

# Mega-Project 5

## Poverty and Livelihood Analysis and Impact Assessment in Dry Areas

### Introduction

Poverty, in its broadest sense (income poverty, water poverty, educational opportunity, gender equity, and vulnerability) is widespread in the dry areas, particularly in the CWANA region. A deeper understanding of the determinants of poverty, and of the livelihood strategies adopted by rural communities, is necessary to continually refine the targeting of ICARDA's research, enhance and track its impact, and identify pathways out of poverty.

Mega-Project 5 seeks to contribute to the identification of research pathways to implement technological, institutional, and policy options to reduce rural poverty in the dry areas globally. This is being done through, among other approaches, improved characterization of the rural poor (assets, context, depth and duration of poverty, vulnerability, basic

needs, and choice of livelihood strategies) in relation to agriculture and its environment, including patterns of adoption and impacts of improved technologies. Another important dimension is understanding the structure, conduct and performance of domestic markets for agricultural commodities across different countries to evaluate the implications of market imperfections for small farmers. Efforts are directed toward the involvement and active participation of end-users in research program development, testing and verification, in order to maximize relevance and adoption of new options and pathways by individuals, communities and institutions. Frameworks and methodologies for participatory and community-based research are being developed and implemented in partnership with NARS to enhance the impact on rural livelihoods.

## Improving food security and alleviating poverty in arid agriculture, Balochistan

Sustainable market-oriented agricultural production can improve the livelihoods and food security of rural people in Balochistan province, Pakistan. To develop appropriate farming practices for this arid area, ICARDA is working to test new technologies with national research organizations, such as the Arid Zone Research Center (AZRC), Agricultural Research Institute (ARI), Technology Transfer Institute (TTI), and the National Agriculture Research Center (NARC).

In the districts of Mastung, Qilla Saifullah, and Loralai, researchers are focusing on improving the management of scarce water resources, improving range management and livestock productivity, improving crop productivity, and introducing agro-processing.



*H.E. Oweis Ghani (second left), Governor of Balochistan, visiting demonstrations of protected agriculture at the Agricultural Research Institute, Quetta.*

In 2006, protected agriculture, using greenhouses, was shown to optimize the use of scarce water resources. Farmers tested cucumber in three protected plots for one season, and the harvest fetched good prices. The net farm income was estimated to be US\$99.20, while the income per cubic meter of water used was US\$2.88.

Researchers also found that introducing improved wheat, barley and lentil varieties that are tolerant to drought and cold, and high-value crops such as olive, almond, pistachio and pomegranate, improved farm productivity.

One high-yielding, cold- and drought-tolerant wheat variety was sown in demonstration plots on farmers' fields, and five varieties were tested on-station. A wheat variety developed between 1985 and 1995 was also tested. One barley variety from ICARDA and two barley varieties developed earlier were distributed to farmers. Three lentil varieties from ICARDA and one developed earlier were distributed to farmers for demonstration plots. Varieties that proved successful in on-farm trials are now being distributed through



Field day in Dasht, Mastung District, Balochistan, 14 May 2006.

community-based seed enterprises. Three mobile seed-cleaning machines shipped from Syria to Akhtarzai, Duki, and Dasht mean that high-quality seed can be produced. Farmers have been trained to operate, maintain, and manage the machines.

Women and two trainers in Siddiqabad, Nali Wali Zai, and Dasht were taught better methods of drying surplus vegetables, so they do not have to buy costly fresh vegetables during the winter season when produce is scarce.

Women in Dasht were also taught how to make apple jam, which was especially liked by children. The returns from making

jam gave a net benefit of Rs 250 (US\$4) from 7 kg of apples – a valuable addition to family incomes. Both vegetables and fruits are plentiful in this area so there is the potential to process produce to sell in markets. In Dasht, women decided to start processing apples, as second-grade fruit suitable for jam making is abundant.

In addition, five field days held in Akhtarzai, Siddiqabad, and Dasht gave farmers the opportunity to see demonstrations of improved crop varieties under both irrigated and *sailaba* conditions (rainfed farming with bunds for water harvesting). The field days also directly involved communities in evaluating the new varieties.

## Analyzing lamb market value chains in Aleppo, Syria

Sheep production is a major economic activity in Syria. It provides over 30% of the total value of agricultural production, employs 20% of the total workforce – including many low-

income families in rural areas – and is an important source of foreign exchange.

Over the past 20 years, the total value of sheep exports has grown at the rate of 14% per year. The sustained shift from traditional, extensive lamb production systems to semi-industrialized,

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specialized fattening systems has had a significant impact on productivity and income. Today, all marketed lambs are fattened in intensive systems. Nonetheless, an information gap in the lamb marketing systems has limited policy action to improve the competitiveness and performance of the sector, as well as the welfare of breeders and market agents.

