Report of a Seminar

Women and Agricultural Technology: Relevance for Research

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Concern for Clients' Agricultural Research at ICARDA

by

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I. INTRODUCTION

The International Center for Agricultural Research in the Dry Areas (ICARDA) is located in Syria. Its headquarters are in Tel Hadya, a 948 ha farm 30 km southwest of Aleppo.

ICARDA was founded in 1977 and had its administrative headquarters in Beirut until all offices were moved to Tel Hadya in 1981. Aleppo Province, where the headquarters are now located, was chosen as a center of research activities because it is possible to observe very different environmental conditions within a 100 km radius. For example, rainfall (long-term averages) ranges from 476 mm in the northwest at Jindiress near the Turkish border to 225 mm at Khanasser, 100 km to the southeast. The Tel Hadya site, more or less in the middle, averages 389 mm. Similar variation can be observed in soils and social conditions. For rainfed agricultural production in West Asia and North Africa, climatic variability is considered to be a crucial constraint. Aleppo Province does provide quite a suitable environment in which agricultural research for diverse rainfed conditions can be conducted.

Within the Consultative Group for International Agricultural Research (CGIAR), ICARDA currently has a regional mandate covering West Asia and North Africa. This region extends from Pakistan to Morocco and from Turkey to Ethiopia. In crops, it has the world mandate to coordinate research on barley, lentils, and faba beans. On a regional basis it conducts research on chickpeas in collaboration with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and in wheat (bread and durum) in collaboration with the International Maize and Wheat Improvement Center (CIMMYT). ICARDA also conducts research in pasture and forage improvement as well as livestock management.[1]

An important characteristic of ICARDA is the adoption of the farming systems perspective in agricultural research. The Farming Systems Program (FSP) is quite active in research in Syria and internationally. FSP is involved in interdisciplinary research. Within the multidisciplinary team of scientists such diverse fields as economics, agronomy, soil physics, soil chemistry, weed science, agro-climatology, microbiology, sociology, anthropology, livestock science, and plant physiology are represented.

These research activities at ICARDA are organized into four scientific programs:

1. Farming Systems Program (FSP)
2. Cereals Improvement Program (CP)
3. Food Legume Improvement Program (FLIP)
4. Pasture, Forage and Livestock Improvement Program (PFLP)

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[1] Livestock research activities are primarily oriented towards management with the local fat-tail Awassi sheep and do not involve breeding activities.

In addition to these, there are a Genetic Resources unit (GRU), a Computer Center, a Training Center, a Communications and Documentations unit and various laboratories and workshops.

ICARDA is a production-oriented center. As such, it seeks to improve the welfare of client countries by contributing to increases in agricultural production. As an international agricultural research center, ICARDA's modus operandi is collaboration with national agricultural research centers. The active exchange between ICARDA and the national programs in outreach activities influences the overall research priorities.

In this paper, a brief discussion is presented on how ICARDA research addresses the needs of its clients. It is necessary to identify two echelons of users of ICARDA's research results.

1. National Research Organizations (NARCs)
2. Producers and Consumers

It must be reiterated that ICARDA produces intermediate goods and services which are utilized by the NARCs ultimately for the benefit of the producers and consumers.

II. NATIONAL RESEARCH ORGANIZATIONS

In an extensive network, the national research programs are actively involved in germplasm evaluation. Information gleaned from this evaluation is processed cooperatively so that ICARDA's breeding programs are geared to the needs of the region. National programs are free and encouraged to utilize any material they feel is suitable to their needs. To date, ICARDA has had input in a considerable amount of germplasm material adopted for testing and/or released by the national programs.

In order to make research more cost effective, ICARDA seeks research which can have generalizable results rather than exclusive location-specific research. Results from variety trials are collated and analyzed with respect to patterns according to environmental characteristics. Pooled analyses of multiple site - multiple season trials which incorporate environmental data, yield more efficient results. Hence, collection and collation of meteorological and soils data is an important activity. We feel that in a region characterized by a high degree of environmental variability (rainfall, available nutrients, etc.), parameters of this variability must be incorporated into analysis. In this way, we will have gone one step further in accommodating the characteristics of the environments our users live in and produce results adapted to their needs.

In this vein, an 'Agro-ecological Zoning Project' is currently underway in FSP.

The objective of agro-ecological zoning is to describe and delimit, on the land surface, areas of similar environmental conditions and potential for agriculture, in order to:

- facilitate the identification and quantification of targets for agricultural research;

- enable the effective generalization of location-specific research;

- provide a well-founded framework for land evaluation as a basis for land-use planning.

A comprehensive zoning scheme has to integrate all environmental variables relevant to agriculture. These variables describe aspects of climate, geomorphology, soils, flora, and fauna. Their variability in space and time forms the basis for the zoning process. It is not possible to incorporate all these dimensions into zoning and abstraction from some elements will be necessary. This necessity is observed in all scientific processes.

