Aiming Agricultural Research at the Needs of Farmers

Some Concepts and Procedures in the Systems Approach

by

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Aiming Agricultural Research At The Needs of Farmers:—

Introduction:

Developing the most appropriate technology for the farmers who will use it, and offering the most workable recommendations require careful consideration and research on the part of agricultural professionals. This short note attempts to point out the roles, goals and strategies in agricultural research, and some of the problems in research transferability. In addition a possible model for an integrated research programme in light of the systems approach is suggested. Such an approach calls for an unlimited collaborative effort of biological and social scientists and the farming community.

Roles Goales and Strategies in Agricultural Research:—

It is widely accepted that steady increase in agricultural productivity through technological change is indispensable to sustained economic growth. It is also notable that increases in productivity in agriculture have come largely from the application of science based farm technology and from changes in management and inputs developed through organized research. A systematic research is the base upon which a modern agriculture can be built. Agricultural research efforts in the development of new varieties of crops, improved breeds of livestock, improved farm implements, better management practices, conservation of land and water resources and etc. are indispensable to accelerate agricultural productivity. Hence, by generating new techniques, research plays a crucial role in agricultural development which is an integral part of and consistent with the national development plans of a country.

If the main goal of agricultural research is greater output through increased productivity, the determination of research priorities and
strategies is a relatively straightforward matter. But when research is also viewed as an instrument for achieving broader socio-economic objectives the problem of selecting appropriate strategies becomes more difficult. The agricultural research that is needed in any country is determined in part by the unique soils, climate, social and other conditions that can be found there. Although an indepth discussion of the policies and objectives of agricultural research is beyond the scope of this paper, it is worth noting that in general the ultimate objective of a country's agricultural research programme must be to enhance the welfare of its human population and in the final analysis, the value of the research effort must be measured by the extent to which it contributes to this objective.

Constraints in Innovation Adoption

The existence of a national research programme is justified by the generation of knowledge and technology necessary to solve agricultural problems. It is not enough to carry out high quality research, but what is important is that the technological innovations are adopted by the ultimate users, i.e. the farmers and help to improve their productivity, income and general welfare. Therefore it is crucial that research results are widely disseminated. The importance of technology dissemination cannot be over-emphasized and efforts in this area will help to give research the important role that it deserves in the agricultural development process.

Despite the existence of some improved packages of innovations in Ethiopia, very few farmers are adopting the recommendations made by researchers and extension workers. As such very limited innovations have...
reached the small farmers. By far the most widely used innovation for improving crop production has been commercial fertilizer. The 1977/78 Agricultural sample survey of the Ministry of Agriculture indicated that overall only 9% of the total crop land in the country has been fertilized and the distribution of improved seeds, herbicides and insecticides in the small-scale sector has been very minimal. As yet livestock husbandry has not changed except in very limited areas where ARDU, the Dairy Development Agency and very recently the Animal Resources Development Department of the Ministry of Agriculture have introduced cross-bred cattle. Why this occurs is the subject of a large body of literature. Some argue that farmers are at a fault, some that extension is ineffective, others that credit is unsuitable and some that inputs are not available in a timely way. A less frequently heard explanation is that the recommended technologies themselves are simply not appropriate to farmers.

Certainly one or the other of these explanations is valid at some time and place. But a number of experiences have shown that even the poorest farmers and usually those with the least access to information, inputs and markets are adopting certain technologies while rejecting others.

The adoption of new technology hinges on many interrelated factors. A particular piece of technology is adopted by a farming community in certain well defined way. First a small number of innovators test the technology and prove its usefulness. Once proven the technology passes to the early adopters who have an adequate resource base and reserves to accept the new technology. Later adopters usually benefit less as they face increased demand for the particular input and often depressed prices as a result of expanded production. This is the normal pattern of yield increasing innovations as experienced during the Green Revolution in Asia.
A technology is appropriate if it can be most suitably adopted to the conditions of a given situation. It must be compatible with the human, financial and material resources which surround its application. Innovation takes many forms: changes in sector structure, in settlement patterns, new crop varieties or animal breeds, new management practices in animal or crop production. Innovations have to be technologically feasible, economically viable and socially acceptable to farmers to be adopted. The appropriateness of innovation is a function of:

a) the nature of the innovation itself.
b) the characteristics of the farming environment and
c) farmers' characteristics

In the content of small farmers, technology is appropriate if it enhances the productivity of the farming systems and improve the reliability of family food supplies. There criteria for appropriateness are important:

a) improve the productivity of limiting resources.
b) be compatible with the levels of resources the farmer is willing and able to reallocate and
c) reduce the effect of uncertainty which surrounds the farming environment.

