

## 2.2 INFRASTRUCTURE FOR AGRICULTURAL SECTOR MECHANIZATION





**Agriculture Mechanization Rehabilitation project served 17 governorates.**

**INTRODUCTION**

The production of such major crops as cereals and legumes in Iraq is largely mechanized. Some farmers own their own tractors or combines, and those who do not rent services from other farmers for cultivation and harvest. When equipment breaks down, it affects both the owner and other farmers who depend on this equipment for agricultural production. The poor condition of Iraq's tractor fleet, and the lack of repair and maintenance services in general for agricultural machinery, have led to significant losses in agricultural production, since farmers do not have sufficient access to agricultural machinery during key times in the cropping season.

To improve access to agricultural machinery, ARDI implemented an Agriculture Mechanization Rehabilitation project to repair 4,719 tractors and 18 combines during 17 of Iraq's 18 governorates in 2005 and 2006. ARDI also provided vocational training to a total of 216 Iraqi mechanics to build capacity for agricultural machinery repair and maintenance services, especially in rural areas.

**REPAIRING TRACTORS AND COMBINES**

One of the major obstacles to developing a modern agricultural system in Iraq is the shortage of properly functioning agricultural machinery. Although accurate estimates are not available, the MOA and FAO have reported that about 78,000 tractors and 5,600 combines are operating in Iraq. Tractors were procured and distributed to farmers at subsidized prices under the Oil-For-Food program, but much of this stock was sold across the border. The remaining stock is aging (about 80% is at least 16 years old) and operating at less than rated or design capacity. Manufacturer Massey Ferguson estimated that half of the 17,000 tractors it has sold in Iraq need repair.

The poor condition of the tractor and combine fleet has reduced farmers' access to agricultural machinery during key points of the cropping season, which has resulted in reduced yields and production, primarily for wheat and barley, but

**TABLE 35 MECHANIZATION PROJECTS 2005-2006**

Activity	Number of Projects	Projects Primary Beneficiaries
Tractor/Combine Repair	5	1 Case New Holland repair program (private sector)
		2 Massey Ferguson repair programs (private sector)
		1 multibrand tractor and combine repair program (private sector)
		1 mechanization monitoring program (private sector)
Mechanics Training	6	5 vocational training courses in agricultural mechanics and welding (private sector)
		1 Case New Holland mechanics training (private sector)



**(above and below) Tractors in a field awaiting inspection for consideration for repair.**

also for legumes and vegetable plots. Inoperable tractors can constrain production in several ways, for example, by restricting plowing depth or limiting coverage area. Reduced production, in turn, lowers farmers' income.

The goals of this program were to repair approximately 5,000 tractors and return them to use for agricultural production, improving the agricultural sector's capacity to satisfy domestic food demand. This will increase rural income and employment, and eventually contribute to developing export markets for several crops.

**ACTIVITIES**

In 2005, ARDI initiated the Agricultural Mechanization Rehabilitation program, which focused on repairing and returning to use for agricultural production approximately 5,000 tractors of two dominant international brands in Iraq: Case New Holland, which owns the Fiat 780 brand of tractors, and Massey Ferguson. Both these companies have US parent companies. Focusing on these two brands simplified the work plan and ensured economies of scale. In 2006, ARDI also implemented a grant to repair approximately 5,000 additional tractors and combines of local brands.



**Tractors at one of the workshops awaiting repair.**



**SUCCESS STORY:  
AGRICULTURE SECTOR  
MECHANIZATION PROJECT  
SPARKS NEW BUSINESS FOR  
REPAIR WORKSHOPS**

In late summer 2006, as the ARDI Agriculture Sector Mechanization project drew to a close, word of the project's tractor repairs spread rapidly to tractor owners who had not participated in the program. In Erbil, some of these owners who wanted repairs for the own tractors went to the CNH distributor repair workshop, willing to pay for CNH branded parts and repairs. The distributor was using its entire inventory for the repair project, but at least 30 tractor owners purchased nonbranded parts available on local markets, and then brought their tractors to the distributor and paid its trained technicians to perform the repairs.

This demand for professional repair services was an encouragement to the distributor to stock CNH-brand parts and to continue to provide repair service. It also highlighted the need to increase capacity for repair and maintenance services in Iraq.

This program is an example which demonstrates the effective use of development funds to encourage sustainability of program objectives through private sector investments.

ARDI and the MOA agreed that the mechanization rehabilitation effort should be led by the private sector. ARDI worked with CNH and MF to select local distributors who would implement the repair program for those brands of tractors, and with a local NGO to implement the program to repair tractors and combines of local brands.

