CROP/LIVESTOCK INTEGRATION IN THE MASHREQ/MAGHREB REGION

A. SUMMARY

1. Title: Development of Integrated Crop/Livestock Production Systems in the Low Rainfall Areas of the Mashreq and Maghreb Regions (The Mashreq/Maghreb Project)


3. Objective: The overall objective is to develop productive and sustainable livestock-based production systems through the integration of feed and livestock production, both within and across production systems, aiming at improving the incomes and welfare of small farmers and livestock owners/herders in the low-rainfall areas of West Asia and North Africa (WANA), meeting national demands for livestock products, and conserving the natural resource base.

Past and ongoing research has identified available, or potential, technologies and management strategies for developing improved crop-livestock production systems, but adoption of such technological innovations has been slow. Furthermore, changes in the economic policies and recent market reforms being implemented by some governments have an impact on the investment and management strategies of small farmers in the low rainfall areas. The project aims to support the development of productive and sustainable livestock-based systems through adaptive research that integrates technologies and management practices with policy and institutional alternatives so as to provide an enabling environment for wider adoption of improved production and resource management practices.

4. Activities:

   Technology development and transfer, including (a) a livestock management component, relating feed production to needs and utilization, and improved productivity and fertility, (b) research and technology development to improve feed and fodder production throughout the arable sector as well as from rangelands and natural pastures, and (c) socioeconomic analysis of production systems and monitoring of technology transfer and adoption.

   Policy and institutional research, including (a) analysis of the impact and role of government policies in affecting crop and livestock production in the low-rainfall areas of WANA, and particularly their effect on economic incentives for the sustainable use of land and range resources and on the alleviation of poverty, and (b) analysis of property rights issues and the role and effectiveness of local institutions in regulating rangeland use.

5. Area: Livestock production systems; natural resource management; policy and institutions.

6. Region: West Asia and North Africa (WANA)

B. STAKEHOLDERS

1. Beneficiaries

The intended beneficiaries are the small farmers and livestock owners in the low rainfall areas of WANA where small ruminants (sheep and goats) represent the principal source for economic output and contribute a large proportion of the rural incomes.
2. **Research Partners**
   - the eight countries of the Mashreq (Iraq, Jordan, Lebanon, and Syria) and the Maghreb (Algeria, Libya, Morocco, and Tunisia) regions of WANA.
   - CGIAR Centers: the International Center for Agricultural Research in the Dry Areas (ICARDA), and the International Food Policy Research Institute (IFPRI).

3. **Donors:** The project is supported by a consortium of donors:
   - Arab Fund for Economic and Social Development (AFESD): US$ 1,500,000
   - International Fund for Agricultural Development (IFAD): US$ 1,500,000
   - International Development Research Centre (IDRC): US$ 180,000
   - Ford Foundation: US$ 100,000
   - "In-kind" contribution of NARS: US$ 3,765,000
   - "In-kind" contribution of ICARDA: US$ 1,100,000
   - "In-kind" contribution of IFPRI: US$ 100,000

C. **PROJECT RESULTS AND IMPACT**

1. **MAIN RESULTS AND IMPACTS**

   (1) **Feed sources: conventional and alternatives**

   (a) **Feed block technology:** The technology was developed to produce multi-nutrient feed blocks from agro-industrial by-products and other ingredients. The blocks represent a low cost, effective system to meet the constraints in seasonal feed supply in the low rainfall areas. Feed blocks have been readily accepted by farmers and the technology has rapidly spread through the countries involved in the project. It has been a major success in the region and has developed into a feed industry in Iraq, which first led the research into developing the technology. The first private production plant in Iraq opened in June 1994 with a capacity of 4 t/day, and was followed by several other small rural plants with similar outputs. By 1997, 21 plants were producing more than 24,000 t of blocks distributed to more than 6,600 sheep owners. In Jordan, three feed block manufacturing units were imported from Iraq in 1998 for large-scale production of feed blocks; these are now in production and demand from farmers is increasing.

   (b) **Cactus production:** Although cactus (*Opuntia* spp.) has long been grown in the Maghreb countries, it is not common in the Mashreq region. Cactus, which is well adapted to the harsh environments of dry areas, represents a productive option for farmers as a feed source for their animals, as well as providing a means of protecting the natural resource base by controlling soil erosion, particularly on sloping land.

