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A FARMING SYSTEMS CONTRIBUTION TO IMPROVED RELEVANCY IN AGRICULTURAL RESEARCH

CONCEPTS AND PROCEDURES AND THEIR PROMOTION BY CIMMYT IN EASTERN AFRICA

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SOME HISTORY OF CIMMYT ECONOMISTS ADOPTION OF FARM SYSTEMS RESEARCH PROCEDURES TO IMPROVE RELEVANCE IN AGRICULTURAL RESEARCH.

The idea of small farmers irrationality has been dispelled. Evidence has accumulated from studies throughout the developing world, that like many of us, the small farmer does what he does in his own best interest. The degree of his success varies with the management ability of the individual. We can readily example the way small farmers have taken to changes which they perceive to be in their interest. Cotton in Sukumaland, Tanzania is a good case in point. Government policy for expanding cotton production in Tanzania from 1950-1966 was very consistent. Plant early, tie ridge and use fertiliser - and production expanded dramatically --

Table 1. The development of cotton production in Sukumaland, Tanzania.

Year	1950	1966
Production (bales)	39,000	405,000
Approximate total cotton acreage	120,000	1,000,000
Acreage using fertiliser	n.a.	28,000
Acreage of cotton per farm	.68	3.36
% area in cotton	9	44

Source: IBRD: Studies in Employment and Rural Development, 13, 1974.

- but official extension policy, aimed at high yields, played a minor role in the expansion. After 15 years exposure to the idea of fertiliser use, less than 3% of the area planted was receiving it. Yet the total crop expanded tenfold and cotton, as an enterprise, had grown from 9% to 44% of the area cultivated per farm. A well organised marketing channel was provided which removed the price uncertainties of selling cotton, and the Sukuma farmer dovetailed an expanding cotton acreage into his farming system in a way which complemented his food crop activities. Tea, coffee, milk in Kenya, Pyrethrum in South Tanzania, Hybrid maize in Kenya, Zambia

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and Malawi, these are all success stories not because of high yields from following recommended management practices, but due to high profitability, complementary with farmers' other production activities and effective marketing. These programmes succeeded, some of them in spite of inappropriate research recommendations. However, many programmes fail due to faulty organisation, others to a poor policy framework, but perhaps more than is often appreciated due to inappropriate technology at the heart of the planning. It is these, given the urgency of the agricultural development problem and the scarcity of resources, especially qualified manpower, that bring out a need for increased relevance in agricultural research.

Inappropriate technology generates two types of adoption failure:

1) Non or partial adoption of new management packages offered as improvements as a result of their ability to raise yield levels in research programmes.

2) Adoption by particular sections of the farm population with results which distort policy objectives.

There is widespread experience of non-adoption and partial adoption. As an East African example Gerhart (1) has shown varying levels of adoption for the complementary management practices extended with hybrid maize in Western Kenya, designed to exploit its yield potential. In some zones with high adoption of hybrid seed, low adoption of timely planting, pure stands and fertiliser application are found.

There is a widening documentation of the second type of failure where the introduction of new practices has had a social and economic impact contrary to government policy objectives. The introduction of the HYV short strawed wheats increased the income gap between poor and rich farmers in some parts of the Indian sub-continent; where only the richer farmers had access to the irrigation water and cash for fertiliser which was needed to exploit the potential of the new varieties. Kiray and Hinderink (2) have described the effects of replacing Yeri, the traditional

cotton varieties in a part of Turkey, with Akala and Deltapine through a government controlled seed distribution scheme. The new varieties matured within a three week period this concentrated the harvest labour requirement and required the employment of casual labour. Only the wealthy farmers had the cash to hire labour and cotton was lost as a cash crop to the small farmers. They turned to casual cotton picking as a source of cash income and found themselves worse off as a result.

Non adoption or distorted adoption may result in a failure to improve the living standards of the intended clients and implies an ineffective development effort in four main ways:

1) Scarce manpower and funds have been absorbed in research on issues which are irrelevant to farmers.

2) Relationships between farmers and extension workers, and government servants in general, are soured. Morale and effort decline and create trends in people/government relationships which are undesirable and difficult to reverse.

3) Where new techniques are incorporated as the content of area based development programmes, these require investment in enabling infrastructure and institutions: Roads, vehicles, supplies and credit are common examples. The anticipated increase in production requires investment in servicing institutions for transport, marketing, storage and processing. With non-adoption such investments are drastically underutilised.

4) Where programme content is irrelevant to the target population such benefits as are realised go elsewhere, frustrating government policy objectives.

Thus inefficiencies in research planning and focus result in nonadoption or distorted adoption and have wide repercussions on agricultural development efforts.

In the early 1970's, following adverse commentaries on some aspects of the Green Revolution, CIMMYT's Economics Programme sponsored studies in seven countries (3) which sought to identify the factors most influential in shaping the adoption of new maize and wheat technology. The studies showed the critical importance of their natural and economic circumstances to farmers in selecting between alternative technologies for use on their farms.

The dominating influence of economic circusmtances on farmers' decisions pointed to a role for economists in planning and interpreting agricultural experiments seeking new techniques for farmers.

Through the 1970's some of the characteristics of experimental methods and research organisation which give rise to irrelevant results have crystallised. At the same time an awareness has emerged that small farmers are different from large farmers in ways which require special consideration in planning and interpreting research for their situations.

Three features of research organisation and method are at the heart of irrelevance.

(1) Biological potential, a perspective too narrow for planning experiments and evaluating new techniques for farmers.

The exploitation of biological potential persists as a perspective for the planning and evaluation of experiments. It gives rise to output per unit of land - yield - as the dominant decision criterion in the selection of recommendations for farmers. Yet farmers never seek biological potential for its own sake. Sometimes yield is used as an intermediate criterion, but it is never a sufficeint criterion alone for small farmers to decide what crop and animal products to produce and what methods to use in producing them.

(2) The prescriptive tradition in agricultural research.

Historically research has been oriented to large scale farmers who, because of their influence have often been able to determine research priorities. Their access and education have allowed them to select out those experimental results they perceive as relevant to their own priorities and conditions. Small farmers do not have this influence, government acts on their behalf, it decides priority lines of research and which findings will be promoted. Researchers themselves select out 'the best' results of experiments and prescribe these as 'improved management practices' for the extension services to teach to farmers. 'I know what is best for you' very much dominates the process.

(3) The isolation of researchers from the farmers, their clients.

Located on experimental stations researchers are isolated from the farmers, their clients. Reward systems are such that researchers have no incentive to understand the farmers they work for.

This mental isolation compounds the prescriptive nature of the recommendation process. The physical isolation of station enclave also promotes irrelevance. Natural and economic conditions there are often very different from those in which the farmers' have to operate. For example soil fertility and labour supply are likely to be very different on an experiment station and on local farms.

Dominance of the inappropriate perspective of biological potential and the associated decision criterion of yield per unit area is perhaps the key to irrelevant research. Relevancy to farmers needs and circumstances demands farmers' perspectives in planning experiments and farmers' decision criteria in evaluating the results.

A further complicating factor is that farmers' perspectives and decision criteria are by no means uniform, they change with farmers' circumstances. Again there are particularily significant differences between the circumstances of Large Scale Commercial farmers and small holders, but also between small holders from different areas. These differences reinforced the need for new procedures in planning and interpreting experiments for the traditional agricultural sectors in LDC's. For example smallholders operating close to the subsistence level, with low resource endowments, have priorities for a secure food supply. Averseness to risks of food supply failure influences their decision making giving rise to resource allocations and management strategies different from those of large farmers with higher resource endowments. Different technologies are relevant to these different situations. Again, amongst smallholders in different situations decision criteria will vary. Take maize and beans as a common crop mixture, farmers' decision criteria on the appropriate balance between maize and beans in the mixture will vary with their circumstances

Criteria will depend on:

(1) The relative potential of the two crops in the natural circumstances of the area.

(2) How the two crops are combined in the staple dishes of the area.

(3) Whether there are profitable market opportunities locally for

(a) Maize (b) beans (c) both crops (d) other crops grown in the system.

It will clearly be impossible to produce relevant improved management practices for the maize and bean enterprise without understanding how local circumstances dictate local farmers' decisions in balancing the crop mixture.

The gradual clarification of these issues on the relevancy of research to farmers is supported by the evidence from the CIMMYT Adoption Studies. A stronger link between farmers and researchers is needed to incorporate farmers' decision criteria and circumstances into the planning and interpretation of experiments to produce relevant recommendations. Farm Systems Research (FSR) offers a linking mechanism capable of reflecting local farmers' priorities and circumstances. A set of procedures for the use of FSR in this context were developed (4) and have since been promoted to national agricultural research services by CIMMYT's Regional Economics Programmes. The first of these, established at the beginning of 1976, was the Eastern African Economics Programme, based in Nairobi, Kenya.