In collaboration with Aleppo University, ICARDA conducted a lamb market study (November 2005 to March 2006) focusing on Aleppo province. This province has the single largest sheep population in Syria (2.2 million head, representing 17% of the country's total sheep population) and is a major domestic and export market. The study aimed to analyze the Aleppo sheep market structure and business practices, identify marketing channels, and determine market competitiveness.

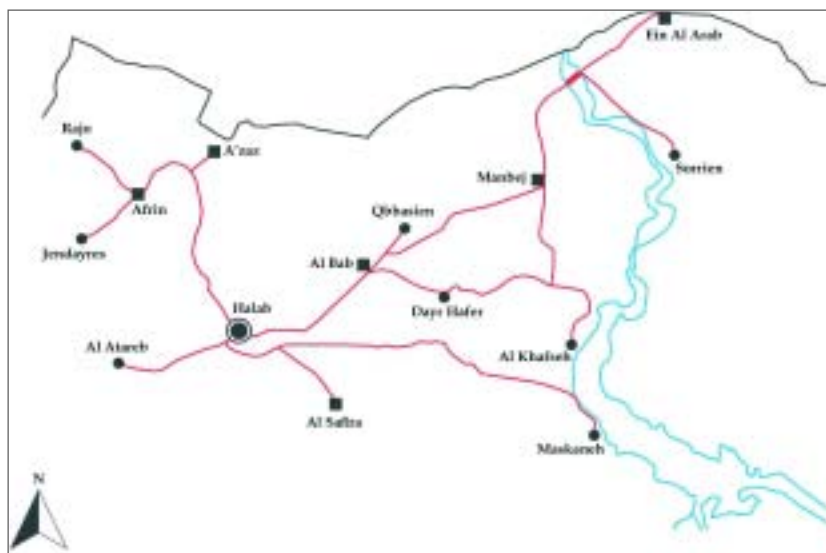


Fig. 5.1. Weekly sheep markets surveyed in Aleppo province.

The project staff conducted rapid rural appraisal surveys and semi-structured interviews in 16 sheep markets. These were the province's two main markets Neqarien and Jebrien (located 15 km east and 12 km southeast of Aleppo city respectively) and

14 small weekly markets in its districts and sub-districts (Fig. 5.1, Table 5.1). The interviewees included a random sample of market agents, including breeders, fatteners, traders, intermediaries, slaughterhouse operators, butchers and exporters. The

Table 5.1. District and sub-district sheep markets in Aleppo province.

District	Sub-district	Market size (ha)	Distance to Aleppo (km)	Business day	Services	Number of intermediaries	Business volume
Afrin		0.50	70	Tuesday	na	15	300
	Jendayres	0.25	90	Monday	na	13	250
	Rajo	0.30	100	Saturday	na	15	250
Al Bab		3.00	35	Thursday	S, Sc	12	600
	Qbbasien	0.30	45	Monday	Sc	10	250
	Dayr Hafer	1.20	50	Thursday	Sc	45	250
Manbej		2.00	80	Saturday	Sc	100	2000
	Al Khafseh	1.50	100	Thursday	Sc	75	1500
	Maskaneh	4.00	85	Tuesday	Sc	65	1200
Ein Al Arab		3.00	175	Sunday	na	40	2500
	Sorrien	1.50	120	Wednesday	na	120	1800
A'zaz		0.30	55	Tuesday	F, Sc	15	500
Al Safira		3.00	45	Monday	F, Sc	100	800
Jabal Sam'an	Al Atareb	0.20	30	Sunday	na	20	500
Aleppo (Neqarien)		10.00	15	Every day	V, F, Sc	60	7000-10000
Aleppo (Jebrien)		1.00	12	Every day	V, S, Sc	50	5000

V: Veterinary unit, S: Stall, F: Fence, Sc: Scale, na: not available  
Source: Market survey

information analyzed included market value chains, channels, costs, margins and structure, and business practices, including fattening, transactions, partnerships and profitability.

Around the markets there are many lamb fattening enterprises (*khan*), where unsold animals were also kept. The sub-district bazaars are generally small with no fences or sheep stalls, with the exception of Maskaneh. However, there is a relatively large number of players. For example, in Al Khafseh and Maskaneh there are 75 and 65 intermediaries, respectively.

The structure of the lamb fattening value chain is shown in Fig. 5.2. Sheep breeders supply the lambs to fatteners who prepare them to reach the slaughter

weight of about 50-60 kg. Market agent preferences are reflected in their roles and activities. For instance, fatteners prefer to fatten weaned lambs in intensive systems over several production cycles (or batches) over a 90-day period, with starting weights of 25-30 kg and finishing live weights of 55-60 kg per lamb.

The many kinds of traders have diverse functions (Fig. 5.2). Small-scale traders (known as *muareq*) buy and sell animals at the same market. There are some 200 small-scale traders reported in Aleppo province. Although they deal with all sheep types (see Table 5.2), they are mainly involved in the sale of ewes for meat. Other traders, known locally as *shahiin*, buy weaned lambs and ewes at the primary markets and transport them to

secondary markets to make a profit. About 25 of these traders are active in Aleppo. A third type of trader, called *qbanji*, buys fattened lambs, processes them at state-run slaughterhouses and sells the carcasses to butchers. About 100 such traders are reported in Aleppo. Although there is only one government slaughterhouse in Aleppo province, used for lambs and culled ewes, a number of private slaughterhouses exist in Al-Marjeh and Qarleq.

