. In 1983 the first research personnel returned from their training programs in the US and elsewhere. Two of these returnees, the irrigation and soil fertility agronomists, have since left government to join the private sector. Because of the lower salaries in government employment this trend will not change in the near future.

With the initiation of the Cropping Systems Project in 1982 7 trucks and 14 motorcyles were purchased for use in the on-farm research program. There was not a sufficient increase in the budget for maintaining these extra vehicles. This has seriously constrained the vehicle maintenance for the Research Division.

Field staff supervision is difficult because of a lack of communication and the distances involved. It has been found that an on-farm trials coordinator is very much needed to maintain a program in ten areas. The coordinator position is currently filled by an expatriate, but there is no government post available to assure that these duties are continued in the future.

E. Summary

Swaziland is off to a good start in farming systems research. Because of past events interdisciplinary farming systems research has had a good chance to grow and expand right along with discipline oriented station based research. The first results are indicating that on-farm research with a farming systems perspective will have an increasing impact upon agricultural research in Swaziland. There are problems in the implementation of the FSR program to be sure, but these are problems that can be surmounted if positive results continue to come from the on-farm program.

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SWAZILAND PRESENTATION DISCUSSION

Mr W. Nts'ekhe (Lesotho)

Why did research leave the auspices of the Ministry?

Response

Felt to be mismanaged within the Ministry.

Mr. T. Monyatsi (Botswana)

When qualified people return and go to the private sector, and government has problems with vehicle maintenance, what is the future of FSR?

Response

Continue training until the vacuum is filled.

Prof. A. Mphuru (Tanzania)

Scattered personnel may be good for FSR diagnosis but not for developing countries.

Response

Not so scattered really, only three agro-ecological zones and distances are not so far, we may consolidate a little in the future.

A REVIEW OF ZAMBIA'S SYSTEMS BASED ON-FARM RESEARCH PROGRAMME - THE ADAPTIVE RESEARCH PLANNING TEAM

by

S.A. Kean, M.R. Mulele and B.K. Patel*

I. INTRODUCTION

This review is in three parts. The first outlines the different stages in the establishment and implementation of the Adaptive Research Planning Team. The second part examines the team's achievements to date and the third part discusses some of the problems which have hindered the team's development.

II. PART ONE: A CALENDAR OF PROGRESS IN IMPLEMENTING THE ADAPTIVE RESEARCH PLANNING TEAM

II.1 1975-76 - Awareness of a problem with small scale farmer adoption of research output

Most agricultural research in Zambia, particularly crop research, is conducted by the Research Branch of the Department of Agriculture. Until 1981-82 this research was carried out almost exclusively on the network of research stations and sub-stations across the country. The research was originally conducted by scientists working on a disciplinary basis e.g. breeding, agronomy, plant protection etc. but recently these scientists have been reorganised into multidisciplinary commodity research teams e.g Cereals, Tubers, Oilseeds etc. (see diagram 1).

In the course of several evaluations of the Research Branch in 1975 and 1976, it became apparent that there were several features of the nature and structure of the research programme which were inhibiting the production of relevant recommendations, which could be rapidly adopted by the majority of Zambia's traditional and small scale commercial farmers, who form approximately 85% of the total rural population. There were four main problems areas which stood out

i. Ineffective research programme formulation - There was no effective means of identifying the problems of specific target groups of farmers, therefore it was impossible to formulate research programmes to meet their specific needs. A single set of recommendations was released to cover all farmers in a province, giving little recognition to the diverse nature of different farmer's circumstances.

ii. Single crop or activity approach - Research was conducted on individual crops in isolation from one another ie. there was no consideration given to the farm in its totality, its crops, livestock and off farm activities which all compete for the farmers limited resources.

iii. Neglect of social and economic factors - Research was undertaken by natural scientists who looked exclusively at the farmers' natural environment e.g. soil climate etc. and gave little consideration to farmers' goals, resources, markets, prices etc. which also influence farmers' decisions.

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iv. Insufficient on-farm trials - The majority of trials were conducted on research stations under high management conditions, which differ considerably from farmers' own conditions.

II.2 1977-79 - Decision to try out on-farm research with a Farming Systems Perspective

Having recognised these weaknesses within the agricultural research programme, the Ministry of Agriculture and Water Development responded favourably, in 1977, to a request by CIMMYT's East African Economics Programme to demonstrate a set of procedures which could improve the method of formulating the research programme. During 1978 and 1979 CIMMYT, together with local scientists, undertook two demonstrations; the first showed how to identify different recommendation domains in which farmers are grouped according to their resource constraints and development opportunities. The second demonstration was of diagnostic survey techniques which could be used to pinpoint the important points of leverage in a farming system, around which adaptive and applied research programmes are formulated.

A steering committee, comprising senior research and extension workers, monitored these demonstrations and at the end of 1979 gave its approval for the procedures to be incorporated into the Department of Agriculture.

II.3 1980 - Decision to build a national capacity in OFR/FSP

i. Different options considered for institutionalising OFR/FSP - Three options were considered for incorporating FSR into the Research Branch. The first would have been to undertake a very major reorganisation and establish regional research institutes which contained all the different disciplines and which would have been capable of focussing on the problems of the local farming systems. However, this option was never a real possibility as it was at variance with the already agreed policy to establish multidisciplinary commodity and specialist research teams (CSRTs).

The second option would have been to have included social scientists in the CSRTs. However, this would have meant that the systems perspective would have been incomplete, owing to the commodity focus. In addition, considerable duplication of effort and confusion for farmers could have resulted from each CSRT carrying out its own surveys and on-farm trials in the same farming systems. Acceptance of the young and inexperienced social scientists, by the majority of natural scientists in the CSRTs, could have seriously hindered their effective involvement, as experience elsewhere has shown. Thus the third option, of establishing a team to conduct OFR/FSP, was agreed upon. This recognised that the CSRTs have a national commodity focus whereas FSR has an area focus and that two complementary approaches would be needed. Similarly, it recognised that adaptive on-farm research requires different organisation and management from applied research on research stations. The complementary approach afforded the opportunity to build a team which could criticise itself openly and thereby improve its structure, methodology and operations. That this more radical option was chosen is an indication of the high level of commitment to the concept of FSR.

ii. Objective and functions of the Adaptive Research Planning Team

ARPT was set up with the overall objective that it should help the Research Branch to produce recommendations which are relevant to the needs of the majority of Zambia's farmers, especially the traditional and small scale commercial producers. The main functions of ARPT are as follows:-

(i) Collect information on the different farming systems in Zambia;

(ii) Select components from previous technical research likely to be appropriate to the immediate needs and circumstances of the specific groups of farmers identified and test these under farmers' conditions;

(iii) Feed unsolved technical problems, identified as important for local farmers' development, to the appropriate CSRT;

(iv) Pass on information to planners and agricultural service institutions e.g. extension credit, marketing etc. to assist in removing institutional and infrastructural problems hindering farmers from adopting recommendations.

Appendix 1 illustrates the sequence of activities which ARPT follows in order to achieve these functions.

iii. Structure of ARPT - ARPT is organised along provincial lines and, by 1988, will have one team in each of Zambia's nine provinces. Each provincial ARPT comprises one Agronomist, one Economist and one Research Extension Liaison Officer (this last position is established in the Extension Branch). These scientists are all university graduates and are based together at the regional research station in each province. There is also an ARPT National Coordinator based at the Central Research Station, who coordinates the work of the provincial teams and liaises with CSRTs, extension workers and planners. The ARPT Rural Sociology section will eventually have four regionally based Rural Sociologists supporting the work of the provincial teams. It is also intended to have two Adaptive Livestock Specialists who will ensure that adequate attention is given to livestock within the farming system. Finally, for a limited period, a Nutritionist is developing methods and procedures for incorporating a nutritional perspective into the work of ARPT.

vi. Phased expansion - The use of a provincial team structure enabled a more gradual, phased expansion of activities. The first phase (1981-83) involved four provinces; Central, Luapula, Lusaka and Western Provinces which represented quite diverse types of farming systems. The second phase (1983-86) saw work extended into Eastern, Northern and North Western provinces. In the third phase (1987-88) work will be extended into Copperbelt and Southern provinces. There has been considerable pressure, both from within Zambia and by foreign donors, to expand the work of ARPT across the country faster than had been originally intended.

Table 2 Operationalising ARPT

Province	Donor	First surveys	First experiments
Central	USAID	1978 (demonstration)	1981-82
Lusaka	ODA/CIMMYT	1981	1981-82
Western	Netherlands	1981	1981-82
Eastern	World Bank	1982	1982-83
Luapula	SIDA	1982	1982-83
North Western	IFAD	1985	1985-86
Northern	NORAD	1986	1986-87

II.4 1980-81 - Recruit first national staff

The decision to incorporate OFR/FSP into the Research Branch was swiftly followed by a decision to allocate the posts of Regional Agronomist (9) and Farm Management Research Officer (2) to ARPT. This meant that positions were available to recruit Zambians and two were recruited during 1980-81. Since then the following Zambian personnel have been recruited.

Annual Recruitment of Zambian Graduates for ARPT

Post	1980	1981	1982	1983	1984	1985	Total
Economist	1	2	3	-	-	1	7
Agronomist	1	1	2	-	1	-	5
Research/Ext. Liaison Officer	-	-	-	-	-	2	2
Sociologist	-	-	-	-	1	-	1
	2	3	5	-	2	3	15

II.5 1980-85 - Donor assistance requested

As both funds and experienced manpower, especially in agricultural research, are limited it was necessary to request assistance from several foreign donors to enable the phased expansion to take place as planned (see Table 2). Eight donors are supporting the provincial ARPTs and the sociology section, these include: CIMMYT, ODA, USAID, World Bank, SIDA, NORAD, IFAD and the Netherlands government. Recruitment of foreign personnel has frequently taken longer than expected which has meant that several teams have only recently been fully staffed. Coordination of donor assistance has been most necessary to ensure that it supports the national programme.

II.6 1980-85 - Training of national personnel

Between 1980 and 1982 five Zambians attended the bi-annual regional training workshops organised by CIMMYT in Nairobi which provided participants with the practical skills to conduct diagnostic surveys and be able to design, conduct and analyse on-farm adaptive experiments. However, by 1983 there were sufficient ARPT staff, 15 including expatriates, to justify CIMMYT organising a five-call in country training programme. During this programme, training was given in the techniques of conducting OFR/FSP and participants had the opportunity to practice these techniques by designing a trial programme for a local farming system. Since 1984 new Zambian team members have attended the regional training workshops organised jointly by CIMMYT and the University of Zimbabwe. In addition, six team members have been or are presently taking Masters degree courses in their respective disciplines.

II.7 1982-85 - Organising relationships between ARPT and Commodity and Specialist Research Teams

Having decided to establish the OFR/FSP programme as a seperate Team for the CSRTs, it has been essential to make special efforts to involve CSRTs as much as possible in ARPTs work. There should be a two way flow of information between ARPT and the CSRTs with relevant CSRTs being involved in ARPTs exploratory surveys; providing insight on specific problems encountered and suggesting possible solutions to be tried in on-farm trials. In this way ARPT can provide information on problems requiring technical component research. Information is also fed back to the CSRTs on the performance of technology tested under farmers' conditions.

Since the team was established several formal points of contact have been established which can be listed according to the sequence of activities undertaken by ARPT:

i. Participation by CSRT scientists during informal surveys conducted by ARPT.

ii. Assistance by CSRT scientists in formulating formal survey questionnaires.

iii. Establishment of pre-research committee meetings/annual commodity review meetings to exchange information and formulate both adaptive on-farm and technical research programmes, including the criteria for inclusion in breeding programmes to meet farmers' varietal preferences.

iv. Exchange of details of experimental programmes between ARPT and CSRT scientists to enable detailed comments to be made on the treatments in both adaptive and technical experiments.

v. Visits by CSRT scientists to ARPT on-farm experiments.

vi. Meetings to discuss the release of research recommendations organised by the Chief Research Extension Liaison Officer.

vii. To facilitate the exchange of information from ARPT to scientists several formats have been developed.

The interaction between ARPT and CSRTs has not been as adequate or as effective as it should have been, as will be discussed below. Nonetheless, it has only been comparatively recently that there have been sufficient numbers of scientists, in both ARPT and the CSRTs, to warrant organising several of the formal meetings mentioned e.g. for recommendation revision.

II.9 1981-85 - Organising relationships between ARPT and extension workers

With the establishment of ARPT, a range of opportunities has been created to involve extension workers, of all levels, more fully in the technology generation process (see Diagram 2). Following the sequence of ARPT's activities these opportunities for cooperation include:

i. Zoning - Extension workers, especially at camp and block level, provide much of the information used to demarcate the different farming systems.

ii. Surveys - During Exploratory surveys, camp and block extension workers accompany ARPT staff to farmers and sometimes act as interpreters. During the Verification Survey, these same officers act as enumerators and administer the questionnaire. Some District and Provincial Subject Matter Specialists also accompany the team during the surveys. All survey reports are distributed to extension workers.

iii. Research priorities - Camp staff participate during meetings with farmers when proposed on-farm trials are discussed. District and Provincial SMS staff contribute during the provincial ARPT committee meetings which help to set research priorities.

iv. On-farm trials - The trial assistants, who supervise the on-farm trials on a day to day basis, are seconded technically from the Extension Branch to work with ARPT for a period of 4 to 5 years. Camp extension staff, in the Target Area, together with the Trial Assistant and the Research Extension Liaison Officer (REL0), are responsible for organising farmer field days, which provide an opportunity for farmers to give their opinions about the technology being tested. In this way extension workers are able to understand why farmers prefer one technology to another.

v. On-farm tests - The RFLO, SMS staff and camp extension workers disseminate information in the Target Area about the new technology, when it has done well in on-farm trials. They then monitor the rate of farmer adoption under 'real world' conditions.

vi. Recommendation release - Through the Provincial ARPT committee meetings, the District and Provincial SMS staff are able to recommend the dissemination of a new recommendation.

II.10 First useful results from ARPT

The first useful results appeared in 1982, by which time ARPT had conducted several farm surveys, which provided focal points for certain trial programmes, for both ARPT and the CSRTs. Closer cooperation with extension workers also dates back to that time. However, it was not until 1984 that certain ARPT results went from the trial stage to the test demonstration stage. 1985 has seen the release of farming system specific crop recommendations for three systems in Eastern Province.

Table 2 summarises each of the steps that have been taken to implement the Adaptive Research Planning Team as has been discussed above.

Table 2 A CALENDAR OF PROGRESS IN IMPLEMENTING THE ADAPTIVE RESEARCH PLANNING TEAM

YEAR	EVENT
1975-76	Evaluations of the research programme which identified the problem of farmer adoption of research output.
1977	Decision to invite CIMMYT to demonstrate procedures for planning adaptive research.
1978-79	Demonstrations of OFR/FSP techniques by CIMMYT.
1980	Decision to build a national capacity in OFR/FSP and establish ARPT.
1980-85	Operationalise ARPT in different provinces assisted by donor support.
1980	Recruit first Zambian staff.
1981	Work started in Central, Lusaka and Western Provinces.
1982	Work started in Eastern and Luapula Provinces.
1984	Work started in North Western Province.
1985	Work started in Northern Province.
1983-84	In Country Training programme mounted for all ARPT staff by CIMMYT.
1981 onwards	Organising relationships between ARPT and extension.
1982 onwards	Organising relations between ARPT and Commodity and Specialist Research Teams.
1984	First on-farm trial results went into test demonstrations.
1985	Crop recommendations released for three farming systems in Eastern Province.

III PART TWO - EVIDENCE OF THE USEFULNESS OF OFR/FSP

III.1 Evaluation the Technology Generation & Dissemination Process

The technology generation and dissemination process is notoriously difficult to evaluate, especially when the evaluation attempts to measure the contributions made by each different group working in the process. If one considers the whole of the technology innovation process, it is clear that many different groups contribute to achieving the goal of farmer adoption e.g. scientists at international centres, commodity and adaptive researchers, extension agents and planners. Each of these groups may wish to claim responsibility for the success of a particular technology being adopted.

Not only is it difficult to separate the different contributions made by each group, but there can be negative effects from attempting such an evaluation as it can create resentment, jealously and general ill feeling between the groups. Evaluations should be conducted of the whole technology generation and dissemination process and should involve all those who participated in the process. We firmly believe that the process must be a complementary one, in which, each group respects, understands and supports the others, recognising that they share a common goal; to see that all farmers benefit from technology developed. Thus where, for example, commodity research or extension services are weak or non-existent, the OFR/FSP programme can achieve very little and must work to ameliorate the situation. In this way OFR/FSP must be seen as one contributor in a whole process.

In Zambia, the Adaptive Research Planning Team must be seen as a section within the Department of Agriculture, complementing the work of the Commodity and Specialist Research Teams and the Extension Branch. To these, it contributes three features:

- An understanding of farmers' activities and their circumstances using a systems perspective.
- On-farm testing of potentially useful technology under farmers' conditions.
- Involvement of farmers throughout the research process.

III.2 Evaluating the usefulness of ARPT

As a section, ARPT has only been in existence for a comparatively short period and, as with establishing any new institution, it has taken time to get the team fully operational. In particular, Zambia at present has only a small number of experienced scientists and thus considerable time and training has been necessary to build up the manpower base to achieve the level of skills and experience required to conduct FSR. Developing institutional links is also a long term task but in this regard, considerable progress has been made.

In the sections which follow, the paper looks at the usefulness of ARPT taking each of the eight measures suggested in the review guidelines and adds four other areas in which ARPT has been useful. The work of six provincial ARPTs is considered but it must be understood that some of these have only been established recently.

Table 3 represents an assessment of the progress of each provincial ARPT. Progress on each of the eight indicators is scored using a scale with three rankings; No progress to date, Moderate progress and Good progress. The details are given in the sections which follow.

Table 3 EVIDENCE OF USEFULNESS OF SIX PROVINCIAL ARPTS USING EIGHT INTERMEDIATE MEASURES OF USEFULNESS

Measure	1 Evidence of adoption	2 Farmer assessment of on-farm trials	3 New recommendations from on-farm trials	4 Thrusts for on-farm trials from surveys	5 Understanding why current recommendations not widely adopted	6 Areas for commodity research from surveys	7 Improved Research Extension Links	8 Improved Links with agricultural services and Planners
Province								
Central	-	**	-	**	*	**	**	-
Eastern	*	**	**	**	*	*	**	-
Luapula	*	**	-	**	*	**	**	*
Lusaka	-	*	-	**	*	**	*	*
North Western	-	-	-	*	*	*	*	-
Western	-	*	-	**	*	*	*	*

Key

- \- No progress to date
- * Moderate progress
- ** Good progress

III. 2.1 Documented evidence of farmers adopting technologies developed through ARPT

There are very few documented examples of farmers adopting technology developed by ARPT largely because the team has not been in existance long enough. In addition, the ability to have documented evidence of adoption requires a capacity to undertake monitoring and evaluation, which presently exists in very few provinces. Nevertheless, the following examples can be cited.

i. In Eastern Province, sunflower demonstrations were mounted following on-farm trials which showed a 100% yield improvement to early planting. A recent monitoring survey found that the average planting time for contact farmers who were exposed to the demonstrations, was the fourth week of December compared with the third week of January for non-contact farmers.

ii. In Luapula Province, three seasons on-farm trial results indicated that farmers could increase returns several fold to planting beans by row planting, reducing their seed rate, which is two to three times the recommended rate, and by introducing one weeding. Observations taken each year from farmers' fields found that farmers have reduced their seed rate each year the trial has been conducted.