   As a result of the project, the experience of the Maghreb countries in cactus production and utilization as a feed is being transferred to the Mashreq countries. Exchange of experience, knowledge and expertise has had a strong multiplier effect: Jordan has started a national project on the promotion of spineless cactus production funded by the Islamic Development Bank, and Syria plans to start activities during the 1999/2000 season.

   (c) **Barley production:** In Syria, improved varieties were accepted by the farmers with an adoption rate of about 63%. In Iraq, the variety Rihane 3 has been released and widely adopted by farmers; the area planted with this variety has increased from 5,000 ha in 1994/95 to nearly 200,000 ha in 1998 in the Gezira area, which receives moderate rainfall (about 350 mm) Two other barley cultivars have been multiplied for use in drier areas and. Two varieties were...
released in each of Tunisia, Morocco and Lebanon. In Lebanon, two further varieties have been multiplied, producing 24 tonnes in 1998 for distribution to farmers during the 1998/99 growing season.

In addition to germplasm improvement, the use of fertilizers has resulted in an increase in grain and straw yields in many countries. Improved production practices and their effect in increasing the grain and the total biomass of barley have been demonstrated to farmers. National programs have assumed responsibility for widespread demonstration and transfer of verified improved barley production practices, while research continues in developing and testing improved germplasm. Particular attention is given to identifying lines with desirable traits identified by producers and users, particularly those traits identified by users that relate to feed quality.

(d) Promotion of rotations that enhance on-farm feed production: Another main thrust in improving on-farm feed production has been the promotion of rotations that include alternative forage legumes (e.g., species of Vicia and Lathyrus) in rotation with barley. The alternative utilization of forage legumes (forage mixtures, hay making, grazing, or harvesting at maturity for stored feed) and their advantages in terms of livestock production have been demonstrated through on-farm trials. Results from Iraq, Jordan and Syria showed average daily weight gains of lambs grazing *Vicia sativa* ranging from 90 g to 275 g. Results from Iraq showed an average increase in milk production from ewes grazing *Vicia sativa* of 175 g/ewe/day. Farmers who have observed the trials are enthusiastic about *Vicia sativa* and demand for seed is increasing.

(e) Enhancing the productivity of natural pastures and other grazing sources: Trials in Jordan and Tunisia indicate that application of phosphate fertilizer significantly increases biomass on unimproved rangeland. Results in Lebanon show that reseeding marginal land, applying phosphorus, and protecting the area from grazing at crucial times of the year, doubles the dry matter produced. In the Maghreb countries, fallows are traditionally left weedy to provide additional grazing for livestock. These weedy fallows can be enhanced by encouraging the growth of native legumes. A system of forage legume seed production, developed by ICARDA using locally manufactured cheap machinery, was successfully demonstrated to farmers in Tunisia and Morocco and will be expanded to other countries in the future.

(2) Small ruminant productivity

Applied research has focused on improving the nutrition of sheep, using alternative feed sources and supplementation, and improving fertility and reproduction, through the use of improved rams and hormone treatment. Iraq and Jordan have shown that use of feed-blocks as protein supplements improved ewes’ daily weight gain, fertility and lambing percentage. In Iraq, supplementation with feed-blocks enriched with vitamin AD3E increased the weight and improved the body condition scores of ewes, and improved fertility and lambing rate by 22% primarily by increasing the twinning percentage. Using urea and mineral solutions as protein supplements, or treating straw with urea, improves feed conversion and increases milk yields and lambs’ growth rate.

Early weaning of lambs increased the economic returns to sheep owners as a result of the extra milk saved; average milk production increased by up to 20 kg/ewe in Jordan and 30 kg/ewe in Syria. Furthermore, with the provision of appropriate feed, early weaning improved the daily weight gains of the lambs.

The demonstration of sponge and PMSG hormone treatment in farmers' flocks in the Mashreq region have resulted in a substantial improvement in both fertility and twinning rates in the three countries. Farmers have willingly adopted these innovations. The technology developed is being utilized by the Maghreb countries in their livestock improvement programs.
In the Mashreq genetic improvement of farmers’ flocks is based on identifying rams that have the genetic potential to improve milk production and growth rates of their offspring, and all four countries have implemented a program of distribution of improved rams to farmers.