During the first phase of the program, ARDI and the MOA generated a database of tractors throughout Iraq that were in need of repair. The MOA placed

**TABLE 36 TRACTORS AND COMBINES INSPECTED AND CONSIDERED FOR REPAIR**

<b>Model Distributor/N GO</b>	<b>Governorates</b>	<b>Machines Inspected</b>	<b>Machines Considered for Repair</b>
Case New Holland (MICTA)	Anbar, Babylon, Baghdad, Dahuk, Diyala, Erbil, Kerbala, Missan, Muthanna, Najaf, Ninewa, Qadissiya, Salah al-Din Sulaymaniyah, Tameem, Thi-Qar, Wassit	5,021	4,143 tractors  625 combines
Massey Ferguson (Zozik)	Dahuk, Erbil, Ninewa, Sulaymaniyah, Tameem	4,258	2,758 tractors
Massey Ferguson (Al-Khorayef)	Anbar, Babylon, Baghdad, Diyala and Salah al-Din	2,666	985 tractors
Antar (a local brand) and others (Khabor)	Dahuk	116	98 tractors 18 combines
<b>Total</b>	<b>17</b>	<b>12,061</b>	<b>8,627</b>

announcements in local media to let farmers know they could apply for an inspection at their local district office. It then screened applications to eliminate tractor owners who were using their tractors for nonagricultural purposes, such as hauling bricks. In most cases, farmers were responsible for bringing their tractors to the inspection station. Teams of engineers inspected inoperable tractors and combines (equipment that is unable to operate at or near design capacity), and estimated the repair requirements of each. The engineers then developed databases of all inspection records to determine the parts needed for each repair, as well as the costs. The vehicles that were most cost-effective to repair were selected from this database.

Once the list of machines to be considered for repair was compiled, ARDI worked with the distributors to narrow this list to minimize parts inventory problems and improve the cost efficiency of the repair process. ARDI limited Case New Holland repairs to a single pervasive model, while several Massey Ferguson models were included because most of this manufacturer's models used the same parts. ARDI negotiated repair cost estimates with the distributors,

who then ordered the required parts, almost all of which had to be shipped into Iraq from international sources.

The distributors and the NGO then established workshops for the repairs. Some of these workshops were owned by the distributors, while others were

**TABLE 37 TRACTORS AND COMBINE REPAIRS AND THEIR COSTS**

Model Distributor/NGO	Vehicles Repaired	Average Cost to Repair
Case New Holland (MICTA)	2,742 tractors	\$4,664
Massey Ferguson (Zozik)	1,725 tractors	\$4,157
Massey Ferguson (Al-Khorayef)	156 tractors	\$5,400
Antar (a local brand) and others	98 tractors	\$630
Khabor	18 combines	
<b>Total</b>	<b>4,739</b>	

joint ventures or independents contracted for repairs. The distributors and the NGO contacted the equipment owners whose repairs were accepted, and transported their tractors to the workshops. The repaired tractors were then delivered back to their owners.

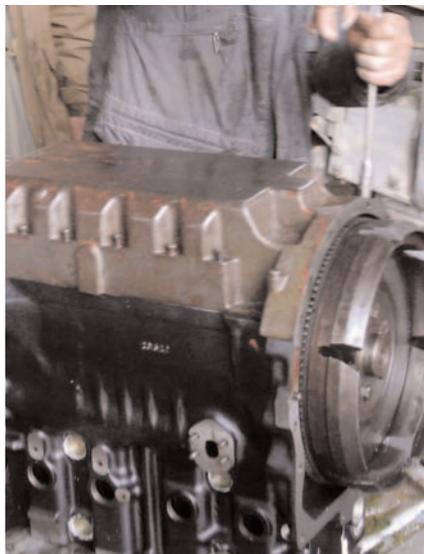
The repairs ranged from engine and transmission overhauls and replacements to the replacement of starter motors and brakes. Although workshop repair times varied, most repairs were completed within three days. All repairs of CNH and MF tractors were made at no cost to the farmer. In the case of repairs made to local brand tractors, farmers paid, on average, 29% of the repair costs.

Independent monitors from a private company supervised the repair process. They verified that each tractor (identified by chassis and engine number) brought to the workshop had been inspected and was eligible for repair. They also observed the repair process to track the work and replacement of parts against the needs identified during the inspection. The monitors also confirmed the satisfactory completion of repairs.

The full set of rehabilitated tractors will be used for the first time in the 2006 – 2007 planting season, which will occur after the publication of this report, so it is difficult to determine the full impact of the rehabilitation project. Anticipated results include:

- Increased revenues for farmers from expanded cultivation and increased production. The repaired tractors should enable the cultivation of an additional 45,000 hectares of land (including both area expansion and a more intensive and timely cultivation of existing land). The additional value of this production over five years (assuming one crop of wheat per year)





is an estimated \$23,745,487 (net present value, discounted at 10%).

