

6. Examples of Technology Transfer Activities and Impact of the Outreach Programme

The headquarters and field research activities constitute one overall programme and, consequently, it may seem difficult to appraise the technology transfer and impact of the outreach activities separately. However, there are many useful examples, which would not have occurred without the additional research activities funded through special projects and implemented under the outreach programme. A number of examples of technology transfer activities and impact in different sub-regions are presented in Annex IV. This information has been summarized mostly from reports provided by the Regional Coordinators. In general impact assessment remains a difficult and costly exercise. Comprehensive impact studies have not always been carried out, but in cases where this has been done the excellent results obtained have been clearly demonstrated. There is no doubt that similar results may have been achieved if economic on-farm surveys had been carried out to determine the impact of the work undertaken under all the regional programmes. The main results obtained under different regional programmes are as follows.

- **Central Asia and Caucasus Regional Programme**

Only five years after the official start of the programme various new varieties have been submitted for official approval and two winter wheat varieties, one chickpea and one lentil variety have already been released. Impressive progress has been made in this short period of time with the adaptation and introduction of improved soil and water management, and feed and livestock production technologies. The programme has contributed significantly to the strengthening of NARS. In addition, it has provided a neutral forum for an active interface among scientists and NARS leaders of the eight countries of the CAC region, which have been working in isolation, and lacked the means to carry out the necessary research, since 1991.

- **Iran/ICARDA Project on Strengthening Agricultural Research for Dryland Farming in the Highlands of Iran**

This project started in 1990 and has continued to constitute the basis for active research collaboration between ICARDA and the Agricultural Research and Education Organization (AREO). The project has led to the establishment in 1993 of the Dryland Agricultural Research Institute (DARI) at Maragheh. ICARDA provides annually about 1000 kg of germplasm seed, representing more than 6000 entries/genotypes of different crops, to researchers from DARI and the Seed and Plant Improvement Institute (SPII). Iranian researchers have evaluated and used this germplasm in their breeding programmes, which has led to the release of seven wheat cultivars, five barley cultivars, two chickpea cultivars and one lentil cultivar.

Farmers using improved crop production technologies, in particular improved tillage practices, in rain-fed areas have seen their yields increased by 10-50 % for wheat, and 100-300 % for chickpea, despite the severe drought that prevailed during the past four years. These new technologies were applied on some 4,000 ha during 2002, and on 55,000 ha in 2003. ICARDA, through the hiring of three consultants and active involvement of AREO, also contributed to the introduction, development and production of oilseed crops, particularly

rapeseed. The area grown to rapeseed has increased from 11,000 ha in 1999 to 48,000 ha in 2002. In addition to the training of over 700 scientists and technicians, 60 scientists have been sponsored by the project for PhD degree training in foreign universities. They are now contributing effectively to the enhancement of the research capacity in their respective institutes.

- **West Asia Regional Programme**

Under this programme several improved crop and livestock technologies have been introduced into the farming systems of Iraq, Jordan, Lebanon, and Syria. The adoption of these technologies has been determined through on-farm surveys. The percentage of farmers using improved barley varieties was over 50% in Iraq, Lebanon and Jordan, and 32% in Syria. Areas planted to improved barley varieties constituted 54% of the total barley growing area in Iraq, 67% in Jordan and 21% in Syria. The feed block technology has been adopted rapidly. In Iraq sheep owners are routinely supplementing the feeding of their sheep with feed blocks; the adoption rate was 21% in Jordan. *Vetch* introduction in barley rotations and early weaning of lambs showed adoption rates of respectively 28.5 and 28.8% in Syria, and influenced in a positive manner sheep production and related economic returns.

Performance indicators have been used to assess technology impact on farm income and distribution, and on household food/feed security and productivity. In Iraq the net benefit of improved varieties on barley productivity was 19%. Similarly in Syria improved varieties resulted in a gain of 20%. These varieties increased the household food security, measured in kg of barley grain/household/year, by 14% compared to local varieties. The use of feed blocks increased sheep production efficiency by 32% in Iraq as a result of the increased number of lambs, and increased meat and milk production. The calculated benefit/cost ratio was 1.56 and the internal rate of return (IRR) was 87%. Economic analysis of the introduction of forage legumes in Iraq showed that the rotations of barley/vicia, barley/vicia-barley mixture and barley/fallow are more profitable than other alternatives.