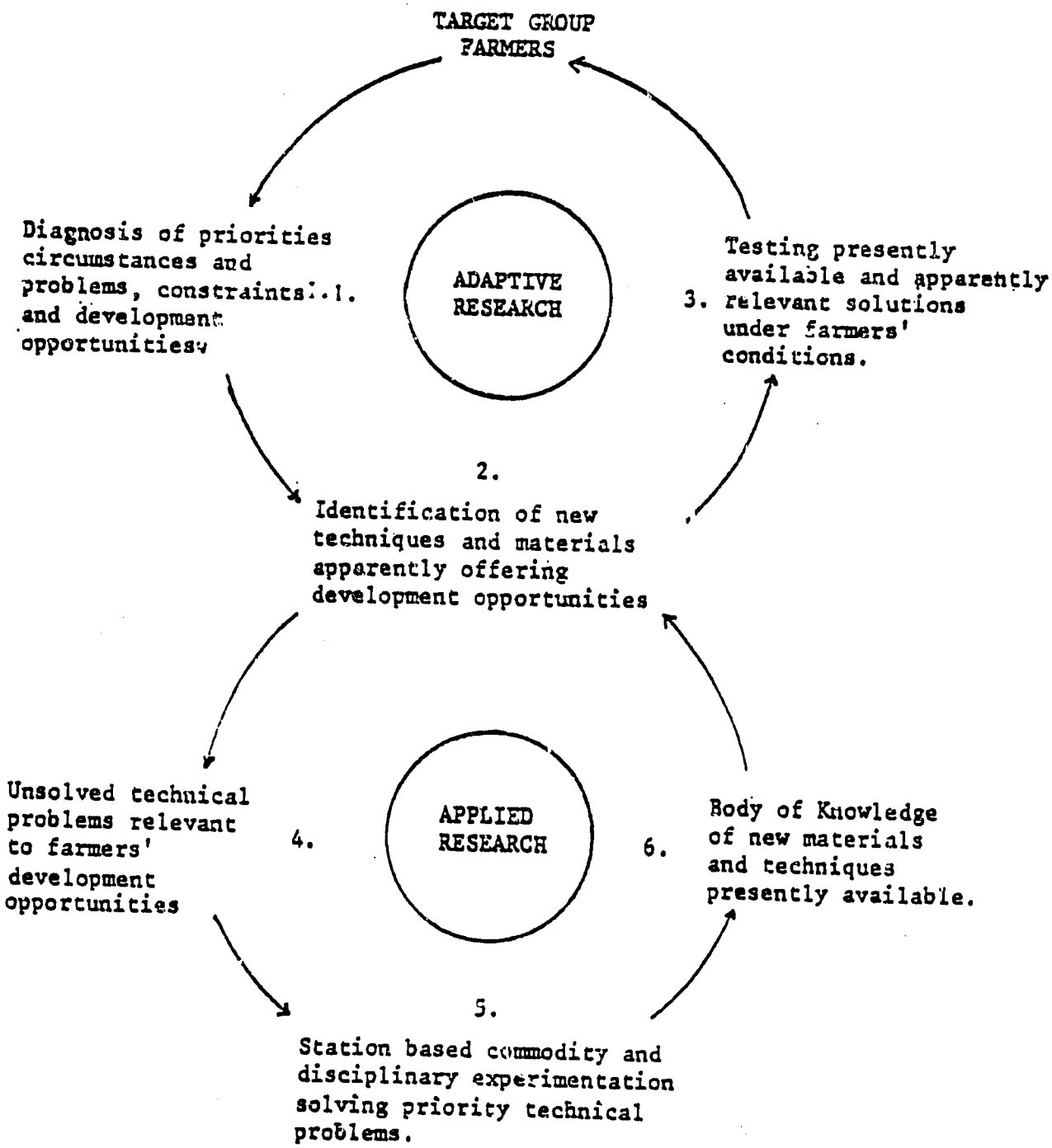
The implementation of a philosophy of agricultural research which has relevancy to farmers problems as its central tenet, and uses Farm Systems Research as a farmer link to operationalise its philosophy, requires two major developments in research organisation and planning.

(1) Recognition of a distinction between Applied and Adaptive research

(2) Recognition of a coordinating role for a Farm System Economist in the Adapcive Research cycle.

Figure .1. models the ideal interactions between Applied and Adaptive research and Target Groups of farmers. Ideally the organisation of research parallels these interactions. Applied research, seen as station based, is seeking new materials and practices which are technically feasible in the natural conditions of the country or region. These are additions to an accumulating body of knowledge on potential management improvements. Adaptive research selects out and tests components of this body of knowledge identified as potentially relevant to the needs and circumstances of target groups of farmers.

FIGURE 1. INTERACTIONS BETWEEN APPLIED AND ADAPTIVE RESEARCH.



THE FSR PROCEDURES DEVELOPED BY CIMMYT FOR USE IN ADAPTIVE AGRICULTURAL RESEARCH

The procedures have been designed as low cost with a rapid turnaround to suit the scarce manpower situation in most research establishments in LDC's. The procedures used first identify target groups of farmers for whom the same research and development effort will be relevant. An investigative sequence is implemented within target groups selected as priorities for intensified research and development efforts. This sequence is concluded with design of a set of experiments tailored to the identified problems and development opportunities of the farming system of the target group. The experiments are implemented under the operating conditions of target group farmers to ensure recommendations emanating from the work will perform as tested when in the hands of local farmers.

(1) IDENTIFYING TARGET GROUPS OF FARMERS

Inevitably there has to be a compromise between research for the particular situation of the individual farmer which is far too expensive, and for the heterogenous conditions of the country as a whole, which is far too generalised. A pre-requisite for the use of FSR procedures in diagnosing farmers' situations is the setting up of a framework of target groups as a basis for planning research priorities and identifying adaptive research focii.

Farmers are grouped into relatively homogenous populations on the basis of their existing farming systems. As a basis for grouping the farming system has three justifications :

(a) The farmer's existing system is a manifestation of a weighted interaction between his exogenous natural, economic and cultural circumstances and his own priorities and resource capabilities. It best reflects the balance of factors important in identifying homogenous groups of farmers.

(b) Farmers operating the same system have the same researchable problems and exploitable development opportunities. The same new technologies will be relevant to the group.

(c) The existing farming system is the starting point for development, the base onto which productivity improvements have to be grafted.

The coordinating role for the Farm Systems Economist is justified by his ability to understand and reflect the farmer's perspective. The farmer's role as a decision maker is to allocate his scarce resources of land, labour and cash between crop, livestock and off-farm production opportunities in a manner which best satisfies his, and his family's priorities. This is essentially the economic problem and the FSE's professional task is to represent the farmer's perspective as a decision maker. His function is to modify the traditional perspective of biological potential to understand farmers' decision criteria and identify how and why, in managing his farm, the farmer compromises on the optimal technical management of any one enterprise in order to raise the productivity of the whole system.

Operationally, locally based Adaptive Research teams, normally made up of an Economist and an Agronomist, but with call on whichever specialists are appropriate, carry out stages 1 through 3 of the Adaptive Research cycle and stage 4, the link stage to the Applied research cycle.

(1) The description and interpretation of the farmers' situations, the identification of system problems and possible development opportunities.

(2) The identification of materials and techniques which show potential for improving farmers' incomes by overcoming problems or exploiting opportunities in their situation.

(3) Testing those potential improvements selected as relevant and feasible for target group farmers, under the conditions they will face in production.

(4) Identifying unsolved technical problems and passing these back as priorities for Applied Research.

These technical problems, identified on farms in the course of adaptive research as important to farmers' development, form a logical focus for disciplinary and commodity oriented station research (Stage 5). The output from this Applied Research is the Body of Knowledge (Stage 6). Such a model has guided the strategies of CIMMYT's Eastern African Programme while helping develop the capacity to use cost effective FSR procedures in improving relevancy in national agricultural research services.

FIGURE 2.

FARM SYSTEM ZONING QUESTIONNAIRE. CENTRAL PROVINCE, ZAMBIA

DISTRICT. _____ WARD NO. _____ HIERARCHICAL GROUP _____

A. ANIMAL KEPT BY MOST FARMERS	1. THREE MAIN TYPES OF ANIMALS KEPT	1		
		2		
	2. IF CATTLE; MAIN PURPOSES FOR KEEPING	1		
		2		
		3		
B. FOODS GROWN (G) OR BOUGHT (B) BY MOST HOUSEHOLDS.	1. STARCH STAPLES	1		
		2		
		3		
	2. RELISH CROPS TO FLAVOUR STAPLES	1		
		2		
		3		
	3. ANIMAL PRODUCTS FOR FOOD	1		
		2		
C. MAIN CASH SOURCES FOR MOST FARMERS (RANK OVERALL) (1st, 2nd, 3rd)	1. NEW CASH CROPS AND % GROWING	1		Overal rankin
		2		
	2. CROP SALES AS CASH SOURCE	1		
		2		
	3. LIVESTOCK AS A CASH SOURCE	1		
		2		
	4. OFF FARM CASH SOURCE	1		
		2		
D. LAND USE METHODS AND TIME OF MOST FARMERS	1. YEARS CULTIVATED	1		
	2. TYPICAL AREA (HA)	1		
	3. MAIN METHODS OF LAND PREPARATION	1		
		2		
	4. MAIN METHODS OF LAND PREPARATION	1		
		2		
E. HIRE AND PURCHASE OF RESOURCES BY MOST FARMERS	1. TYPES OF HIRED LABOUR & PAYMENT	1		
		2		
	2. WORK DONE BY HIRED LABOUR	1		
		2		
	3. MAIN INPUTS	1		
	PURCHASED, CROPS AND % FARMERS USING	1		
		2		
		3		

Grouping farmers on the basis of present activities has two dimensions; activities alter geographically with changes in the natural and economic environment and hierachically with changing resource endowments. Both dimensions are important to present and to potential crop management.

A short questionnaire is developed to collect descriptive information about farmers in each local Administrative Unit. An example questionnaire is shown as Figure . 2. It seeks to tap the experience of agricultural staff locally involved in day to day agricultural administration in the areas to be covered. Foreknowledge of their likely biases is used to ensure balanced information.

The aim in data interpretation is to separate different farming systems. The key step in interpretation is to identify sources of variation which play a significant role in resource allocation in the farming systems covered. This reduces the collected information to manageable proportions.

The cost of defining homogenous target groups, using this methodology, are low. In terms of professional time three stages can be distinguished.

(a) Preparation : 6 - 8 mandays.

(i) Developing and testing the questionnaire

(ii) Arranging the programme of visits.

(iii) Preparing background material and maps.

(b) Data collection 6 - 10 mandays: (Administering a questionnaire for some 100 enumeration units)

(c) Target Group Identification 8-12 mandays

(i) Tabulation of the collected data (done by clerks)

(ii) Interpretation of the data

(iii) Deriving, describing and a preliminary mapping.