- Increased revenues for farmers from increased contract services. Assuming that farmers can rent out their tractors for 190 days a year and charge for plowing, seeding, cultivation, harvesting, and transport, the total revenue from contract services will be \$81,206,362 over five years (net present value, discounted at 10%).

The ARDI Agriculture Sector Mechanization project has also led to the development of a repair shop network and distribution network in Iraq for new tractors, combines, and other agriculture implements. The workshops that were set up by the Massey Ferguson and Case New Holland distributors will continue to offer agricultural machinery repair services, and will also sell new machinery. ARDI implemented a complementary program in rural mechanic training to build capacity for repair and maintenance services for agricultural machinery, which is described in the next section.

**TRAINING**

Tractor owners in rural areas rely on local workshops for repair and maintenance services. These workshops are run by self-trained mechanics who often lack the facilities, appropriate equipment, and skills to provide effective repair services. As a result, machine owners often have to travel to urban centers

**TABLE 38 MECHANICS AND WELDERS TRAINED**

<b>Training Location</b>	<b>Mechanics Trained</b>	<b>Welders Trained</b>	<b>Total</b>
Sulaymaniyah	21	21	42
Dahuk	19	27	46
Erbil	12	16	28
Tameem	27	31	58
Turkey	42	0	42
<b>Total</b>	<b>121</b>	<b>95</b>	<b>216</b>

for repairs and servicing, which takes the machines out of operation for longer periods than if repair facilities were available locally. During critical planting and harvesting times, these delays and the resulting lack of access to agricultural machinery can significantly reduce on-farm productivity.

Building the capacity of rural mechanics was an essential step in improving the availability of agricultural machinery repair and maintenance services to tractor owners, to reduce production losses. ARDI worked with local companies and NGOs to implement five training courses for a total of 174 rural mechanics and welders from Sulaymaniyah, Dahuk, Erbil, and Tameem. Each training course had separate sessions for mechanics and welders. The training for mechanics covered work hazard protection, diesel motors, water cooling, oil and air cycling, troubleshooting, and preventive maintenance and testing, among other topics. Welder training included work hazard protection, arc, gas, and electric welding, welding strings, equipment, ox-acetylene welding, and maintenance and testing. At the end of each training session, ARDI granted the mechanics and welders basic toolkits that contained the equipment necessary to run an effective repair shop.

In addition, ARDI worked with the Case New Holland distributor in Turkey to provide advanced training for 42 Iraqi mechanics. This distributor heard of ARDI efforts to increase the capacity of Iraqi mechanics through the ARDI Agriculture Mechanization project, and offered the five-day course at no cost as part of its effort to build a market presence in Iraq. ARDI paid for transportation, accommodation, and meals.

The training covered a standard advanced training program for mechanics, primarily for CNH equipment, although many of the fundamentals are applicable to other international tractor brands. These mechanics are employed at workshops at which they will be able to offer improved repair and maintenance services to tractor owners.