Aleppo has 40 exporters who ship lambs to the Gulf markets. As shown in Fig. 5.2, intermediaries or *dallalin* (singular *dallal*) mediate almost all transactions, earning 50 Syrian pounds per head as a commission. There are about 60 intermediaries in Aleppo, which gives an indication of the competitiveness of the market. Because these traders cannot keep animals for long periods and do not have fattening facilities, their small profit margins may turn into net losses as prices fluctuate.

The structure of the market, the large number of sellers and buyers, and the very small margins that dealers gain demonstrate the competitiveness of the Aleppo markets and the absence of concentration of market power in the hands of a few.

The study also found that there is weak institutional capacity in terms of animal health monitoring. Diseases can be transmitted at the market place as animals from different places meet and mix. Intermediaries enforce the return of sick animals to the seller as part of the transaction agree-

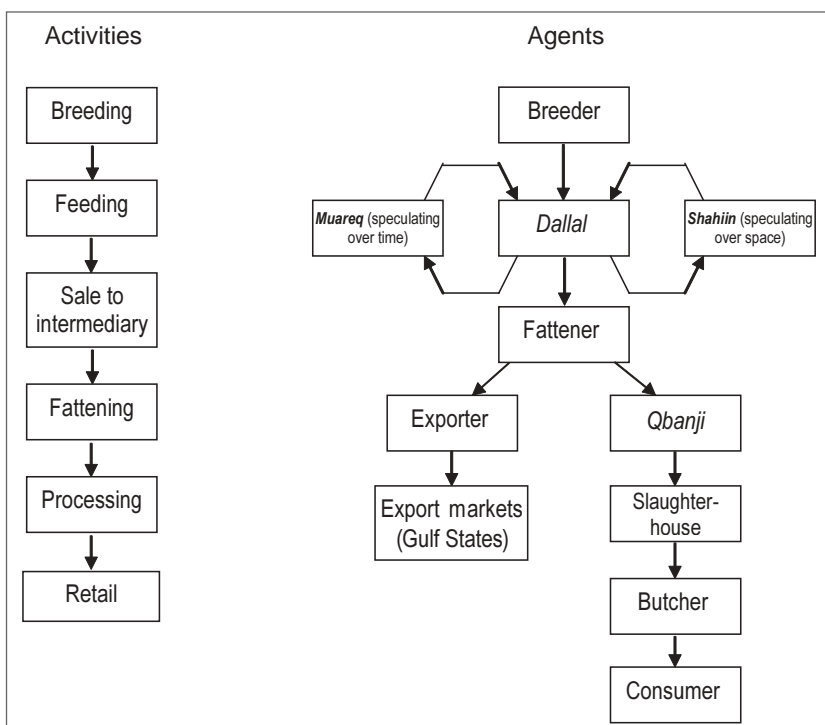


Fig. 5.2. Market value chain in Aleppo province.

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**Table 5.2. Sheep type and their prices on the Aleppo market.**

Sheep type	Unit	Price (SYP)
Female yearling	kg	97
Female lamb (< 1 year)	kg	102
Male lamb (< 1 year)	kg	125
Fattened lamb	kg	115
Culled ewe, old or out of production	kg	85
Ewe without lamb	Head	4130
Ewe with new born lamb	Head	6000
Pregnant ewe	Head	4500
Productive ram	Head	9500
Unproductive/old ram	kg	105

Source: Market survey, average prices (2002-2006).

1 US\$ = 50.5 SYP (Syrian pounds).

ment, which is considered quality assurance for the buyer.

The study also showed there were weaknesses in the recording of transactions and prices. Price information is critical for production and marketing decisions. Continuous recording of lamb prices at primary and secondary

markets would provide valuable information for policy makers, producers and traders. Yet payments for lambs at the Aleppo markets are not made at the time of purchase, but rather two weeks to one month later. This practice is also a disadvantage for fatteners, particularly resource-poor small-scale fatteners.



*Sheep market in Aleppo province, Syria.*

Finally, the study highlighted the strong business partnerships between exporters and fatteners, which help capital flow to the sector, linking producers to markets. Understanding these vertical alliances along the value chain is essential for promoting them as instruments that can improve rural livelihoods.

## Improving farmers' food security and incomes in Ethiopia, Sudan, Egypt, and Yemen

The project "Technology Generation and Dissemination for Sustainable Production of Cereals and Cool-Season Food Legumes" funded by IFAD for the Nile Valley and Red Sea region was completed in March 2006. The goal was to improve food security and farm household income through developing and transferring technologies to farmers to improve the yields and yield stability of wheat, faba bean, chickpea, and lentil in Egypt, Ethiopia, Sudan, and Yemen. The technologies includ-

ed information on seeding rate, planting date, fertilizer rates, weed and pest control, irrigation requirements, tillage, and improved crop varieties.