It is important to emphasise that these are preliminary groupings. As the diagnostic sequence is implemented among these identified target groups, boundaries between groups will be defined more precisely, and group characteristics detailed more fully.

Within selected target groups the adaptive research cycle is established as described in Figure .1, there are three stages. The first stage, the main application of FSR method, is the understanding of farmers' priorities and their circumstances to perceive the rationale of their management strategies and isolate the problems of system expansion. It identifies development opportunities for the target group and specifies relevant adaptive research content.

(2) FARMING SYSTEM DIAGNOSIS

Diagnosis of the Farm System has three steps. The sequence acts like a sieve, progressively sifting out unimportant facets of the farming system and irrelevant research issues. Each step funnels the diagnosis towards key circumstances of target group farmers, key problems of their farming system, and the identification of appropriate development opportunities. At the same time steps are increasingly expensive in terms of professional manpower. Cheaper diagnostic procedures are used to focus subsequent, more expensive procedures onto key issues.

Step .1. The Use of background information to evaluate Target Group circumstances.

This first step reviews available secondary information on the natural and economic circumstances of the target population of farmers. The objective of the review is to identify management problems posed by the local circumstances within which target farmers must operate. The focus of enquiryis consistently that of how these local circumstances will influence farmers' resource allocation decisions. Important facets, and some of the implications for farmer management, are listed here.

(1) Natural circumstances

- (a) Rainfall amount and reliability
  - (i) the length and timing of the growing seasons
  - (ii) uncertainties caused by periods of excess rain or drought.
- (b) Seasonal temperatures
  - (i) As an indicator of growth rates
  - (ii) Frost incidence as a source of uncertainty to growth.

(c) Soil characteristics and topography

(i) As a guide to possible erosion and soil fertility problems.

(ii) To indicate possible locational advantages and disadvantages; flooding and the use of residual moisture are examples.

(d) Pest and disease incidence as a source of uncertainty of crop output.

(2) Institutional circumstances.

(a) Types and usage of marketing and supply channels.

(b) Types, usage and reliability of food distribution channels.

(c) Existing extension and credit programmes; the types of programmes, the numbers participating and the types of participants.

(d) Land tenure arrangements.

(e) Farmer groupings; cooperatives whether voluntary, organised, official or unofficial and their planned and actual functions.

This information describes the available physical infrastructure. On marketing and government intervention programmes it allows some assessment of the content and degree of penetration of the local institutions. Information on land tenure and farmer groupings describes part of the institutional environment which will influence farmer decision making. Details on extension and credit programmes are particularily useful in identifying extension biases. For example, if the investigators know in advance that 5% of the areas farmers' have credit for the purchase of grade dairy animals, it gives a basis for judging the comments of extension staff on the incidence of grade animals in the area.

(3) Economic circumstances.

(a) Population numbers and density, and the pattern of settlement. This information gives a useful indication of whether the extensive margin is likely to compete with the intensive margin for system expansion. Different settlement patterns have different implications for access to water and grazing, as well as to advantageous locations for special crops. Patterns of land use will be closely related to whether farmers live in villages or on their holdings.

(b) Available acreage and production figures give a prior idea of what should be found in the area and the relative importance of the various enterprises making up the Farming System.

(c) Marketed Products.

(i) Volume, trends over years and over the calendar, in outputs sold and inputs purchased via the market and supply channels.

(ii) Foods purchased, relative volume, trends are the years and between seasons.

(iii) Prices, trends over years and over the calendar, and marketing margins if available.

Information on the workings of the market improves the understanding of what farmers face in both producing for sale and buying for consumption and for use on the farm. Trend information helps to highlight how things are changing in local farming - what is coming in and what is going out, trends are much easier to reinforce than reverse. Each facet reflects circumstances of local farmers' production environment and is a potential influence on their decisions on what to produce and how to produce it. Reviewing secondary sources of information on farmers' circumstances is a two or three day task. Where secondary information is limited it can be supplemented by discussion among the target group with local officials and business men.

The review of background information aids the understanding of the target group by identifying the features of their production environment expected to have a strong influence on management practices.

Step 2. The Informal Survey

The pivotal procedure in the sequence of three steps for understanding the farmers situation is the Informal Survey. The economist and biologists talk to farmers of the Target Group, on their farms, over a period of ten to fifteen days. The economist comes to understand the farmers' perspective in production and the biological researchers identify major shortcomings and compromises in management which appear to under exploit the biological potential of the area. Interaction between the social and biological scientists identifies new management practices which would better exploit biological potential and which, at the same time, would be consistent with the farmers' perspective; giving better satisfaction of his priorities from within his resource capabilities.

(1) Content

The informal survey proceeds by unstructured interviews with target group farmers which are focused by detailed guidelines held by the researchers. These are best conducted at a time in the season when the crops can be observed in the field. For the first two or three days discussions concentrate on describing the farming system as manifest in the enterprise pattern and agricultural calendar. What are the enterprises farmed, how are the products used, how are the inputs and outputs of production spread over the agricultural year. What is the relative size of enterprise in terms of resources absorbed. This description of how the Farming System is manifested on the ground provides the basis for understanding the farmers priorities and decision criteria as reflected in product end uses and in the relative importance of enterprises as resource absorbers.

During the next few days discussion aim to identify constraints on the expansion of the system and on the improved satisfaction of farmers priorities. These discussions are concerned to describe in detail the practices used in managing the major enterprises. Their management practices reflect farmers' strategies to satisfy their priorities in the fact of resource constraints and production hazards. At this point the biologists begins to identify compromises which underexploit biological potential, and the economist aided by the previous review of background information, begins to understand the pressures from resource limitations and production hazards that create these same compromises. Once farmers' management strategies are understood the biologists and economist interact to identify new materials and practices which would better exploit biological potential and at the same time improve the satisfaction of target group farmers priorities. New materials might include varieties, fertilisers, pesticides, machinery and equipment and even new enterprises. New practices could cover any one or any combination of the management components involved in producing one or more enterprises; seedbed preparation, time and method of planting, crop arrangement in the field, weeding timing, frequency and intensity and many others relevant to crop production. All aspects of housing, breeding, health and feeding management are relevant to the livestock enterprises.

Better satisfaction of farmer priorities would require that the new materials or practices improve his capacity to manage local production hazards, to alleviate his resource limitations or offer strong enough incentives for the re-allocation of resources within existing limitations. The third and final set of discussionswith target group farmers aim to test their attitudes to the management changes identified by this interaction between the biologists and economist.

(2) Method

The discussions are a recursive learning proces. Guidelines setting out the areas of information which may need to be covered are divided into 'bite sized' sections. Each section forms a basis for detailed discussion on that aspect alone. Some farmers will be sufficiently interested to discuss several such sections, others will have had enough after one. The researchers interview a farmer on one or more sections making field notes. At the end of the day, after talking to perhaps three farmers on various sections of the guidelines field notes should be re-written and filled out as an aid to absorbing and evaluating the material obtained. Researchers may interview the same or different farmers on the same sections of the guidelines and interaction between researchers at the end of the day is an essential aid to their understanding local farming. Further farmers are interviewed on the same sections until researchers are confident that they understand those aspects of local farming summarised in a section. At this point each researcher makes detailed notes against each heading of that section of the guidelines. Gaps in the information are identified and filled by subsequent interviews. Wherever possible interviews are carried out in farmers fields with visible evidence of farmers management before the researchers, the visits during the Informal Survey represent a real oppotunity for researchers to interact with their clients. Interviews should move across the zone with an initial set of questions to check that selected respondents fall within the Target Group. After the second set of discussions with target group farmers the economist writes a scenario of the farming system which specifically covers the following facets:

(a) A description of the system covering enterprise pattern, product end uses and the agricultural calendar.

(b) Farmers priorities and decision criteria.

(c) Factors constraining exapansion of the system.

(d) Major management strategies to achieve priorities in the face of resource limitations and production hazards.

This establishes hypotheses on points (b), (c) and (d) and is used as a base paper for the interaction between the biologists and the economist in devising further hypotheses on possible improvements in materials and methods for the development of the system. The final four days of discussions aim to verify that these proposed changes are attractive to local farmers, or to modify proposed changes until farmers react positively to the ideas put forward. The changes form the proposed content for a programme of adaptive research, which together with the hypotheses on the characteristics of the farming system, is the output from the informal survey.

Step .3. The Verification Survey

The Informal Survey uses an almost anthropological approach to understand the farming system of the target group. It is followed up by a formal sample survey which verifies that the understanding obtained by informal discussions with target group farmers is indeed valid for the target population as a whole. The formal sample survey may also seek deeper understanding and occasionally quantification of key parameters to improve the quality of experimental planning and interpretation.

(1) Verification The major objective of the Verification Survey is to ensure that the understanding of the Target Group Farming System has not been distorted by the informal selection of farmers with whom its characteristics have been discussed. The initial facet for verification is the homogeneity of the Target Group itself. Survey questions cover the variables by which the Target group has been specified and demarcated. The data from these questions is tabulated to show the distribution of sample farmers across these variables ,reasons are sought for sub-groupings which emerge. Re-definition of the Target Group may be necessary. The description and understanding of the farming system are verified by the formal survey.

Particular emphasis is placed on farmers priorities, their decision criteria for each enterprise, the resource limitations operating, the relative importance of production hazards and the way these facets relate to resource allocations, management strategies and production methods.

Finally conclusions reached on the management possibilities for the improved exploitation of biological potential are tested. The process of interaction between the biologists and economist has rejected some management changes because of the demand for resources they imply or because of the strong clash with presently expressed farmer priorities by their resource reallocation implications. Where such changes would offer dramatic opportunities for target group farmers it is important to test attitudes and verify that the resource reallocations implied are either infeasible or unacceptable for their present circumstances. Other management changes have been accepted both by the biologist and by the economist as content for an adaptive experimental programme. The implications of these proposed changes are verified as acceptable to local farmers.