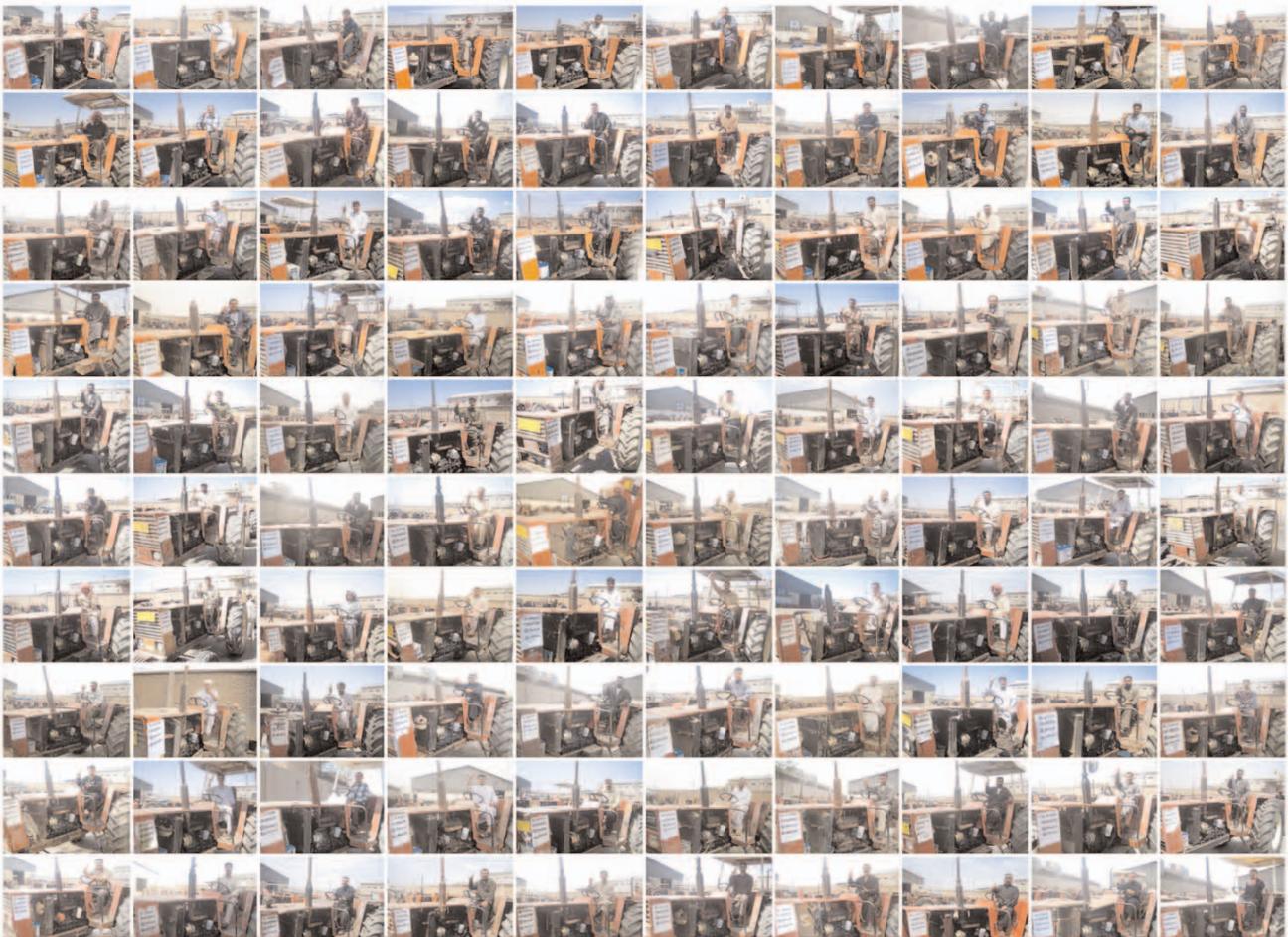
## **RESULTS**

The ARDI training effort increased the capabilities of mechanics and welders in four governorates to provide improved repair and maintenance services for agricultural machinery. The 216 rural mechanics and welders trained under ARDI will work in approximately 210 workshops, each of which represents a new small business opportunity in a rural village. Each workshop should be able to offer improved services to a minimum of 100 clients, for a total beneficiary population served of 21,600 tractor owners. Given that many tractor owners contract their services to other farmers during the planting and harvesting seasons, the total impact on farm families will be higher.

The training should also lead to improved equipment operation and greater income for the trained mechanics and welders. The provision of suitable workshop tools and equipment, as well as the increased skills of mechanics and welders, will also strengthen the network of rural independent mechanics and improve the operating performance of the agricultural equipment fleet.

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## ARDI AGRICULTURE RECONSTRUCTION AND DEVELOPMENT PROGRAM 2003~2006