(3) **Policy and property rights**

(a) **Policy research:** Sets of policy and other institutional reforms were identified for quantitative analysis. Assessment of the effects of GATT-related market liberalization on farmers’ investments and management decisions were conducted in four countries. The farm-level impacts of market liberalization on sheep and barley production in low rainfall areas were found to be sufficiently negative to justify targeted assistance to these areas. Community modeling, based on data collected in detailed surveys, corroborates sector-level findings with respect to income distribution and environmental sustainability; trade liberalization policies, while enhancing welfare at the national level, do not necessarily improve the well-being of farming communities in the low-rainfall areas. Domestic price reforms tend to reduce farmers’ welfare but yield a more equitable income distribution between rich and poor farmers in the community. Effects of these reforms on natural resources tend to be specific. However, the introduction of a new technology (e.g., new dual-purpose barley cultivar for fodder and grain production) was found to improve farmers’ welfare, enhance crop–livestock integration, and reduce pressure on natural resources without worsening income distribution.

(b) **Property rights research:** Assessments of property rights legislation in terms of their effect on farmers’ investments and management decisions in the low rainfall areas have been conducted. Quantitative results show a direct relation between levels of private agricultural investments in the low rainfall areas and the security and completeness of property rights.

In crop lands, there is strong evidence that property rights do matter in determining farmers’ management and investment behavior. However, land rights do not prevent farmers from making long-term investment. In addition, positive relationships were found between shares of crop income and completeness of land rights and between shares of livestock and off-farm incomes and incompleteness of land rights. Moreover, households deriving their incomes from off-farm activities and livestock were building their capital assets by purchasing privately owned lands. Existing property rights systems in rangelands result in inefficiency (for example, land disputes) related mainly to the exclusion of local communities in the control and management of their common pastures, or the inability of tribal institutions, when their ownership rights have been recognized, to respond to the growing demands of their members.

2. **Dissemination of Results**

Initially the project focused on farmer participatory testing and demonstration of technology components at the farm level. On-farm trials, farmers’ field days and visits to demonstration trials are a regular part of the technology transfer process. In addition, the project has produced numerous extension bulletins and fact sheets on specific technologies, as well as other multi-media material (videos, and radio and television material).

In the second phase of the project, technology transfer has shifted to testing and evaluating combinations or packages of associated technologies at the whole-farm household level, and to working at the community level, involving the local private and cooperative sector as well as farm households. Utilizing the community modelling work initiated in the first phase will assist in identifying solutions that take account of the communities’ existing production systems and how they manage their landscape.

The project is now focusing its efforts in selected communities in pilot sites within each country. Such an approach provides a mechanism for integrating the activities of the project and assessing their
impact on whole farm productivity and the management by a community of its resources. On-farm testing of specific technology components will continue on a wider scale to ensure broad dissemination and transfer of proven technologies. The selected communities will also serve to demonstrate improved integrated production systems to the wider farming community, as well as to national decision-makers, with a view to encouraging rapid adoption and impact.

D. PARTNERSHIPS AND PROJECT IMPLEMENTATION

1. PROJECT COORDINATION AND MANAGEMENT

The project is coordinated by ICARDA through its Regional Coordinators and their offices in Amman and Tunis, who bear responsibility for helping the national programs interact at the regional level through the exchange of research results, technological developments, and information; exchange visits between countries; organization of regional workshops and annual regional technical meetings; and, in coordination with research scientists, arranging for training both within and outside countries. Technically, the project is supported by ICARDA’s research programs and IFPRI’s Environmental and Production Technology Division.

Activities within each participating country are undertaken by a number of national agricultural research institutes, universities, and extension agencies within a multi-institutional, multidisciplinary approach. Activities are coordinated by designated national coordinating institutes, each represented by a National Coordinator.

A Project Steering Committee has been formed comprising the National Coordinators, ICARDA’s Regional Coordinators, ICARDA’s ADG for International Cooperation, an IFPRI representative, and donor representatives. The Committee meets once a year to review, amend and approve annual workplans and budgets. A Regional Technical Coordination and Planning Meeting is held annually in which the staff from the national institutions collaborating in the project, ICARDA and IFPRI review the results of the past work and finalize plans for the coming season.