(2) Quantification A major consideration in the development of the sequence of procedures being promoted has been to keep costs down and allow a rapid turnaround of information. It is important however to maintain a flexibility in design to accommodate very specific facets which might dramatically enhance the effective planning or interpretation of a research programme. In developing the procedures the quantification of parameters has been deliberately avoided, the emphasis has been on <u>understanding</u> the farming system. Normally, if precise quantification is required to tell us whether changes will not benefit farmers, it will be a doubtful development opportunity. Those opportunities significant enough to stimulate a shift in the system will normally be very clear. If quantative support is needed for the understanding on which proposals are based, 'back of the envelope' calculations, using interpolated figures, will give an adequate indication of the likely benefits arising. Exceptionally the quantification of a limited number of parameters may add considerably to the design of experiments or to their interpretation.

Where methods of collecting such quantative data are available and are consistent with the major methodological goals of low cost and rapid turnaround, survey design is flexible enough to incorporate these. For example, labour peaks are often identified as constraints on system expansion or on better husbandry methods. Quantification of the enterprise-operation combinations contributing to the peaks may add a further dimension to the planning and interpretation of experiments on management components designed to alleviate the peak and allow expansion of the system. Adequate labour data on the identified peak period can be collected in a single visit to the farm.

(3) Innovators. Many development opportunities will have been identified and the better farmers in any community will have worked out their own ways to improve their situation. These should be identified in the formal survey. Farmers who appear to have found and developed management strategies which relieve system constraints should be followed up after the survey with a view to detailing their solutions which, after experimentation, could be spread across the community.

(4) Methods. Normal Farm Survey methods are used to mount the Verification Survey. To allow rapid turnaround it will usually consist of a single visit of between 1½-2 hours to fifty or sixty target group farmers. The Target Group has been identified as a homogenous sub-population and many sources of variation have been externalised in establishing the Target Group framework. Some thirty respondents would normally be adequate to reflect the local situation. To allow for the emergence of sub-groups and the possible need to re-define the Target Group fifty or sixty sample units will be safer. The questionnaire is developed from the Informal Survey output and is completely local specific and highly selective in content. Many of the focii; for example one establishing farmer priorities, resource limitations and management strategies, will be common across many target groups and standard question <u>sequences</u> can be employed to elicit the information On the other hand the <u>content</u>, that is the enterprises followed and methods used, will vary between target groups.

As always with a single visit survey it is important to enlist the support of local leaders and ensure the selected respondents are participating in an investigation which has the backing of the farming community. Thorough training of the enumerators in the aim and delivery of each question, careful pre-testing of the questionnaire, and a level of supervision which allows careful evaluation of each completed questionnaire while still in the field, ensures the good quality of the data . Pre-programming of the farm visits and a careful reconciling of the sampling design with the logistical demands of the fieldwork will ensure smooth adminsitration of the questionnaire.

There is a value in hand tabulation and analysis of initial surveys to gain familiarity with the approach to their interpretation. However with the formal survey as the end of a sequence, and with much of its content aimed at verification, it lends itself to a high proportion of pre-coded answers and easy computor processing.

(3) COMPLETING THE ADAPTIVE RESEARCH CYCLE. Stage 2 of the adaptive research cycle set out in Figure .1. emerges out of the diagnostic sequence described. In the course of the sequence the biologists have reviewed the Body of Knowledge as well as applied basic principles of their discipline, and put forward changes in management which would better exploit local biological potential. The economist using the farmers' perspective has evaluated the compatability of the resource re-allocations implied with the existing farming system.

Final output from the verification survey is the content for a set of adaptive experiments to test possible management changes designed to meet the priorities and fit the capabilities of target group farmers. Study variables in these experiments are those identified management changes which the biologist believes will improve the exploitation of local biological potential and which, at the same time, the economist believes will enhance the satisfaction of farmers' priorities. The range of levels over which these experimental variables will be tested is decided by the farmers' flexibility in managing the resources required to make the changes. For example, where it is decided that animal manure is cheaply available to local farmers, and the best base for fertility maintenance, the amount to apply and the timing of the application might be the two major study variables.

The levels of farmyard manure to be tested will be dictated by the typical availability of manure to target group farmers. The treatments on timing of application will be decided by other factors, for example; when during the rotation the manure is to be applied, when is labour readily available during the cropping year as the carrying and application of manure are labour intensive, and the quality, and therefore best timing for use, of the manure under present methods of storage. Information on these facets is fed into research planning from the survey . Once the use of readily available manure emerges as a relevant experimental variable in the course of the informal survey, further discussions with farmers will focus on these and other facets required for relevant experimentation on manure. All such facets will be verified in the formal survey. Equally important to the planning of relevant experiments is the selection of levels of non-study variables. In seeking the expression of biological potential in traditional experimentation non-study variables are often fixed at levels which will not inhibit the effects of the study variables; ad lib insect control, ad lib labour for weeding, optimal time and method of planting are some common examples. Clearly these may be completely irrelevant to the target group farmers' situation. The study variables have been selected with the farmers' ability to change their management as a paramount consideration. Other variables have been rejected because he is not flexible enough to modify their management. Clearly, the experiments must show whether productivity will increase if the changes are introduced <u>within the farmers' present management regime</u>. The parts of this regime the diagnostic sequence has identified as inflexible, are simulated in the experiments to ensure the study management variables are tested in the context in which they will have to perform when tried by farmers. The control treatment in the experiment will be as close as possible to farmers' existing management, the only relevant baseline against which improvements in performance, from the changes proposed in the management of the study variables, can be measured and evaluated.

The farmer management levels adopted for the non-study variables and for the control treatment are also derived from the survey information. Stage 3 of the cycle is the implementation of the experiments as close as possible to the conditions under which farmers have to operate. The survey provides information on site characteristics and cropping history to further ensure representation of farmers' conditions. Similarily the understanding of the farming system, forms a context for the interpretation of the experimental results. Each management change implies a reallocation of resources within the system. Each re-allocation has costs and benefits, often in both market and non-market terms, which are peculiar to the particular system being researched. The understanding of farmer priorities and resource constraints given by the survey sequence allows the identification of the costs and benefits arising from changes in management implied in the experimental results. It ensures that the interpretation of the experimental results wll be relevant to the specific situation of the Target Group under investigation.

III

SOME ISSUES IN CIMMYT'S CONCEPTS AND PROCEDURES FOR THE USE OF FSR IN AGRICULTURAL RESEARCH AND PLANNING

This section explores five issues in the use of low cost FSR procedures for planning agricultural research. The first one touches on the broader aspects of agricultural planning and policy.

(1) THE FRAMEWORK OF TARGET GROUPS AS A LINK BETWEEN NATIONAL AND LOCAL PRIORITIES.

A framework of Target Groups of farmers provides an interface between national and local priorities. Use of the framework as a planning link allows a marriage of a top down flow of policy objectives and of bottom up local needs into relevant, and therefore more effective, research and development programmes. Figure .3. sets out a common pattern for deriving agricultural research and development programmes:

(1) National policy objectives dictate a commodity as a policy vehicle.

(2) Areas are selected with suitable natural conditions, sometimes where the commodity is already produced.

(3) Areas are selected which already have infrastructure and institutions onto which programme enabling and marketing services can readily be grafted. Altematively the necessary infrastructure and institutions form part of the development programme.

(4) A package of practices, traditionally aimed at optimaltechnical management of the commodity under the climate and soil conditions of the chosen area, is specified as programme content.

Farm System concepts warn that this pattern lacks a vital element. It fails to weigh the priorities and social and economic circumstances of local farmers in decisions on programme content, and this may be crucial to programme performance. Farmers priorities are manifested in the resource allocation of their existing system which may be incompatible with the resource requirements of programme content. Either the commodity vehicle or the management practices recommended for its production may conflict strongly enough with existing priorities and resource allocations consequent on these, to be unacceptable to local farmers.

Information from the zoning questionnaire and from secondary sources on local farmers' existing system and circumstances is used to build a framework of Target Groups. It permits an evaluation of each Target Group as a basis for the location of programmes selected also for their relevance to national priorities.

Once the survey sequence is completed for all the target groups in the framework, its value in fitting programmes, selected to meet policy objectives, to appropriate Target Groups is greatly enhanced. Detailed research and development programme content, screened for relevance to Target Group farmers' priorities and for compatability with the existing resource allocations these require, can be specified. In addition understanding the system involves understanding its relationships with the local production environment and the survey sequence also helps specify the complementary infrastructural, institutional and policy interventions needed to mobilise and service the programme.

Table 2 shows a hypothetical framework of Target Groups. The tabulated information is from available secondary sources and a zoning questionnaire. It will gradually be supplemented by diagnostic survey reports as adaptive research coverage of each Target Group is achieved. However even this preliminary information is a useful aid to the decision maker. In this hypothetical example the framework set out in Table 2 is used to demonstrate the selection of priority Target Groups for an Adaptive Research Programme. Selection is based on the relative potential of the Target Groups to satisfy a variety of a national policy objectives. The weighting of the various objectives remains the problem of the decision maker. Knowing the areas have very much the same climate and soils our hypothetical decision maker would weigh serveral policy guidelines in reviewing this information on the six target groups.