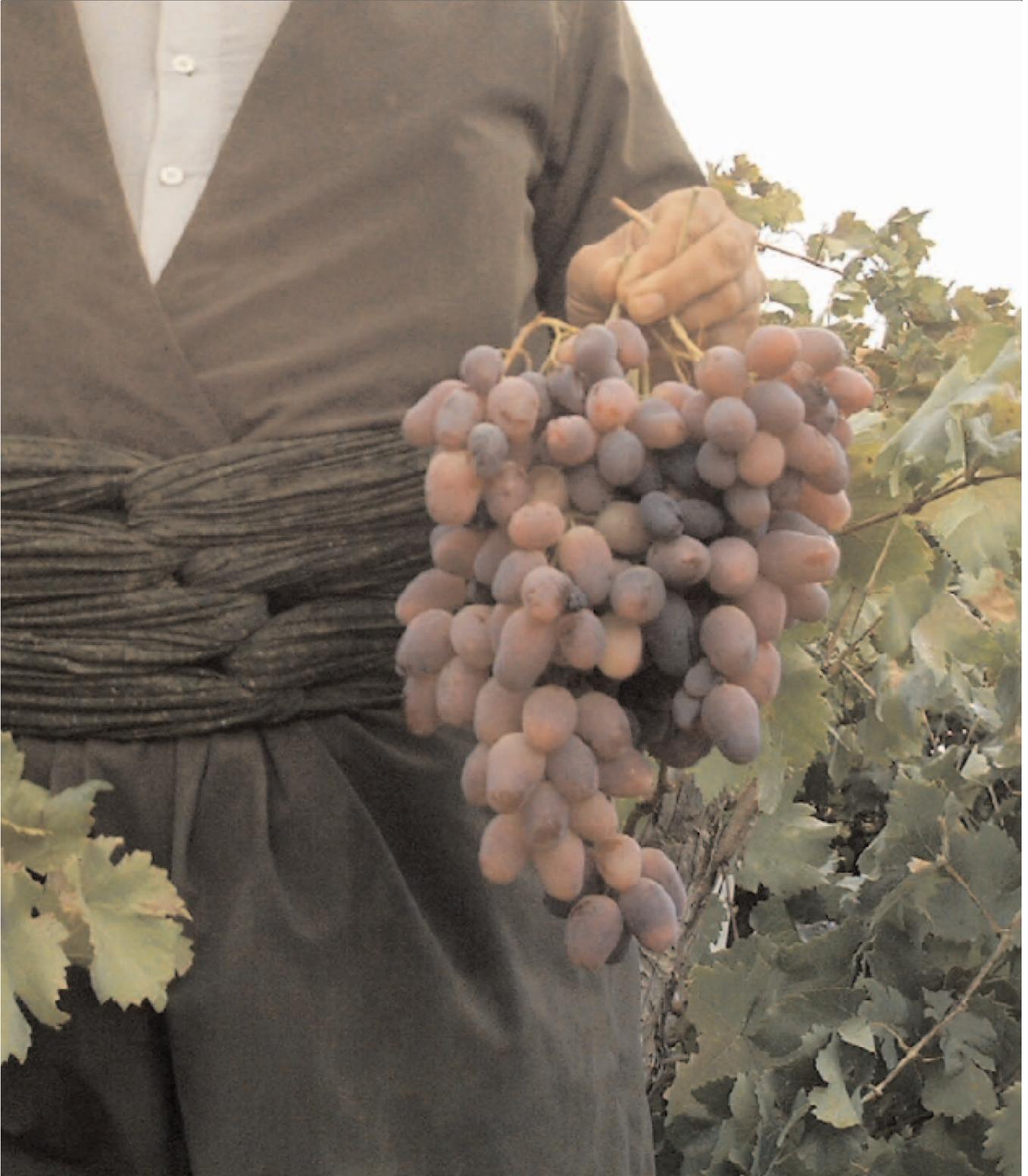


### Mechanization

The ARDI Mechanization Program impacts Iraqi farmers in several ways. It insures that the farmer has the primary tool he needs to keep his farm running for years to come, it offers the opportunity for additional income by having the tools to bring previously fallowed land into service and it provides a means to transport his harvest to market where optimum prices are available. The ARDI Mechanization Program repaired thousands of tractors throughout the nation, trained mechanics and established, through this program, more than a dozen new workshops across the country.



## 2.3 PHYSICAL AND TECHNOLOGICAL IMPROVEMENTS



**PHYSICAL AND TECHNOLOGICAL IMPROVEMENTS**



**High value agriculture projects were conducted in all 18 governorates.**

There are over 30 different vegetables and 25 different fruits grown in significant quantities in Iraq. For the most part, these vegetables and fruits are grown using traditional practices and provide meager income for thousands of subsistence farmers. There is almost no large-scale, modern production of vegetables and fruits in Iraq, and virtually no postharvest handling or storage facilities. Consequently, Iraqi products are generally of lower quality than imports and are only available at harvest. The combination of low quality and market gluts at harvest means that Iraqi horticulture producers are supplying the least remunerative segment of the Iraqi market. This can only be changed by building a modern horticulture industry.

ARDI has mainly worked through NGOs to reach small horticulture producers, to increase productivity and income. There were two approaches to the problem: 1) supplying improved seeds for vegetables and grafted plantlets for fruits; and 2) extending improved practices through demonstration plots and orchards, especially the correct density of planting, the use of improved varieties, increased use of fertilizers, appropriate pest and disease control, and better quality control at harvest.

**TABLE 39 HIGH VALUE AGRICULTURE PROJECTS AND PRIMARY BENEFICIARIES**

High-Value Product	Number of Projects	Projects Primary Beneficiaries
Dates	8	3 to establish 17 mother orchards for the Ministry of Agriculture (MOA) 2 to establish 16 nurseries (MOA) 3 to restore orchards (farmers)
Olives	2	1 for 16 high-oil olive demonstration orchards (MOA) 1 to establish orchards (farmers)
Grapes	6	1 to benchmark varieties (MOA) 1 to collect cuttings for nursery stock (MOA) 3 to establish private sector nurseries (private sector) 1 to produce vineyards with trellising and irrigation systems (farmers)
Fruit Orchards	8	1 apple orchard census (MOA) 2 to establish and rehabilitate peach and apple orchards (farmers) 1 to establish fruit orchards (farmers) 4 to establish and rehabilitate fruit orchards (farmers)
Horticulture	1	1 national horticultural conference (MOA, farmers, private sector, NGOs)
Tomatoes	3	1 to improve tomato production (farmers) 2 to expand hybrid variety tomato production (farmers)
Beekeeping	14	5 beekeeping and honey production projects (communities) 1 carpenter training workshop on beehive making (agrobusiness) 2 to support research and extension (MOA) 6 to establish and develop beekeepers associations (see Section 3.2)