The values of these environmental variables are known only from a strictly limited number of sampling points such as weather stations. For each variable, therefore, a spatial model has to be constructed to provide estimates of the values the variable assumes between sampling points. Depending on the nature of each variable and our state of knowledge, these spatial models may be based on mathematical relationships, feasible for most climatic variables, or may be purely descriptive, as for geomorphic and soil variables where they take the forms of contour and soil maps.

Many variables and especially climatic ones, cannot be regarded as constant over time. In such cases, a mathematical analysis of their temporal day-to-day and year-to-year variability at each sampling point has to precede the construction of the spatial model in order to summarize the time series in a manageable set of parameters, be amenable to mathematical spatial modelling, and without losing any relevant information.

Agro-ecological zoning takes place in a sequence of four logical stages:

1. Mathematical analyses of the temporal variability of environmental variables relevant to agriculture.

2. Modelling of the spatial distribution of the environmental variables.

3. Simulation of the temporal variability of agriculture over the spatial continuum of the land surface.

   The simulation models of this stage describe the interdependence between the environmental variables and three other categories of variables: variables describing the genetic make-up of crops, response or yield variables, and variables describing management decisions and inputs. They cannot incorporate management decisions as integral parts, thus attempting to model human behavior, but they can help to analyze its effects and to optimize management.

4. Classification and clustering of the spatial continuum of probabilistic data created by the previous simulation stages delimiting quasi-homogeneous agro-ecological zones.

It is feasible to widen the scope of the exercise to include economic modelling by attaching monetary values to the physical inputs and outputs as economic variables.

The information that will be produced by this project will be valuable in itself. However, it is expected that the utilization of this information will facilitate cost-effective methods of conducting research with generalizable results.

The preferable way to make use of this exercise is to determine the values of the yield variables as a function of the other groups of variables: environment (variable both in space and time), management, and the genetic parameters of the grown cultivars. This should allow prediction of performance of cultivars, farming practices, and cropping systems not only in similar, but also in vastly dissimilar environments and thus facilitate agrotechnology adaptation and the generalization of the results of agronomy trials. A corresponding result in mapped form would consist of probabilistic land suitability maps for each considered combination of crops, livestock and management.

If, on the other hand, yield variables form part of the input into the simulation models, the values of the genetic variables which would lead to the given results from known treatments under the particular environmental conditions can be determined.

The next logical and feasible step would be to determine those combinations of genetic or management variables which result in the optimal combination of yield variables. This would lead to the definition, for any location, of cultivars, farming practices, cropping, and possibly farming systems expected to show optimal performance over time. Mapped results could take the forms of agricultural land development potential maps or population carrying capacity maps.

We feel that this will lead to a more scientific determination and use of information on environments with common characteristics, or 'mega-environments' according to some of our colleagues' terminology.

This approach does not imply that we neglect the human element. The next section will provide insights into our activities in this respect. It is indicative of the concern that we have about the balance between social and technical factors in approaching agricultural research.

III. CONSUMERS AND PRODUCERS

Concern for the needs of producers and consumers has been dominant at ICARDA. In its formative years, a concerted effort was made to establish a sound basis in biological activities, in particular germplasm development. During the formative years a massive effort was also mounted to develop methods to gain a better understanding of the farming environment, socially and biologically. These activities have constituted the core of the Farming Systems Program. The philosophy of constant involvement with the issues of the producers and consumers permeates all ICARDA programs and activities. To present all such activities would take up too much time in a meeting such as this one. Here are some salient examples:

1. Village Level Studies (VLS) were undertaken in Aleppo and Hama provinces between 1977 and 1980. These studies had two basic objectives: (a) to enhance the understanding of the farming systems

in Aleppo province where ICARDA's headquarters are located; (b) to develop methods which could be used to assess and identify critical parameters of farming systems.

A major finding of these activities reinforced our belief that environmental factors (climate, soils, etc.) are dominant in determining farming systems. For example, typical systems were identified: barley-livestock systems in the drier areas (350 mm and less) and wheat-dominated systems involving rotations with legumes and summer crops in the wetter areas (over 350 mm).

The VLS also provided valuable information on input and output flows in the farming systems of the villages. The choice of the village as the target unit was valid under some circumstances but was inadequate when factors such as transhumance or off-farm employment came into the picture.

2. Subsequent to the VLS, more focused, crop-oriented survey activities were undertaken. Some examples in this respect are the barley survey, the steppe survey and the lentil survey.