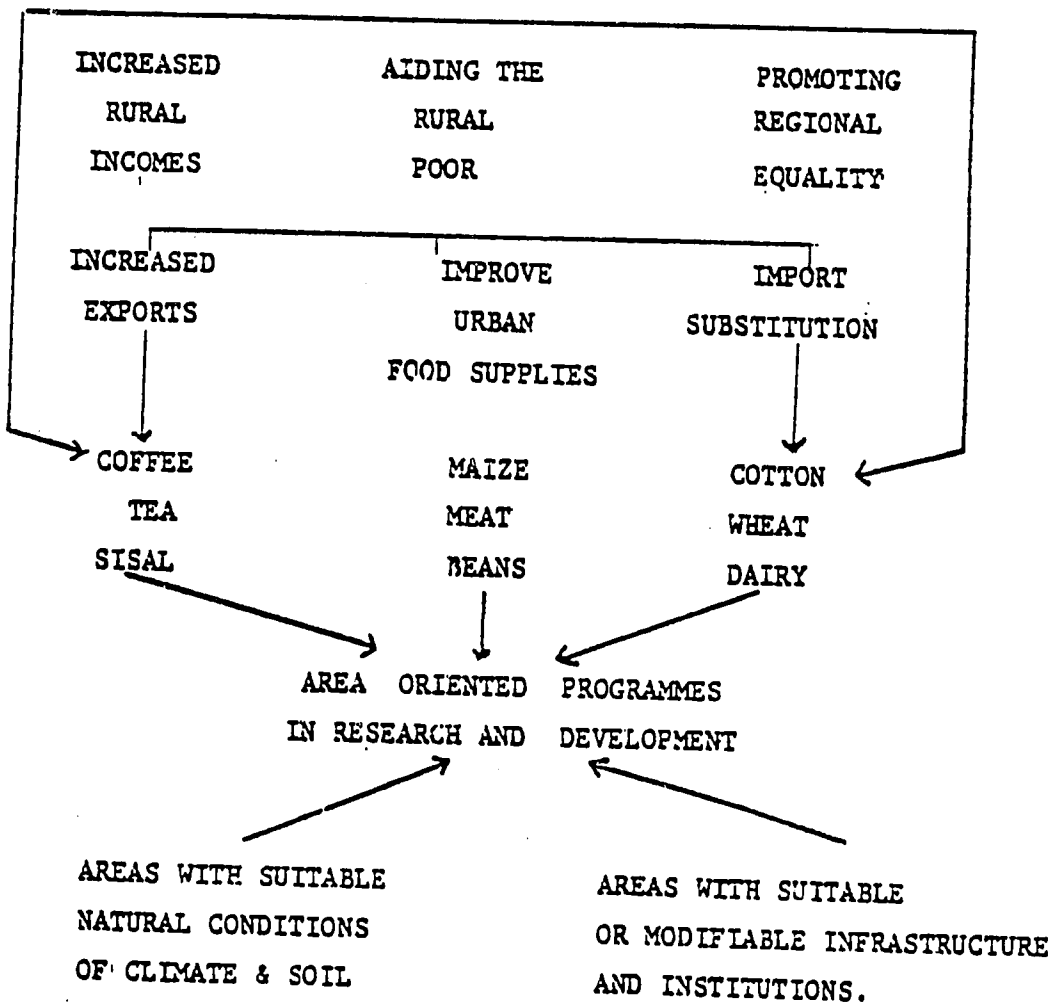
(1) The number of farmers to be reached by priority adaptive research programmes should be as high as possible.

(2) Infrastructural development and institutional penetration cannot be made cost effective, except in extraordinary circumstances, under 25 persons per square kilometre.

(3) Urban population is growing at 10% per annum requiring rapid increases in marketed maize for urban food.

(4) The newly established textile industry needs cotton as raw material much of which is presently being imported at a high cost in terms of foreign exchange.

FIGURE 3. DERIVATION OF PROGRAMMES FOR AGRICULTURAL RESEARCH AND DEVELOPMENT



His decisions would emerge from the following: Adaptive research efforts for Target groups 2 and 3 are low priority, both are relatively small and neither have the population density to allow the development of a viable infrastructure and marketing system. Target groups 1, 4 and 6 offer prospects of rapid development at low cost, expanding the farming systems towards the extensive margin . Both Target groups 6 and 1 cover large numbers of farmers. Target groups 6 and 4 are very similar, 4 has better infrastructure and the sale of livestock gives higher cash incomes. For crop development the same adaptive research effort is likely to be relevant. All three Target Groups have a relatively low population density and a low area cultivated per household, probably due to restricted market contact. With draft animals already mobilised in 4 and 6 which have the capacity to prepare of the order of 5 hectares per season per household,rapid expansion of the cultivated area can be achieved. Progress will be slower in Target Group 1 with a poor infrastructure, no current cash crop and no current use of animals for draft. Target group 5 farmers have a relatively high income level from two well established cash crops and an infrastructure developed to exploit these. However high population density and high proportion of land used indicates a long term soil fertility problem unless rotational and manure regimes are working within the system.

Decisions hypothesised are: - Immediate priority is for an adaptive research programme in Target Groups 4 and 6, it will focus on;

(1) The introduction of cotton as a new enteprise

(2) Possible interactions between the present system, particularily the maize enterprise, and the pattern of resource requirements to grow cotton.

(3) Maize and cotton management methods with particular concern to alleviate the existing weeding problem. This may have repercusions on relative time of planting and variety selection.

(4) Alternative methods of weed management, including the use of ox-weeders.

If recommendations are generated from the Adaptive Research effort a development programme will need to provide on an increased density of buying points to give better access to market for local farmers. Enhanced production will render a higher density of points viable. Target group 6 will also need more intensive extension coverage and improved access roads.

A second priority for an adaptive research effort would be as part of a development effort in Target Group one. Plans for an improved infrastructure and marketing system and more intensive extension coverage are a pre-requisite for an adaptive research effort with this high a priority. Initial extension effort on the mobilisation of local animals for draught purposes would allow encourage rapid development of the system towards the extensive margin which, is usually more easily managed and with only 20% of the land area utilised will almost certainly be the more profitable alternative. With a clash between millet and cotton labour requirements for harvesting, the initial focus for an adaptive research effort will be the introduction of maize as a joint food and cash crop.

Third priority for an adaptive research effort is intensification of the production system in Target Group 5. This would improve to second priority in the absence of resources for a programme for infrastructure and market development in Target Group 1. Given land preparation as a factor constraining system development the survey phase of an adaptive research programme will focus on management practices and varietal types to give improved complementarity between the resource requirements of cotton and maize as the two major resource absorbers, over the land preparation, planting and weeding period. Also, given that 60% of the available land is cultivated, in the absence of an animal enterprise regimes for chemical fertilisers will be important. The relatively high levels of cash income and the lack of extra land to move to the extensive margin indicate that cash outlays for additional intensifying purchased inputs will be made available by farmers. More certain conclusions on this would follow from the diagnostic survey sequence in the Adaptive Research Programme. This information from background sources and the zoning questionnaire can provide a description of local circumstances and outline characteristics of the farming system of each Target Group. The description is enough to allow vital local social and economic factors to weight decisions on what policy objectives can be achieved where, given the present circumstances of the target groups. It gives an improved basis for the selection of broad programme content.

TABLE 2 . The framework of Target Group information as an aid in deciding Adaptive Research priorities; a hypothetical example.

TARGET GROUP NO.	1	2	3	4	5	6
Number of farmers (000)	12	6	8	4	15	20
Population p. square Km.	30	10	15	40	120	40
Roads and transport.	weak	weak	weak	good	good	fair
Extension staff number.	5	2	2	5	18	15
- staff/farmer ratio.	2400	3000	4000	800	750	1300
- % farmers participate.	neg	neg	neg	5	10	3
Buying points : number.	6	2	4	5	30	20
- point/farmer ratio.	2000	3000	2000	800	450	1000
- % farmers' using.	3	neg	neg	50	90	30
Credit facilities % using	Neg	neg	neg	3	8	1
Main Starch Staple	Millet	Sorghum	Millet	Maize	Maize	Maize
Main Cash Sources 1	Beer	Fish	Beer	Maize	Cotton	Maize
2	-	Beer	Meat	Meat	Maize	Beer
Present cash income status.	low	low	fair	fair	good	low
Area cultivated p. farm (ha)	1.0	1.0	1.0	2.0	3.0	2.0
Method of land preparation.	hoe	hoe	ox	ox	hoe	ox
Main planting month.	Jan	Jan	Jan	Dec	Jan	Jan
Main reasons for cattle keeping. 1	Security	(none)	Draft	Draft	(none)	Draft
2	-	-	Sales	Sales	-	Security
Peak labour Months 1	Dec	Dec	June	Feb	Dec	Feb
2	June	-	-	-	June	-
Peak labour Work 1	Dig	Dig	Pick	Weed	Dig	Weed
2	Pick			-	Pick	

(2) CAN RESEARCH RESOURCES HANDLE THE DIVERSITY OF TARGET GROUPS LIKELY TO EMERGE ?

One important use of Target Groups as a planning framework is in ranking priorities for research attention. Not all Target Groups can be researched simultaneously, resources wont normally be adequate. If we make assumptions about the diversity of Target Groups and the rates of work of Farm Systems Researchers and Agronomists we can demonstrate hypothetical rates of coverage of small holder agricultural sectors in LDC's.

First, how many groups do we expect in the agricultural sector and what resources are available to handle this number. The only large scale zoning exercise done on a farming system basis raised an average of 10,000 farms per Target Group (5) Given a small farm population, for Kenya as an example of 1.5 million farms, this implies some 150 Target Groups. Continuing to use the Kenya case as an example, there are presently twelve graduate Farming System Economists in the research services. Marry these with twelve Agronomists as adaptive research teams to carry out local specific survey and experimentation and make the following assumptions about work load:

Farm Systems Economists : With commitments to join agronomists and farmers at experimental sites, and in the economic interpretation of experimental results, two diagnostic surveys of new Target Groups are feasible per professional per year.

Agronomists: Six sites are required for each target group and an average of 2 years work are required to arrive at farmer recommendations for each group. Each professional can supervise 18 sites, that is 3 Target Groups, each year.

Under these assumptions the completion of 2 years adaptive research in all 150 target populations, countrywide, would take 9 years. Priorities would decide which areas were covered first.

Table 3.

Projected coverage of 150 Target Groups by 12 Adaptive Research Teams.