Researchers assessed the impact of technologies on the livelihoods of rural households using indicators such as crop productivity, employment, family income level and its distribution, household food security, and poverty. In collaboration with the national agricultural research programs, 915 house-



*Researchers planning a joint assessment of the impacts of improved wheat and legume technologies in Egypt, Ethiopia, Sudan and Yemen.*

**Table 5.3. Adoption rate of wheat and faba bean technologies (percent of farmers).**

Technology component	Wheat			Faba bean		
	Egypt	Sudan	Yemen	Egypt	Sudan	Ethiopia
Variety	68	62	91	100	8	71
Sowing date	74	53	15	44	8	22
Weed control	68	66	na	100	80	100
Pest control	na	64	na	100	63	45
No. of irrigations	88	17	19	na	na	na
Seed rate	65	17	20	58	25	4
Fertilizer	58	44	22	50	0	15

na = not applicable

**Table 5.4. Impact of improved technology packages on crop productivity. Yields obtained by adopters and non-adopters, and percentage increase brought by adoption.**

Crop	Country	Technology component	Yield (t/ha)		Increase (%)
			Adopters	Non-adopters	
Faba bean	Egypt	Variety	3.3	2.8	18
		Seed rate	3.4	2.8	21
		Weed/pest control	3.3	3.0	10
		Full package	3.4	3.0	13
Faba bean	Ethiopia	Variety	1.7	1.2	42
		Weed	1.6	1.5	7
		Fertilizers	1.5	1.6	-7
		Seed rate	1.7	1.6	6
Faba bean	Sudan	Tillage	1.4	1.6	-12
		Variety	2.7	2.5	8
		Seed rate	3.5	2.6	35
		Weed control	2.6	2.8	-7
Wheat	Egypt	Pest control	2.7	2.7	0
		Variety	6.0	5.2	15
		Seed rate	6.0	5.2	15
		Sowing date	6.0	5.2	15
		Weed control	5.9	5.4	9
		No. of irrigations	5.7	5.6	2
Wheat	Yemen	Full package	6.1	5.2	17
		Variety	3.0	2.1	43
		Seed rate	3.2	2.8	14
		Fertilizer rate	3.2	2.1	50
Chickpea	Ethiopia	No. of irrigations	2.2	3.0	27
		Variety	1.8	1.1	63
		Seed rate	2.0	1.5	25
Lentil	Ethiopia	Variety	1.7	1.0	70
		Sowing date	2.0	0.85	135
		Weed control	1.6	1.00	62

holds in nine locations were interviewed using a pre-tested formal questionnaire and stratified random sampling. The national programs' capacities in impact methodologies, survey techniques, data analysis, and reporting were strengthened by two regional training workshops.

The adoption of the technological packages was selective. Some elements such as sowing methods, improved varieties, and pest control were more widely adopted (Table 5.3).

### **Effect on crop productivity**

The recommended technologies improved crop productivity. In all countries and for nearly all crops and technology components, yields obtained by farmers who adopted all or some components of the package were higher than those of non-adopters. The only exception was faba bean, where weed control in Sudan, and fertilizer application and tillage in Ethiopia generated lower yields for adopters. Improved varieties were important in increasing yields, especially in Ethiopia where rainfed agriculture predominates. Depending on the crop and the country, the yield differences between adopters and non-adopters varied between 8% and 70% (Table 5.4).

An appropriate seeding rate was important, increasing faba bean yields by 6% in Ethiopia and 35% in Sudan. Using the recommended sowing date increased wheat yields by 15% in Egypt and lentil yields by 135% in Ethiopia. Econometric estimates of crop production functions for Ethiopia and Egypt confirmed

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the net effect of improved varieties and other inputs on crop productivity increases.

### Impact on employment

Labor requirements were clearly reduced for certain operations, especially plowing chickpea and lentil in Ethiopia, and harvesting lentil in Ethiopia and wheat in Yemen. There was a substantial increase in labor required for lentil sowing and weeding, chickpea weeding and harvesting in Ethiopia, and for wheat irrigation in Yemen. Compared with traditional practices, the overall effects of the recommended plowing, sowing, weeding, irrigation, and harvesting methods reduced the labor required by 1.5% and 7.8% for chickpea and lentil in Ethiopia, but increased it by 44% in Yemen. Thus, the package did not give a uniform employment outcome for all crops and countries.

### Impact on household income

The recommended technologies reduced labor costs in Ethiopia

and Yemen, although the direction of change in total production costs per hectare was not clear. In Egyptian wheat production, as a result of higher yields and lower labor costs, returns for adopters were US\$300/ha higher than for non-adopters. For the wheat package, adopters in Egypt had average net returns of US\$1190/ha, compared to US\$830 for non-adopters: an increase of 43%. In Sudan, the corresponding figures were US\$510 and US\$134 per hectare: an increase of 280%.