## DATES



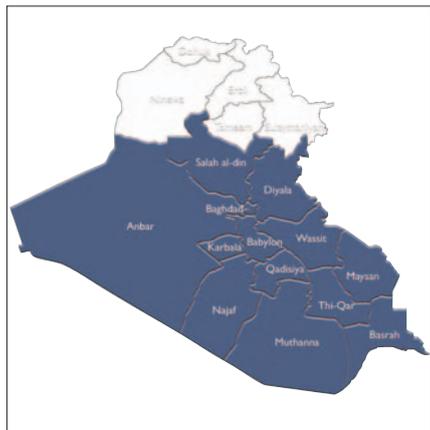
**Traditional small scale date merchant with hand woven vine and palm frond baskets. The paper lining in some baskets protects the delicate skin of the fruit from injury.**

Hundreds of thousands of farmers in central and southern Iraq depend on the cultivation of date palms as a source of income. There is high demand for dates by Iraqi consumers, and commercially desirable varieties can bring a good income to date palm farmers. In addition, many other crops such as pomegranates and citrus grow well in the shade that date palm orchards provide, increasing the benefits of cultivating these trees.

At one time, Iraq exported a large portion of its date production, and its exports accounted for 30% of the world's date supply. Iraq was also famous for its high-end date varieties, which are prized around the world for their high sugar content and superb flavor and texture.

Date palm production suffered greatly during the previous regime, when over half of the date palm orchards were destroyed. This problem was compounded in the south by improper drainage and the desiccation of the marshlands. Economic sanctions made it difficult for date producers to find markets; as a result, many have left their orchards to look for other jobs, and those remaining are unable to care for their orchards properly.

Over the past few years, large numbers of date palm trees have aged beyond productivity, died, or been badly damaged. The number of viable date palm trees



Date palm projects.

in Iraq today (16-19 million) is less than half of what it was a decade ago (32-35 million). In addition, the MOA has estimated that around half of these trees are past their prime production and need to be replaced. This situation has led to decreases in date palm production in Iraq, forcing local markets to import date fruits. In addition, farmers do not have access to high-quality, commercially desirable date palm varieties that could be used to replenish their orchards and improve production.

Iraq's date palm farmers face two major problems: the high cost of offshoots to use as new planting material, and a shortage of stock of the most desired date palm varieties. The average price of offshoots ranges from \$5 for the most common varieties (these are often used for animal feed) to around \$40 for the most prized varieties that are sold for human consumption. It is often difficult for Iraqi date producers to obtain offshoots of any variety, because many farmers would rather prune offshoots as soon as they appear to increase yields of fruit, rather than allow the offshoots to grow and sell them to other farmers.

ARDI worked with both the MOA and individual date producers to help restore date palm production in Iraq. ARDI increased the MOA's capacity to supply Iraqi date producers with high quality date palm offshoots by supporting the construction and establishment of date palm mother orchards and nurseries in all date producing governorates. ARDI also assisted individual date producers to replenish their existing orchards with high quality date palm offshoots of commercially desirable varieties, helping them to increase their production and income.

**ESTABLISHING MOTHER ORCHARDS IN THIRTEEN GOVERNORATES**

In 2003, the MOA established a National Date Palm Improvement Program with two objectives: protecting the over 600 varieties of date palm in Iraq from genetic deterioration or eventual extinction, and increasing Iraqi date palm producers' access to high quality, commercially desirable date palm varieties. In support of these objectives, the State Board for Date Palm Development is establishing 21 date palm mother orchards in the 13 governorates where dates are commonly cultivated. This will ensure that date producers have at least two sources of low-cost offshoots in each of the governorates. ARDI provided support to establish seventeen of these orchards, in 2004 and 2006.

**ACTIVITIES**

The most reliable method for establishing or replenishing a date palm orchard with new trees is by planting offshoots, which are exact genetic copies of the original adult, and carry the same characteristics, including those of the fruit they produce. An offshoot is essentially a "daughter tree" which grows from a bud produced at the base of a mature tree. A mother orchard is a "gene bank" of date palm varieties. The mother trees produce offshoots which are then purchased by farmers and planted into new orchards. Because the offshoots are exact copies and grow true to type, the farmer can be sure that the investment made in the offshoot will yield results in terms of commercially valuable date fruits.

To help the MOA establish mother orchards in date producing governorates, ARDI provided 40,000 date palm offshoots to 17 mother orchards in 2004, and

another 40,000 in 2006. These offshoots will become mother plants, and the orchards will be maintained to preserve these varieties and produce new offshoots to sell to farmers at a low cost.