YEAR		1	2	3	4	5	6	7	8	9
FSR'S	NEW RD'S	24	24	24	24	24	24	6	-	-
	COVERAGE	24	48	72	96	120	144	150	-	-
AGRONOMISTS	NEW RD'S	24	12	24	12	24	12	24	12	6
	COVERAGE	24	36	60	72	96	108	132	144	150

The capacity of the Agronomists limits the speed at which Adaptive Research Programmes cover the country.

If a hypothetical 150 Target Groups with six sites required among each are accepted as constant, Table 4 below shows the years required to cover the sector if the number of sites supervised per agronomist and years of work required at the site are varied.

Table 4.

The range of years to full sector coverage with variation in the Agronomists workload.

		Number of sites supervised per agronomist.			
		12	18	24	30
Average years of experimentation at each site.	1.0	6.3	4.2	3.1	2.5
	1.5	9.4	6.3	4.7	3.7
	2.0	12.6	8.4	6.3	5.0
	2.5	15.8	10.5	7.9	6.3
	3.0	18.9	12.6	9.5	7.5

Within a long term effort to re-orient the focus of agricultural research to the problems of small farmers, nine years is a modest period. If priority is given to Target Groups containing large numbers of farmers the majority of the small farm population will be covered much more rapidly. At the same time an assumed allocation of some 24 professionals to this Adaptive Research Programme is relatively modest in terms of the numbers in the professional research establishments in many LDC's. Given the stored 'Body of Knowledge' from Applied Research results and the burgeoning role of the International Agricultural Research Centres in Applied Research, the adaptation of knowledge to local situations would seem a logical priority for national agriucltural research programmes.

(3) THE ROLE OF THE FARM SYSTEM ECONOMISTS VIS-A-VIS OTHER SCIENTISTS IN AGRICULTURAL RESEARCH.

Economics has been described as the science of allocating scarce resources between competing ends to maximise utilities. The farmer as a manager, and therefore a decision maker on resource allocation, exactly parallels this definition. It is this congruity between the perspective of the farm system economist and the farmer which justifies a unique, coordinating role for the farm system economist in planning agricultural research. The economists role vis-a-vis other technical and social scientists in agricultural research is well identified by the relationship their specialisations have with farmers' decisions. The farmer coordinates and weights technical, social and cultural factors in taking his management decisions. Biologists and engineers working with technical factors, supplemented by sociologists working with social factors and anthropologists working with cultural factors make partial contributions to the decision process for research planning. These partial contributions are coordinated and weighted by the farm system economist, his perspective of their relevance representing that of the farmer.

The comparative advantage of disciplinary specialisation is only effectively mobilised in interdisciplinary research. Where research organistion is compartmentalised each discipline is isolated and blinkered, each is convinced that its own answers are those needed by farmers.

Interdisciplinary organisation, focussed on priority farmer problems, can bring a synergistic effect to the research process.

(4) IF WE NEED TO UNDERSTAND A FARMING SYSTEM TO MODEL IT, WHAT DO WE GAIN FROM MODELLING?

The procedures promoted by CIMMYT have been designed with the LDC institutional situation in mind; limited funds and limited manpower. The procedures allow the understanding of the system of a Target Group of farmers over a 3 or 4 month period. Costs are low and turn around time is rapid. A major controversy among micro-economists working in LDC agriculture centres around the intensity of investigation and analysis required to understand systems. A spectrum of data collection methods is available; from single visit surveys to cost route methods in which farmers are visited regularily over the agricultural calendar. Similarly a spectrum of analytical tools is available with simple cross tabulations and sophisticated variants of mathematical programming as extremes. Thinking of extremes the CIMMYT procedures are close to the rapid and cheap end of the collection and analysis spectra, with a turn around time of 3-4 months for any one target group of farmers, compared to 18-30 months for frequent visit data collection and programming analysis. Intensive investigation is vastly more expensive, particularily in opportunity cost terms.

Cheap and rapid procedures allow an understanding of between 4 and 10 target groups over the time period used to study a single target group by very intensive methods. Where research manpower is scarce it is assumed that the benefits from an understanding of 4-10 target groups are very much higher than from the increased understanding of one target group through detailed data collection and the use of sophisticacted modelling techniques for system analysis. Further, mathematical programming cannot in practice effectively represent real life situations and the level of control of enumerator and respondent error in cost route data collection techniques dependent on interview is usually very poor . Our conclusion is that the sophisticated ends of the spectra of collection and analytical methods do not offer effective operational procedures.

The understanding of a system has to be so sound to model it and to allow a realistic interpretation of the results, that the modelling itself becomes superfluous. The original understanding does the job in a way best fitted to the manpower resources of LDC's. Cost/effectiveness and this assessment of the existing state of the arts are the rationale behind the CIMMYT procedures which mobilise an almost anthropological approach to understanding farmers and their systems of operation.

(5) FARMING SYSTEMS RESEARCH: CARTE BLANCHE OR PRE-DETERMINED FOCUS ?

The issue is whether, in trying to identify farmers' needs, the diagnostic survey sequence should or should not be pre-focussed onto one enterprise.

It is a major issue. There has been much criticism of the blinkered approach in traditional experimentation due to compartmentalised research establishments and heavy disciplinary specialisation. The breeder believes variety is the main problem, the soil scientist fertility, the entomologist insects and so on. The farmer will have a list of problems, many interrelated. If research effort addresses those well down on his list, missing say his top three, he will regard such changes as irrelevant to his priority needs and will be unwilling to commit his limited resources to their adoption. The question is does a systems approach which is pre-focussed onto one facet of the system fall into this same trap of treating what may, for the farmer, be secondary issues. Should the initial diagnosis of the system be completely without prejudice as to what the key problems might be? Even with a whole system orientation investigation does have to home in on the problem area which is crucial to the development of the system. It will almost always be found that one enterprise offers the best leverage on that problem and will form the focus for experimentation and development But investigation from a whole system orientation may focus research on a different enterprise than investigation of a pre-determined enterprise. Clearly, ideally, the investigation and planning process should be initiated carte blanche with a whole system orientation and the intention to focus research on key problems and the enterprise, or enterprises offer best leverage on those problems.

In CIMMYT our mandate for work on maize and wheat demands compromise to a pre-identified commodity approach. However, the funnelling process in investigation, from general to particular, allows confirmation at the Informal Survey stage, before costs are significant, that the commodity pre-focus is consistent with effective leverage on the system as a whole. It also has some operational advantages:

(1) The pre-determined enterprise orientation is particularily feasible when research is planned in a region (across several TG's) where the enterprise in question is the major resource absorber in the system. This enterprise usually offers the best leverage on system problems. This is particularily true for starch staples in subsistence and semi-subsistence farming systems.

(2) Many national research efforts are commodity oriented. The pre-determined enterprise approach allows easier introduction of a farming systems based research planning sequence into existing research establishments. A whole system orientation implies a radical re-organisation and the abandoning of commodity programmes; too much for existing establishments to swallow.

(3) Many important policy objectives are commodity based and readily related to commodity based research programmes.

PROGRESS IN THE PROMOTION AND IMPLEMENTATION OF CIMMYT FSR PROCEDURES IN EASTERN AFRICA

(1) OVERALL PROGRAMME STRATEGY

The programme has followed a two stage strategy. Where national level agricultural research administrators have shown an interest in the need to bring research closer to the small farmer, a demonstration of the procedures is mounted in a maize or wheat growing area of their choice. Usually an area is chosen for which there are no recommendations, or where administrators feel the current recommendations are not being accepted by farmers. These initial demonstrations are organised, supervised and reported by CIMMYT but involve country professionals in both biological sciences and economics. In these demonstrations the CIMMYT procedures are implemented within a homogenous target group to understand their farming system.. An adaptive research programme, tailored to produce new techniques to solve problems and exploit opportunities in the system, is drawn up as a conclusion of the demonstration.

The initial demonstration in each interested country is fully written up as a formal report to promote interest in the procedures on the part of research adminsitrators and country professionals, and to provide an example of how the procedures operate to interested professionals elsewhere. Although CIMMYT usually carries a major part of the costs of these initial demonstrations it has been deliberate policy that subsequent activities be funded nationally to try to ensure that further cooperation is more than a gesture. The Eastern African Economics Programme annual budget of US$ 125,000 is regarded as 'priming' for a national commitment to financing the use of the concepts and procedures being promoted.

The second stage of the strategy follows where the demonstration convinces national agricultural research administrators that the procedures can improve the relevance and efficiency of the research effort. Where adminsitrators are sufficiently convinced to recruit graduate staff as trainee Farm System Economists, CIMMYT has helped to build up their professional capacity to implement the procedures within the research services

CIMMYT's in service training input to develop this capacity has been supplemented by further formal training. Where overseas universities have been used, masters degree training has been funded by a parallel Ford Foundation programme.

(2) PROGRESS WITH THE PROMOTION AND DEMONSTRATION OF THE CIMMYT PROCEDURES IN EASTERN AFRICA; 1976 - 1980.

During 1976 discussions were held with senior agricultural policy makers and research administrators in Ethiopia, Uganda and Tanzania, as well as in Kenya.

In Ethiopia senior research administrators showed an awareness that experimental results may be irrelevant to many farmers. Their concern had already manifested itself in the establishment of a Socio-Economics Unit in the Institute of Agricultural Research. There was interest in testing CIMMYT's procedures to promote coordination between the long established biologists and the newly introduced social scientists. In Uganda there was an awareness of the problems of relevancy in the Faculty of Agricutlure, Makerere University and in the Planning Unit of the Ministry of Agriculture. In both institutions economists were interested in procedures for identifying farmers' problems. However there was no concern over the issue of relevancy within the Research Division of the Ministry of Agriculture and this, together with the unstable political situation, deterred us from embarking on field activities in Uganda. A proposal on the procedures being promoted by the Programme, and on the concepts behind them, was put to the National Crop Research Planning Committee in Tanzania in October 1976, as a result of interest in the Programme on the part of senior research administrators. The Committee gave CIMMYT permission to approach Directors of Research Stations and to seek their interest in a demonstration of procedures to improve relevancy in research. Two Directors were approached; of the Central Research Station, Ilonga, and Uyole Agricultural Centre, Mbeya. Both expressed concern with the problem and interest in procedures to alleviate it.