III. 2.2 Farmers assessment of technologies being developed through ARPT

There has been considerable progress made in obtaining farmers' assessment about technologies being developed both through ARPT and the CSRTs. The ability of the team to collect and incorporate farmers' comments has improved from the time when ARPT was set up. This improved assessment is due partly to having established better cooperation with extension workers, partly through giving greater attention to improving the organisation of farmer field days and partly due to the involvement of the ARPT Sociology Section, which has developed techniques for provincial teams to elicit more genuine farmer comments. Farmers' assessment can have three possible outcomes; first if the assessment is positive the technology can proceed from an on-farm trial into more wide spread on farm-test demonstrations; second, they could cause ARPT to modify the treatments in an on-farm trial and third, the assessment could cause ARPT to discontinue work and pass the problem back to the relevant CSRT. There have been examples of all three types of assessments.

a) Positive assessment leading to on-farm test demonstrations

i. In Central, Eastern, Luapula, Lusaka and Western Provinces, farmers have commented favourably about several different maize varieties both hybirds and composite, some of which are shorter in duration than material previously available and these have gone into test demonstrations. Interestingly, in Eastern Province, farmers in a plateau farming system were enthusiastic about a short maturing composite maize variety MMV 400 which the CRT had earmarked primarily for the drier valley areas - farmers liked the earliness of the variety because it can meet their need for early food.

ii. In the valley system of Eastern Province, farmers have commented positively about the 'Steadfast' variety of finger millet which not only had larger heads than the local variety but was also judged to be acceptable for food.

iii. As already mentioned, farmers in an area in Luapula Province have agreed that the reduction of the bean seed rate, together with one weeding, has produced significant benefits and this will go into more widespread demonstrations.

b) Farmer assessment modifying on-farm trials

i. In a system in Central Province, the farmers questioned the wisdom of planting beans in flat seedbeds as compared with ridges owing to the problem of water logging.

ii. Farmers, again in Central Province, appreciated that zero tillage could assist earlier planting of maize but were concerned about the large quantities of water which had to be transported to the fields. Concern was also expressed by farmers who intercrop their commercial maize with pumpkins, squash, and cowpeas because the herbicide could seriously affect the intercrops.

c) Negative assessments resulting in trials being discontinued

i. When a poorly fabricated rotary jab planter was tested on farms, it gave highly variable seed rate and depth. Farmer comments were highly critical and work has been discontinued until a Farm Machinery and Tillage Research Team is established to ensure that only effective machinery is tested on farm.

III. 2.3 New recommendations drawn up and issued as a result of ARPT

A major achievement of ARPT in Eastern Province has been the compilation and in some cases revision of the Crop Memos for the three major farming systems in the province; Eastern Plateau ox-cultivators, Eastern Plateau hoe cultivators and Luangwa Valley hoe cultivators. These three crop memos have now replaced the single crop memo which covered all farmers in Eastern Province. This work was a joint exercise between ARPT, the Commodity Research Teams and the Provincial Agricultural Office. The revision was based on reviewing past trial work by ARPT and Commodity Research Teams as well as ARPT survey findings. The exercise helped to clarify the procedure for revising recommendations.

III. 2.4 On-farm experimental thrusts identified as particularly relevant to specific groups of farmers by the diagnostic phase of ARPT

One of the reasons for establishing ARPT was to help to develop a mechanism for identifying and quantifying technological problems of specific target groups of farmers. In so doing, both applied and adaptive research programmes could be formulated with those specific target groups in mind. Good progress has generally been made in this regard. However, it has not always been possible for ARPT to address itself to the key problems in each system on account of the non-availability of technical solutions which can be tested in adaptive, on-farm trials. This has resulted from the shortage of funds and manpower available for certain CSRTs. Some of the thrusts identified in different farming systems are listed below:

i. Central Province: Three systems in the province are characterised by shortage of labour at peak times, limited working capital and institutional constraints, which have all had the effect of inducing compromises on farmers' maize management. The experimental thrusts, in one of these systems has been:-

(a) The selection of shorter duration maize varieties which will help to spread the labour peak especially at planting.

(b) The local evaluation of the timing of weeding in relation to fertiliser application.

(c) Determination of economically optimal rates of fertiliser application for early and late maize plantings.

ii. Eastern Province: In the Eastern plateau system, three main thrusts have been identified.

(a) Labour is in short supply for planting and weeding maize, and work has focussed on finding shorter duration maize varieties and improving labour efficiency in weed control.

(b) Identification of late season, low input cash crops.

(c) Efficient methods of fertiliser use on maize and other cash crops.

iii. Luapula Province. In two systems in the province, the team, besides conducting rainy season experiments, has an extensive dry season trial programme in conjunction with several CRTs to identify suitable cultivars and agronomic practices to utilise the dambo areas of residual moisture during the winter. This would enable people to improve their diet and could somewhat relieve the labour bottleneck during the rainy season.

iv. Lusaka Province

(a) In the Luangwa Valley system, the environment is particularly harsh and the team is working to identify shorter maturing crops with better drought escaping characteristics.

(b) In a plateau system, near Lusaka, maize is late planted and receives insufficient fertiliser and minimal weeding on account of limited cash and labour. The experimental thrusts focus on shorter duration maize varieties for later planting and secondly, identifying other crops which could give better returns when late planted.

The above gives an idea of the range of experimental thrusts in the on-farm trial programmes but of course it excludes a large number of other trials being undertaken.

III. 2.5 Understanding through OFR/FSP diagnosis why current recommendations are not being widely adopted by farmers

ARPT has collected much information which indicates that small scale farmers frequently have to make compromises in the management of a single enterprise. Several common features have been identified.

- Small scale farmers produce to meet many objectives e.g. food, cash and social obligations, but decisions about subsistence production frequently override the others.

- Such farmers face shortages of labour, especially at peak periods, and have only limited cash available.

- The climate and institutional environments are often highly uncertain and farmers are obliged to adopt risk avoidance strategies.

For these reasons many recommendations, developed for individual crops in isolation, under good management at research stations, are not widely adopted by small scale farmers.

i. A specific example of these problems, which is representative of many farming systems, comes from a system in Central Province.

Until very recently, the recommended hybrid maize variety was SR 52, which is a 170 day hybrid and is recommended to be early planted. Data from the Serenje system showed that 88% of farmers used this variety but 43% of maize plantings were made with only 140 days of moisture remaining and 22 with only 125 days. Field tests have found that the loss of yield potential for such hybrid varieties can exceed 50% when planted even 28 days after the rains begin. The survey not only identified late planting of maize but also found that the late maize plantings were planted in poor seedbeds. Furthermore, weeding of the hybrid maize was both late and infrequent.

Findings of a diagnostic survey indicated that the reasons for the maize recommendations not being adopted were due to:-

(a) Subsistence objectives dominated farmers' priorities and farmers gave priority to finger millet, local maize and beans before hybrid maize.

(b) All crops, both subsistence and cash are recommended to be planted at the same time.

(c) The majority of farmers (72%) did not own oxen, and there is limited labour available for land preparation, planting and weeding. Cash to hire labour and oxen are also scarce.

ii. Lusaka Province: Another recommendation which was found not to be widely adopted was hand planting of maize by ox cultivators. The LIMA recommendation of maize aims to improve fertiliser efficiency by applying a known quantity of fertiliser in a beaker to a known row length of 25 m. This has been highly successful for hand cultivators but for ox-cultivators, in parts of Lusaka Province, who frequently plant by dribbing maize seed into every third furrow, the recommended method involves twice as much labour at the critical time of land preparation and planting. For this reason the ox cultivators have not adopted the idea.

iii. Eastern and Western Provinces: In both provinces those farmers applying fertiliser to maize often do so after the plants have emerged and not at the time of planting as recommended. Several studies and trials have been made of this and it has been found that farmers with limited cash do not wish to invest fertiliser on plants until they have emerged. Applying fertiliser with the seed at planting has been found to significantly lower plant populations when plantings are made light soils during dry spells. Farmers support their present practice by saying that it saves labour at planting (by not having to cover fertiliser) and that it is less risky in poor rainfall conditions. Trials have shown as a good response from applying basal fertiliser soon after emergence and by mixing with top dressing and applying them together.

iv. Varietal characteristics: The poor storage qualities of some maize varieties is another reason why some farmers do not purchase certain recommended varieties. Serious bird damage is inhibiting farmers from utilising new sorghum varieties more widely and acid sensitivity has made farmers reluctant to grow some groundnut varieties.

v. Uncertainty of input supplies and marketing: In several systems, farmers are reluctant to grow certain crops and are unable to follow recommended practices on account of non-availability or late arrival of inputs and or late marketing and delayed payment of produce.

III. 2.6 Technical, station based research thrusts identified as important to farmers and guided in decision by OFR/FSP

There are two types of information passed on to the CSRTs, first, information on specific problems requiring applied research and second, information about farmers' preferences for particular varietal characteristics which can be incorporated into breeding programmes. Much of this information provided by ARPT is not new to the CSRTs but can now be quantified more precisely and focussed on specific groups of farmers.

(a) Maize: In many systems the need has been identified for shorter duration varieties which can be planted, early for early food, as well as later to help spread the labour planting period. Streak resistance and an ability to store well are two characteristics which farmers consider to be important. A joint proposal is also being developed with the maize, sorghum and grain legumes teams to collect germplasm from Zambia's valley areas and incorporate information about the reasons why farmers prefer their local varieties. In so doing desirable trials from local germplasm can be incorporated into breeding programmes. Much of the maize has been found to be grown under different fertility levels and it has been suggested that National variety trials should be conducted under different fertility levels at research stations.

(b) Sorghum: The two main characteristics required of improved sorghum varieties are acid tolerance and bird resistance. A joint proposal in Lusaka Province aims to study some of the factors which have been reducing stand establishment of new varieties.

(c) Rice: A request for upland rice has been made by ARPT in Luapula Province and for swamp rice varieties suitable for late planting on dambo edges in Eastern Plateau areas.

(d) Millet: Shorter duration finger millet varieties suitable for late planting have been requested for the Luangwa valley system. A joint trial with the soil research teams at Luapula research station is evaluating different techniques for raising soil pH on permanently cultivated lands for finger millet production.

(e) Tubers: In Luapula Province, several promising lines of cassava, resistant to mosaic virus, having been tested at the research station were tested on-farm but were found to be susceptible to bacterial wilt which was not a problem at the research station. Work on the two problems is continuing.

(f) Grain legumes: Several ARPTs have requested improved beans, both dwarf and climbing for use in sole and intercrop trials. Short cooking time has been identified as being an important characteristic for beans in certain areas.

(g) Soil research: Several specific joint proposals have been made with soils research, on soil acidity in Northern and Luapula Provinces; on physical soil structure problems and possible pan formation in Central and Lusaka Provinces, and manuring practices in Western Provinces.

(h) Irrigation: A large programme of dry season dambo trials work is planned for Luapula Province and much work on variety screening and agronomy as well as water management is needed.

(i) Farm machinery and tillage: Several ARPTs have raised issues related to improving land preparation, planting and weeding through improved machinery. However, the team has very limited manpower and no full time joint proposals can be undertaken at the present.

(j) Food conservation and storage: Luapula province has identified the need to give preservation of fruit and vegetables much greater attention to provide a better diet for more months in the year. A programme has to be worked out with the Food Conservation and Storage team together with the nutritionist to identify appropriate preservation techniques. ARPT participated in a socio-economic evaluation of improved grain storage structures in conjuction with a loss assessment survey. Findings showed differences between traditional and improved structures were non-significant while the costs availability of materials and permanence of improved structures rendered them attractive only to the more wealthy farmers.

III. 2.7 Improved linkages between research and extension efforts as a result of ARPT

In general, good progress has been achieved in improving linkages between research and extension workers through the establishment of ARPT, most notably in those provinces which have already recruited Research Extension Liaison Officers.

In addition to general cooperation in the ARPT sequence of activities outlined in section II.9, several other important steps have been taken to improve the level of interaction between ARPT and extension workers.

1. Nine positions of Research Liaison Officers have been created in the Extension Branch. The Research Extension Liaison Officer (RELO) is a Provincial Subject Matter Specialist, who is a member of ARPT. The RELO is involved in all the teams activities but takes a major role during the on-farm test stage when together with Subject Matter Specialist and local extension workers, they monitor demonstrations and the adoption level of new technologies which have proved successful in on-farm trials. The RELO also undertakes a lot of training of extension staff in order to explain the farming systems perspective, in clear practical terms, and thereby help staff to plan their work programmes to address farmers' needs. Other important activities of the RELO include eliciting farmer reaction about new technologies being tested in trials, organising field days and extending the latest research findings.

2. The provincial ARPT committees provide valuable opportunities for ARPT staff and extension workers to discuss important issues regarding the work of ARPT. The committee is chaired by the Provincial Agricultural Officer and in addition comprises all ARPT staff, the Officer-in-charge of the Regional Research Station, all District Agricultural Officers, most Provincial Subject Matter Specialists as well as representatives from key institutions such as the Provincial Planning Unit, the Cooperative Marketing Union and the Provincial Agricultural Coordinator. The committee meets several times each year to discuss the following issues:

   - Results of ARPT's findings.
   - ARPT annual work programme.
   - Decides where ARPT will be working ie. which systems in the province.
   - Organisation of field days for farmers and extension workers.
   - Revision of research recommendations for the different farming systems in the province.
   - Decides what the technical messages should be in the different demonstrations being conducted by extension workers.

The provincial ARPT committee enables the province to play a major role in decision making and in so doing helps the process of decentralisation.

3. The use of extension workers as ARPT Trials Asssistants is another very important way in which field level extension workers are brought into day to day contact with the technology generation process. The Trial Assistants are seconded to ARPT for a period of 4-5 years, after which they resume their extension duties. Their work programme is decided by ARPT and they are responsible for the day to day supervision of the trials as well as collecting essential data and farmer comments about the trials.

4. Involvement of the camp extension workers from the Target Area, where the trials are conducted, is most essential. The camp staff need to be involved in the design of trials and the training of Trial Assistants, so that they can explain the objective of trials to farmers and be able to stand in for the Trial Assistants whenever necessary. Greater cooperation has taken place when they have been most fully involved in all activities and have been given most responsibility e.g. to organise farmer field days at the on-farm trials.

5. Through the Training and Visit system of extension, several opporunities for cooperation with ARPT have become possible. As the process of selection of contact farmers becomes more systematic, and contact farmers become representative of their community so it is possible for ARPT to select some contact farmers as trial farmers. Even where this is not yet the case, it is possible for the Train and Visit farmer groups to meet at the site of a farmer having ARPT trials, several times during the season, in order to get farmers' comments on the technology being tested. Similarly, the monthly training of block supervisors can be done two or three times during the season at the sites of on-farm trials.

6. The National Demonstration Programme (previously the Lima Fertiliser Programme) has been rationalised in such a way that there are two sources of ideas for demonstrations. The first, are those problems identified by farmers and extension workers at camp level who, for example, may wish to have demonstrations on weeding. This problem is discussed by the Provincial ARPT committee which decided what is the best solution to the weeding problem, given the circumstances of the farming system in question and results of previous research. The second source of demonstrations is the ARPT on-farm trials which, after several seasons may identify an important improvement for a particular farming system. This will then pass on to the on-farm test stage as a demonstration, to be carefully monitored by camp staff in the Target Agrea, where the ARPT on-farm trials have been conducted but not yet throughout the whole farming system. For both types of demonstrations it is the Provincial ARPT committees which makes the final decision. As an example, in Eastern Province, the on-farm demonstrations for the 1985/86 season have been agreed by the provincial ARPT Committee and include the following:

   (a) Demonstrate the value of MMV 400 which is a short duration maize variety providing early food.

   (b) Demonstration of yield loss resulting from late application of urea top dressing to hybrid maize.

   (c) Demonstrate the value of MM 601 as a short duration maize hybrid for later plantings.

   (d) Demonstrate yield improvements from planting sunflower at the recommended time.

7. By conducting farming systems research through ARPT, the research programme is becoming more "farmer oriented" and "bottom up" in its approach. The farming systems perspective can also help extension workers to have a better understanding of their target farmers and be better able to handle research recommendations as they are developed for the different farming systems in Zambia. For this reason, both formal and in-service training courses for extension staff are in the process of incorporating material on the practical use of the farming systems perspective.

III. 2.8 Input supply and credit decision mechanism re-geared to locally appropriate technology developed by OFR/FSP

Less progress has been made in this area, but attempts have been made in several provinces to involve planners, particularly at provincial level in ARPT's work. There have been several reasons for trying to involve planners:

i. To help decide whether the institutional and policy environment in different farming systems are fixed or whether improvements can be expected in the near future, which might affect technology adoption.

ii. If certain inputs or improved agricultural services are required to support a new technology, planners need to be made aware of these requirements.

iii. When new development projects are proposed planners can be informed about the probabilities of the technologies working in specific farming systems, to ensure that only feasible projects are implemented.

Interaction with planners has consisted of the exchange of information; participation by planners in the Provincial ARPT committees and participation by ARPT in several planning committees.

III. 2.9 Cooperation between ARPT and University of Zambia

Several attempts have been made to have closer cooperation between ARPT and different Departments at the University of Zambia including Economics, Agriculture and African Development Studies. The intention is to explain in particular, the importance of inter-disciplinary cooperation. The most recent area of cooperation has been with the School of Agriculture which has been intending to introduce a course on interdisciplinary cooperation for final year students as part of a research course. ARPT is hoping to be able to assist with running the course and may work with several under-graduate research projects, involving students from different disciplinary backgrounds to be undertaken in a farming system close to the university.

III. 2.10 Incorporating a nutritional perspective into research

With its area specific focus, OFR/FSP is able to identify the nutritional status of different target groups in different areas. In addition, it is able to attempt to address some of the root causes of nutritional deficiencies by using technology to utilise resources to either improve the quality or quantity of food produced or to use resources more efficiently e.g. save labour. In Luapula Province a nutritionist conducted a methodological study to see how best ARPT could incorporate a nutritional perspective into its work. In addition to the guidelines and manual prepared, three specific thrusts were identified in Luapula Province.

- Increased production of nutritious foods.
- Labour saving devices, especially for women.
- Food preservation and storage.

This nutrition perspective is currently being introduced into the work of all ARPTs.

III. 2.11 Better understanding of social and cultural issues affecting technology adoption

The work of the economist in each provincial ARPT and more especially of the ARPT Sociology Section, is generating a wealth of information about issues which have hitherto gone relatively unnoticed by agricultural scientists. With their community focus, the sociologists have drawn attention to the plight of resource poor households and the role of women in agriculture. To understand and address these issues has required the perspective and methodology of sociology. The methodology of both the survey and trial work is becoming increasingly sensitive to the social and cultural issues which play a key role in deciding whether farmers adopt a particular technology. In particular, a perspective on indigenous knowledge has been introduced, and methods of sampling and farmer selection are being improved.

III. 2.11 Assist national policy objectives

A specific objective for the research programme, contained in the Third National Development Plan, was to give greater attention to solving locally identified problems. This was part of the overall goal of increasing the process of decentralising decision making. The establishment of ARPT has helped the Research Branch to meet this objective.

IV. PART THREE: PROBLEMS WITH OFR/FSP

IV.1 Unrealistic expectations

There has been a tendency for some people, both in Zambian institutions including ARPT, and amongst foreign donors, to place unrealistic expectations on ARPT. FSR has been seen by some as a panacea; capable of solving many problems overnight and not as a complementary component within the technology generation and dissemination process. In addition it has not always been realised that ARPT is conducting research which takes time to produce acceptable results for farmers because some of the research will be unacceptable to them. Furthermore, the whole process of institutionalising FSR takes time because new perspectives, attitudes and relations are required of scientists and extension workers and these take longer to achieve than the relatively simple installation of a team to conduct OFR/FSP. The goals of ARPT must be clearly understood by policy makers and foreign donors and a realistic time frame for achieving these goals should be set, otherwise the team will be prematurely judged a failure.

IV.2 Difficulties in getting qualified and experienced Zambian staff for ARPT

Zambia has only a small cadre of qualified agricultural scientists and this has meant that ARPT has had to recruit new graduates from the University of Zambia with only limited experience. This has meant that it has been necessary to establish most provincial ARPTs using technical assistance personnel, which has created its own problems as mentioned below. However, it has also meant that, in some cases, work produced has not been of the highest standard. This, in turn, has caused concern amongst the more long standing and experienced scientists in

commodity research teams, some of whom have misgivings about the role of ARPT as will be mentioned below. This issue highlights the need to improve the undergraduate training given to agricultural scientists, in particular, by incorporating courses and research projects which emphasis interdisciplinary cooperation, on-farm research methodology and diagnostic survey techniques.

IV.3 Drawbacks with donor programme support

Two issues mentioned in the review guidelines are relevant in Zambia. First, there has been a tendency for certain donors to give insufficient priority to building a national capacity to conduct OFR/FSP. Attention has focussed more on the technical output of individual and technical assistance staff than on improving the national structure, manpower base and developing a capacity which will be sustainable in the long term. Second, certain personnel recruited have not been well versed in the concepts and methods of OFR/FSP and this has hindered effective interdisciplinary cooperation within provincial ARPTs.