**TABLE 40 DATE PALM SEEDLINGS SUPPLIED, 2004-2006**

Governorate	Hectares	Seedlings
Anbar	10	4,000
Babylon	15	6,000
Baghdad	20	8,000
Basrah	30	12,000
Diyala	10	4,000
Kerbala	15	6,000
Missan	15	6,000
Muthanna	15	6,000
Najaf	15	6,000
Qadisiya	15	6,000
Salah al-Din	10	4,000
Thi-Qar	15	6,000
Wassit	15	6,000
<b>Total</b>	<b>200</b>	<b>80,000</b>

The MOA provided land for the orchards, and to ensure the success of the MOA's orchards, ARDI also provided infrastructure support, including drip irrigation systems in the 17 orchards established in 2005, and reservoir basins, pump houses, and miscellaneous equipment in the majority of orchards that were not yet fully functional. The following equipment was supplied:

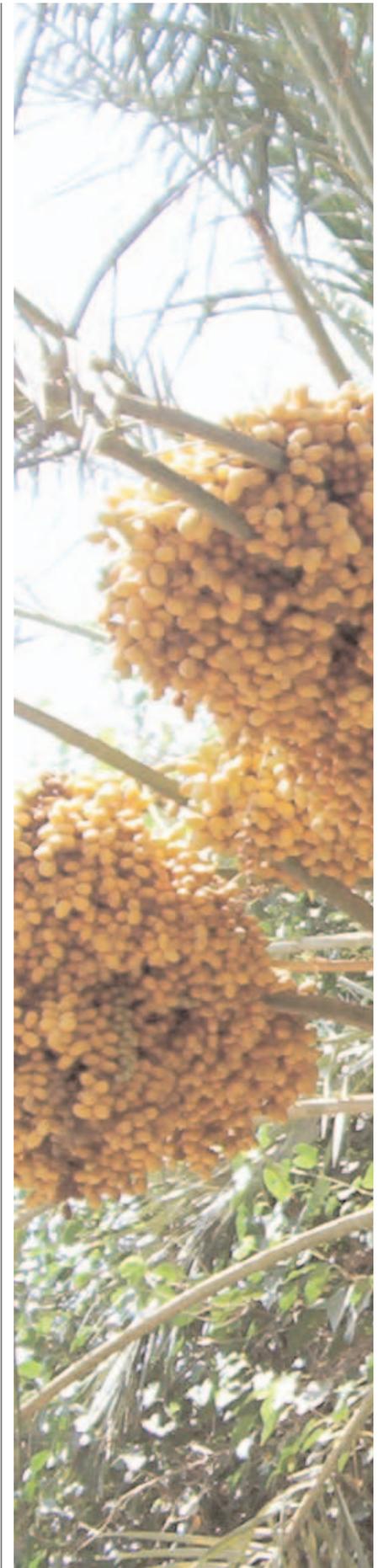
**TABLE 41 DATE PALM MOTHER ORCHARD INFRASTRUCTURE SUPPLIED**

Item	Number
Reservoirs	15
Pumps, 30 hp	7
Wells and pumps	5
Pump houses	15
Generators, 60 kVA	5
Drip kit systems*	40
Installation drip systems*	40

\* One drip kit system was required for each 2.5 ha of orchard. The 17 orchards comprised 200 hectares.

Once the infrastructure was in place, the offshoots were treated with rooting hormones and fungicide, and 400 seedlings were planted per hectare in each orchard. The young seedlings were irrigated using the drip kit systems.

Each "mother tree" will be used to produce three or four offshoots ("daughter plants") per year, which can be separated to create new palm trees. Once the offshoots are established, the MOA will collect them and care for them in nurseries until they reach maturity and can be planted. Most of the offshoots will



be sold to farmers at greatly reduced prices. However, a portion of the offshoots will be sent to the MOA's date palm nurseries for a year before being transferred to private farms. This will allow the offshoots to grow a stronger root system before they are transplanted to farmers' fields, and increase the success rate of transplants.

**Date palm offshoots ready for distribution to the farmer.**



**Palm offshoot in ground and wrapped in palm frond to protect it from sun and wind.**

**RESULTS**

Each of the 80,000 mother trees ARDI supplied will produce a minimum of three offshoots per year, for a net expected increase of 240,000 offshoots annually. This will help assure date farmers in 13 governorates of local access to new date palm stock at affordable prices.