If technologies are appropriate to farmers circumstances, they will by definition be rapidly adopted by farmers. Farmer circumstances, are all those factors which affect farmers' decision with respect to a technology - their natural, economic environment and their own goals, preferences and resource constraints. Technical economic and sociological factors contribute to the success or failure or research transferability. These factors can only be determined a priori with an intimate knowledge of the farming system in question.
It is thus high time for researchers to ask themselves how much of their research efforts to generate new technologies have been attained? What is the impact of the technologies they developed on agricultural production and the welfare of the rural sector?

It has become apparent that the generation of new technology alone has not provided solutions for helping the rural farmers to achieve higher levels of living standard and increased agricultural productivity. The constraints on adoption of new technology appear to be more complicated than was earlier conceived by scientists and researchers. Technology was developed on research stations under conditions quite different to those of the small farmers and therefore in most instances, the technology was not adaptable or acceptable to the farmers for whom it was intended. If an appropriate technological base is chosen and farmers do not adapt it, not only the research effort expended in producing the technology been wasted but a whole range of development resources used for its dissemination have been misapplied. Hence the need to ensure that the technological base acceptable and relevant to the circumstances of small farmers is apparent. Beyond this, given limited resources the generation of technological alternatives must be focused on the problems and opportunities relevant to the farmers to whom the results will be offered.

In situations where the mechanisms of technology transfer to the farmers are weak or inefficient, researchers should not feel that technology dissemination is the responsibility of extension agents but must contribute and participate more actively in the transfer process. The roles and the degree of participation of researchers in such a process will be discussed in the next few pages. However, if one begins with the premise that little research has been conducted to solve the pressing needs of farmers or the on-going approach to agricultural research has not succeeded in developing easily transferable technologies, then the need for a new approach is evident.
The Systems Approach

A system is a group of interacting components operating together for a common purpose, capable of reacting as a whole to external stimuli. It is unaffected by its own outputs and has a specified boundary based on the inclusion of feedbacks. A system is a functional or conceptual unit made up of interacting parts at various levels of organizations. At any level the parts interact with one another and as parts of a system have the following properties:

1) each part affects the properties of the system as a whole and

2) each part depends for its own properties and its own effect on the whole system, on the properties of some other parts of the system.

The parts of the system thus interact in such a way that the system exhibits distinct and identifiable behaviour.

To illustrate this systems concept one can consider a farm as a system. A farm is an organized decision making unit in which crop and/or livestock production is carried out for the purpose of satisfying the farmer's goals. Since several activities on the farm are closely related to each other by the common use of the farm's labour, land and capital, by risk distribution, and the joint use of the farmer's management capacity it can be considered as a system. The various activities receive some or most of their inputs from the system environment and deliver the output either to other activities or to the environment.
Anderson defines the systems approach as a way of thinking about and looking at systems which features conceptualization of a whole systematic structure and a formal modelling phase. In order to build a model of a system it is necessary to determine all the significant factors and relationships that go together to produce the overall system behaviour. It is at the farm level where technical, scientific questions and also social, economic and political questions arise. Understanding the farm level system at prescribing for it cannot be done well from within the narrow confines of any one discipline. Thus the major disciplines must complement one another.

Farming System Research refers to any type of research which views the farm in a holistic manner. The research is conducted with a focus on the interdependencies and interrelationships in the farm system and its environment. Farming Systems Research aims to enhance the relevancy of agricultural research, facilitate the generation and testing of innovations for their applicability to the farm thus contribute to the efficiency of the farming system.

The Consultative Group on International Agricultural Research*(CGIAR) Technical Advisory Committee lists the following specific objectives of a farming systems research programme:

1. To understand the resource constraints and evaluate the existing farming system as operated by the farmers.

2. To improve problem identification for better research programmes.

3. To conduct research on new or improved practices for possible testing on farms.
Choice of Target Farmers and Research Priorities

Policy Context

National goals, input Supply credit, markets, etc.