IV.4 Developing methodology appropriate for Zambia

(a) Survey methodology

It has been necessary to take the methods of OFR/FSP as demonstrated by CIMMYT and modify them to suit conditions in Zambia. A much wider range of data collection techniques is now being used and these include multiple visit formal surveys, to collect 'flow' data, participant observation techniques as well as systematic agronomic monitoring in farmers fields. It has also been found necessary to recruit sociologists in order to give adequate attention to certain critical social and cultural issues which the ARPT economists have tended to ignore. Certain specific problems have been encountered. Tendency in surveys to select men and more progressive household and overlook women and resource poor households due to poor sampling frames and the lack of a community perspective.

A bias towards crops rather than livestock or off-farm enterprises.

(b) On-farm experimental methodology

When ARPT started on-farm trials there were fewer manuals and sets of guidelines available and thus several methods have been tried. Consensus is slowly being reached on various areas. Several specific problems have been encountered:

- Farmer selection has been biased towards wealthier male farmers and there has been a lack of a community perspective.
- Insufficient farmer and extension worker participation in trial design.
- Too large and scattered trials programme making it difficult to obtain meaningful data to explain all outcomes.
- Inadequate Trial Assistant and enumerator training, especially to ensure that good records are kept, including farmers' comments about trials.
- Insufficient quantified agronomic monitoring from trial farmers' fields.

IV.5 Inadequate data base

Insufficient use has been made of previous experimental data and survey reports partly due to the difficulty of getting access to this information and this has hindered ARPTs work and sometimes resulted in duplication of work. The need to have good bibliographies, libraries and micro computer data base systems is essenti

With such a data base, including ARPT data, it should be easier to pass information to commodity scientists, planners and policy makers.

IV.6 Difficulties encountered with building relationships between ARPT and CSRT Scientists

Several problems have been encountered with building effective relationships between ARPT and the CSRTs.

1. Certain criticisms of the work of ARPT have been made by CSRT scientists including:

   (a) ARPT has been accused of doing technical research which should have been done by CSRTs. This has arisen because for some crops, the number of technical solutions available has been limited, owing to limited funding and staffing of CSRTs. In addition many CSRTs have only recently recruited agronomists, in addition to breeders, and in general, staff turnover has been very rapid. Thus at times ARPT scientists have had to decide whether to work on lower priority problems or do some technical research themselves on research stations.

   (b) ARPT has also been criticised for repeating previous research. This criticism has arisen partly from the difficulty of locating previous research results but also due to the fact that it has not been fully realised that sometimes it is necessary to test whether biological relationships, which hold on research station, still hold under farmers' circumstances.

   (c) CSRT scientists are sometimes critical of the experimental designs, methods and apparent poor quality of work of adaptive research scientist There have been cases of poor research management of on-farm trials, sometimes due to the inexperience of agronomists and the results have not been accepted. However, some CSRT scientists, find it difficult to accept that on-farm trials will often look different from experiments conducted at research stations because of variation in non-experimental variables, under farmer management.

   (d) Certain CSRT scientists have considered that some ARPT scientists have acted unilaterally, without consulting them about certain issues, such as trial design. This criticism is, of course, not unique to ARPT but, nonetheless, being a new section, such behaviour helps to create the impression that ARPT sees itself as a panacea. This has necessitated the establishment of more formal occasions for interactions.

2. Resource constraints and considerable distances in Zambia have reduced the effective interaction between ARPT and CSRTs.

3. Insufficient attention has been given to ARPT-CSRT interaction in project documents and job descriptions concerning ARPT and CSRT.

4. There has also been a tendency for scientists, in both ARPT and CSRTs, to be concerned with their individual disciplinary programmes, rather than with interdisciplinary cooperation. This is in part due to the fact that recognition and promotion are largely made on the basis of disciplinary excellence. There is a need for university training to give greater emphasis to interdisciplinary cooperation as well as to disciplinary excellence.

IV. 7 Problems encountered with achieving effective relationships between ARPT and extension

1. Lack of Research Extension Liaison Officer in some provinces.

2. In some areas there has been insufficient awareness of the purpose of ARPT amongst extension workers.

3. Insufficient forward planning by ARPT staff has reduced the involvement of extension workers in ARPT's activities.

4. Lack of resources prevent extension workers participating as much as is desired.

5. Insufficient time is allocated by extension workers to interact with research workers.

6. Lack of sensitivity of extension workers to the problems of resource poor farmers. Insufficient attention has been given during extension workers' training to teaching methods which could enable workers to better understand farmers' problems.

ARPT is closely monitoring its activities and methods and in this way has identified the above problems. Steps have already been taken to address most of these problems and there is optimism that considerable improvement will be achieved in the near future.

ZAMBIA: QUESTIONS ON COUNTRY PAPER

Mr J. Gatheru (Kenya)

I see in the table 'Positive Farmer Assessment' but no adoption by farmers.

Response

Assessment comes in during the trial programme, allowing re-designing of experiments or decisions on recommendations, ie. before both recommendation and adoption.

Dr D. Dafalla (Sudan)

Why dont farmers adopt your recommendations for fertiliser application rates? I am surprised to hear that there are no agricultural graduates to employ though Zambia has a Faculty of Agriculture.

Response

A new Faculty of Agriculture, with only 15-20 graduates per year until 2-3 years ago, and a big commercial sector.

Dr Seme Debela (Ethiopia)

How do adaptive and commodity scientists cooperate in setting up programmes?

Response

It has been a major problem. We have set up procedures and compulsory meeting opportunities between the 'two sides' and incorporated commodity scientists into both survey and trials design and evaluation.

APPENDIX I

ADAPTIVE RESEARCH PLANNING TEAM

SEQUENCE OF ACTIVITIES FOR UNDERSTANDING FARMERS' PROBLEMS TO PRODUCE ACCEPTABLE RECOMMENDATIONS

ACTIVITY	OBJECTIVE	PARTICIPANTS	DURATION (Approx.)
1. Zoning	Group farmers by their farming activities into different farming systems.	ARPT staff interview extension workers and community leaders.	3-6 months
2. Survey	Study the constraints of each farming system to understand the farmers' problems and identify potential for development	ARPT staff interview farmers using extension workers as enumerators	3-9 months
3. Research Priorities	Formulate a programme of applied and adaptive research which aims to solve the most important technological problems identified in the farming system.	ARPT staff with Commodity and Specialist Research Team staff plus Provincial ARPT Committee members.	2-3 months
4. On-Farm Trials	Test, and, if necessary, modify the possible research solutions on farmers' fields under realistic conditions until acceptable solutions are found. The trials are conducted on 3-10 farms within the Target Area.	ARPT staff with the Trial Assistants provided from Extension Branch.	2+ years
5. On-Farm Tests	Information about technological components or packages which are successful in on-farm trials are extended by various means, including on-farm tests/demonstrations, still within the Target Area. The level of adoption is monitored.	Research Extension Liaison Officer with camp level extension workers.	1-2 years
6. Recommendation	Technological components or packages which are adopted by the majority of farmers within the Target Area are then released and extended to farmers throughout the farming system.	ARPT staff CSRT staff and Provincial ARPT Committee members.	

DIAGRAM 1. ORGANISATION CHART FOR MINISTRY OF AGRICULTURE AND WATER DEVELOPMENT

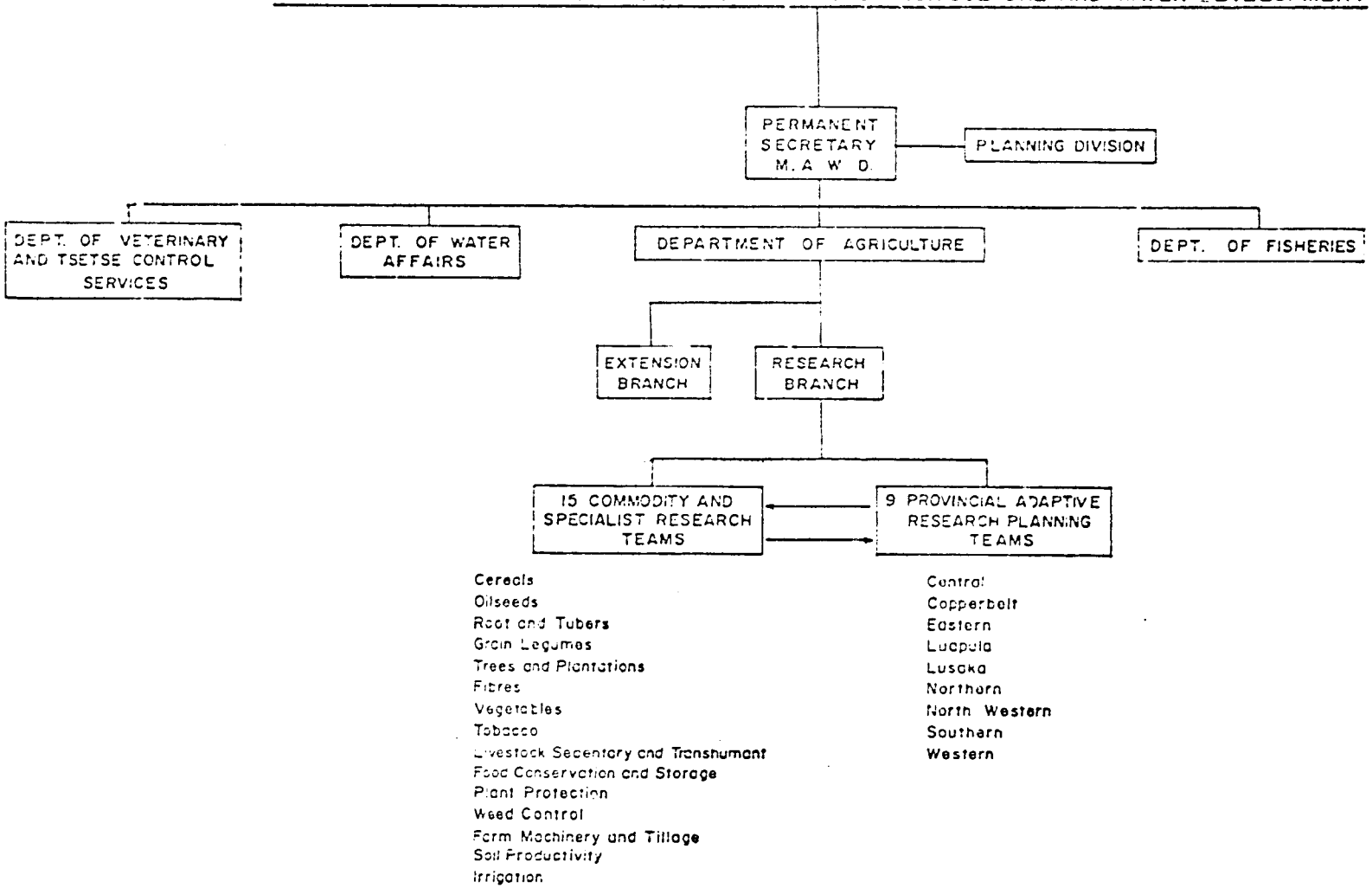
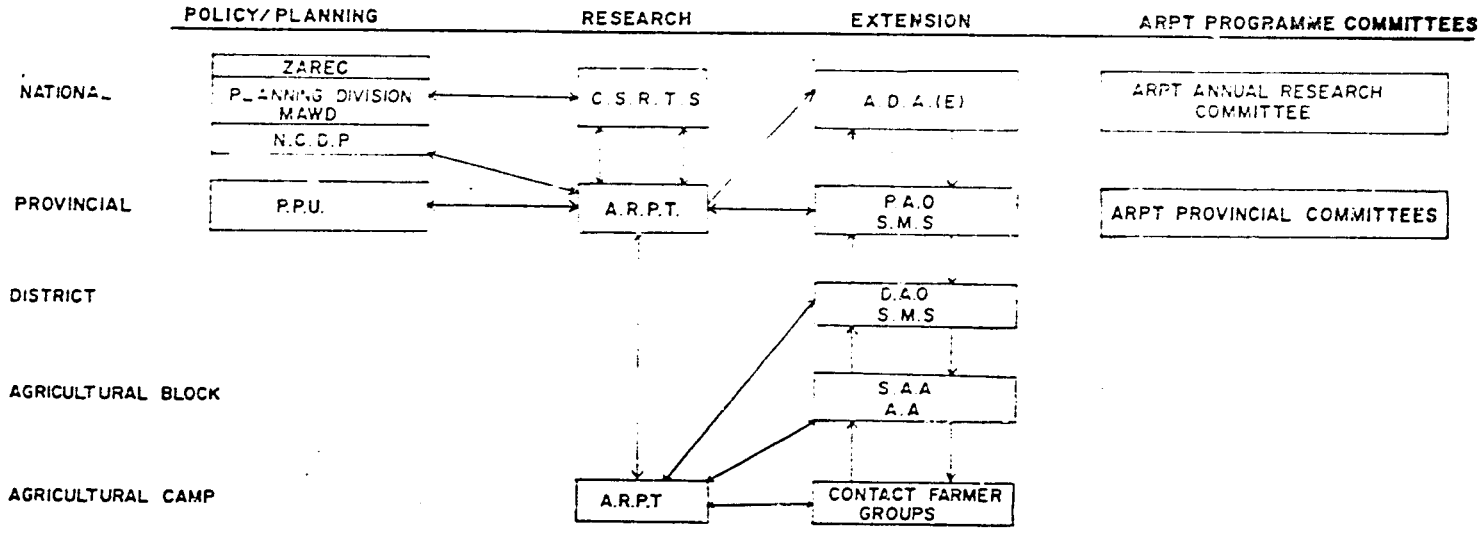


DIAGRAM 2. OUTLINE OF THE RESEARCH, EXTENSION AND PLANNING SYSTEM



ZAREC—Zambia Agricultural Research and Extension Council.
PLANNING DIVISION, MAWD—Planning Division in the Ministry of Agriculture and Water Development.
N.C.D.P—National Commission for Development Planning.
P.P.U—Provincial Planning Units.
C.S.R.T—Commodity and Specialist Research Teams.
A.R.P.T—Adaptive Research Planning Team.
A.D.A(E)—Assistant Director of Agriculture (Extension)
P.A.O—Provincial Agricultural Officer.
S.M.S—Subject Matter Specialists.
D.A.O—District Agricultural Officer.
S.A.A—Senior Agricultural Assistants.
A.A—Agricultural Assistants.

FARMING SYSTEMS RESEARCH EXPERIENCE IN ZIMBABWE

by

M. Avila and B.N. Ndimande*

ABSTRACT

Considerable FSR experience has been gained by international and national research centres in the developing countries. However, critical aspects to be considered in institutionalising FSR are the appropriateness of the model, team composition and interaction, and the role of station scientists.

Agricultural research has a well established reputation in Zimbabwe. Although the focus was primarily on the large scale commercial sector, on-farm research in the communal sector has dramatically increased since independence, covering all natural regions and traditional and new enterprises.

The FSR Unit is one active group in DR&SS in the communal areas. Key characteristics of the programme include: antonomy of the crop/livestock unit, participation of station researchers/extensionists and international research centres and interfacing of diagnostic and technology screening methods. Some beneficial effects are stated as improved understanding of the communal systems, modified direction of research priorities, cooperation with development and training institutions, and farmers' interest in some technology outputs.

Some problems identified refer to administration, communication/organization, number of workshops and meetings, visitors from abroad, and institutional interests of international centres.

The future of the FSR Unit in DR&SS points to a more active role in research planning and coordination, more emphasis on farmer-managed trials, and greater collaboration with the extension organization.

OVERVIEW OF FSR AND PROBLEMS

FSR is an approach for generating appropriate technologies that evolved over a rather extended period in many developing countries because of the need to study the existing farming systems and involve the technology users, usually the small farmers, in the planning and evaluation process. The approach is justified on the basis of three vital considerations. Firstly, the farmer and his family are rational in their decision-making process. Given their available resource base, circumstances, opportunties and knowledge, they typically manage a combination of crops, animals, other on-farm and off-farm activities to satisfy basic physical, financial and social needs. Secondly, the production system of small farmers, embody an integrated set of husbandry practices that has developed over centuries to the extent that these systems are stable, complex and very sensitive to the ecological, biological and socio-economic environment. Thirdly, a farming system belongs to the goal-setting and purposeful category of systems and its direction is determined by the farmer and his family. The decision to introduce changes or adopt any innovation depends entirely on how the household assesses the relative advantages and disadvantages in terms of its own perceptions and priorities. Because of these considerations, FSR is an interdisciplinary, integrative, problem-oriented and farmer-centred approach.

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* FSR Unit, Department of Research and Specialist Services, Harare.

The research experience on cropping systems at international and national institutions in the context of the developing countries has resulted in a progressive refinement of FSR concepts and methodologies (Harwood 1979, Byerlee et al 1980, Gilbert et al 1980, and Zandstra et al 1981). Similarly there are research experiences on livestock production (Li Pun and Zandstra 1982, Fine and Lattimore 1982, CATLE 1983, Gryseels and Anderson 1983, and Ruiz and Li Pun 1983) and mixed production systems (McDowell and Hildebrand 1980, Hart 1981, Fitzhugh et al 1982 and Huxley and Wood) which have successfully applied FSR approaches and methodologies. State of the art reviews have also been carried out at the request of donors (Dillon et al 1978, Shaner et al 1982, and Simmonds 1984).

At first glance the review of the wide range of experiences tend to strongly suggest a state of confusion in FSR. There appear to be differences in terminologies, approaches and methods sometimes exaggerated intentionally by FSR proponents for personal or institutional reasons. Upon careful analysis, however, these differences can be explained on the basis of the following characteristics of research programmes: the primary objective (system description and analysis, technology development, or methodology development), the type of farming system/environment interaction under study (maize production in humid areas, lowland and upland rice production, savannah livestock production, agroforestry in semi-arid areas, etc.) and the composition/leadership of research teams (economic, agronomic, land use planning, plant protection, or other bias). Furthermore, it is interesting to note that crop FSR generally tends to have its roots in the "Green Revolution" and studies of adoption pattern; livestock FSR in systems analysis and modelling; and agroforestry FSR in resource conservation and ecology. These schools of thought determine to a large extent how the practitioners perceive and analyse a given farming system.

Inspite of the varied experience and schools of thought there is a consensus on FSR philosophy and strategy. To improve a farm system, it must be studied and understood. FSR is an interactive stepwise process that has three actors - the researchers, extension agents and farmers - in the conduct of the four basic phases:

- Characterization involves an understanding of the structural and functional relationships or current farming systems in specific geographical areas an identification of the endogenous and exogenous constraints to achieving farmers' goals.

- Design of technological alternatives involves an ex ante evaluation and selection of strategic interventions - components, inputs and/or practices - that results in a well defined and effective agenda for follow-up research with respect to farm monitoring, component experimentation and/or technology testing.

- Testing involves evaluation, on farmers' fields and under partial or exclusive farmer management, of the assumptions, decisions and expected performance of the technological alternatives as designed in the previous phase.

- Diffusion usually refers to the dissemination of tested innovations to credit and extension personnel or to small groups of farmers usually through intensive assistance. Large-scale adoption and impact on productivity is more difficult to achieve.

Athough extension to farmers is an intrinsic activity of FSR, there are not many experiences in this phase. In most instances FSR is planned and managed by research organizations with very little attention to the basic needs, responsibilities and capabilities extension professionals can bring to bear on the technology generation and utilization process.

The institutionalization of FSR in the context of national programmes has also been a problem, due in part to the following reasons:

- high input FSR model: FSR is usually financed with donor assistance and teams are highly trained, logistic support is excellent, and their administration is rather efficient (farmers may even be compensated for cooperating). When donor assistance ends, FSR activities drastically diminishes, if not end.

- Team composition and interaction: questions arise as to what is the most effective way to conduct interdisciplinary research, particularly on crop/ livestock production systems. The influences of disciplinary biases and objectives, academic interests and professional advancement, are often cited as obstacles, but probably the major obstacle has to do with who sets the terms of reference for whom in the research process. Another critical factor is simply personalities.

- Role of station scientists: FSR has often been presented as a criticism of traditional on-station research, however they are complementary, not only with respect to the generation of technical information but also with regard to their contribution on the various phases of OFR. For example, identifying relevant production constraints may require experienced natural scientists to analyse the technical interactions of the system at an early stage in order to gain time.

There are some of the FSR experiences and methodological problems that were considered to design the FSR model in the Department of Research and Specialist Services in Zimbabwe (DR&SS).