Similarly, for lentil and chickpea in Ethiopia and faba bean in Egypt, farmers who adopted the technologies had net returns per hectare of US\$451, US\$551, and US\$962, respectively. These were 17% to 173% above those obtained by non-adopters in each country (Fig. 5.3).

The Gini coefficient was used to estimate the equality aspect of increases in income. Among households that adopted wheat, lentil, and faba bean

technologies in Sudan, Ethiopia, and Egypt, respectively, the low Gini coefficient indicated less inequality. Inequality was high for wheat in Egypt and chickpea in Ethiopia, and researchers are studying this issue in more depth.

### Household food security improvement

The per capita production of each crop was an indicator of project's impact on the food security of farm households. It was calculated by dividing the household's total production for the specific crops by household size. The project has clearly improved food security among adopting farmers. On average, per capita faba bean production in non-adopting households was 428 kg in Egypt and 138 kg in Sudan (both under irrigation), and 44 kg in Ethiopia (under rainfed conditions). Households who adopted the technology had yields that were higher by 8% in Sudan, 13% in Egypt, and 42% in Ethiopia. In Yemen, per capita wheat production was 188 kg, representing an increase of 38%.

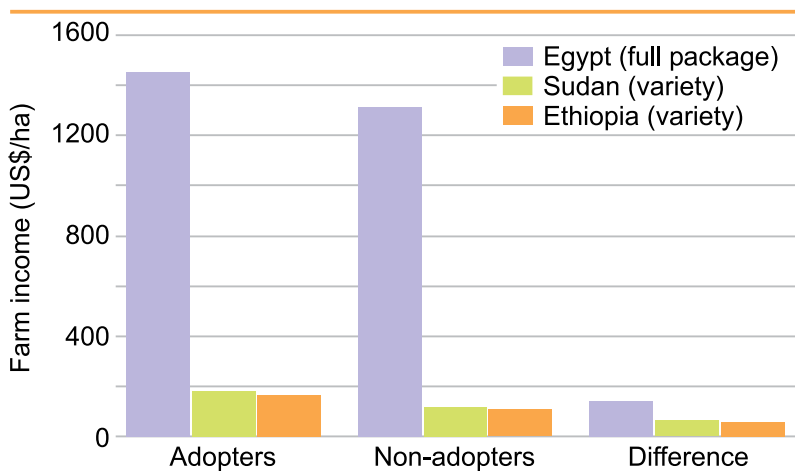


Fig.5.3. Impact of faba bean technology on farm income.

In conclusion, impact indicators showed the project was effective in increasing crop productivity, farm income, and food security, and in reducing poverty among technology adopters. Such positive impacts should stimulate wider adoption and greater impacts over time. The study also provided important information on the main constraints to wider dissemination of the technologies to farmers.

For example, in Yemen, the most important constraints are that farmers cannot afford the full

package, extension agencies are weak, and competition exists between wheat and cash crops such as potato and onion. For farmers in Egypt, the constraints are the unavailability of inputs, such as improved seeds and fertilizers, at the right time;

weakness of extension services; and a shortage of policy measures in the areas of input and output markets, credit, and financial support.

After the project's lifespan of four years, it was clear that farm-

ers were still experimenting with components of the technology, given the variations in adoption rates between countries. Risk aversion may be important in farmer decisions not to attempt the full package early in the adoption process.

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## A sustainable livelihoods approach to improving livelihoods and preserving natural resources in Algeria, Morocco, and Tunisia

Making a living in most mountain communities is hard. In developing countries in particular, infrastructure, education, health, and other government support rarely reach mountain communities. These communities, therefore need to turn the challenges of their environment into opportunities, for example by making the most of their particular climates by exploiting high-value crops and products. To deliver high quality products, however, they need to improve production and marketing dramatically.

Mountain communities in Algeria, Morocco, and Tunisia teamed up with ICARDA and NARS researchers in a three-year action research project to improve their livelihoods and manage natural resources better. The communities, Lghil Ali in the Biban mountains (Algeria), Ouled H'lel in Kouriminie (Tunisia), and Aït Bazza in the Middle Atlas and Anouggal in the High Atlas (Morocco), are very different, so the sustainable livelihoods approach served as a common framework for the project across the four areas.

The sustainable livelihoods approach has five main thrusts. The first is to get more out of the assets that communities and households already have, such as water, local plant genetic resources, skills, equipment, inputs, and access to credit. The second looks at improving the social assets of communities and households, for example access to credit and extension services. The third thrust is to find new livelihood options, for example diversifying into higher value products, and the fourth to empower vulnerable groups, such as women and young people. The fifth area is to establish links, such as to market chains and mountain development policies. The Maghreb Mountains Project, as it is known, looked at various ways to improve the livelihoods of mountain communities in these five areas.