Identification of Policy issues

ON-FARM RESEARCH

1. Plan
Obtain a knowledge and understanding of farmer circumstances and problems to plan experiments.

2. EXPeriment
Conduct experiments in farmers' fields to formulate improved technologies under farmer circumstances

3. RECOMMEND
Analyze experimental results in light of farmer circumstances to formulate farmer recommendations

4. ASSESS
Determine farmers' experience with technologies.

5. PROMOTE
Demonstrate improved technologies to farmers

New Components incorporated into On-Farm Research

EXPeriment STATION

Developing and screening new technological components (e.g., varieties, new herbicides)

Identification of problems for Station Research

OVERVIEW OF INTEGRATED RESEARCH PROGRAMME

Source CIMMYT, Economics Programme

Fig. 1
As illustrated in the figure an integrated research programme consists on-Farm Research which is linked to two other important factors in developing technologies. On the one side is experiment station researcher which emphasizes the development of new technological components such as new varieties. On the other side is agricultural policy which sets the economic environment such as national goals, input prices and supply, product markets and infrastructure in which researchers and farmers make decisions.

**ON-FARM RESEARCH**

On-farm research is research conducted in farmers' fields with the participation of farmers. Effective communication of researchers and farmers ensure a greater awareness of the constraints and problems in the design of technologies. It also ensures that technologies are formulated under farmers' conditions and overcomes the difficulty of using experiment station results to make farmer recommendations, particularly where experiment stations are not representative of an area because of intensive management practices or locations. The various stages of on-farm research are indicated in the figure i.e planning, experimenting, recommending assessing and promoting improved technologies to farmers.

**Experiment Station Research**

Experiment Station Research is primarily aimed at developing new technological components which require more controlled conditions. Promising technological components arising out of experiment station research are further refined and evaluated for their appropriateness to farmers. The flow of information between on-farm research and research stations in two way. Information generated by on-farm research is important for guiding experiment station research. Information from on-farm research aggregated over several regions can help establish broad priorities of the national research institution. Increasingly we find that information fed back to experiment station research is as important as the recommended technologies fed forward to farmers.
According to studies conducted by CIMMYT many experiment station research programmes have lacked an effective mechanism for relating research decisions to farmers' needs. In such a situation, the on-farm research programme should initially focus on screening the technologies developed on-station for relevance to farmers.

Policy Context

Agricultural development programmes are highly influenced by government policies. Government actions and rules that have to be implemented in order to meet regional or national development scale also influence research decisions directly. Farmers' production decisions as well are affected by government policies. The effects of policy on farmers' decision making in turn have implications for agricultural research. Equally, agricultural research and particularly on-farm research programmes can provide valuable information to the policy maker that might encourage a change in policies to facilitate the introduction of improved technologies to farmers. In planning agricultural research programmes researchers must subjectively decide which elements of the policy environment to consider fixed and which to consider variable.

Problems in Farming Systems Research

It is necessary to recognize possible problems in Farming Systems Research. Norman mentioned the following problems in conducting such an integrated research programme.

(a) Since the approach is holistic its coverage becomes very complex,

(b) Since farmers tend to indicate problems that are related to short-run private gains, a conflict between short-run private gains and long-run social costs,

(c) Since there is a dependence on other research sources, the approach can become time consuming until relevant solutions can be developed.
(d) Since farming systems research is locationally specific, it is intrinsically expensive unless efforts are made to make research results widely applicable.

(3) Finally, until people appreciate and understand the approach farming interdisciplinary farming systems research teams may be difficult.

Summary and Conclusions

In this short note attempts were made to indicate the need for the generation of transferable and acceptable innovations that will solve felt needs of farmers and increase agricultural production. It is a well known fact that one of the most important aspects of research is that of choosing which result to recommend to farmers. The choice hence requires socio-economic assessment of innovations. A simple recommendation for farmers to delegate their researchers differently does not result in improvements in farm production and increased incomes unless specific constraints that inhibit increased production are overcome.

Since previous efforts in research tended to emphasize individual disciplinary approach, the discussion in the preceding pages stressed the importance of a multidisciplinary approach in farming systems research. The Farming Systems Research is an attempt at a different approach to design and test technologies/packages which have been developed with a knowledge of the constraints and needs of small farmers. Adopting a research philosophy that is oriented toward the practical production problems of farmers has been repeatedly mentioned. Such a philosophy should accept the use of multidisciplinary teams conducting research in different commodity and farming system and be backed up by field studies of farmers' circumstances and at the same time must have strong links with extension work to facilitate information flows from researchers to farmers and from farmers to researchers.
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