FSR MODEL

Background

The tremendous success of agricultural development in the large-scale commercial sector of Zimbabwe can be attributed to the skillful implementation of appropriate government policies and to a large extent to the intensive interactions and effective communication between farmers, development or extension officers and researchers from different institutions in the country (Saunder 1978; Kirkman 1985). As far back as 1909, for example, trials were being established on farms because of the need to test crop varieties and husbandry practices under farmer conditions, and by 1922 more than 300 farmers were participating on this programme (Weinmann 1972). The close association between researchers and farmers ensured precise definition of production constraints and researchable problems and quick feedback on the profitability and acceptance of technological innovations produced by DR&SS, under practical management conditions (J.L. Grant, personal communication, 1984).

With respect to communal agriculture, these linkages are also absolutely necessary and the appropriate mechanisms and methodologies to achieve such interactions must be adapted from past experience or developed to reduce the existing productivity gap between these two major sectors, as estimated by Tattersfield 1982.

Because of the need to focus more directly on the communal sector, several national institutions have initiated OFR programmes (Shumba et al 1985). The Faculty of Agriculture and the Institute of Applied Social Studies, University of Zimbabwe, are investigating soil profiles, sorghum production and household labour patterns in the Subungwe region. The Agricultural and Rural Development Authority has carried out socio-economic and technical surveys of various communal areas for designing development projects. The Dairy Marketing Board is presently carrying out fodder production and feeding experiments within the framework of pilot projects to stimulate milk production. In the extension organization AGRITEX, the Monitoring and Evaluation section is conducting

studies to identify socio-economic and institutional constraints to technology adoption, and the Institute of Agricultural Engineering is developing appropriate technologies for animal draught and grain storage. In all provinces, AGRITEX teams have established experiments with and demonstration for farmers.

OFR in the communal areas has been a major thrust in DR&SS in the last 2 years. Such research basically consists of formal and informal surveys (approximately seven have been carried out by its various institutes and units) and on-farm research trials (Avila 1985). The distribution of OFR trials by region and institute is presented in Table 1. There are four very active groups: FSR, AI, CBI and CRI. The work is slightly concentrated in Natural region II but there is a large proportion in regions III, IV and V, the lower potential areas of the country which accounts for approximately 90% of communal lands.

Table 1. Distribution of OFR trials according to natural region and institute/unit, DR&SS

Region	FSR	AI	CBI	PPRI	SPRL	LSR	CRI	TOTAL NUMBER
	%							
II	72	16	19	86	86	-	-	140
III	-	29	41	5	12	-	50	87
IV	13	55	30	-	12	12	50	126
V	15	-	10	9	-	88	-	56
TOTAL NUMBER	105	118	54	18	17	34	63	409

FSR Farming Systems Research, AI Agronomy Institute. CBI Crop Breeding Institute PPRI Plant Protection Research Institute. SPRL Soil Productivity Research Laboratory, LRS Lowveld Research Station and CRI Cotton Research Institute in DR&SS.

With respect to enterprise breakdown, 23% of these trials deal with maize, 20% sorghum, 12% groundnut, 9% sunflower, 4% soyabean, 8% millets, 5% cowpeas, 1% field beans, 15% cotton, and 3% forage legumes and veld reinforcement. The FSR Unit has recently initiated trials on crop residue improvement for feeding draught animals. Most of these trials are in their second year and thus will continue for the next two to three years.

Because of the dramatic increase in OFR work, the FSR Unit must clearly define its role in DR&SS in terms of serving as an effective link between researchers, extensionists and development planners.

Organization of the FSR Unit

The specific objectives of the Unit in DR&SS are to study mixed crop and livestock production systems in the communal areas; to adapt, develop and test on-farms improved crop and livestock production technologies and systems; and to provide information for the formulation of agricultural development policies for the communal areas (FSR Unit, 1985). The FSR Unit is autonomous, neither under any of the three divisions in DR&SS (Fig. 1). The rationale for this decision was that a) opportunities to improve the farming systems should be assessed from a whole farm perspective which invariably involve crops and livestock and b) team interaction, given a minimum critical mass of researchers, was considered essential for developing and implementing appropriate FSR methodologies (Chigaru 1984).

The FSR Unit consists of one agricultural economist (team leader), two livestock scientists, two agronomists, eight research assistants and four field hands under the overall coordination of the Deputy Director of DR&SS. The five-member core team, which is stationed at DR&SS Head Office in Harare, is technically responsible for designing or adapting research strategies, methodologies and programmes of work and for guiding, supporting and participating with the field teams in the implementation. One member of the Head Office team has also been assigned the task of coordinating technical and resource inputs for and monitoring the activities in each of the two selected communal areas.

A field team, consisting of a research technician, two agricultural assistants and two field hands, has been permanently assigned to each area. Specifically their duties include selecting suitable research sites and farmers, conducting farming systems surveys and monitoring studies and implementing research trials as well as continuous liaising with farmers to obtain feedback on proposed interventions and as they develop competence, participating in the analysis and interpretation of research results.

The contribution of institute or station research scientists of DR&SS to the FSR Programme has been substantial in that they have provided reviews of past research on key topics or problem areas, have assisted in assessing farmer situations and identifying research opportunities in situ, have participated in designing research trials, and are planning to establish on-station trials which have been identified as priorities for component technology development. The close interaction between the FSR staff and station scientists in the various DR&SS activities has resulted in a better understanding of FSR philosophy and strategies and in a mutually beneficial working relationship.

An interesting feature of the model is the active participation of the extension staff and organized communal groups in the research programme. Extension staff usually helps with designing and carrying out diagnostic activities. Additionally, to cover a large number of households while saving on travelling time and costs, trial sites in each research area are clustered on the basis of extension workers and their farmer groups, given particular soil, climatic and farmer characteristics. Extension staff participate in discussions on farmer problems, research progress and research diagnosis. Extension workers accept responsibility for establishing and monitoring farmer-managed trials and conducting season. An added dimension of extension participation is the contribution of the social experts in planning and implementing household and community decision-making studies in support of the technology testing process.

The international research centres, IDRC, CIMMYT and ILCA have a special role to perform in terms of providing experienced scientists whose aim is to assist, complement and build on FSR in DR &SS. They provide technical expertise in methodological approaches and subject matters, training of the staff and documentation services. The participation of all the centres has been coordinated to focus almost exclusively on the felt needs and priorities of the FSR programme.

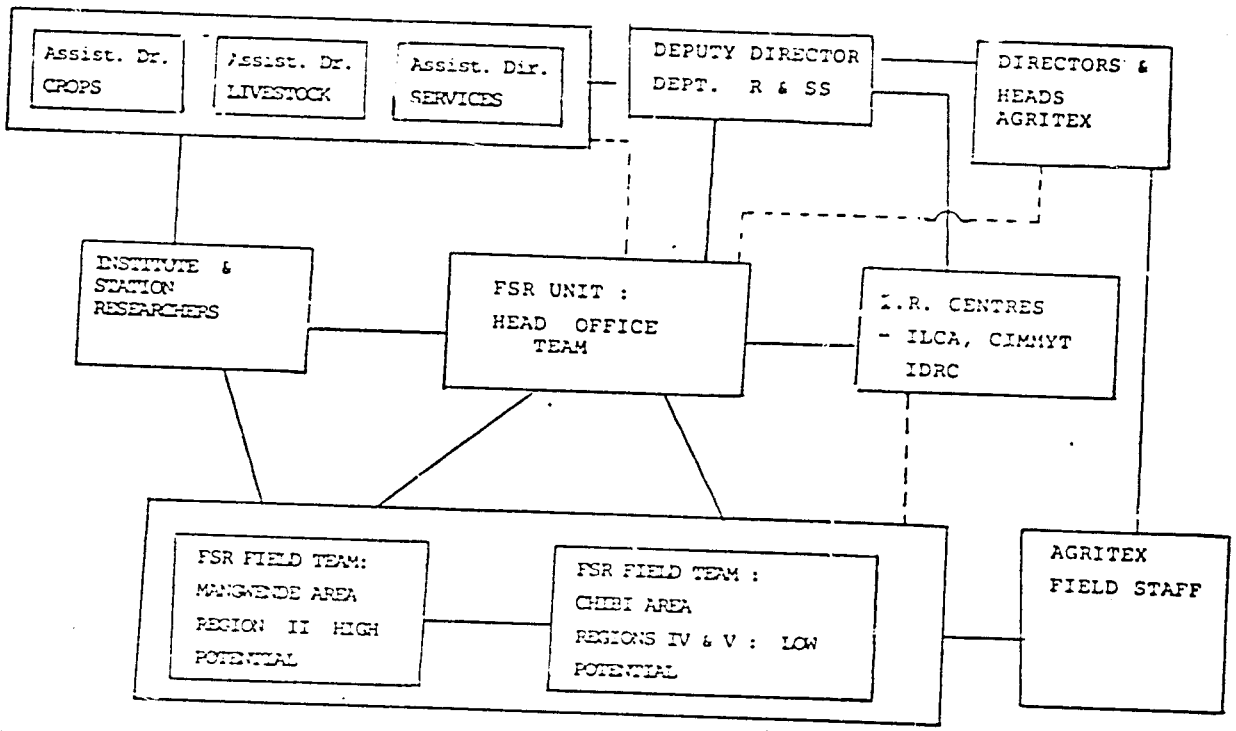
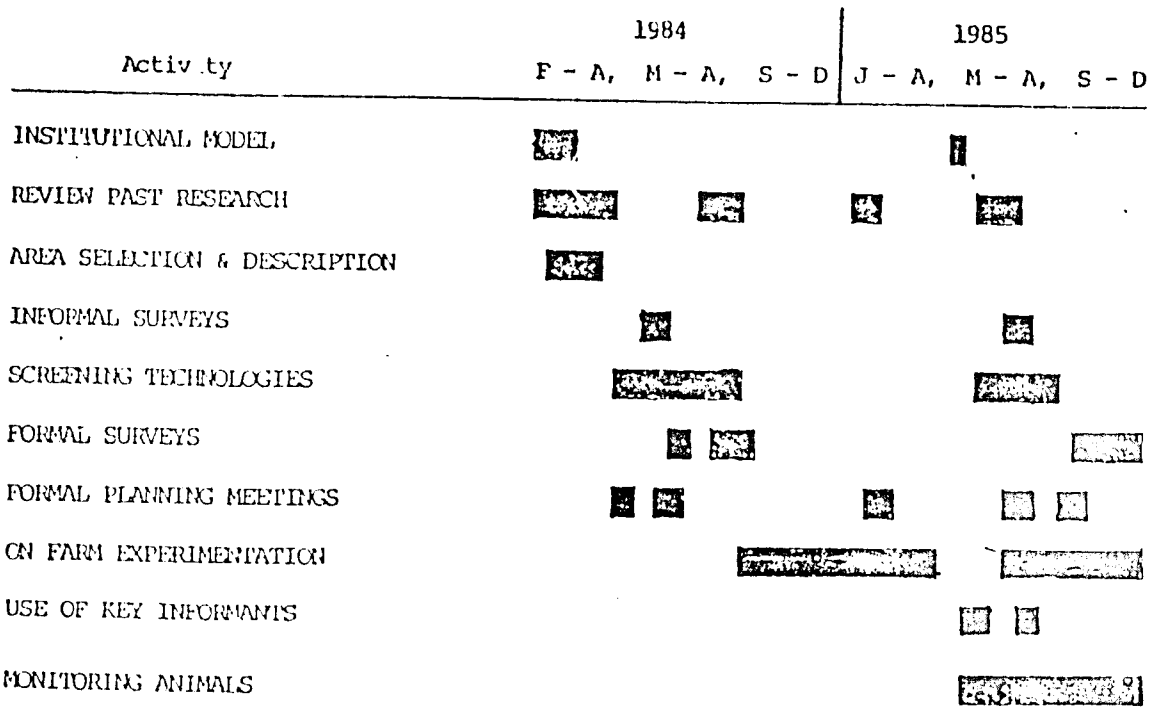


Fig. 1. Organization of the Farming Systems Research Unit in DR & SS

Methodological steps

The FSR Unit implemented the following activities in 1984 and 1985 which delineates the stepwise procedure being followed:



There are several points worth noting in this stepwise procedure being followed. Firstly, several diagnostic methods have been sequentially employed to satisfy the immediate information requirements of the research team at each particular phase. Secondly, methods and procedures that promote team interaction have been selected. Team work and analysis have been the basic modus operandi, particularly in the review of past research, area selection, screening technologies, etc. Thirdly, most of the time has been spent on on-farm experimentation, ex ante evaluations, and reviewing past research, in that order of importance. These are the productive activities of adaptive research as far as designing and evaluating appropriate technologies is concerned. Fourthly, planning meetings have been extensively used, first at each research area with the extension collaborators to analyse the previous years' results and henceforth to plan the preliminary programme for the following year, and subsequently at the head office with station researchers and foreign experts (CIMMYT and ILCA) to improve proposed research designs, identifying needed complementary on-station research and obtain relevant information from other research work in Zimbabwe or elsewhere. In this respect, probably the most important benefit of these meetings has been the accelerated way in which the FSR Unit has improved its technical competence and gained experience in group work.

At every step in the design process, decisions and assumptions are being made to the basis of the actual on-farm, community and exogenous conditions or on the basis of possible changes that could be affected thereof. It is essential to record them for two simple reasons. Firstly, such decisions and assumptions define the target group of farmers (e.g. farmers with and without draught cattle, farmers with and without fallow arable land) for whom each technical intervention is being designed and therefore with whom interventions should be tested.

Results of the testing phase further refine the definition of the target groups. Secondly, the set of "possible" changes which is assumed in the design phase and becomes necessary to promote adoption after successful testing, defines the basis for interphasing FSR with the political or policy setting entities. In other words, researchers can also be very precise as to what non-technical elements need to be assessed or changed (credit, markets, roads, etc.) to promote particular innovations among farmers. These should be formulated into policy recommendations for communal area development.

This particular model of FSR in DR&SS and the methodological steps followed were designed to the peculiar circumstances prevailing in Zimbabwe, namely: the strength and tradition of the agricultural research organization, the DR&SS commitment to FSR, the objective/commitment of the international centres and present socio-economic and organizational conditions in the communal areas. Periodically the model is and will continue to be assessed by DR&SS directors and reseachers, with the assistance of foreign experts, to improve its operational efficiency.

Usefulness of the FSR Unit

Not all directors and professionals in DR&SS are totally convinced of the necessity of the FSR as it exists at present, however, it does have full administrative and financial support. In the long run, their doubts and skepticism will disappear only if the FSR Unit can produce the expected results. ie. appropriate technologies for the target farmers, and quality research papers and information for the station scientists/planners/other professional working in the communal areas.

With respect to appropriate technologies for target farmers, it is only possible to speak of circumstantial evidence that will likely affect their adoption patterns So far more than 100 farmers in Mangwende are using the ripper tine + herbicide technology which has been developed to reduce draught and labour bottlenecks. Although it is not a formal recommendation, it is estimated that it can increase net cash income by 31% and returns to labour by 63% over the present conventional tillage + handweeding practice (FSRU, 1985). Farmers have also shown keen interest in other cash crops being tested in the area (sunflower and soybean), forage legumes and strategic feeding of draught animals.

During the last 2 years, the FSRU Unit has involved a large number of households in its various activities: approximately 200 with on-farm trials, 100 with the livestock monitoring studies, 400 with the formal and informal surveys, and a minimum of 1000 have attended field days. Usually there are more offers than the Unit can accommodate. Such intensity of contact should difinitely improve farmer knowledge and management capabilities.

During the last 2 years, the FSR Unit has notably enhanced its understanding of the communal production systems, its needs and potential opportunities for improvement (FSRU 1985). This knowledge is evident in several contributions the Unit is making, ie.

- assistance in modifying on-station research: forage legumes under different production patterns, intercropping of cereals with legumes, urea utilization for cattle supplementation, and manure management.

- design of a large scale livestock study for the Department of Veterinary Services, Ministry of Lands, Agriculture and Rural Development.

- collaboration with AGRITEX: labour-saving and draught implement testing with farmers, designing of farm management research, and field staff training.

- cooperation with University of Zimbabwe: lectures to B.Sc. students and OFR/FSP training workshops with CIMMYT.

In general there is a strong demand for updated technical information of the communal areas required by planning and development organizations such that the FSR Unit is often consulted or requested to attend meetings.

It seems that the extension organisation has seen some benefits of working with the FSR Unit since there is a standing request from at least two provincial offices that the FSR Unit begin work as soon as possible in their areas.

Problems of the Unit

Although the FSR Unit has excellent administrative and financial support, there are some problems that are particularly disturbing for off-station work.

1. Quick processing of subsistence claims, particularly for research assistants who carry out their duties at the grass-roots level, is an absolute must. Administrative delays at various levels (field-head office-ministry, etc) make recovery of monies very slow, as much as 2 months.

2. Procurement of inputs is sometimes a very tedious exercise due to stringent tender board regulations. This together with lack of strategically located storage facilities and unsatisfactory transport infrastructure often cause failure to meeting optimum operational periods.

3. Due to strict audit regulations, no petty cash is allocated for meeting any emergency or small problems.

The organisational structure and chain of command within divisions in DR&SS does not facilitate horizontal communication and joint planning particularly in cases where the mandate for programme approval rests fully with the individual heads. Of course the problem in Zimbabwe is probably less serious since in some countries there is more than one research institution, and communication and planning between these institutions may be non-existent. This usually results in duplication of efforts and ineffective use of limited national resources.

One of the most distracting activities is the proliferation of workshops and meetings, both at the national and international levels. More often that not, these meetings tend to be too general and unproductive and competition for the very limited national staffs leaves less time for programme implementation. Furthermore, senior administrators tend to spend a large proportion of time on ministerial meetings, resulting in reduced attention to their divisions and leaving crucial matters unresolved too long.

Harare and Zimbabwe are becoming a metropolis of international agricultural activity, and visitors to DR&SS are quite frequent such that senior administrators and scientists spend much time dealing with them. Some are very useful (Professionals from international centres and donor community), but many just want some information of communal area agriculture, a topic other DR&SS scientists are conveniently willing to concede as the expert domain of the FSR Unit.

Finally, it must be mentioned that it is quite a task to have international research centres working together. Suffice it to say that there are differences in institutional and personal styles, objectives, methodologies and, of course, competition. DR&SS hopes that, however valuable their expertise, they can only be successful in their own mandate if they support and reinforce the technical capability and professional dedication of the local staff.

FUTURE STRATEGIES OF THE FSR UNIT

FSR was initiated in 1980 under the Agronomy Institute with the technical and complementary financial support by CIMMYT. In 1984 it was expanded to cover livestock production with the technical and financial assistance of IDRC and ILCA, including the provision of an expatriate as team leader. In 1986 a local team leader will be selected and another livestock scientist will be hired to

replace the only other expatriate on the Team, thereby eliminating all expatriates from the permanent staff. Then the FSR will be a truly national programme.

The general approach of the FSR Unit will continue with some minor modifications of emphasis. Firstly, the FSR Unit will concentrate its efforts on farmer-managed trials in the light of the increased operations of other DR&SS institutes in the communal areas. However, this implies that more attention must be given to technical coordination which will be a priority concern of the FSR Unit. Already the Department encourages a series of informal and formal activities to promote coordination: seminars, peer review papers, field trips, joint field projects and coordination meetings. To improve the identification of research priorities and selection of projects, the institutionalisation of technical Advisory Committees has been proposed to assist the directorate in assessing research proposals in relation to DR&SS policies and priorities, previous research results and other on-going research within and beyond DR&SS.

A DR&SS symposium is being planned for July 1986 with a view to identifying research priorities and implementation strategies for improving crop and livestock productivity and sustainability in the communal areas. It is believed that taking stock of knowledge of existing production systems and research progress after three years of intensive work in the communal areas should provide a sound base for an in-depth analysis by competent scientists as to what directions DR&SS should take during the next decade.

The increased emphasis on farmer-managed trials aimed at developing farmer recommendations will definitely strengthen FSR Unit - AGRITEX bonds.

There are already proposals for AGRITEX provincial specialists to participate more actively on FSR trials on the justification that such experience would put them in direct contact with most recent research results, gain more knowledge of the existing production systems and intervention possibilities and thus provide more relevant information and back up to their extension workers. Such proposals, if implemented, will provide in the long run a more effective means whereby DR&SS can serve its clients, both extension agents and farmers.

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ZIMBABWE COUNTRY PAPER QUESTIONS

Dr D. Dafalla (Sudan)

How are the four organisations working on FSR in Zimbabwe coordinated?

Response

Each has a slightly different mandate, e.g. Agritex - service supply bottleneck identification and demonstration. University has a training programme emphasis. Agritex and DR&SS are working towards coordination.