Lghil Ali, in Algeria, is typical of mountain communities. Although the area is arid, there are many small springs and streams – natural assets – which could be used more effectively. The team of villagers and researchers tested ways to harvest water and carry it from springs or water sources to the fields. They made 'straw pockets' to irrigate vegetables and 'buried stone pockets' to irrigate fruit trees. These are traditional Mediterranean techniques that have recently been resurrected and tested successfully in Tunisia. To make even better use of water, the team restored old irrigation channels and put in pipes from remote springs to fields. These improvements led to greater yields of fruit and vegetables.

In Aït Bazza, Morocco, a survey of local barley and maize varieties turned up two promising varieties of farmers' maize. A study of medicinal and herbal plants also came up with a list of species with commercial potential, for example, thyme, oregano, artemisia, and rosemary. To make the most of these plant genetic assets, farmers will need to learn how to grow

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*The project is helping farmers intensify production by introducing high-value vegetable crops such as peas.*

these species intensively, and how to process the products (by extracting essential oils, etc.), and how to market them.

The research teams also looked at the main crops in the different communities to see where they could be improved. In Ait Bazza, this meant finding better ways to grow potato. In Anouggal, it meant looking at fruit trees and bee keeping. Here, because apples are a commercial crop, production needs to be market-oriented and take advantage of the specific benefits of the mountain environment for growing apples. In this case farmers need better technologies, technical assistance, and training.

When they looked at the social capital of communities, researchers found that formal and informal (customary) organizations and institutions seldom worked together. To demonstrate that working together

could open up possibilities, representatives of credit and government development agencies met with farmers in Lghil Ali to tell them about opportunities offered by government institutions.

Although there has been great progress in setting up local development support organizations, these still need help to learn how to plan and manage projects, and to encourage democratic representation and empowerment. In Ouled H'lel, there are no longer any traditional community organizations, so helping to build community-based organizations really paid off. They now operate independently but will still require support for some time. In Anouggal, the combination of giving information to farmers, training, technical assistance, participatory field trials, and exchange visits, proved valuable in building social capital.

Mountain areas do have opportunities to diversify and develop new sources of income. Their unique climate is one area where they have an advantage. For example, they can specialize in late-season crops that fill the gap when main crops in the lowlands are over. By growing new varieties, farmers can get good prices in both local and export markets. They do, however, need to improve production and marketing dramatically to deliver high quality produce.

In Ouled H'lel (Tunisia) and Anouggal (Morocco), there are significant opportunities to brand honey as a specialized product. Farmers would need to improve honey production by managing their hives better, training young bee keepers, and extending the range of plants bees feed on. Another possibility for diversifying into new sources of income is to produce goat cheese.



*Honey is a local product with great potential for improving incomes.*

Empowering vulnerable groups is a significant challenge. For example, for women to make profits from their skills in weaving

local wool and goat hair, major changes will be needed. Only with high-quality design and strong marketing will they be able to penetrate over-crowded markets for handicrafts.

Perhaps most importantly, mountain communities need good links with markets for their products. Commercialization of all high-value products depends on meeting quality standards. In Anouggal, researchers looked at market chains for fruit and walnuts, and the feasibility of labeling and certifying mountain products. At present, fruit and walnuts are either sold to visiting traders or at the weekly market. The volume of production is low and roads are bad, so there are just a few traders who more or less have a monopoly and keep prices low. Nonetheless, these traders are also often farmers' sole source of inputs, credit, and other items, so the situation is not simple.

Another study compared market chains for apples, rural infrastructure, and the role of traders in Anouggal and Taddarine, two villages that are agro-climatically and demographically similar. For various reasons patterns of

commercialization were quite different. But, despite the differences, both communities face similar challenges – how to differentiate their products, how to manage cash flow, and how to store apples properly. Between them, the communities have considerable experience. Sharing locally generated solutions could make a big difference in these areas, which tend to be ignored by government extension programs. Farmer-to-farmer and community-to-community knowledge and technology transfer make good sense.

Labeling and certification would also do a lot to promote mountain products. Pressure from the European Union for agricultural products to comply with international quality standards means that these regulations will come sooner or later. So, measures can be taken right now to label and pilot mountain brands under such schemes as the terroir of origin.

There are three promising avenues: the territorial mark, the bio-label for niche products, and conventional trademarks. Many products, for example olive oil, honey, walnuts, apples, cherries,



**Bejaya, Algeria: a woman processes red pepper into spice to generate income.**

almonds, wool, and meat, are already eligible for at least one of these schemes. Nonetheless, even with labeling and certification, farmers will need better production, processing, and marketing skills before they can depend on these products to improve their livelihoods.

## Low-cost durum wheat technology for North Africa and West Asia

In most Mediterranean countries, durum wheat is an important part of the diet for both rural and urban people. The five countries of Algeria, Morocco, Syria, Tunisia, and Turkey account for over one-

third of global durum consumption and area, and yet Algeria, Morocco and Tunisia are net importers, with Algeria alone accounting for 40% of world imports. ICARDA has been working to improve durum yields for many years, and in 2006 completed a four-year project known as the Integrated Research and Durum Economics Network (IRDEN) project, which was funded by IFAD.