   These surveys utilized sampling procedures and covered larger areas. The basic purpose of such surveys was to produce information on production practices, utilization of outputs, and related problems. Identification of issues through the surveys influenced research priorities as well as leading to further probing of the issues. Some examples are given below.

   a. Cereal straw, in particular barley straw, was identified as an important element in the diet of sheep. Farmers were as sensitive to straw quality as to grain quality. The status of straw was elevated in variety development and straw quality is screened for at advanced stages of germplasm development.

   b. Labor problems appear to cause constraints in lentil production, even though the major source of the problem is declining yields. Since mostly women are involved in lentil weeding and harvesting, a further study was undertaken in a limited area of Aleppo Province to assess the effects of technological developments on women. It has been found that with winter planting of chickpeas, increased weeding labor from the women would be required unless chemical control is introduced. On the other hand, mechanization of lentil harvesting, as a solution to labor scarcity, would essentially substitute for female labor. The same study indicates that, in terms of hours of work, women and children contribute 57% of the labor input. The results of this study clearly point to the fact that while certain technological developments are desirable at the national level, they will have effects on particular groups. Further study is necessary to see if the increased requirements for female labor for weeding would reflect adversely on the family and whether mechanization would imply loss of job opportunities for women with few alternative off-farm employment venues or whether this, aided by complementary rural development activities, would enhance the quality of life at home by allowing women to devote

more time to family needs. The field survey for the PhD research on nutrition and agriculture, mentioned in 5. below, will provide some insights in this respect. Part of this research aims to look at the relationship between nutrition and women's, in particular mothers', work patterns.

c. It was identified in the barley survey that farmers expected a high rate of occurrence of years in which low yields or crop failures would occur (20-35%). Hence, their sensitivity to the performance of varieties at lower rainfall levels has reflected on breeding strategies. Now, there is more concern for assessing the performance of varieties under stress and more emphasis is given to stability.

3. It was found that in some cases the viability of research results have to be proven to national scientists. In Syria, scarce phosphate fertilizer is not encouraged to be used in drier areas by policy. However, it was found the phosphate application in barley advances maturity, hence providing a drought escape mechanism, produces dramatic results in yield increases and, considering variable rainfall, would be expected to pay off around 80% of the time in typical barley areas. A collaborative project is now underway to demonstrate these results to Syrian scientists and policy-makers. The study is complemented by a fertilizer allocation policy study.

4. In our activities in Syria, Tunis, Egypt, and the Sudan, on-farm trials constitute the main mode of research. Farmers are involved in trials on their land in several ways. First, by following the fact that farmers rarely adopt packages but adaptively select components of technology, and effort is exerted to build on their current practices with improved practices. Their reactions to on-farm trial results are as important information as the technical results of the trials. The Nile Valley Project conducted in Egypt and the Sudan has produced impressive results in terms of adoption of innovations and training of national scientists.

   We feel that our pasture and forage research activities have to be complemented by on-farm research involving interactions with livestock. It is through those interactions that the social and economic viability of new forages and improved pastures can be assessed.

5. We are also conscious of the implications of our research for improving nutritional standards. Quality testing of improved varieties for various nutritional parameters, such as protein and fibre, is a routine activity. Taste panels and processing under consumer conditions (village bakeries, farm household cooking processes) are now accepted as the norm. In 1982, an international workshop was held in Aleppo under ICARDA/United Nations University auspices on the interfaces between agriculture, and nutrition and food science. This was followed by a regional workshop on the topic in the Sudan in 1983. In Jordan it was observed that price incentives to wheat producers may have adverse effects on producers who are net purchasers of wheat and cannot benefit from consumer

subsidies directed at urban areas. Special PhD research has been supported in ICARDA to identify how nutritional concerns could further be incorporated into our research.

6. Finally, we feel that while the economic evaluation of increased yields and higher input use is relatively easy, complications arise when technological innovations involve changes in the use of machinery or labor processes. We are currently initiating a study to look further into issues of mechanization and labor constraints as they may actually turn out to be limiting factors.

In general, we can say that problems of users have been considered as integral of farming systems. Consequently, solutions are directed to the farming systems rather than to specific user categories.

IV. CONCLUSION

ICARDA addresses itself to two sets of users:

1. national agricultural research programs as users of the intermediate goods and services provided by ICARDA;

2. consumers and producers who are the ultimate targets of agricultural research.

ICARDA is sensitive to the needs and characteristics of these user categories. This concern is exemplified in the research activities aimed at understanding the environments and the systems in which they operate. We believe that our research can be more cost effective if it is generalized. We also feel that a concern for understanding the farming systems allows us to produce more pertinent results.

It is clear that, despite our concern, our activities will not provide us with as complete information as we would need. However, we recognize the limits of our expertise and look to entities outside of ICARDA which may have comparative advantage in particular research areas. For example, we are particularly interested in obtaining aggregate and disaggregate demand parameters for the commodities we work on and this information could be forthcoming from other organizations.

Finally, we are happy to see this 'concern for clients' in the national research programs we collaborate with. We benefit from this collaboration with increased sensitivity to the needs of the users and, where constraints have prevented NARC scientists from doing as much as they wish, we are happy to be instrumental in increasing their sensitivities to the needs of the users.