Prof Mphuru (Tanzania)

What of all the other scientific disciplines, pathologist, chemists, etc. do they not take part. Are animals not of interest?

Response

Commodity/on-farm researchers are complementary and interact to generate and locate technologies appropriate to specific groups of farmers.

PART II: ORGANISATIONAL ISSUES IN ON FARM RESEARCH

INTRODUCTION.

Many research and extension administrators in the region had brought up issues on the organisation and management of OFR/FSP since the last senior administrators meeting in June 1984. The second days programme was dominated by group discussions focussed on four of these issues;

A. Building OFR into existing Agricultural and Extension institutions.

B. Systems based OFR as a Research/Extension Linkage

C. OFR, Farmer Recommendations and links with Planning, Services and Policy.

D. Programming and Management of OFR teams.

Participants chose the issue they preferred to discuss and divided into groups. Each group had a chairman and rapporteur. In this Part II of the report the briefing papers on each issue are followed by a summary of the questions and comments arising during the groups discussion.

These four briefings are relevant to three roles to be played by a systems based On Farm Research approach in national agricultural research and development efforts:

(1) Identifying improved technologies relevant to the priority needs of local specific groups of farmers and, where necessary, adapting them to local conditions.

(2) Feeding back priority technical problems of local specific groups of farmers to focus and help prioritise commodity specialist technical research, much of it done on research stations.

(3) By operating among farmers, on their fields, providing a link between farmers and research and between research and extension.

Table 1. shows one sequence of OFR activities and possible roles of different institutional actors in each activity. One asterisk indicates the actor has a role, two that the actor has a dominant role, in that activity.

TABLE 1. Possible roles for 5 actors in Systems based OFR activities; Farmers, OFR Scientists, Commodity and Specialist Scientists, Extension Staff and Regional or National Policy makers and Planners

OFR Activities	FARMER	OFR	CST	EXT	POLICY PLAN
1. Target Grouping		**		*	*
2. Selection of priority target groups				*	**
3. Diagnosis					
(a) Interpretation of Background Information	*	**	*	*	*
(b) Informal Survey	*	**	*	*	
(c) Formal Survey		**		*	
4. Planning Relevant research thrusts		**		*	
5. Prescreening apparently relevant solutions					
(a) Technical i. Adapted to local climate etc		*	**		
ii. Interaction with local farmer Management practices		**	*		
(b) Economic i. Can technology be serviced locally		*		*	**
ii. Is the technology compatible with the farmers system	*	**		*	
iii. Is is profitable to the farmer in local economic circumstances	*	**		*	
6. Experimentation on local farms					
(a) Researcher Management					
i. Planning		*	**		
ii. Implementation		**	*		
iii. Assessment	*	*	**		
(b) Res/Farmer managed					
i. Planning	*	**	*	*	
ii. Implementation	*	**		*	
iii. Assessment	*	**	*	*	
(c) Farmer Verification					
i. Planning	*	**		*	
ii. Implementation	**			**	
iii. Assessment	**	*		*	
7. Determine priorities for CST research		*	**	*	**
8. Formulate recommendations		*		*	
9. Organising Servicing and Supplies		**		**	*
10. Demonstration; test marketing	*	*		**	
11. Monitoring Farmer reaction	*	**		*	
12. Full Extension to Target Group	*			**	

A. BUILDING OFR INTO EXISTING AGRICULTURAL RESEARCH EXTENSION INSTITUTIONS - SOME ALTERNATIVES

INSTITUTIONAL OPTIONS FOR SYSTEMS BASED OFR

Presently in the Eastern and Southern African region research and extension are divided institutionally, often within the same ministry but relatively autonomous. Present research organisation usually takes the form of research stations with multi-disciplinary commodity or specialist research teams with national responsibility for their specialisation. In larger countries there may be many such stations with the commodity or specialist teams at each sometimes focussed on commodity or disciplinary issues of particular importance in their immediate region. Within this historical pattern there are at least four options for the organisation of systems based OFR. Each option has advantages and disadvantages in terms of its ability to perform the roles designated for systems based OFR and in terms of the ease of institutionalisation and arrangements within existing research and extension institutions.

OPTION 1

Each Commodity/Specialist team in NARS adds a social scientist to bring the farming systems perspective into their research. All scientists of the team carry out both technical and on farm research related to the team's commodity or specialisation across its area of responsibility i.e national or region wide.

Advantages

- Little institutional change or management re-organisation is required for implementation.
- The technical/or farm research interaction is inherent, within the team.
- Researchers keep a foot in 'real' research with promotional prospects and peer recognition and traditional, established criteria. They feel less threatened than being transferred to a 'new' type of research in which novel criterial are relevant.

Disadvantages and difficulties

- The pre-determined focus onto the team commodity or specialisation limites the benefits from the systems perspectives.

  -research effort may be focussed on what to farmers are relatively minor problems. Identified solutions may not be attractive to farmers whose overriding concerns are elsewhere in their system.

  -technical research problems requiring CST attention can only be identified and ranked within the special focus. This option cannot aid prioritisation of CTS efforts across commodities and specialisations - a major contribution from a full systems perspective.

- There is potentially massive overlap in the farmer focus of CS Team based OFR. (At the extreme five or six teams may be carrying out a special focus diagnostic and OFR experimental programme within the same target group of farmers).

- The disadvantages listed for this option contribute to the limited cost-effectiveness of systems based OFR when integrated with CS Teams.

- The linkage role with extension is inhibited in this option. Little re-organisation is required and OFR's primary concern is the commodity or specialisation. This is relatively incompatible with area oriented extension organisation.

- Unless the social scientist added to the CS Teams is very experienced in systems based OFR it is very difficult for him to make the case for social science and carry the team of technical scientists with him introducing a systems perspective. Such experience is so far rare in NARS.

OPTION 2

Each Commodity/Specialist Team in NARS has a complementary OFR team (usually on agronomist and social scientist) which handles the systems based OFR work relevant to the CST throughout its area of responsibility i.e. nation or region wide.

Advandages and Disadvantages

- This has similar disadvantages to Option 1. with respect to the restricted exploitation of the systems perspective both in mobilising technical research results and in drawing priorities across CST's. It requires more re-organisation than having all CST scientists involved in both technical and on farm research.

- It also asks OFR scientists to desert the traditional peer groups evaluation criteria in research and face the lack of an OFR career structure in many NARS, risking uncertain promotional prospects.

- It provides a clear institutional niche for scientists, allowing for development of their capacity in OFR before being drawn into 'confrontation' with technical researchers.

OPTION 3

The set of Commodity and Specialists Teams are complemented by a set of systems oriented OFR teams in NARS. Each OFR team has regional responsibilities, each draws from and feeds back to all or any CST's which are relevant to circumstances and priorities of farmers in its region of responsibility.

Advantages:

- In diagnosing focii in the system without pre-determination to a particular Commodity or Specialist, priority problems are identified. It is these priorities which offer best leverage for improvement of the systems, and appropriate solutions for these should be readily absorbed by target group farmers.

- Feeding back technical research agenda to CST's made up of unsolved priority farmer problems helps balance technical research efforts according to identified farmer needs.

- The two points above and the responsibility of one OFR team for any one region make a strong contribution to a cost-effective research effort.

- The regional or area orientation of the OFR teams is wholly compatible with extension organisation. It offers great potential for drawing extension staff into the later stages of generation of the techniques they will later have to sell to their farmer clients. It helps extension staff identify with technologies incorporated into recommendations.

- It creates institutional niche for scientists where they can be sheltered during orientation, while their professional competence in OFR is built up.

Disadvantages

- The separation from CST's may have several adverse effects:

  -It asks scientists to isolate themselves from traditional peer group criteria in assessing research programmes.

  -It may cause uncertainties as to career structure and promotional opportunities.

  -Draw down from and feedback to CST's are indispensable features of the complementary roles of CST's and OFR teams. By separating the two sets, albeit within NARS, there is a danger of poor linkages between them.

- A more complex re-organisation of institutions and budgets is required to implement this option.

OPTION 4

This is the same structure as option 3 but with the OFR teams institutionalised within the extension services, not in NARS. It has the same advantages as option 3. It has the added disadvantage of the complete isolation of the CST's and thus greater dependence on feedback loops for the effective application of the system perspective by the OFR teams.

With each country a unique situation there is no universally best option for incorporating a systems based on farm research approach in national research and extension services. The options must be weighed by decision makers in the light of their specific country circumstances.

- The variability of farming situations across the country - the more variable the more local specific will be technology needs.

- The complexity of farming systems - the more complex, the greater the potential contribution of a systems perspective in research prioritisation and the generation of appropriate technology.

- The existing organisation of research and attitudes of researchers. It may be important to minimise re-organisation. It may be counter productive to risk alienation of the existing research cadre.

- The existing linkage between research and extension - where this is effective then less weight need be given to reconciling the structure of OFR with extension.

- Analogous situations with strong technical research efforts in other countries of the region - this will, given regional cooperation, influence the balance between technical research by CST's and OFR in country.

The size and complexity of the country affects the desirable balance between technical and on farm research and the choice of OFR option. At the extreme, very small countries with larger, agro-ecologically similar and cooperative neighbours or near neighbours, may choose OFR and rely on cooperation to provide the technical stockpile for domestic OFR to utilise. Larger countries may do this for areas which have analogous conditions elsewhere in the region with strong technical research efforts. There is massive scope for regional cooperation between countries in agricultural research in which the need for a critical mass of researchers is recognised but domestic resources - in terms of both manpower and budgets are often limited.

DISCUSSION

It was brought out in the discussion that a diversity of historical experiences, different economic conditions and different current organisational structures in various countries made a consensus on the institutionalisation of OFR/FSP difficult.

There was a consensus that the systems approach had an important contribution to make and there were three important considerations for its institutionalisation.

(1) The level of committment by policy makers in research and extension.

(2) How well the OFR/FSP process integrates research and extension.

(3) Cost.

Some participants felt that a systems team working across commodities was the best way foward (Option III) others that the aim should be to have a systems approach adopted by a commodity team. It was agreed that simply adding a social scientist to a commodity team was inadequate, social science is clearly needed but the team as a whole needs training in a systems approach.

B. SYSTEMS BASED OFR AS A RESEARCH/EXTENSION LINKAGE

INTRODUCTION AND PROBLEM STATEMENT

Agricultural research, as now established in LDC's, is based on a technical perspective of agricultural problems and provides a product which is unfinished in terms of the needs of the market of small farm managers it seeks to serve. The technical perspective manifests itself in research recommendations which are unfinished products in three closely related ways:

(1) Farmers never use a purely technical perspective in managing their farms and consequently, never use it in evaluating new technologies introduced to them by the extension services.

(2) Recommendations inevitably take the form of 'final solutions', the best way to produce. They seek full exploitation of biological potential under the present state of the arts. Farmer markets may only be willing and able to handle intermediate or partial solutions due both to the managerial perspective they use, and to their limited resource endowments.

(3) Recommendations are made on a 'blanket basis', at best for a specific agro-ecological zone. This fails to recognise that economic circumstances dictate farmers decisions and modify, often dramatically, these agro-ecological influences.

Agricultural research is tied to a technical perspective and technical criteria by the essential features of classical experimental methodology. In the course of the research and extension sequence, aimed at the development and dissemination of new technology appropriate for farmers, the perspective and criteria have to change from the technical ones inherent in experimentation, to the managerial ones used by farmers.

The institutional linkage failures between extension and research are relatively superficial, the fundamental problem in the research/extension sequence commonly followed in Africa, is this failure to use a managerial or systems perspective in the diagnosis of farmers problems and in the development of farmer recommendations. Neither research nor extension establishments are truly farmer oriented due to the dominating technical perspective. Recommendations are fed from technical research to senior extension staff then on down the hierarchy to the local contact extension man. The contact extension officer, or the contact farmer, who lives in and must live with the community, is often charged with promoting new technologies he sees as inappropriate for his neighbours. He is caught in a squeeze between his bosses and his neighbours. Holding the purse strings the bosses view prevails but at high cost in terms of his credibility in the community and his own morale.

This fundamental problems of perspective is certainly re-inforced by the characteristic institutional and operational gap between research and extension services, and by the physical isolation of station based researchers from their farmer clients. The integrated planning and operation of research and extension is clearly desirable. However, only the introduction of a managerial or systems perspective to generation and dissemination will solve the technology transfer problem.

SYSTEMS BASED OFR AS A SOLUTION

On Farm Research uses practical, cost effective procedures to interface the technical and managerial perspectives. At the same time, by bringing farmers, extension staff and researchers together on local farms, it eliminates the secondary problem of poor institutional linkage.

The continual interaction between farmers, researchers and extension staff allows a ready consensus when improved technology is ready for dissemination. The most obvious sign is host farmers beginning to use experimental techniques on their own crops and animals. Extension staff who have been involved with the On Farm Research programme, have an intimate knowledge of the managerial implications of the new techniques, as well as the ability to lay down demonstrations on farmers, fields, the first step in wider dissemination. Where a relatively senior cadre of extension staff are involved in the OFR programme (subject matter specialists in the T&V approach are obvious candidates) they will merge as ideal trainers of contact extension staff throughout the target group area.

Two points should be emphasised about the systems based OFR approach. First, the approach pulls down technology diagnosed as appropriate to local farm situations, a major difference from current, top down pushing of technologies at farmers, regardless of the specifics of their local situation. Second, extension staff have a great deal of confidence in recommendations developed in this participatory way on local farms.

Operational linkages: OFR/Teams and extensions: One possible scenario

The senior agricultural professional in a region will have a significant influence on decisions on priority Target Groups for OFR initiatives. As a result of these decisions he will initiate a modification of workplans and budgets for his staff in the area of the selected target groups to coordinate activities with the OFR teams(s).

Locally, in the designated target group areas, two levels of extension staff are involved. First, the senior agricultural extension officer in the immediate area, normally of graduate or diploma status, who coordinates with the On Farm Research team. Where T&V is in operation he briefs subject matter specialists to monitor the On Farm Research, otherwise he monitors it himself. Extension aims in monitoring the research are:

- To have input on decisions in the evolution of the experimental programme.
- To have input on decisions on recommendations to be made for local extension programmes.
- To be familiar with the management requirements of emerging recommendations and their implications for input supply, credit and extension training.

The senior extension officer in the immediate area modifies the workplans and budgets allocations of the lower staff who assist the OFR team. Where the structure the extension services allow the lower level staff

involved are contact staff supervisors who have training responsibilities towards contact satff once recommendations have emerged. They play the following roles:

(a) Organise farmer meetings to discuss the OFR programme with the community.

(b) Organise the farm visit programme of the OFR team during the diagnostic survey.

(c) Where necessary interpret at farmer interviews for the OFR team.

(d) Help in the identification of farmers as hosts for On Farm Experiments.

(e) Help in the laying out of the experiments, the routine recording and in the supervision of treatment management.

(f) Organise farmer groups, researchers and senior extension staff in meetings on experimental sites to assess the treatment being investigated.

The subject matter specialists or lower level staff in other extension structures are closely involved with farmers and researchers throughout the development of recommendations. They emerge with an inside knowledge of the technology, farmers attitudes to it, and any managerial snags it involves. From their experience with verification experiments they are fully versed in laying out comparisons of improved and current technologies. Both sets of knowledge give them a capacity for training contact staff in requirements of the technology, and in laying out demonstrations as an initial dissemination strategy. Where extension organisation is less intensive contact staff themselves support the OFR activities.

This is an illustrative scenario, there are others. As with institutionalisation existing circumstances in country will dominate decisions on the detailed linkages to be established between OFR researchers and extension staff. The key points of the arrangements are: first; that the systems perspective used in OFR, is allowed full play in identifying and using farmers criteria to choose and evaluate technology bridging the gap between technical research and farmers management. Second; that the extension workers help develop the technologies they will be expected to sell to their farmer clients.

DISCUSSION

The discussion ranged around a definition of the roles of the different actors in the technology research and development and dissemination process; commodity researchers, On Farm researchers, extension workers and farmers. This took a good deal of time and in a sense manifested the linkage problem by arguments over the boundaries of the roles of the different parties. These role boundaries were then used to elaborate the types of linkage which would be desirable to ensure the technology R&D and dissemination process ran smoothly.

It was felt strongly that the systems approach to technology development was a part of the process and a part which should not require an institutional niche of its own outside existing research and extension organisations. The strong point of OFR was that it is research done in farmers fields, farmers which are already the responsibility of the extension hierachy. This physical compatability gave strong linkage possibilities which are absent with researchers isolated on stations. The question was raised as to whether research and extension should be within the same organisational structure. It was pointed out that they often are within the same ministry, but the ministry structure by function effectively isolates them. Again it was emphasised that countries differ in their existing institutional patterns and linkages to ensure a smooth technology R&D and dissemination process would differ with different institutional contexts.

C. OFR, FARMER RECOMMENDATIONS AND LINKS WITH PLANNING, SERVICES AND POLICY

With the short history of systems based OFR in the ESA region the issues forming the substance of this brief are only just beginning to emerge, even in countries with more advanced institutional structures of OFR. However, emerging recognition of these issues makes them relevant to a wider range of ESA countries planning an institutional niche for OFR.

The importance of the OFR link to policy and planning lies in the fact that the choice of technology, (new technology being the only intervention which can improve physical input/output ratios on farms) is the heart of agricultural production development. If we get the technology wrong and farmers don't use it, we are likely to be left with lots of other very expensive things wrong: - delivery systems, processing facilities, marketing infrastructure, extension training and deployment. All these are often dependent on the targeted crop and the technology chosen to develop it. A major feature of OFR is the exposure of possible technologies for assessment by farmers in the course of their development. It aims at acceptance of technologies by farmers before recommendation in order to avoid rejection afterwards. At the same time the bottom up flow of information from OFR diagnostic techniques can be valuable material for planners sensitive to the need to reconcile local and national priorities in designing both programmes and policies.

A systems based OFR approach tailors technology to the needs of specific groups of farmers. It implies the servicing of the technologies chosen for each local group with unique distribution infrastructure and policy. Table 1. shows the points in one OFR process at which linkages with policy and planners are important. It will guide us through this brief. Broadly speaking two sides of the OFR process require a policy and planner input - planning its implementation and using its output. If the linkages in planning the OFR implementation process are good then the technologies output from the process are unlikely to be rejected on policy grounds or for lack of enabling services.

IMPLEMENTATION OF OFR - POLICY AND PLANNING LINKAGES

The final column of table 1. identifies six OFR activities requiring input from and therefore linkages with, policy makers and planners. The first two of these are in the choosing priorities for the attention of OFR, two are in the planning of on farm experiments, and two are in mobilising the results of OFR.

(1) Identification of Target Groups: Policy considerations are not dominant in this activity but planning requirements raise some linkage issues. Groups of farmers operating the same system, and therefore, for whom the same new technologies will be relevant, form targets for a research and extension effort. Such groups may not coincide with administrative boundaries. This poses a problem in identification of such groups in terms consistent with the administrative hierarchy, usually the framework for government or programme action. One way round this is to characterise the local circumstances and the farming system of a target group and specify the region or area covered by the group in terms of the smallest administrative units. Thus a target group may be found in 22 out of the total 60 wards/locations/divisions in the three districts.

A second dimension of this problem of linking target groups to administrative units is that of hierarchies of target groups. Table. 2 illustrates this by characterising four target groups in the same geographical area (Cols. 2&3). Varying power sources, hand, oxplough, tractor, are related to different sizes of operation and women headed households are distinguished by a smaller maize enterprise. Here area cultivated, power source and the sex of the farmers characterise groups for different research and extension efforts - different technologies are likely to be appropriate to the circumstances and capabilities of these three groups. Linkages between OFR, policy and planning are needed to recognise and facilitate different action programmes for these 3 groups.

Linkages have to be achieved locally, perhaps within local committees, which have authority to coordinate activities of different public and, by raising appropriate signals, private executing agencies.

(2) Selection of Priority target groups

Policy considerations need to dominate this activity. Referring to table 2; columns 4-9 provide additional facts about the four hypothetical target groups. Assuming we have only enough resources to mount an OFR programme for only one group, which takes priority?
National policy considerations are brought to bear on the decisions, as examples four policy objectives are listed below:

- Improve rural incomes, particularly to inhibit urban drift (- points to Target Group No. 1).

- Increase marketed surpluses of maize to feed urban areas (- points [probably] to No.4, certainly if need is urgent).

- Encourage transition from traditional to small scale commercial farming (- points to No.1 and No. 3).

- Improve child nutrition among disadvantaged groups in rural areas (- points to No.2).