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The project aimed to improve the livelihoods of the small-scale farmers who depend on rainfall to grow durum in semi-arid regions. These farmers' yields fluctuate greatly, but are often low because of frequent drought, high temperatures, diseases, and insect pests. The IRDEN project built on the successes of another IFAD-funded project, called WANADIN, which ran from 1996 to 1999 in these five countries.

The IRDEN project promoted participation by involving farmers and their families, researchers, extension staff, local administration, the seed sector, business entities, development agencies, and other stakeholders. ICARDA coordinated the project. The Center selected germplasm, provided scientific information and training, and catalyzed collaboration among institutions in the five countries. NARS in Morocco and Turkey tested the germplasm locally.

Project activities were grouped into five areas (Table 5.5). Staff characterized communities and worked at two pilot sites in each country. They raised awareness of the new technology options through field days, farmer workshops, and constant contact with farmers.

In terms of the project's impact, grain yields from the improved technologies varied according to farmer, location, and variety. However, the average improvement in yields, as compared with those from traditional farming practices, was 30-100% in Algeria, 20-40% in Morocco, 20-30% in Syria, 5-10% in Tunisia, and 15-80% in Turkey (Fig. 5.4). In some cases, for instance the use of varieties resistant to Hessian fly in Morocco, the yield advantage was over 300%.

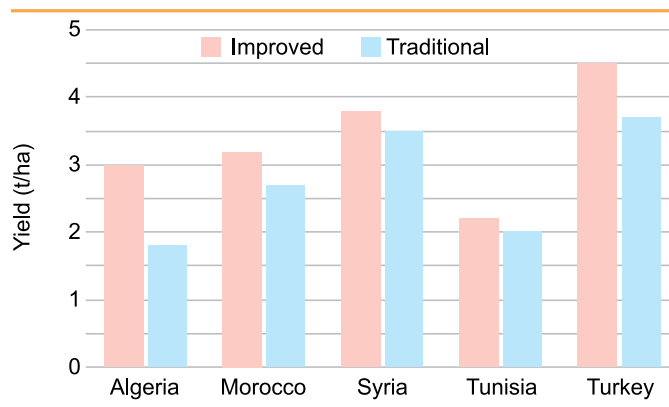
As farmer awareness of the technologies increased there was a gradual shift to adopting them, with a rate that varied depending on the country and

agro-ecology. In North Africa, traditional varieties that are very old (50 years or more) or moderately old (20 years or more) still cover more than 60% of the total durum wheat area. Farmers are, however, switching to the new, higher yielding varieties made available through the project. This was shown by the increasing farmer requests for seed of the new varieties and a rapid rise in the multiplication of seed of improved cultivars in the areas covered by the project, especially by lead farmers in the project communities (Table 5.6).

Farmers bought all the quality seed that was produced, indicating the tremendous impact of the project over a short time period. The lead farmers played a key role, multiplying seed and selling it at competitive prices with payment options that were more advantageous than the ones offered by certified seed sellers in the formal sector. The project demonstrated that it is viable for communities in these

**Table 5.5. Activities of the Integrated Research and Durum Economics Network (IRDEN) Project, 2003-2006.**

Theme/activity	Countries	Outcome
Technology transfer	Algeria, Morocco, Syria, Tunisia, Turkey	Increased farmer awareness and adoption of new technology
Seed production and distribution	Algeria, Morocco, Tunisia	Quality seed produced on-farm and marketed to communities at a reasonable price
On-farm value-adding technologies	Algeria, Syria, Tunisia	Durum end-products produced on-farm and marketed in cities
Back-up research	Morocco, Turkey	Germplasm with improved drought tolerance and quality made available to NARS through ICARDA
Capacity building	Algeria, Morocco, Syria, Tunisia, Turkey	- Farmer participation and acceptance of new technologies - Improved technical competence of farmers and extension and research staff - Network of durum researchers - Improved flow of information



**Fig. 5.4.** Average on-farm grain yield of durum wheat in 2006 for improved versus traditional technologies at two target sites in each of the five countries participating in the IRDEN project.

countries to establish small-scale seed enterprises. Although seed processed on-farm may not meet the standards of certified seed, the difference in yields is negligible and economically insignificant.

The project also boosted awareness of the importance of exchanging information among farmers and forming groups of common interest. In addition, participatory research helped to shed light on how the value of durum wheat end-products can be enhanced. For example, although the variety 'Biskri' is an old cultivar in Tunisia, consumers prefer its characteristics.

Breeders are therefore working to transfer these characteristics to modern, high-yielding varieties. In other countries, the new varieties – such as 'Douma-1' and 'Bohouth-7' in Syria, and 'GTA Dur', 'Ouarsenis', and 'Sersou' in Algeria – already possess good quality attributes.