2. PARTNERSHIPS: ROLES AND MECHANISMS

The project is implemented through a diverse range of partnerships among:

- national agricultural research institutes and universities
- NGOs and the private sector
- extension services
- farmers and end-users
- policy makers
- international research centers, and
- donors

The mechanisms employed in each of these partnerships is briefly reviewed below, together with their contribution to the impact and sustainability of the project and the lessons learned in terms of factors that contribute to successful partnerships.

(a) NARS:

The project emphasizes a multidisciplinary research approach which requires inputs from a number of research institutes within a national program. National workplans are developed, and results reviewed in National Coordination and Planning Meetings. Selected national scientists are responsible for management and coordination of specific components of the research program.

At the regional level, the multidisciplinary approach is supported by inter-country exchange of material and results, which encourages complementarity and efficiency of research. The networking concept has been the main foundation of the project, which has established a multinational, multidisciplinary
network among researchers from the eight countries participating in the project. This network has had considerable success in reducing the potential risks inherent in implementing a multi-national multi-institutional technology transfer program. The personal and professional relationships that have been established among scientists have enhanced the institutional linkages generated by the project activities and as a result an enduring network between researchers within and among countries has been established. The strength of the networking and the commitment of the national scientists are demonstrated by the fact that it has continued throughout recent periods of disruption and conflict in the region.

The project focuses not only on national efforts in technology transfer to farmers, but also on transfer of technology and experience between countries. Not all activities need be conducted in all countries. Lead national centers for the development of specific technologies have been identified; these lead centers transfer their findings to other countries. In this way, the traditional continuum of on-station through on-farm testing and validation within each country can be circumvented. If a proven technology is available in one country, it can be transferred directly to on-farm participatory adaptation and testing in other countries. This requires greater flow of information between countries and consequently the project supports regional technical and scientific workshops that bring together scientists and farmers to discuss specific topics, and exchange visits between scientists from different countries.

(b) NGOs

Examples of partnerships with local or international NGOs include:

- **In Tunisia:** Representatives of the Farmers’ Union (UTAP) attend the National Coordination meetings of the project and participate in various in-country and regional training courses. The project is promoting feed block production using the facility and frameworks of a local farmer association, “Association d’Interet collectif” (AIC), which groups the farmers of the community around areas of interest to them. This is done through local agreements.

- **In Lebanon:** The project has promoted the establishment of an association of herders and sheep owners.

- **In Morocco:** The project collaborates with an Italian NGO, “Comite European de formation en Agriculture”, in the rehabilitation of rangeland, and with another private group, “Recherche/Development”, in the mass production of feed blocks.

(c) Private sector

Each national program determines the most appropriate mechanisms for involvement of the private sector. The extent to which the private sector may become involved depends on the nature of the technology developed by the project. One example is the further development of feed blocks in Iraq, which is now totally in the hands of the private sector. The technology has been transferred to farmers through a bilateral agreement between private investors and a project national coordinating research institute, which continues to provide the necessary technical advice.

(d) Extension services

The national extension services have been involved in the project from the outset. They are regarded as partners in the adaptive research and technology transfer program and are closely involved in the participatory research and technology development with farmers (see below). The knowledge gained both of the technologies produced by the project, and farmers’ objectives and constraints, supports the wider dissemination of the project's results.
(e) Farmers

The project recognizes that involving farmers in both the research planning and implementation ensures that appropriate solutions are developed. The involvement of farmers has shifted over the life of the project from simple on-farm testing to participatory adaptive research and their wider involvement in the planning and evaluation of project activities. The intended end-users of the project's research are involved in a variety of ways:

- Representative farmers and/or community leaders participate in the national planning meetings. The concerns expressed by farmers, on both technical and policy issues, are considered in planning future activities.

- Farmers are involved in the evaluation and selection of improved germplasm and breeding livestock (improved rams). Farmers' participation in the evaluation and selection of germplasm ensures that their requirements, and what they consider to be desirable traits, are incorporated in the development of germplasm that is adapted to both the biophysical environment and to the intended end-use.