Inevitably political imperatives play a modifying role in the decision, compromises feature heavily in allocating priorities. A decision may feature the following considerations:

- Large scale commercial farmers can look after themselves from the technology side - talk to researchers, read findings, absorb what is useful to them. Improve price incentive will be more effective to meet an urgent need to provide extra maize as food for urban areas.

- Although the traditional women headed households are a disadvantaged groups the system they operate is the same - on a smaller scale - as that operated by traditional men. The same research and extension effort is likely relevant to both target groups 1 and 2.

- Urban drift is largely from TG. 1. and, at the same time, with TG.2 (from which urban drift is already in progress) this covers 95% of the rural population.

Thus, a programme focussed on TG. 1 and 2 will improve the incomes of the rural majority and help prevent urban drift. It will help women headed households, contributing directly, or through higher incomes, to improved child nutrition. It will also encourage an expansion of the small scale commercial farmer category as the better traditional farmers are able to exploit new technologies. Finally, if the system focus is found to be maize it will contribute to the urban food need.

Target grouping of course does not remove the need for decisions or for these sorts of compromises. It does however, provide agricultural administrators with the operational framework and information to allow more considered decisions. It can thus enhance management, improving the effective of research and extension resource deployment to meet national policy objectives. Implementing these kinds of decisions requires good linkages between OFR Teams and local or regional planning bodies.

(3) Planning relevant research thrusts

Stages 4 and 5 in the OFR process (Table.1) usually involve the choice and specification of experimental content as a result of diagnosis. (Exceptionally diagnosis may lead immediately to recommendations). Policy and servicing considerations will often play a dominant role in this choice process. Three examples are outlined below:

(a) Policy examples

(i) Capital intensive innovations which replace labour may add to unemployment problems, and, though perhaps more profitable to the individual farmer, maybe very costly socially. The use of machinery for harvesting tea is a recent example from the region.

(ii) A national scarcity of foreign exchange may weight the choice of technology. For example in the overall national context herbicides, only obtainable overseas, may have a low priority, other methods of weed control would be favoured in solving a weeding problem.

(b) Servicing example

Where soil fertility is a dominant problem the use of chemical fertilisers is a possible solution. It is only a practical solution if the infrastructure of the area is capable of delivering fertilisers to farmers at the time they need them. If farmers are not using purchased inputs it is unlikely that a fertiliser distribution system will quickly evolve to service a fertiliser recommendation. If there is an existing input distribution service it should be relatively easy to develop it, by judicious policy measures and planning, to handle fertilisers (though the storage and transport requirements for fertiliser handling are much heavier than for seed, insecticides, etc.). It is often a 'chicken and egg' question. Suppliers won't stock fertilisers until farmers have the opportunity to see its value in their fields. A judgement must be made; will it be easy/difficult/impossible to mobilise fertiliser supplies in the area if we show high returns to fertiliser use through experiments.

TABLE 2 Some characteristics of 4 hypothetical target groups in the same geographical area

1 FARMER TARGET GROUP	2 AV. AREA (HA) UNDER CULTIVATION	3 PRIMARY TILLAGE	4 NUMBERS IN AREA	5 % OF TOTAL NUMBERS	6 AV MAIZE AREA (HA)	7 AV. MAIZE YIELD (T/HA)	8 AV. ANNUAL MAIZE PRODUCTION	9 AV. TONNAGE MAIZE MARKETED
TRADITIONAL								
1. Men headed households	1.0	Handhoe	12,000	66	.50	1.5	15,500	4,500
2. Women headed households	.7	Handhoe	5,000	29	.25	1.0	1,250	250
4. SMALL COMMERCIAL	5.0	Oxplough	800	4.5	3.0	2.5	6,000	5,200
4. LARGE SCALE COMMERCIAL	200.0	Tractors	80	.5	150.0	5.0	60,000	60,000

- Easy - no problem, fertiliser experiments go ahead as part of the OFR programme.

- Difficult - contact with government and perhaps private distribution planners is vital. Initial clearly positive results from fertiliser experiments may be crucial in making the case for the development of a fertiliser distribution system.

- Impossible - fertiliser experiments are of no near term value, any recommendations could not be serviced.

Many solutions in the ESA region would fall into the 'difficult' category, again emphasising the importance of the linkage between the OFR work programme and local or regional planners.

4. Determine priorities for Commodity/Specialist research

On the first page of these briefings one of the three roles played by OFR was specified as:

> 'Feeding back priority technical problems of local specific groups of farmers to focus and help prioritise commodity and specialist technical research, much of it done on research stations'.

Because of their direct interaction with local farmers in their own situations and with their diagnostic capabilities, OF researchers can identify technical problems which, if solves, will have the biggest effect in improving those farmers incomes. An experienced OFR team will be able to evaluate approximately how much benefit solving the problem will bring to the system of Target Group farmers, and how many farmers, including spin off to other target groups, will likely benefit. This provides a basis for the calculation of the returns to that particular technical research focus. It is a significant contribution to the processing and prioritisation of technical research effort, but not of course the whole story. OF researchers will see the best interest of their own farmer clients but can only contribute a part to the picture of farmer target groups across the country as a whole. At least two other actors are essential to final decisions on priorities.

(a) Commodity and specialist researchers are best placed to assess the probabilities of success and the costs, including time, of working on problems feedback to them by OFR. The difficulty of the research task helps rank technical research priorities, potential benefits are weighed against expected costs.

(b) Decision makers balance national policy priorities, local priorities are expressed through OFR diagnosis, and the resources available for Commodity and Specialist research. This balancing needs to consider three types of work:

- On new crop and animal enterprises with domestic market, import saving or export earning potential.

- Maintainance research vital for crops such as wheat, potatoes and others with inherent disease or pest susceptibilities and current farmer priorities expressed through OFR.

Again, neat sums with clear and final answers are out of reach. With the flow of grass roots information from OFR teams research policy makers and administrators are better equipped to make the judgements required in their decisions on technical research priorities. Effective linkages to bring the information in front of the decision makers is an important pre-requisite for better decisions on research priorities.

(5) Using the results from OFR

A guiding principle in OFR is that assessment and acceptance of experimental treatments by host farmers and neighbours, a representative sample of the Target Group, is a signal for recommendation. The aim being to minimise rejection after recommendation with the gearing up of enabling services to the widespread dissemination of the technology already complete.

With OFR results being very local specific, relevant to specified Target Groups of farmers, there are implications for two sets of decisions concerning their use - the issuing of recommendations and the mobilising of enabling services to support these new recommendations. Stories abound of the results of experiments having to move up the research hierarchy to head office in the capital, at this point they cross the wobbly research/extension bridge, are put into print perhaps and then travel down the extension hierarchy to the local area for which they are relevant. Then a second cycle begins, local agencies for input supply, for credit and for extension training are handed a recommendation to be serviced. The managers of the local agency branch or bank feeds this back to head office in the capital for a decision on whether he can carry stocks of credit for it to farmers. Where foreign exchange is required application must be made to the Central Bank etc etc. Though this is an exaggerated scenario, there is no doubt that the journey from experimental results to farmers adoption of the new methods implied is time consuming and often uncertain. It probably prevails in order to see that national priorities are fully reflected in what is offered to farmers. It often ignores the fact that unless those national priorities are compatible with local priorities resulting action programmes will not be implemented by local farmers. The local specificity of OFR results indicates the need for de-centralised decision making on recommendations and on the mobilising of enabling services of input supply, credit and training to support them. This is very consistent with recent moves towards the de-centralisation of administration in a number of countries of the ESA region - Kenya is a strong example. Local planning committees need the authority to approve new recommendation and local branch managers of services need the authority to be able to support these.

This briefing has implied standing traditional highly centralised procedure on its head. Farmers circumstances are local specific and localised procedures are needed to handle these. The national interest is guarded by ensuring that national priorities and policies are brought to bear in the local process. Linkages and information flow between the 'five actors' of Table. 1. are vital to ensure national needs weight the judgements and compromises always a part of development planning.

DISCUSSION:

The group accepted that the interaction between technology choice and planners and policy makers is an important one. Services are need to

mobilise the technology and appropriate services are dependent on planners and policy makers knowing what is to be mobilised. Participants felt that the same framework of Target Groups could be used not only for technology development but also for policy implementation and planning. It was seen as a useful common focus for all the parties concerned.

Participants underscored the need for all the parties to be aware of the process of making recommendations and servicing them once made, for each party to know his responsibilities in that process, and that the operating strategies of all parties are compatible. (There will be little harmony if four of five parties concerned have the authority to take decisions locally on the allocation of their organisations resources to service recommendation, but the fifth party must await a review process through a regional and national office which may take a year to complete). Participants also emphasised that all the parties concerned must be involved at the onset, once a technology thrust is confined for the OFR programme, and be kept informed as the thrust develops to have early warning of the type of action that will be required of them if it comes to fruition as a recommendation.

The point was made in the discussion that an on farm experimental effort might often be justified in order to provide hard data to provide hard data to convince both planners and policy makers that certain actions were required on their part, or that past decisions needed reversing.

D. THE PROGRAMMING AND MANAGEMENT OF OFR TEAMS

It is neither feasible nor necessary for an OFR team to work permanently with farmers in a target group. An OFR cycle will provide content for a 5 year extension campaign among the Target Group farmers. The programming and management of OFR teams depends to a significant extent on how the teams are structured into existing institutions. This has been discussed in brief A. This section assumes option 3 is chosen; a set of OFR teams with regional responsibilities drawing from and feeding back to whichever commodity and specialist team is relevant to farmers priority problems in their region. This is the option so far used most by countries in the region, it is capable of the most effective exploitation of the systems perspective and is consistent with a renewed emphasis on regional research centres.

OFR team capacity.

A trained and budgeted OFR team of 2-3 professionals (Agronomist, Farm Economist and Livestock Specialist when required) can probably work with three farmer target groups at any one time. On start up there will be time spent identifying the framework of Target Groups within their region of responsibility and getting decisions which of these groups represent priorities for their efforts. A team can only initiate OFR among one new farmer target group in any one year. It will likely take them an average of three experimental cycles to arrive at recommendations. (n.b. Although the activities in Table 1. are listed as a sequence, recommendations may emerge directly from diagnosis, alternatively only the final farmer verification step in experimentation may be needed, rather than all three experimental steps which have differing objective).

Country coverage

Country coverage by OFR depends on the manpower and resources made available to the programme, the ecological, social and economic complexity of the country and the number of farmer target groups this creates. Table three makes assumptions about the manpower allocated to OFR, with numbers of teams down the side of the table, and the members of target groups which may be found in countries of different ecological, social and economic complexity, along the top. Using the estimates of team capacity made above, the body of the table shows the years required for the indicated numbers of OFR teams to cover the indicated numbers of farmer target groups.

Table 3. Years required for country coverage with OFR

		No of Farmer Target Groups		
		20	40	80
No. of OFR teams	5	6	10	18
	10	4	6	10
	15	4	5	8
	20	3	4	6

A five year cycle is perhaps appropriate for OFR in a target group. Three years OFR work to provide appropriate content for a five year extension campaign. With the OFR team returning after a two year gap to generate further appropriate technology for the subsequent interation of extension.

With this as a guide, countries which are relatively homogeneous, perhaps with less than twenty priority target groups, might handle their OFR with five teams - some 15 professionals. At the other end of the scale highly complex countries, with radical differences in ecologies and in economic circumstances, and therefore with many discrete priority target groups, might need to consider 20 or more OFR teams, 60 agricultural professionals, to achieve desired coverage. With Kenya as an example of a complex country, this would represent less than 15% of its professional agricultural research cadre.

Programming.

A framework of the main farmer target groups in the country allows the allocation of regional responsibilities covering some 5 priority target groups to each OFR team. Local planning committees mindful of national policies, rank identified target groups into priorities for an OFR workplan. The first year of OFR work among a new target group requires the most intensive effort, subsequent years are relatively routine. The workplan might schedule an OFR team into a new target group each year building to a maximum of three at any one time and, completing work in 5 target groups over an eight year period. After five years a decision would be made whether to move into a second interation of the original priority target groups or whether to continue to lower priority groups. The decision would, inter alia, depend on the status of the extension campaign and the stock of unused content remaining for extension in any one target group area.

Management.

Again, the alternative outlined in Brief A have different consequences for management. With Optional 1 & 2, management responsibility clearly rests with research administrators. With Option 4 management is clearly with extension administrators. Option 3 is something of a hybrid. It recognises that OFR is research and must have close and informed supervision of methods and standards by senior research staff. At the same time, under Option 3, researchers will be oriented and deployed in the same organisational pattern as extension staff. Further their work focus will be guided by local planning committees rather than by research administrators. It is truly a hybrid; methods and standards supervised by research, work focus and often content supervised by local planners and senior extension staff.

DISCUSSION.

The groups provided a summary statement of their discussions which is reproduced below:

PROGRAMMING AND MANAGEMENT OF OFR TEAMS

1. Planning

It is desirable to have a master plan for each country which should consider the following points or factors:-

(i) Homogeneity or Heterogeneity of areas and subsection of sample site for each area.

(ii) Target groups.

(iii) Size of country and population.

2. Teams Composition and Responsibilities

(i) The core of the field team should be comprised of one Social Scientist and one Biological Scientist (Agronomy/Livestock).

(ii) Backstopping from commodity researchers.

(iii) There should be a team leader for each team and a National Co-ordinator for all teams.

(iv) Clear job descriptions emphasizing interactions among members should be laid down.

(v) The team leader should have an aptitude for inter-disciplinary approach and interactions.

(iv) Team member selection should ensure co-operation and flexibility in a team effort for multi-disciplinary approach.

3. Coordination (Important in both team and national level).

(i) The OFR teams should be part of the National Ministry of Agriculture structure.

(ii) Numbers of coordinators should depend on the number of teams in provinces and districts.

4. National Staff Development (Training)

The main set-back is the lack of national trained competent staff in FSR or OFR.

(i) In-service training for staff has to be emphasized.

(ii) Formal training should be undertaken to include:-

(a) interdisciplinary approach;

(b) diagnostic survey methods;

(c) On-farm methodologies.

in addition to the basic discipline work. This should be in an effort to have nationals take over the work in the long term.

5. Monitoring and Evaluation

(i) The field teams should be capable of assessing their achievements in relation to their set of objectives or targets.

(ii) Regular programme reviews.

(iii) Regular progress reports.

PART III: INVITED PAPERS ON TRAINING, INFORMATION EXCHANGE AND IARC'S IN CFR

THE ROLE OF THE UNIVERSITY IN THE DEVELOPMENT OF ON-FARM: TRAINING CAPACITY IN SOUTHERN AFRICA.

by

M.J. Blackie and P. Anandajayasekeram*

1. INTRODUCTION

Agricultural research systems in Africa face a difficult and potentially traumatic adjustment process. While agriculture is a predominant part of many African economies, and the major employer of African households, the fall in per capita agricultural production throughout the continent is well-documented. So also are the various policy shifts by both national governments and international agencies in determining priorities in national agricultural policy and resource allocation. While it would be premature to predict a consensus, there is a growing awareness of the significance of investment in agricultural research as a stimulant to economic growth in Africa and of the relative neglect of the African smallholder in both colonial and post-independence agricultural policy.

Thus, while the record on an individual country basis is mixed, the general trend in Africa over the past three decades has been one of either under-investment or mis-investment in agricultural research. Underlying this tendency has been a serious lack of understanding of the role of the smallholder in African agriculture. At worst, attempts have been made totally to eliminate smallholder production as a source of agricultural growth; more typically, the smallholder sector has been regarded as the residual employer of labour which cannot be absorbed into the modern, often industrial, sector.

Running counter to this wisdom has been a growing body of evidence to indicate that the potential for increasing smallholder production in Africa is substantial. Where policy and technology has been designed with the specific needs and constraints of smallholders as a priority, the response has been substantial. Example include hybrid maize in Kenya and Zimbabwe, tea in Kenya, cocoa in the Ivory Coast and cotton in Malawi and Zimbabwe. While in some instances, such as the adoption of hybrid maize by Zimbabwe smallholders, technology transfer has been a degree fortuitous, there has been evolving an awareness amongst both agricultural researchers and research administrators of the importance of incorporating small farmer circumstances into agricultural research design and policy. The evolution of various approaches towards on-farm research is evidence of this change. In order to make this change effective, there is a need for developing both a research and a training capacity in national institutions.

2. NATIONAL ON-FARM RESEARCH CAPACITY

The development of an effective national capacity for on-farm research requires recognition of some key characteristics of the approach:

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1. Location specificity: Fundamental to the decision to devote resources to on-farm research, is the recognition that there are specific and important characteristics to local agricultural production that are not reflected by extrapolation from existing research station data. Family labour availability at various points in the farming cycle, rainfall patterns and variability, or soil features are examples of typical location specific production variables. The on-farm research programmes required thus vary from simple data collection on rainfall up to expensive and time-consuming detailed housold labour studies. Most commonly, however, on-farm research will require both the identification of some location specific problem through survey and data analysis and also direct experimentation in the area on the identified problem.

2. Researcher/Farmer/Community relationships: Possibly the most initial element in establishing the success or otherwise of an on-farm research programme is the relationship between the researcher and the community in which he is working. On-farm research requires the farmer to play a central role. The fundamental signals for on-farm research come from farmer/researcher interaction and on-farm research requires, at the minimum, the active co-operation of the farmer. Thus the relationship between the farmer and the researcher defines the success or otherwise of an on-farm research project. Even a simple rain gauge requires protection from damage or vandalism by livestock and children. An experimental programme will require access to land and other resources whose allocation is a farmer or community decision. Experience at the University of Zimbabwe over the past six years suggests that national scientists, with a common cultural background to the community in which they are working, have a clear and substantial advantage in establishing the necessary relationships. Expatriate scientists, or nationals with significant different cultural backgrounds, have more difficulty in establishing an experimental programme and are also less liable to identify subtle, but often critical, elements of the production systems in which they are interested. In thus follows that national level training of national scientists is a key feature in the development of a national on-farm research capability.

3. Use of observational data: In a conventional laboratory or research station trial, the enthusiastic and competent scientist will note untoward or unexpected events. Some of the great scientific discoveries have their roots in precisely such observations. The on-farm trial requires even greater powers of observation as the rationale for that trial will typically be derived from survey data. In much of rural Africa, the data base on elements critical to survey design such as household composition, location and resources is weak. Frequently weather and soil data are inadequate and logistical constraints will further inhibit ideal survey design. Thus the on-farm research programme needs to incorporate an important component of survey verification and, where appropriate, subsequent modification to research programme orientation. The establishment of a coherent and reliable institutional memory, while important in any research

programme, is absolutely fundamental to progress in on-farm research.

4. Timeliness of research interventions: Farm management research has fully documented the costs to the farmer of such events as the late delivery of fertilizer, and delays in harvesting. Similarly, an on-farm research programme, if it is to yield useful and reliable data, requires that programme activities be carried out in a timely and expeditious manner. The researcher requires excellent access to transport and he requires the budget flexibility to hire local support staff as and when appropriate.

5. Linkages to research and extension: Adaptive on-farm research requires a substantial foundation of basic research on which to build. Similarly adaptive research programmes can be used to set priorities amongst competing basic research alternatives. The typical conventional position is that applied research is an on-farm activity while basic research is a research station responsibility. It is possible, however, that research progress can be enhanced by incorporating on-farm elements into both basic and adaptive research programmes. For example, diagnostic surveys in the Siabua Valley, Zimbabwe, indicated that farmers were apparently avoiding cultivation on the limited areas of heavy but fertile soils in the valley. Detailed investigation indicated that the high water retention capacity of these soils combined with a highly variable rainfall made crops growing on them dangerously susceptible to drought. The ensuing research programme envisages a three pronged attack on the problem. Firstly, basic soil/water relationship data relying on both field and laboratory studies will be collected so as to gain a better understanding of the specific characteristics of the soils. Secondly, researcher managed field trials of promising water conservation measures will be carried out to investigage the potential for improved water utilization. And finally farmer managed agronomy trials of appropriate drought resistant or short season crops will be implemented to identify the potential for improved technology within the existing system. While each programme is primarily the province of an individual specialist researcher, the trials are jointly planned, data are pooled and there is important interaction between the researchers involved. Thus there is a continuum in research strategy from basic to adaptive research with the farmer constraints and objectives receiving priority at all levels.