Research also showed that consumers prefer on-farm processing of durum end-products (e.g. couscous) to standard commercial processing and are willing to pay higher prices for what they perceive as better quality. The fact that this processing is done by women adds a gender equity dimension to this activity.

**Table 5.6.** Quality seed of durum wheat cultivars produced and distributed to farmers in target communities at start-up (2003) and end (2006) of the IRDEN project (in tons).

Country	2003	2006
Algeria	<1	197†
Morocco	<1	40
Tunisia	<1	320

†197 tons were produced by lead farmers; an additional 153 tons were produced by other farmers

Increased exchange of expertise and information among researchers from the five countries is another positive impact of the project. It also produced a number of publications – including 8 refereed journal articles, 17 brochures, 13 workshop presentations and 3 newspaper articles. Furthermore, 15 students from Tunisia, and one each from Morocco and Syria, conducted research projects or theses on related topics.



**Farmer-made durum end-products, valued by consumers, help to improve livelihoods in rural communities.**

Looking ahead, there is a need to assess the adaptability to dry areas of the technologies that are currently available – and to adjust them, taking into consideration the specific environmental and socioeconomic constraints of these areas. In North Africa, drought is a quasi-permanent threat that can have disastrous consequences, including total crop loss. Drought mitigation options based on technologies that include crop rotation, reduced tillage, water harvesting, and supplementary irrigation will lessen the negative effect of low rainfall in dry areas.

### Mapping poverty through links to resource endowment

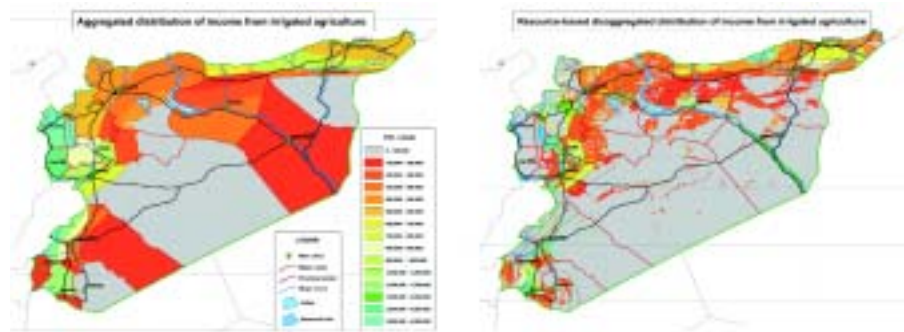
Many countries use poverty mapping to design policies that aim to reduce income disparities. However, poverty mapping is based on large-scale household surveys, which are expensive. Yet many countries in CWANA have databases that contain statistics, such as those on agricultural production, prices, and populations, that could provide data for calculating agricultural incomes and compiling maps of rural poverty. The major disadvantage though is that the data is quite generalized and it would only be possible to calculate average incomes over large areas. Poverty 'hot spots' would not show up.

Many studies show that rural poverty correlates strongly with ownership of resources, such as land, water, animals, and machinery. They also show that rural poverty correlates with agroecological variables, such as climate, soil, and water for irrigation. Despite awareness of these linkages, relatively few studies in CWANA have investigated the influence of 'resource poverty' on human poverty and actually used this information to identify poverty 'hot spots'. So researchers deduced that it should be possible to map poverty by combining agricultural statistical data with agroecological information.

To test this new kind of poverty mapping, researchers integrated macro-level socioeconomic statistical data and micro-level environmental data in a case study in Syria.

At the national level (macro level), researchers used the Agricultural Resource Potential Index (ARI) to measure ownership of – or access to – natural resources. This index takes into account resources such as irrigation water, climate, topography, and soils. Then, they used these ratings to estimate Agricultural Productivity Coefficients (APCs) which indicate agricultural production. They plotted the results on a map of Syria divided into 49 climatically uniform sub-regions.

In each sub-region, the distribution of the productivity index correlated with the distribution of the resource potential index. Income from different livestock enterprises was also mapped and incorporated with estimated land-use coefficients. Per capita income was calculated on rural population density. The final set of maps shows total and per capita income distributions from rainfed agriculture, from irrigated agriculture (Fig. 5.5), and from livestock, with and without the resource index.



**Fig. 5.5. Aggregated (left) and resource-based disaggregated (right) income from irrigated agriculture.**

These new poverty maps suggest that rural poverty hotspots in Syria are likely to be found in marginal, resource-poor areas. However, they also occur in areas where there are more resources, but where population pressure reduces the per capita income, for example in the Euphrates Valley.

To cross-check the results, researchers compared total agricultural income of the Khanasser area in northwestern Syria estimated by this method with the results of a recent survey. There was overall agreement, although estimates of per capita income at the village level were somewhat higher than incomes indicated by the survey. Further validation of the method came from household-level nutritional surveys in the same area, which showed that child malnutrition also coincided with areas endowed with few resources.