The adoption study by Gerhart supported by CIMMYT and done in Kenya (1) had heightened awareness of the relevancy problem among both policy makers and research administrators.

A strong political emphasis on increasing the prosperity of the rural population had perhaps begun to expose shortcomings in the application of research results. Agricultural administrators were actively seeking a re-orientation of research and development efforts to improve the realisation of political aspirations. There was interest in the CIMMYT procedures as a means to this end. Contact was made with both Zambia and Malawi in the second half of 1977. In Malawi the Research Division of the Ministry of Agriculture and Natural Resources was in the middle of re-organisation. There was the belief among senior researchers that experimentation was always done in the interests of the farmer and the programme was not pressed further. In Zambia there was strong political concern that the rural population should be drawn into the development process, presently centred around copper and the large commercial farm sector. Administrators were conscious that the mass of small farmers operate under such different circumstances that a new orientation would be necessary. There was interest in the set of CIMMYT procedures as a contribution to a re-orientation. Recently, in September 1980, interest has been expressed by the agricultural research services of Zimbabwe in a demonstration of the procedures.

In Ethiopia the area chosen for demonstration of the procedures was around Bako, 250 kilometres West of Addis Ababa and adjacent to a major research station. With agricultural economists established in the Institute of Agricultural Research (IAR), and one posted at Bako, staff from there, with the addition of the Head of the Socio Economics Section, IAR, and a Farm Economist from the College of Agriculture, University of Ethiopia, at Debre Zeit, participated in the demonstration of procedures. With the first two stages of the investigation completed travel in the countryside became difficult with the organisation of the peasant milita and the war against Somalia. Cimmyt was asked to postpone the final stage of the demonstration of procedures. A Food and Agricultural Organisation (FAO) Farm Economist was appointed to IAR at about this time and , once communications eased, continued with the implementation of a programme based on the concepts behind the CIMMYT procedures. In Tanzania the interest of Station Director's at Ilonga, in Kilosa District, Central Tanzania and at Uyole Agricultural Centre, Mbeya, promoted demonstrations of procedures in both areas.

Economists were already established in the Research Division, and in Mbeya, station economists and biologists were brought together for the demonstration. In Ilonga economists from the Faculty of Agriculture at the University of Dar-es-Salaam were teamed with biologists from the Station. Reports were prepared for both demonstrations. These set out an experimental programme for maize tailored to the needs and circumstances of the target groups of farmers. The Report on the Ilonga demonstration was presented to the National Crop Research Committee in October 1978. It was well received by the committee and was given detailed consideration, as a means of improving the linkage between farmers and research at a workshop arranged to discuss the re-organisation of agricultural research in Tanzania in March 1979. The procedures and concepts behind them have been taken up in the Faculty of Agriculture, University of Dar-es-Salaam, and at Uyole Agricultural Centre, Mbeya, a zonal center with research responsibilities throughout the Southern Highland areas of Tanzania.

CIMMYT's Eastern African Economics Programme is headquartered in Kenya where procedures were demonstrated in two areas in 1976; one in Siaya District on the shores of Lake Victoria, the other in Kwale District on the Coast. At this time Kenya had no farm economists in her Scientific Research Division of the Ministry of Agriculture and these two demonstrations brought together economists from Egerton College, and biologists from the research services. The Siaya demonstration was written up as a formal report and was well received by senior research administrators in 1977. A one day seminar for senior research staff, held at the Faculty of Agriculture, University of Nairobi in June 1977 provided the opportunity to discuss the procedures and the concepts behind them.

As a result of the interest among senior agricultural administrators in Zambia a demonstration of procedures was implemented near Serenje, a small town in Central Province 400 kms north of Lusaka. The demonstration brought an economist from the Rural Development Studies Bureau, a research unit attached to the University of Zambia, together with biological scientists from the Central Research Station, Mount Makulu. The field work was carried out in the first half of 1978 and the final report was accepted by a meeting of the Programme Steering Committee in December 1978. The Committee charged CIMMYT with responsibilities for development of a capacity to implement the procedures within the research services.

(3) PROGRESS IN BUILDING CAPACITY TO USE CIMMYT PROCEDURES

CIMMYT is helping to build up capacity to use FSR procedures in planning and interpreting adaptive research in Kenya and Zambia. The Scientific Research Division, Ministry of Agriculture, Government of Kenya, established thirteen posts for Farm Systems Economists, including a senior professional as Economic Adviser to the Director of Research, by October 1979. Agricultural graduates were recruited to these posts of whom four had completed Masters Degrees and one is a Ph.D, candidate in Agricultural Economics. Six of the seven graduates recruited with Bachelors degrees have started Masters training and four of these have completed requirements. Since undertaking the training commitment in July 1978 six week long workshops, the more recent ones for agronomists as well as economists, have been undertaken jointly by CIMMYT and the Scientific Research Division in the Kenyan Ministry of Agriculture.Regular visits are paid to research stations to help trainees plan their work and to monitor its progress. The first aim of the training and work programmes has been to build up the capacity of the Farm Economists to understand farmers' present management strategies in term of their priorities and constraints which also restrict the changes in management which are relevant and feasible for farmers. On the whole good progress has been made with this. The best trainees have a grasp of the spectrum of methods available for data collection and analysis and a good idea of the relative suitability of the alternative methods for various situations. Most trainees are now capable of making a contribution to planning experiments relevant to an identified target group of farmers and of interpreting the results in the light of the circumstances of that group. Some of the Farm Economists have been able to use their knowledge of farmers' situations, gained from survey work, to propose specific adaptive experiments directed to relieving major constraints in the systems of identified target groups of farmers.

The second aim of the training and work programmes has been to build up the credibility of the Farm Economist with the biological researcher. Here the programme has met with limited success. The failure to establish a strong interaction seems to be related to two sets of factors:

(1) A lack of interest in relevance to farmers problems on the part of the biological researchers.

(2) Features of research organisation which inhibit both the effective use of Farm Economists and a strong interaction between disciplines.

These factors are discussed further in describing the evolution of strategies for implementation of the procedures in the final section of the paper.

In Zambia the programme Steering Committee directed that two Farm System Economists be recruited and two new graduates joined the research services in this capacity in July 1979. CIMMYT has been responsible for helping to plan and supervise their work programmes and has sponsored their participation in the Workshop Programme mounted in Kenya. Planning is underway in Zambia to adopt a two level hierachy for Applied and Adaptive research, to increase the establishment of Farm System Economists and pair them with Farm System Agronomists in Adaptive Research Teams to be based locally across the country. It is proposed that the coordinator of these teams will be a Senior Farming Systems Economist under the Assistant Director of Agriculture (Research).

THE EVOLUTION OF STRATEGIES FOR INTRODUCING FSR PROCEDURES INTO RESEARCH ESTABLISHMENTS FROM EXPERIENCE IN EASTERN AFRICA.

In this last section I trace the evolution in our thinking on ways of introducing FSR procedures for improving relevancy into research establishments. Kenya was the first country to ask for help in building up a capacity to apply the procedures devised by CIMMYT for planning relevant experiments.

(1) INITIAL STRATEGIES to introduce the procedures into the Kenya agricultural research services were based on experience elsewhere, as well as on the organisational implications of the procedures.

Experiences elsewhere had emphasised two points: First, historically economists interested in agricultural technology had dwelt on exposte criticism of agricultural researchers; coming back after the event and telling biologists they had got it wrong. Not only was this not constructive but it also built up an antipathy in research establishments to these 'commentators'. In the light of this sort of background it was felt important to emphasise a positive approach, presenting the use of FSR as a development in research procedures, not as a remedy for its failings.

Secondly, in the past economists attached to agricultural research establishments had been isolated in their own units or section. With the essentially interdisciplinary nature of the procedures such isolation was seen as anathema to effective implementation. Two strategies adopted to forestall isolation were; to avoid setting up separate Economics Units on research stations and to establish a direct professional link with senior research administrators. Past experience had seen research station based economists passing their operational and methodological problems through three levels of the technical establishment for decision. At each level an attitude of 'what is this odd fellow doing in agricultural research anyway' often brought decisions inimical to his effective operation.

A senior economist close to the Director of Research, to handle professional queries in liaison with the Director, was seen as a necessary counter to the scepticism of administrators with a wholly technical background.

The procedures have very strong organisational implications. The need to examine farming situations, to decide what experimental content is relevant to the needs of farmers and within their capacities to absorb, and to provide the context for proper interpretation of the results, has uncompromising organisational implications.

(1) Adaptive experiments can only be done effectively with a particular farm situation and thus a particular target group of farmers, in mind.

(2) Disciplinary based organisation is not conducive to effective adaptive experimentation. A compromise is required on specialist technical viewpoints if research is to address farmer's needs.

(3) To form the basis of good recommendations to farmers, experimental results must be achieved under conditions as close as possible to those under which the farmer will implement them.

The full implications, presented cold, could be unacceptable to an existing establishment. The new procedures were treated as a set of inovative components with the re-organisational implications to be introduced one by one as the programme developed, the easiest first.

In Kenya major research stations have national responsibilities on a crop basis, smaller stations tend to have zonal responsibilities. Stations are organised internally on disciplinary lines. In mid 1978 the move began to introduce economists on to research stations avoiding the establishment of 'economics units'. The following description of the initial strategies followed is from the working paper, written in 1978, to guide implementation efforts.

" Initial objectives will be:

(1) To teach the FSE the tools of his trade and expose him to experimental methods.