Similarly a strong link to the extension services is desirable. On-farm research activities provide a valuable medium to improve the adaptation of new technologies to local environments. Extension staff, using simplified on-farm trials such as demonstration plots, can use these both to improve the effectiveness of their own activities and also to identify technological gaps requiring further study. The planning and management of on-farm trials can be done most efficiently where research and extension staff co-operate actively in the implementation of the programme. A continuum thus can be created between the large numbers of smallholders operating under diverse circumstances and the limited number of

agricultural scientists and extension workers available to support technology development. Even under less than ideal circumstances, such a system should improve the delivery of appropriate agricultural technology and services to farmers.

3. NATIONAL ON-FARM RESEARCH TRAINING CAPACITY

The previous section has shown that on-farm research is becoming an increasingly important tool in the rehabilitation of African agriculture. It has also indicated that the implementation of a productive and viable on-farm research activity requires the considered reallocation of resources and structural adjustment in a station-oriented research system. Thus on-farm research is not just an adjunct to station research. Rather it is a complementary activity whose incorporation into an integrated research network requires sensitive and thoughtful planning. Similarly, the training of on-farm researchers needs a significant investment in both resources and time. While ad hoc short courses, either internationally, regionally or nationally, are value in either as a short-term measure for familiarisation with, or updating of the appropriate research methodologies, they lack the continuity necessary to ensure the flow of suitably trained researchers.

There is both a short - and a long-term perspective to the problem of training. There is also the question of training at different levels within the agricultural research and extension services. In the longer term national training institutions must develop their own capacity to support on-farm research activities. This issue is explored more fully below. It is apparent, however, that these institutions, for a variety of reasons, are responding more slowly than the urgency of the present situation requires. Egerton College, Sokoine University and the University of Zimbabwe all have a commitment to on-farm research and some training capacity. The expansion of this initial capacity will require short-term activities both to develop from the current base and to create an appropriate demand for researchers and extension staff with on-farm research skills in the national services.

One alternative is to use institutions from developed countries with training capacity in farming systems. The limitation of this approach is that only a few overseas institutions offer such training and those that do can only provide restricted exposure to the methodologies involved. By its nature, on-farm research training requires local research experience and local training materials; a generalised grounding in on-farm research methodologies based on materials from other regions or even continents makes a poor substitute. A rather better solution is to utilize the capacity of the international centres. Experience in both Southern and Eastern Africa suggests that the international centres can play a seminal role in filling the short-term training gap and in supporting the evolution of integrated long-term national training programmes. CIMMYTY, ILCA and IITA have scientists working in the region who are experienced in the field application of on-farm research.

In several countries, links both to the national research and extension services and to the universities are well established. CIMMYT, in co-operation with the University of Zimbabwe, already operate a highly effective regional training workshop series on on-farm research. Similarly, national and regional workshops and meetings have been held

throughout the region at both the field and the administrative levels to encouraged more effective implementation of on-farm research projects.

On-farm research in Africa, as a major focus of development policy, has only a short history. Consequently there is a need to develop a critical mass of scientists at the national level with exposure to the methodologies together with field experience both in home country and from within the region. Experience over the past decade has shown that creation of such a pool requires the investment of both time, manpower and resources. Jointly funded and implemented projects involving the national research institution, the international centres and national universities offer a promising route whereby the necessary international and national investment may be made.

This same approach may be used to deal with the problem of training at different levels within the national services. The issue of formal degree and diploma level training is covered separately below. But such training satisfies only part of the overall training needs. The in-service training and up-dating of staff ranging from administrators to field assistance is an integral part of a long-term training plan. Much of this is best done within national institutions and again provides fertile ground for co-operation between the three groups of institutions. With some expansion, such activities could also form the basis for regional networks on on-farm research.

4. NATIONAL TRAINING INSTITUTIONS

Mention has already been made of the advantage that nationals have in the implementation of on-farm trials. Most such nationals will have received either a diploma or a degree in agriculture from a national college or university. Thus the incorporation of the various research methodologies necessary for on-farm research into the curricula of national institutions is a critical step in the establishment of national on-farm research capacity. For example, while surveys design may be taught at a general level without reference to a specific farming community, the field effectiveness of a researcher is considerably enhanced if he has learned and applied survey methodology with farmers and farming systems with which he is familiar. The need for national training capacity in the heavily location-specific applied methodologies of on-farm research is largely self-evident. The constraint lies to a considerable extent with the nature of national agricultural training institutions themselves. It is to this that attention must now turn.

Virtually without exception, degree training in agriculture in sub-Saharan Africa is a post-colonial phenomenon. While diploma training of nationals is of slightly less recent origin, diploma college curricula have typically been orientated towards the extension service to the training of research technicians. In both cases, diplomates are expected to have the technical competence to follow out instruction from their seniors; the diagnosis and analysis of farmer circumstances is not an important objective in these circumstances.

Following independence, national degree-level training in agriculture has evolved; either from the partial or complete upgrading of diploma colleges to university faculty status or from the creation of separate university facilities of agriculture. Some common, although not universal, characteristics emerge. Linkages between college and

university curricula are poor and those between the agricultural training system and the research system are inadequate. Research facilities and support at training institutions often constrain staff to the conduct of limited, on-campus experimentation; at worst, a highly negative attitude towards research at universities and colleges exists in the national agricultural research system. At diploma colleges particularly, the lack of research facilities and the limited opportunities for promotion discourage the recruitment and retention of well-qualified staff. The absence of research funds leads to university curricula heavy in theory but light in practice.

While the diploma colleges have probably succeeded in maintaining a flow of technically qualified diplomates with adequate practical skills for conventional research and extension activities, their record for modifying their training to suit the requirements of smallholder farmers is less satisfactory. The university record is bleaker. While in Southern and Eastern Africa, many universities have a useful complement of well-trained nationals, the poor articulation of the university/college/research system network leaves this resource seriously underexploited for research.

The implementation of a national on-farm research training programme offers not only the advantage of local training for researchers but, as importantly, a medium for closer integration of research and training. Few colleges and universities have the resources to run an extensive research station system. Government funded research stations already exist and the establishment of a university/college station is perceived, and often rightly, as a duplication of effort and resources. On the other hand, training institutions could legitimately establish an on-farm programme, either in their own vicinity or in an area not well served by the national service. In Zimbabwe this approach has been used with some success to draw the university squard into the national agricultural research system. The approach avoids the problem of duplication and also provides an environment in which substantially improved training in the on-farm research techniques will evolve naturally. Optimistically also, the linkages between farmer, academics and researcher would be enhanced to the benefit of all.

5. IMPLICATION

Just as national on-farm research is not just "tacked on" to the research system, so does the training system advocated above require structural change within the training system. Firstly, and probably most important, the training institutions need to co-ordinate their curricula at the diploma, degree and post-graduate levels. This not only would help in the transmission of emerging developments in agricultural research through all levels of the training system but would also provide better career advancement opportunities through training for diplomates. This group, who often have good farmer communications and practical skills, are obviously well placed, if they exhibit scientific aptitude and enthusiasm, to become excellent on-farm researchers with further training.

Secondly, the role of training institutions in the national research system must be explicitly recognised. Additional staffing will be required at these institutions if researchers are to be free to attend satisfactorirly to both teaching and research activities. Heavy teaching

loads and lack of transport are amongst the obvious constraints to an on-farm training capacity at national institutions. Previously the important of the timeliness of research interventions in on-farm research was discussed. Lecturers, without good access to transport and who cannot guarantee to be present in the field at critical periods, cannot be expected to undertake on-farm research commitments. The development of a graduate student group working under lecturer supervision can alleviate, to some extent, the teaching load problem. Such students can be national research staff seconded to the university for either full-time or scholarships. Again, experience from Zimbabwe provides some evidence that this approach can improve the effectiveness of the university as an institution and make a major contribution to the training of researchers in the national service.

Thirdly, leading on from this is the possibility of greater staff mobility within the research/training system. While in many countries the likelihood of substantial move in this direction is unlikely in the immediate future, greater mobility could enhance institutional linkages. Possibly as a first step. The joint funding of certain core budget activities between research and training institutions could be useful. For example, prestigious, well-tended scholarships might be awarded annually to the top graduates in agriculture to enable then to proceed to further study at their local university on problems identified jointly by the national research service and the faculty of agriculture. Such study could indicate an appropriate period of overseas course work to minimise the problem of "in-breeding". Egypt has operated such a system for many years with conspicuous success.

None of these changes are institutionally impossible and partial implementation of this agenda is already apparent in several countries. However, progress will require that greater national support be given to national training institutions in terms of budgets, salaries and access to scarce resources such as foreign exchange and transport. Given the importance of agricultural production to African economies, it is surprising that real, as opposed to rhetorical, recognition of the importance of agricultural training is still so scare. Possibly the reason lies in the failure of most training institutions to establish and build an effective lobby for their needs. The introduction of a national on-farm training and research programme, carefully articulated between colleges, universities, farmers and national research administrators, would do much to improve both the effectiveness of national training for the research needs of the coming decades and also establish a sympathetic client group of farmers and policy makers.

INFORMATION EXCHANGE IN FARMING SYSTEM RESEARCH

by

Allan Low*

1. The Need for Information Exchange

There is no need to emphasise the value of exchanging ideas, information and experience in any sphere of life. In a new field of activity, such as on-farm research, the need for special information exchange efforts arises because:

(a) practitioners tend to be few and scattered;

(b) formal links, e.g., through specialised journals, do not exist;

(c) the development of sound methodologies will not speedily occur in the absence of cumulative trial and error experience.

On top of this we have the situation in Eastern and Southern Africa where on-farm research is being promoted very largely through international donor-aided projects in support of national research and extension programmes. Each of these projects is individually funded, contracted, implemented and assessed. Even within USAID there is no provision for exchange of ideas and experience among the various contractors. Regrettably, co-operation and exchange of experiences between donors is even less likely.

In these circumstances there is every chance that the lessons and experience gained in one programme in one country will not be taken account of in the planning or implementation of another programme in the same or a neighbouring country. Given the young stage of on-farm research methodology and the way it is being rapidly promoted through a large number of individual projects (over 30 USAID projects in Africa have an on-farm research component), information exchange is expected to pay substantial dividends.

2. Ongoing Information Exchange Activities

Given the need for information exchange, the next question is what is the best way to go about it. The widespread distribution for a regular publication is one obvious way of keeping OFR/FSP researchers in touch with what is going on outside their own localities or countries. CIMMYT puts out a farming systems newletter from Nairobi. Experience suggests that this type of information exchange tends to be somewhat passive in that most readers are happy to receive information and ideas but only a few make significant contributions. More active ways of seeking out ideas, experiences and results and bringing them to the notice of others can usefully complement the newsletter approach.
Technical and Review Networkshops have been organised by CIMMYT. The proceedings of two of these are available for you here. Dividents from

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* CIMMYT Regional Economist ESA.

technical workshops such as these are expected to come from generating exchange and widening the data and experience base from which technical researchers can draw in their local specific situations. We do not expect networkshops such as this to come up with common solutions to a common problem. Rather, we expect that knowledge of how the same problem manifests itself under different circumstances and a knowledge of a range of potential solutions that have been tested under different conditions will allow researchers to:

(a) better understand the specific nature of the problem in their own localities;

(b) be in a better position to choose technologies or procedures for on-farm experimentation that have a good chance of being successful in their particular localities; and

(c) identify shortcomings in current component research efforts, institutional linkages, methodologies etc.

Inventoring of Research Experiences on Specific Topics is another approach that we have tried. Here the idea is that a first stage should be to identify specific areas of concern that are common across country locations. The next stage would involve the inventoring of two aspects of the area of concern:

(a) First, we would describe the characteristics of local specific systems where the problem area was important. The aim would be to see how the problem manifested itself under different agro-climatic, economic and social conditions and to inventory the ways in which farmers were managing the problem under different circumstances.

(b) The second inventoring task would concentrate on listing past ongoing component, station-based, research and generate a directory of current researchers working on the problem area.

The aim of the two inventoring tasks being to give on-farm researchers ready access to a body of information which they can bring to bear on particular problems when they are diagnosed as important in a local farming system. An example of the output of this type of activity on the draught power and animal feeding problem in Botswana, Lesotho and Swaziland is also available here for you to look at.

3. A New Proposal - Documentation Clearing house Service

Many of you have ready received information on this proposal from Mike or myself. Those in the southern countries have received an initial accession list. An updated list for the southern countries is included at the end of this paper.

The origin of this initiative was the suggestion by some of you that the IARCs involved in FSR could play a useful role in obtaining a distributing documents and reports that are being increasingly produced on aspects of FSR work ongoing in Eastern and Southern African.

It was proposed that this clearing house function be divided up between IARCs on the basis of a regional grouping of countries for which an IARC liaison person has been named. The groupings are as follows:

Country Groupings

1. Great Lakes Group
   Burundi, Rwanda, Zaire (Kivu)

2. Eastern African Group
   Ethiopia, Kenya, Somalia, Sudan, Tanzania, Uganda

3. Southern African Group
   Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Zambia, Zimbabwe

4. Indian Ocean Group
   Madagascar, Mauritius

We decided to work initially on the Southern African Group, to see what the response was like and how the system might best be implemented. Up to now a limited library has been built up for the Southern Group with a little over 100 titles, listed in the attached accession list.

The intention is to send out accessions lists from each country group to OFR workers/administrators and to duplicate and send out copies of any of the documents on the list as requested. In order for a programme to be eligible for this service it was stipulated that we must receive copies of their FSR documents not already on the list or confirmation that all issued documents are listed.

For particularly bulky documents (e.g. annual reports) it will be necessary to restrict distribution to one per major project/programme and it would probably be best to send these out automatically according to a fixed mailing list (probably one per country or major programme). These types of documents are marked with an asterisk against the reference number on the lists.

A Database Setup and Potential Uses. This list has been set up as a database on a microcomputer. The record format is presented below as Figure 1. All the information up to the keywords is printed out on the accessions list.

Figure 1

Farming Systems Research Documents Information Form

Country: ----------

Author: ----------

Title: ----------

Subject: ----------

Keywords:
1. ----------
2. ----------
3. ----------
4. ----------
5. ----------
6. ----------
7. ----------
8. ----------

The purpose of the keyword section is to enable selective searches to be made for specific types of information. We have put out via the newsletter a suggested keyword structure as follows:

Keyword 1 - Subject matter results from one of the following
- Informal or formal Survey work: SURVEY
- On-farm experiments: OFE
- Component technical research experiments: CTR
- Farmer participation and assessment: FPA
- Monitoring of adoption of technologies: MAT
- Annual reports: ANREP
- Mixed results: combination of codes, e.g. SURVEY, OFE
- Other general: GEN

Keyword 2 - Descriptors of rainfall
Aims to identify unimodal or bimodal (U or B) seasons, the length of the season(s) in months and the long term average amount of rain in millimetres for the (each) season:

e.g. ·B--5/4--350/400

Keyword 3 - Descriptors of altitude, soil and population pressure
Aims to identify hight a.s.l in metres, rough soil characterisation (SANDY/LOAM/CLAY/MIXED) and the population density in persons per square kilometre:

Keywords 4-6 - Descriptors and the focus of the substance of the document
Any combination of:
- Major enterprises; e.g. one or more crops or livestock enterprises of off farm activity.
- Major husbandry practices: e.g. oxtillage, herbicides, insecticides, weeding, harvesting, etc.
- Major methodological topics: e.g. target groups, farm selection, sampling, interviewing, questionnaire, design analysis evaluation, etc.

Documents will often be mixed with something on many crops, or something in all three of these categories, the aim will be to try to reflect the balance of the document in the descriptors selected in this category.

e.g. (4) MAIZE (5) HOE WEEDING (6) HERBICIDES

Keywords 7-8 - Two other keywords
Words which will help to capture the substance of the document.

In the absence of any criticism or alternative suggestions, this structure has been used for the southern database and Figure 2 below gives an example of the keyword input for the record No.08.010.

Figure 2

Example of Database Record

REF: 08.010	COUNTRY: Zimbabwe DIST No. 1
AUTHOR:	Enos Shumba, Dept. Research and Specialist Services, Ministry of Agriculture
TITLE:	The Farming Systems Research (Crops) Testing Programme for the 1984/85 Season in Chibi Communal Area
SUBJECT:	Describes on-farm trial programme developed on basis of diagnostic survey. Maize, sorghum & millet varieties and fertility; moisture conservation techniques in maize and sorghum; maize reduced tillage & manure x fertiliser.
KEY1: OFF	KEY2: U--6--300 KEY3: 1000-SANDY-70
KEY4: MAIZE	KEY5: SORGHUM KEY6: MILLET
KEY7: TILLAGE	KEY8: FERTILITY

Operation of the Clearinghouse Service.

The above information together with input forms (figure 1) have been distributed to all countries/programmes in the southern countries. The response has been very limited. I have been sent copies of reports from Botswana (without any input forms accompanying them) and I have collected the other documents myself in travelling around the region. The task of data entry and summarisation of just over 100 documents has not been a huge one, but for a single person to do the same for 1000 documents it would be. And it is only when we get up to about 1000 entries that setting up a computerised database with keyword structure and search facility really makes sense.

For this activity to work in the region we do need to have more input from national researchers, both in terms of submitting documents and completed input forms to us and in terms of utilising the duplicating and research service. We do not want to force researchers to go to the trouble of sending in documents and input forms to us for the sake of building up a library, unless it is going to be utilised. Let us look at examples of how such a service might be used.

1. Circulation of document lists and reproduction.
This is the main clearinghouse function that some of you were asking for. It would provide a central place for researchers to look to get regional documents on farming systems research work relatively quickly. Researchers in a region would have one contact - the IARC person for their country group - and he would be responsible for getting relevant documents from the other country groups also.

2. Production of annual bibliography with author, title and keyword indexes.
This would be similar to the bibliography by the IARC liaison persons to the researchers in their regions is all that is needed to fulfill your information needs.

3. Provision of individual search and report service.
This would utilise the keywords in the database to produce reports on FSR documents covering specific topics. Lets illustrate this with some examples from the limited database we have.

SEARCH REQUEST 1

Researchers may be interested in looking at descriptions of systems in the region which have particularly low population densities, say 20 persons/sq km and less. The following report gives a list of such documents selected from the keyword structure in the database. Of course it is possible to be more specific and stipulate, for example, that the documents must also have information on labour utilisation. As the database expands it becomes more meaningful to refine information needs to this sort of level.

FARMING SYSTEMS SURVEYS FOR AREAS WITH 20 PERSONS/SQ KM OR LESS

02.004	Botswana	Agricultural Development Ngamiland Phase 1 Report
02.007	Botswana	Cowpea Base Line Survey Implementation and findings in Tutune District ATIP
02.008	Botswana	ATIP Selection of Villages and Participating Households in Tutune
02.010	Botswana	Early Season Cropping Plans of ATIP Mahalapye Farmers ATIP PR M83-2
02.011	Botswana	1984 Cowpea Baseline Survey: Table and Summary Findings ATIP PR M84-5, Dec.
02.012	Botswana	1983 Agricultural Demonstrator Survey: Tables and Summary Findings Part Two
02.013	Botswana	1983 Crop Management Survey: Tables and Summary finding part
02.014	Botswana	Analysis of Census Frame Survey Matebe Mathangwane and Marapang Village in
02.015	Botswana	Recommendation Domains for Districts in central and Francistown regions of
02.017	Botswana	The structure of Traditional Agriculture in Botswana
02.021	Botswana	A Methodology for Farm Management Research in Botswana. Paper for ARPT
07.002	Zambia	Report No.4 - Deriving Recommendation Domains for Central Province, Zambia
07.006	Zambia	Summary of the Major Findings from the Labour Survey
07.010	Zambia	Income and expenditure patterns in relation to age of cultivator and
07.014	Zambia	Labour requirments for crops and livestock (Zambia, 1968/9)
07.016	Zambia	Annual report of the weed control research and extension team 1981
07.018	Zambia	Report on an Informal survey of farmers in the Chipata area of Lusaka Rural
08.002	Zimbabwe	Farmer participation in Research Programme Design and Implementation in
08.006	Zimbabwe	An examination of children's labour in a subsistence economy

SEARCH REQUEST 2

Researchers may be interested to get copies of documents from the region that give information on weeding or herbicide use. The following report lists such documents from the current database.