- From the outset, the project's adaptive research has been conducted in farmer-managed trials on farmers' fields. These trials also serve as demonstrations to neighboring farmers and field days are held where farmers can view and discuss the trials, in the presence of researchers and extension workers.

- Workshops and training courses on specific technologies developed by the project have been held for farmers together with extension workers.

- Regional "traveling workshops" for farmers are an innovative mechanism introduced by the project in the region. Farmers from different countries travel together to a particular country to view the project's activities. Not only does this expose farmers to the project, but it also provides a forum for farmers from different countries to exchange their experience in the presence of researchers. This provides much valuable feedback to the project's research and technology transfer program.

- The role of women in on-farm production, processing and management is addressed through gender-disaggregated analysis of the implications of new technologies and by involving women in the technology testing and evaluation.

(f) Policy makers

One aim of the project is to increase the understanding by policy-makers of the effects of economic policies, property rights and institutional changes on productivity and resource management, in order to ensure that policy and institutional support for the wider adoption of improved production and resource management practices is provided. Contacts with policy makers have been strengthened throughout the course of the project. Workshops with national policy makers have been held in which detailed workplans were developed in a consultative process between national researchers and policy makers.

The results of the project's policy and property rights research were presented in an International Conference on Agricultural Growth, Sustainable Resource Management and Poverty Alleviation in the Low Rainfall Areas of West Asia and North Africa in which senior national policy makers participated. Recommendations from this workshop were incorporated in the workplans for Phase 2 of the project.

(g) International Centers

ICARDA and IFPRI provide technical support and training to the project through their research scientists who work closely with their NARS partners. In addition, to support the research on policy and property rights, ICARDA and IFPRI have signed a Memorandum of Understanding which
governs the joint appointment under the project of two international scientists specialized in policy and property rights research.

(h) Donors

The project is fortunate in having been supported by two donors, the Arab Fund and IFAD, who were involved early on in the formulation and development of the project and have continued to be actively involved in monitoring the project's progress, providing technical input and advice and supporting its regional approach. More recently, IDRC and Ford Foundation have contributed to the project, providing co-financing for the research on policy and property rights.

E. CONCLUSIONS

The Mashreq/Maghreb Project is a mature project that has developed and evolved over time. It builds upon previous regional collaborative programs between ICARDA and the national programs, which focused on increasing the productivity of barley, forages and other feed crops, and small ruminants in the rainfed semi-arid areas, and had already made progress in testing and verifying improved technologies under farmers' conditions. Thus, the Mashreq/Maghreb project did not start from scratch, but had previous research to build on. The new aspect is the integration of research on policy, property rights, and the institutional and socio-economic environment.

The project has evolved from a technology component testing program to one of integrated adaptive research, addressing issues from a technical, socio-economic, cultural, institutional and policy perspective, with the full participation of the intended beneficiaries and other stakeholders. This has been further facilitated by shifting to a community approach. These developments in research concepts and approaches have involved intense discussions and consultations between all partners involved, ensuring that there is a common agreement on the aims of the project and the way that it is implemented.

The strength of the project comes from its multidisciplinary approach and the strong interaction between NARS that has developed through the regional project. The strength of this network and the maturity of the project is confirmed by the fact that the NARS have now assumed leadership of the project, with ICARDA and IFPRI providing a coordinating role and technical support where needed.

As already noted, the project has benefited from the support of donors that remain highly involved in the project's activities. The Mashreq/Maghreb project represents a large and ambitious undertaking. The project’s budget must support both the operational costs of research, and the coordinating and networking activities that, by ensuring the exchange and dissemination of information and research results between countries, are essential to the success of such a regional program. As financial resources have become more constrained, adjustments have had to be made. The greater part of the budget has been directed towards maintaining and facilitating regional activities, while national programs are contributing greater resources to national activities. The national programs have recognized that sustainability of the project in the future will depend on their own resources.

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1 In Mashreq, Increased Productivity of Barley, Pasture and Sheep in the Critical Rainfall Zones (1989-1994), co-financed by UNDP (RAB/89/026) and the Arab Fund; In Maghreb, the Collaborative Research and Technology Transfer Programme to Increase Barley, Food Legumes and Livestock Production in North Africa (1992-1995), supported by IFAD and the Arab Fund.