(2) For the FSE to gain credibility with the technical scientists on research stations that he can improve the relevancy of the experimental programmes and research recommendations to farmers' needs and to national priorities.

(3) To foster the ideas of target group focussed experimentation and farmer participation in the research process.

The work programme strategy will depend on the local situation. So far in Eastern Africa technical scientists have little or no idea of how a FSE can help the relevancy of their work. Indeed relevancy, except as 'a good thing' is a hazy concept, a prescriptive mentality often still dominates technical research work. On the whole strategies can be divided positive and negative. Positive strategies should normally be the basis of the effort made at research stations. Unless used carefully negative strategies will enhance the barriers between technical and economic researchers. However, if used carefully, negative strategies - essentially criticism of past or present work - can increase the awareness of the technical scientist of what is and what is not relevant. There strategies, with emphasis to be placed where possible on the first, positive one are listed below.

(1) To interest individual technical scientists on stations in the circumstances and priorities of farmers who will be offered the results of their research. The FSE begins to feed information on priorities and circumstances of target group farmers to selected individual scientists outlining the implications for experimental content. Technical scientists who appreciate the need for relevancy and express on interest in co-operation are the ideal.

(2) To review past research results and, by economic interpretation, demonstrate how modified recommendations are more consistent with farmer circumstances. Though a critical strategy, it has proved positive in practice. It can give immediate benefits in revising extension recommendations either by omitting components which are unacceptable to target group farmers, or by modifying treatment levels to bring them within the reach of farmers. The more relevant improvement packages build credibility for the economist with the extension service and with research adminsitrators. It is less painful if the results and recommendations reviewed are from thework of past researchers and not present incumbents.

(3) Questioning the relevance of ongoing research programmes.

(a) By asking who, which target group of farmers, is the work being done for. Making a strong issue of local specificity and relevance.

(b) By asking whether target group farmers will be able to absorb the level of changes implied in the management variables being tested.

Both types of questioning are immediately critical of current research efforts and therefore of the station management and technical scientists. The questions are justified if relevancy is a major issue and sympathetic individual technical scientists cannot be identified. Both types of questioning should be specific, and reviewing experimental programmes and investigating target group circumstances will be a pre-requisite for the FSE before embarking on detailed discussions along these lines with technical scientists."

(2) PROBLEMS EMERGING FROM EXPERIENCE IN EASTERN AFRICA.

Experience in institutionalising the procedures over the last two years have picked large holes in these strategies. At the same time key issues in introducing FSR procedures have crystalised. Care was taken through out the demonstrations of procedures to expose national research administrators to the concepts and methods. However the authority of Research Station Directors, both to influence research planning within disciplines and to control operations was badly underestimated. It had been foreseen that the budgetary needs for on farm trials would be an obstacle to this component of procedures being introduced, but in fact budgetary factors also proved a barrier to Farm Economists moving off their stations and working among farmers, and against taking biologists with them. Station Directors were loathe to release transport and travel funds in what appeared to be disproportionate amounts, to new, junior research officers. Despite briefing sessions on all stations at which economists were introduced, Directors were often not clear or convinced of the role of the trainees. At the same time they identified 'money related' jobs on the stations which they felt to be the proper responsibility of an economist. These range from costing the station dairy herd, or station vegetable production, to assessing future market prices for a new crop currently under observation. An economist can do these jobs, the danger is their detracting from his role of improving relevance in planning and interpreting adaptive research.

Working links with biologists proved to be very difficult to establish. Several facets inhibited cooperative research efforts.

(1) The biologists prime interest is his professional status within his discipline. This is reflected in the execution of closely controlled experiments demonstrating his disciplinary competence. Dilution of this specialist orientation, as is implied by cooperation with economists, threatens his professional peer group status. There are similar penalties in working close to the farmer where science is less pure.

(2) Technical researchers are locked into sets of specialist experiments which are programmed and budgeted over a period of years. Additional commitments are difficult to reconcile with these programmes and supplementary budgeting is awkward.

(3) When any particular set of ongoing experiments is concluded the established mechanism for deciding new commitments comes into operation. Attempts to override this by the economists trainee creates conflicts with established channels and his interventions, given his junior status, are usually squashed.

(4) This junior status of the trainee economist exacerbates the impression of 'unjustifiable intrusion' in two ways: Cooperative efforts with 'senior' biologists are awkward, the trainee is very much the underdog. The trainee has a poor command of his new profession and cannot put his case in a convincing way. The would be marriage has proved an extremely difficult one to consumate.

Overall, the introduction of FSR procedures into research planning and interpretation tends to shift the economist and agronomist, perhaps perceive traditionally as playing service roles to disciplinary researchers, to a central, pivotal role. The establishment feels threatened and the social scientist seen as the intruder, is rejected.

(3) EVOLUTION IN IMPLEMENTATION STRATEGY

Lessons have been learned from this experience. Of first importance is the recognition of the need for flexibility and a pragmatic approach to particular institutional situations and to the personalities dominating such situations. A major point of strategy is to focus on research establishments where there is already a strong awareness that relevance is a problem.

Within such establishments where authority is strong, institutional change may be a valuable vehicle for bringing in FSR procedures. Where direction is weak or conservative, or where organisation is poor, procedural innovations are seen as an added source of confusion - a nuisance. In such circumstances only a bottom up approach, working through the station and individual scientist level, seems feasible.

Ideally the two; top down with authority, and bottom up through individual researchers are complementary.

A clear distinction has emerged between applied and adaptive research. Applied research is the solution of technical problems on research stations organised on disciplinary and commodity lines. Adaptive research is a selection and testing from the range of potentially relevant technical solutions of that part or whole solution which is within the resource and management capabilities of target group farmers for whom the particular problem addressed by the solution is a priority,

A good example of the applied,adaptive distinction, and the dilemma of having no basis for the choice of relevant solutions, is semi arid areas with reliable starch supply as the major problem for farmers who nevertheless late plant their major start staple, maize. They 'should' plant dry to give the crop full use of the limited moisture. However their oxen are in such poor condition at the end of the dry season that they cannot break the land until their condition improves with new grass brought by the same rain which softens the land and reduces the power required to break it . 'Plant on time before the rains' does not address their problem it address the management compromise of late planting, which they are forced into by their circumstances, the poor condition of their animals.

Applied research is a range of fields has generated a variety of potential solutions to their real problem.

(1) Animal Production

(a) Feed through the dry season

(i) by planting grass types that will carry over the dry season

(ii) by planting productive grass types in local low lying areas where residual moisture persists.

(iii) Specifying purchased feeds to be used.

(b) Provision of AI service to reduce the need to carry male calves through for breeding purposes and thus reduce the stocking-rate.

(c) Cows used for draught to reduce the conflict between priorities for oxen for draft and for cows for milk, to further reduce the stocking rate.

2) Engineering

a) Yokes giving improved power transfer

b) Equipment for breaking the land requiring less power.

3) Plant Breeding

a) A shorter term maize variety which can be planted late and still escape the periodic cut off at the end of the rains which brings crop failure.

b) Alternative species known to be less susceptible to drought.

4) Agronomy

a) Minimum tillage techniques which, with or without the use of herbicide, will allow early establishment.

b) Land preparation at the back end of the previous rains, while the land is soft and animals in good condition will allow timely planting.

In contrast to the bald, uncompromising and unhelpful advice to plant early, all these techniques are relevant and bear on the problem. However, these are only possible, or potential solutions. Only an understanding of the target group farmers' present system, through adaptive research, allows the selection and subsequent local testing, of apparently feasible solutions. Feasible solutions have resource demands within the reach of target group farmers and resource allocation requirements which are compatible with the resource allocation requirements of other competing farmer priorities. The example demonstrates the strength of the case for an institutional adaptive research function and a two level hierarchy in research organisation. Within a two level hierarchy every research worker should know his role is either applied or adaptive. Current vagueness allows sloppy generalisations about working for farmers when the real aims are either papers for journals or a quiet life!

Operationally a two level hierarchy offers the opportunity to build the adaptive research effort on young professionals trained from the start in this approach. It gets over the senior biologist/trainee economist conflict and avoids the need for the new discipline of economics to break in to the on going disciplinary programmes. Among the young professionals all are learning their roles simultaneously, this avoids the imbalance created where a new economist has not built up the experience to demonstrate his usefulness and argue his case to the established biologist.

A revised strategy then is to establish adaptive research teams, who build up their experience together, drawing on the existing body of knowledge and older disciplinary oriented specialists for potential solutions to identified system problems. Once established, adaptive teams begin to trickle unsolved technical problems, important for farmer development, back to applied specialists. The trickle builds up to a flow until technical problems, identified on farms, preoccupy both Adaptive and Applied levels in the research hierarchy. At this point the appropriate manpower balance between the two levels will have identified itself.

(4) OUTSTANDING ISSUES IN MOBILISING FSR FOR AGRICULTURAL DEVELOPMENT

There are major outstanding issues in mobilising the utilisation of the FSR procedures which could well fill further papers in this series. Most important in encouraging the use of FSR procedures in agricultural research, is gearing the incentive system for scientists more closely to the benefits for farmers arising from their work.

Training for would be researchers, and perhaps more generally for would be third world agriculturalists, is a second urgent issue. All professionals working in smallholder agriculture need a systems perspective. University agricultural training at Bachelor level should include courses on understanding how small farmers operate their systems as a foundation for relevance in research, programme planning and extension.

Finally it should be emphasised that while CIMMYT's immediate interest is in the application of FSR procedures to improve the relevancy of research recommendations, the understanding of the farming system necessarily includes an understanding of the relationships between the farm and its production environment. Much of this environment is made up of infrastructure, delivery systems and policy variables, all areas of government intervention. The potential of FSR as a link between local and national priorities and between the farm and its infrastructure, giving insights into both policy and programme requirements, needs urgent exploitation.

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