- **Arabian Peninsula Regional Programme**

Three main research themes are pursued by this programme with, at the same time, strong emphasis on strengthening the national institutional and human resource capacities. These are (i) on-farm water use and irrigation; (ii) rangeland, shrubs, irrigated forages and livestock; and (iii) protected agriculture. To improve water use efficiency specialized measurement equipment has been introduced and an automated weather stations network has been established. To address water shortage and rangeland problems indigenous species have been collected and evaluated. A total of 114 accessions were collected in the United Arab Emirates and 68 in Oman, out of which 27, including 10 grasses and 15 shrubs/trees, were classified as high priority according to various criteria, including their nutritional value. Heavily degraded rangeland in Saudi Arabia has been successfully rehabilitated through seeding and transplanting of indigenous drought tolerant shrubs and trees. Priority grass species have now been identified in Bahrain, Emirates, Oman, Qatar, Saudi Arabia and Yemen, and their seeds multiplied for use in forage production and rehabilitation of rangelands.

Cash crops in greenhouses have been promoted to increase farmer's income in Yemen. The use of drip irrigation in plastic houses proved of interest to farmers because of more efficient water use. Cost/benefit analysis revealed that total costs can be recovered in three seasons. Integrated Production and Protection Management practices provided greenhouse growers with easily applicable techniques for crop protection instead of relying exclusively on pesticides. Economic analysis after the introduction of soil-less production techniques showed significant returns on the investment, with major savings in water, fertilizers and labour, in addition to reduced salt accumulation and infestations by soil-born pathogens.

- **North Africa Regional Program**

This programme has evolved from a commodity focus, emphasizing technology testing/demonstration at the farm level, to a community and participatory based approach, addressing technical, socio-economic, institutional, and policy dimensions. Strengthening of NARS' capacities has been an integral part of most of the project activities undertaken. Regional networks and meetings have significantly fostered exchanges of experiences among NARS' scientists. Various on-farm surveys have been undertaken to determine the adoption of improved technologies. A large proportion of farmers' fields are now planted with new cereal and food legume varieties, and in particular the adoption of improved wheat, barley and winter chickpea varieties is widespread across the region. Improved barley varieties are now grown on 40% of the cultivated area in Morocco resulting in a 35% increase of productivity. Surveys have shown that the average yield advantage of improved varieties of cereals and food legumes ranges from 20 and 50%.

A bio-economic model predicting the effect of macro-economic reforms on farmers' production strategies at the community level has been developed under the Mashreq-Maghreb project. It allows policymakers and researchers to better assess the implications of policy and institutional reforms on technology uptake. For rangeland development encouraging results have been obtained through the introduction of new plant species, in particular *Lathyrus* and vetch, as well as fodder shrubs, for example, *Acacia* and *Atriplex*. The feed block technology has been widely adopted in countries of the region; the estimated IRR was 57%. Another technology developed/revived to overcome feed shortages has been cactus, *Opuntia* spp., production. The internal rate of return for cactus in marginal cereal production areas in Tunisia ranged from 61-66 %; while for cactus growing in the form of alley cropping with barley the IRR was between 81-89%. A large number of scientists and technicians have been trained at ICARDA, contributing to the strengthening of their national programmes.

- **Nile Valley and Red Sea Regional Programme**

This programme has had a strong impact on agricultural development in Egypt, Ethiopia and Sudan. Until 1995 the total number of improved cultivars released was 17 for faba bean, 6 for chickpea, 7 for lentil, 5 for field pea, 8 for wheat and 3 for barley. In addition improved production practices have been developed and transferred to farmers. These varieties and improved practices

have been widely adopted and have resulted in significant production increases.

The Matrouh Resource Management Project in Egypt serves as a good example, because an in depth impact analysis has been carried out at the end of this project in 2001. The project has used holistic inter-disciplinary approaches to research and development in full participation with the local Bedouin communities. It addressed the whole watershed as the physical development unit, the whole farm as the agricultural development unit, and the local communities as a consolidated social development unit, in bottom up planning.

Improved water harvesting systems increased water supply by 45%, and the net benefits of the overall farming systems by 88% on average for about half of the beneficiaries. More than 5.1 million fodder trees have been planted on more than 15,000 feddan (1 feddan = 0.42 ha), and perennials and annuals have been re-seeded on more than 2,500 feddan. Productivity of barley has been increased by about 70% on 45% of the total barley growing area. Fodder shrub plantation has reduced concentrate use and animal feed expenses by 37% on average for about 40% of the beneficiaries. Shelter belts have been planted on a total length of 64 km of sandy soils suffering from erosion and sand dune movements; 33% of farmers increased their orchard area, 19% adopted crop rotation, and 16% inter-planted fodder shrubs with barley, all contributing to soil conservation. Fig and olive productivity has increased by 60% and that of vegetables by 27%. The beneficiary social pool was enlarged from 6,000 households at the time of the original project preparation, to more than 18,600. Over 3,620 illiterate girls have been educated, and many thousands of women benefited from extension workshops and other activities to increase environmental, nutritional, and health awareness.