ON FARM RESEARCH WERE WEEDING AND/OR HERBICIDES FEATURE STRONGLY

02.002*	Botswana	Report No. 8 Final (1984)	Part I
02.003*	Botswana	Report No. 8 Final (1984)	Part II Summary 1976-1984
04.002	Malawi	Additional Information From Formal	Survey Thiwi/Lifidzi Rural Development
04.007	Malawi	Formal Survey Results and Discussion	EPA1 Ntcheu Rural Development Project
04.013	Malawi	Adaptiveresearch Pasture Improvement	Trial in Dowa West 1984/85
04.019	Malawi	System Overview Background information	Kasungu Rural Development Project
04.024	Malawi	Dedza Hills (EPA 8) Formal Survey Report	
06.006	Swaziland	An On-Farm Research Approach to the	Identification of Appropriate Weed
07.007	Zambia	Annual Report 1983/84 part I	
07.011	Zambia	An investigation into small scale	farming improvements
07.016	Zambia	Annual report of the weed control	research and extension team 1981
08.003	Zimbabwe	A Diagnostic Survey of Mangwende Communal Area, Zimbabwe for On-Farm Research	

SEARCH REQUEST 3

A more specific request may be for documents that give results of on-farm trials looking at the fertilisation of maize on sandy soils. For this request the following list could be produced.

MAIZE FERTILIZER TRIALS ON SANDY SOILS

07.005*	Zambia	Adaptive Research Planning Team Trial	Programme of 1982.83
07.007	Zambia	Annual Report 1983/84 Part I	
07.011	Zambia	An investigation into small scale	farming improvements
07.015	Zambia	Technical, economic and social	efficiency in the mechanization of
08.007	Zimbabwe	Restoration of productivity depleted sands	
08.010	Zimbabwe	The Farming System Research (Crops)	Testing Programme for the 1984/85

The form of the reports produced could be simple references listings are those given above or the more complete information on author, title and subject as given in the accessions list.

4. CONCLUSION

We would like to get a response from you on how you view these proposals. Which are going to be useful and which not. How can we operationalise this on a regional basis. Should the IARCs be doing this or some other regional organisation such as SACCAR. As you will know SACCAR is proposing to set up a Southern African Data Information Service on agricultural research. The basis of this is the baseline data collected by DEVRES in the Agricultural Research Resources Survey. Martin Kyomo tells me that IDRC will be seconding one of the former Deputy Directors of CAB to Botswana in January to help set up the SADIS database on an IBM personal computer there. Should we look to this service to provide our information needs on farming systems research in the southern countries and linked into it with databases from non SADCC countries? What other information exchange mechanisms should we be looking at?

For any networking activity to be successful, there needs to be given and taken on the part of the national researchers. Only if significant numbers of researchers contribute to the network will there be anything for others to take from it. How do we encourage more active contributions from national researchers? An annual OFR documentation competition, with cash prices, has been suggested as one possibility.

We can put forward ideas and suggest how they might work but it is only you who can judge where we should concentrate our efforts and what level of national involvement is possible and desirable. In other words we are seeking guidance from you on where do we go from here.

NOTES ON THE INTERNATIONAL AGRICULTURAL RESEARCH CENTERS AND SYSTEMS BASED OFR IN EASTERN/SOUTHERN AFRICA.

by

Dr Malik Ashraf*

1. IARCs are currently engaged in streamlining their on farm research approaches to avoid confusion to the national agricultural research service (NARS). With the feedback reaching, the AIRCs, they have taken some steps to harmonize the various research approaches to the extent it is feasible and is desirable. Some of these steps are:

   (a) CIMMYT/IITA unified maize improvement, testing and evaluation programs for the African countries. The program is being organized under a Director of Maize Programme located at the IITA headquarters.

   (b) IRRI/IITA unified International Rice Testing Program (IRTP).

   (c) Inter-centre consultations on OFR in Eastern and Southern Africa, the first meeting was held in Nairobi, Kenya, October 1984.

2. Eastern/Southern African countries are extremely diverse with large agro-ecological variation. The crops of maize, sorghum, millets, cassava, sweet potato, phaseolus beans, cowpeas, soyabeans are all grown in the region within the mixed farming systems. Livestock including cattle and small ruminants are an important feature of the farming systems. A number of IARCs with a focus on different commodities are involved to serve the various crops and livestock. In most cases IARCs are seeking to work with the same research stations and staff.

3. While the socio-economic survey and OFR experimental design for different crops and systems may be somewhat differently oriented, it can be a source of enrichment of ideas and range of approaches to employ for different situations. The feeling that different IARCs offer conflicting advise is perhaps due to the shortage of trained manpower such that many IARCs seek to work the same researchers.

4. The OFR methodology consists of the following four major steps:

   (a) Diagnosis of constraints and description of target domains;

   (b) Design of improved technology;

   (c) On-farm testing and evaluation of new technology;

   (d) Extension and dissemination of improved technology.

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* IITA

All IARCs agree on this sequence of steps and are engaged in promoting the methodology with the NARS. The difference among IARCs in the application of OFR methodology is the degree and the form in which the centers participate in each of the first three steps depending upon the following three factors:

(a) State of NARS in a given country;

(b) Available body of knowledge and component technologies in support of the OFR; and

(c) Research mandate of each centre.

5. Two additional points may be noted here:

(a) OFR methodology is developed by doing the actual case studies and then testing the procedures across a number of locations. The methodology development work is undertaken with the participation of NARS, like CIMMYT's work during 1970s is an excellent example of a joint partnership. If NARS lacks facilities and research manpower, which many African countries do, some IARCs are called upon to improvise the resources. The direct involvement of IARCs to identify appropriate new technology through the on-farm adaptive research is often dictated by the urgency of food production as expressed by the national governments and donors.

(b) OFR experimentation is heavily built around the research information and technologies produced by the research stations. Without a direct feedback to the research stations for the development of component technology, OFR has a limited role. Not all IARCs are required to work on the design phase of OFR if strong NARS exists and there is an access to the stream of improved germplasm and component technologies. However in countries where strong NARS and component technologies are lacking, some IARCs are involved in the component technology design phase in support of the OFR through the technical assistance program.

6. Regarding the system based OFR methodology for the different crops, it seems to be a subset of an overall approach for the long-term improvement of farm systems which address the issues of declining soil fertilitity, acidification of soils, soil erosion, etc. It is often necessary to use the OFR programs to seek stepwise improvement of the farm systems as part of the long-term improvements.

7. <u>IARCs role</u>

(a) The overall role for IARCs is to assist the NARs for the generation of improved technologies which the client farmers can adopt;

(b) IARCs role would be what the NARs would ask them to do and which IARCs can manage within the limited research resources available to them;

(c) Some countries have strong research system and others have very weak research infrastructure, the role may thus vary from country to country.

Table 1 lists possible roles of NARs and IARC as partners to the development and institutionalization of system based OFR Methodology. The major thrusts of the IARCs are to support the NARs to develop its strengths in undertaking the location specific OFR research for the adaption and transfer of improved technologies. IARCs also have the role to strengthen the NARs and commodity based research for the development of component technologies. For the Eastern/Southern African countries possible sources for component technologies and related information are summarized in Table 2.

8. In the past, IITA has been less active in the countries of Eastern/Southern Africa. More recently it has responded to the requests of region's countries by making available its limited research resources and material. This year IITA has placed three grain legum scientists in the region in addition to the 2-man FSR team and a root and tuber crops breeder in Rwanda. The three grain legume scientists are at Harare, Morogoro and Nairobi locations to better serve the regional programs. The regional country grouping for each of the three grain legum scientists is given below:

(a)	Breeder:	Zimbabwe, Zambia, Mozambique, Swaziland, Lesotho, Angola, Botswana and Malawi.
(b)	Agronomist:	Tanzania, Burundi, Rwanda, Uganda and Madagascar.
(c)	Breeder:	Kenya, Ethiopia, Sudan and Somalia.

In Zimbabwe IITA has also provided a maize entomologist to the CIMMYT/IITA joint program of maize improvement for the mid-altitude. In Tanzania IITA is organizing commodity based short term training program in collaboration with the Sokoine University of Agriculture, Morogoro.

Table 1: Possible Roles for National Research Institutes and International Agricultural Research centers for Institutionalizing OFR in Eastern/Southern Africa

Activity		NARS	IARC
1.	Technologies:		
(i)	Germplasm	**	**
(ii)	Component	**	**
(iii)	Semifinished		**
(iv)	Finished	**	
2.	Methodologies/Procedures for:		
(i)	Diagnostic surveys	*	**
(ii)	OFR experimentation	*	**
(iii)	Agro-economic analysis	*	**
3.	Training:		
(i)	Technical material	*	**
(ii)	Staff	*	**
4.	Networking:		
(i)	Organization	*	**
(ii)	Newsletters	*	**
(iii)	Meetings/workshop	*	**
(iv)	Documentation	*	**
5.	Implementation:		
(i)	Planning	**	*
(ii)	Staff	**	
(iii)	Technical assistance		**

** Indicate major role.
* Indicate some role.

Table 2: Possible IARC sources of Germplasm and Information on Component technologies for Eastern/Southern Africa.

Crop	Germplasm/Cultivars
Maize	CIMMYTY/IITA
Rice	IRRI/IITA
Sorghum	ICRISAT
Millets	ICRISAT
Beans	CIAT
Cowpeas	IITA
Soybeans	IITA
Cassava	IITA/CIAT
Sweet Potato	IITA/CIAT
Irish Potato	CIP
<u>Component Technology</u>	<u>Information</u>
Plantain	IITA
Livestock	ILCA
Agroforestry	ICRAF/IITA
Multiple cropping	IITA
Land clearing	IITA
Tillage/Erosion Contro	IITA
Mulching	IITA
Fertility maintenance	IITA/ICRISAT
Moisture conservation	ICRISAT
Storage	CIP

DISCUSSION

Time limited discussion of the three invited contributions and it focussed on Prof. Blackie's Paper on Role of Universities in OFR Training.

Dr. Galt (U.S.A.):

I like Prof. Blackie's points on University staff interaction with farmers and indigenous staff training on OFR. However, is there a need to supplement university staff to replace those doing OFR? How do university staff link with OFR thrusts to gain hands-on-experience?

Prof. M. Blackie (Zimbabwe)

As the IARCs know, nothing comes free a national decision is required to make more resources available. Hands-on-experience can be gained by working with Ministry of Agriculture (MOA) teams, identifying opportunities to complement them, and defining university priorities in line with MOA to satisfying both parties.

Dr. M. Collinson (CIMMYT)

For 10 years CIMMYT has been trying to involve universities in OFR training without much success. I guess that they must first develop sympathy and interest in small-scale, mixed production systems for this to occur. I would like to ask whether the OFR orientation requires a change of curricula or addition to the existing curricula and what level of success you have had in pulling in the support of your staff.

Prof. M. Blackie (Zimbabwe)

Overseas training of University staffs liaises local teaching to foreign production systems and problems. In my opinion, there definitely has to be a change of orientation in some courses, but a major change must be made with respect to practical training which requires cooperation and planning with MOA. On involving staff on OFR, as you know, a dean is just one whom everybody shouts at. I have no budgetary control. I can suggest but there is slow progress. In the department in which I am more directly involved, there has been more progress.

Dr. J. Henson (Lesotho)

U.S. Universities such as University of Florida and Washington State University have a growing interest and capability in OFR but of course they lack on-the-ground experience. At present efforts are being made by these universities address small-scale producers in the context of the U.S.A.

Also US Agency for International Development has a strategy to develop NARs and faculties of agriculture, and therefore some resources could be made available to national programs.

Prof. S.O. Keya (Kenya)

How about the problem of strong, independent departments that have no responsibility for interdisciplinary work? This makes it difficult to do

research on areas such as biotechnology which requires interdisciplinarity. Then there is the problem of flight of competent staff to international bodies. Universities have research and education functions but lack extension responsibilities. In Kenya, the University of Nairobi (UN) has succeeded in working closely with MOA to the extent that MOA provides many scholarships for higher degrees. International centers and donors have assisted in UN and should assist more to fund local scholarships since training at local university is cheaper than overseas training. For FSR, I believe we must strengthen local capability. Another criteria is that the quest for high quality publications gets in the way of acquiring OFR experience.

Dr. S. Debela (Ethiopia)

The objective of universities is manpower development. If resources are limited, why did you select a reserach area so distant from Harare which is costly? Secondly, could you tell us how much involvement you have with NARS?

Mr. J.K. Gatheru (Kenya)

University education is universal, and therefore local and/or overseas training is desirable and good depending on the quality of libraries and information available.

Prof. M. Blackie (Zimbabwe)

The role of universities is manpower training, training has to be top class, and to provide it on OFR, field experience is essential to understand real production problems. Why so far for a research area? MOA took up all the nice places, from where they come back to Harare for tea. However, the selection of a distant, food-deficit and unknown area is proving to be a wise decision by the latest results. The University of Zimbabwe has a long history of cooperation of MOA. It is not an either/or situation with overseas training but these programs must be controlled and carefully tailored to satisfy local needs.

ANNEXES:

A. PROGRAMME
B. LIST OF PARTICIPANTS
C. CIMMYT NETWORKING SURVEY

PROGRAMME: MONDAY 25 NOVEMBER

Chair: Mr. Winston Nts'ekhe, Director, Research Specialist Services, Lesotho.

8.30 Registration of Participants

9.00 Welcome and Official Opening by Ministr of Agriculture

9.30 Welcome by CIMMYT and paper on Maize Research with Low Resources by Dr. R.L. Cantrell, Director Maize Program

10.10 Housekeeping details - Dr. M. Collinson

10.15 Tea/Coffee

COUNTRY PAPERS ON PROGRESS, RESULTS AND PROBLEMS WITH THE IMPLEMENTATION OF ON-FARM RESEARCH

10.45 BOTSWANA: Ministry of Agriculture

11.30 LESOTHO: Mr. M. Matli, Deputy Director Research

12.15 MALAWI: Dr. G. Mkamanga & Mr. F. Nyirenda, Dept. Agricultural Research.

13.00 Lunch

Country Papers Continued

Chair: Mr. J. Gatheru, Director of Extension, Kenya

14.00 SUDAN: Dr. D. Dafalla, Manager, Western Agricultural Research Project

14.45 SWAZILAND: Dr. C. Seubert, Agronomist, Ministry of Agriculture and Cooperatives

15.30 Tea/Coffee

16.00 ZAMBIA: Mr. S. Kean, National Coordinator Adaptive Research Planning Team

16.45 ZIMBABWE: Dr. M. Avila, Head, Farming Systems Research Unit, DR&SS

18.00-1930 Reception: Lesotho Sun Hotel.

[Workshop office is in room 050 (lower lobby)]

PROGRAMME - TUESDAY 26 NOVEMBER

Tuesday's programme is of group discussions around four themes suggested by research and extension administrators in the region. These themes become important in institutionalising OFR as part of the national research and extension programme. Links with various other government agencies working to a common goal of farmer improvement become vital to a coordinated, effective research and development effort. Groups will discuss these themes through the morning. In the afternoon the groups will report back to the plenary meeting for further deisucssion.

8.15 Individual study of Briefs.

9.15 Plenary meeting for formation of interest groups on four topics:

(1) Building of OFR into existing agricultural institutions - some alternatives;

(2) Systems based OFR as a Research/Extension linkage;

(3) OFR, farmer recommendations and links with Planning, Services and Policy;

(4) Programming and management of OFR teams.

9.30 Group meetings (Coffee will be available from 10.15 - 11.15).

12.00 Group chairpersons repporteurs and interested participants prepare presentations.

13.00 Lunch.

Group presentation and Plenary Discussions.
Chairman: Dr. Sene Debela, General Manager, Institute of Agricultural Research, Ethiopia.

14.00 Building OFR into existing agricultural institutions.

14.45 Systems based on OFR as a Research/Extension Linkage.

15.30 Tea/Coffee.

16.00 OFR, farmer recommendations and links with Planning, Services and Policy.

16.45 Programming and Managing OFR teams.

PROGRAMME - WEDNESDAY 27 NOVEMBER

Participants will tour selected rural areas of the country hosted by the Ministry of Agriculture, Lesotho.

PROGRAMME - THURSDAY 28 NOVEMBER

Resource persons have been invited to speak on three themes.

(1) Training needs in systems based OFR at university and in-service levels.

(2) Current networking activities in systems based OFR and future network developments.

(3) The role of the International Agriculture Research Centres in OFR in the region.

Presentation will be of 20-25 minutes with 35-40 minutes for discussions. In the afternoon an agenda will be put together from issues raised for consideration by participants, it will include a discussion on a future meeting.

CHAIRMAN: Dr. D.A. Dafalla, Director, Western Sudan Agricultural Project, Sudan.

9.00 University and in-service training needs in systems based OFR. Prof. M. Blackie, Dean of Agriculture, University of Zimbabwe.

10.00 Coffee/tea.

10.30 Networking in systems based OFR in the Eastern and Southern African Region; current activities and future development.

Dr. A.R.C. Low, CIMMYT Regional Economist.

11.30 The role of the International Agricultural Research Centres in systems based OFR in the Eastern and Southern African Region.

Dr. Malik Ashraf, IITA.

12.30 Lunch

14.00 Chairman: Dr. G.H. Semuguru , Director of Research Tanzania Agricultural Research Organisation.

Issues raised for discussion by participants. Future meetings of senior agricultural administrators on systems based OFR.

19.00 Closing dinner, Lesotho Sun Hotel.

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CIMMYT NETWORKING IN OFR IN EASTERN AND SOUTHERN AFRICA

This is a note of responses to a questionnaire completed by the thirty three senior agricultural administrators from 13 countries of the region attending the networkshop. The main results from the questionnaire are analysed below:

(1) Eleven present and proposed networking thrusts were scored on the scale 1-5. Thrusts scored an average 3.79, all scored greater than 3-useful, the rand order is set out below:

Thrust	Rank
- Quarterly Farming Systems Newsletter	4
- Annual Senior Agricultural Administrators Networkshop on O&M in OFR	3
- Biannual OFR scientist networkshops	
: On Methodological issues in OFR	6
: On problems common to several farming systems in the region	8
: In Field reviews of OFR programmes	10
- Reports on Networkshop Proceedings	7
- Inter-country exchange visits of OFR scientists	2
- Information exchange across countries	
: between OFR scientists working in similar farming systems	1
: between station based component and OFR researchers	9
: between station based component researchers in same crop/discipline	5
- Competitions to motivate interest in OFR	11

(2) Participants were asked if the number of regional meetings call by agencies, donors etc. presented a problem. Only 45% responded Yes. Asked how this can be alleviated respondents emphasised that control should be exercised by national administrators, priorities made and attendance spread over larger numbers of scientists. Respondents felt donors and agencies could help by better coordination in planning meetings and longer lead times for announcing meetings.

(3) Asked which months of the year are best for meetings June - September showed up strongly for both administrators and researchers. This of course is 'out of season' in many areas of the ESA region. 'In Field' meetings, to see crops in the ground will almost inevitably be January to May for most parts, especially away from the Eastern African Highlands.

(4) Suggestions made by the regions OFR scientists for networkshops in 1986 were scored by the participants and ranked as follows:

- In Field review of an ongoing OFR programme..... 1
- Crop/Animal Interactions in ESA Farming Systems..... 2
- Case-studies of On Farm Experiments in ESA..... 3
- Micro-computers and data analysis for agronomists in OFR..... 4

(5) Respondents were asked if there was a need for nationals to be trained as OFR trainers. Over 85% of responses were positive. Ranking three ways of achieving this gave the following order:

- Starting an additional training course for training trainers..... 1
- Inviting national scientists, nominated as OFR trainers to help as resource people at the Regional Training Workshops..... 2
- Switching the focus of the RTW's to the training of trainers..... 3

Currently CIMMYT does not have the resources to start a seperate course for trainers. We will initiated an effort to bring nominated national trainers to the Regional Training Workshops as resource persons.

(6) Respondents were asked to rank special training requirements, arising from discussions around the ESA region, in order of priority to them.

- Training of technicians and Trial Assistants in the layout, recording and involvement of farmers in OFE.. 1
- Training in survey methods for farm economists working in OFR 2
- Training in micro-computers for economists working in OFR..... 3
- Training in micro-computers for agronomists working in OFR..... 4

We hope to make a start tackling the first two of these during 1986.

Information exchange featured strongly in the ranking of thrusts by senior agricultural administrators participating in the Lesotho meeting, yet we have had poor response to our efforts to initiate an exchange system. Dr. Allan Low of CIMMYT, based in Swaziland, initiated a pilot information scheme during 1985. He listed reports on OFR available with him and asked programmes to send in their reports which were not on the list. Once they had sent in their reports they could request copies of any of the other reports listed of interest to their work. To facilitate searches for OFR reports of interest we suggestd a keyword scheme in Farming Systems Newsletter No. 21, we asked for comments but didn't receive any. We obviously need to re-think our approach.