MOA will take 170,000 of the new offshoots each year and plant them in nurseries, thus providing about 4.25% of the needed replacement stock (the MOA estimates that about 4 million of the country's aging date palm trees should be replaced immediately). The remaining 70,000 seedlings will be transferred directly to producers' fields, providing 1.75% of the needed replacement stock each year. Thus, ARDI's assistance will replace 6% of the aging stock in Iraq annually, beginning in 2006/2007. When the plants mature, the value of production added per year for the 15,288 tons of dates produced is \$8.2 million (in 2000 dollars)

Iraq's export markets also stand to gain. The total value of date exports from Iraq in the year 2,000 was approximately \$230 million, so the replacement of the aged date palm orchard at a rate of 6% per year will have an increasing effect on maintaining or increasing the value of the export market with each succeeding year:

**IMPROVING DATE PROPAGATION THROUGH NURSERY ESTABLISHMENT**

The MOA's national date palm improvement program also includes the establishment of nurseries, in which date palm offshoots produced in the mother orchards can be cultivated for a year before being sold to farmers, to increase rates of successful transplant to farmers' orchards. The nurseries were established in 2005, and the MOA requested that ARDI procure offshoots to be cultivated in the nurseries while the mother orchards were being established. ARDI provided funds for the purchase of 48,385 date palm seedlings for the nurseries, which will be cultivated for one year before being sold at low cost to date producers. ARDI also provided the MOA with drip irrigation systems for all 16 nurseries, and reservoir basins, pump houses, and miscellaneous equipment for the majority of nurseries, which were not so equipped. The following was supplied:

**TABLE 42 DATE PALM NURSERY INFRASTRUCTURE SUPPLIED**

Item	Number
Reservoirs	14
Pumps, 30 hp	7
Wells and pumps	5
Pump houses	10
Generators, 60 kVA	5
Drip kit systems*	17
Installation drip systems*	17

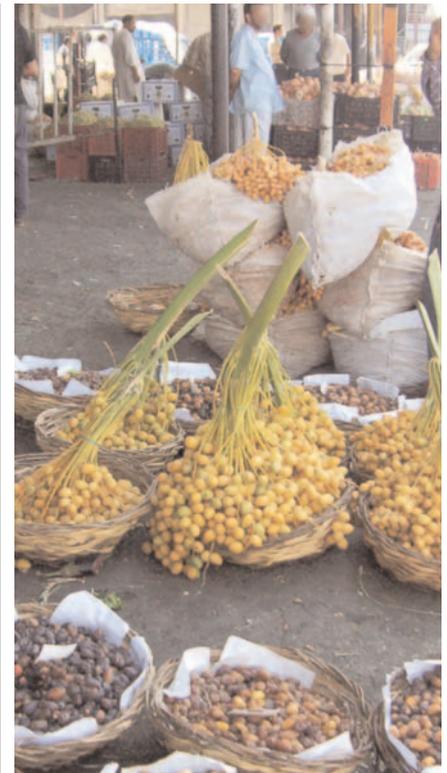
\* Although 16 new nurseries were established, 17 drip kits were installed because one large nursery required two.

The support to these nurseries will help date producers increase their production in the long run, as date offshoots from the mother orchards that are cultivated in the nurseries will have a greater chance of being successfully transplanted to farmers' orchards. As noted above, the 170,000 trees moved from nurseries to farmers' fields each year; combined with the 70,000 offshoots moved directly from the mother orchards to farmers' fields will total 240,000 new trees per year; for a 6% replacement/increase of the national orchard each year.

**RESTORING DATE PALM ORCHARDS IN BASRAH AND MUTHANNA GOVERNORATES**

Most date producers in southern Iraq suffered from the destruction of their date orchards, either from abandonment during political conflict or from damage done by poor drainage management. Those producers who have maintain their lands still suffer from ever-decreasing production due to aging or damaged trees.

ARDI worked with 120 date producers in Muthanna and Basrah governorates (the Basrah project included the Hammar marshland area of Al-Midaina district) who had maintained the basic irrigation and drainage structures in them, but badly needed new planting material to replenish their orchards. The projects provided higher-value planting material and technical assistance to increase the amount of land dedicated to the cultivation of high-value date palms, and raise the income of participating farmers.



(above and below) Early dates in the market



(below) Ripe dates in the market





ARDI provided 800 offshoots to 20 farmers in Muthanna to replenish date palm orchards.

**ACTIVITIES**

The 120 selected date producers were low-income farmers who suffered from poor production due to damaged, dead, or aging trees. ARDI supplied each producer with 40 high-quality date palm offshoots from commercially desirable varieties: Barhi, Bream, Sayer, and Khadrawi (a fifth variety – Chebchab – was added in the marshlands project). Two local nongovernment organizations (NGOs) trained farmers on offshoot planting, including the use of rooting hormone, and helped them plant the offshoots. The NGOs also provided training in after-planting care, methods for protecting date palms from pests and diseases, the importance of fertilization, and other best practices for production.

**RESULTS**

**TABLE 43 DATE PALM OFFSHOOTS PLANTED IN BASRAH AND MUTHANNA**

Governorate	Beneficiaries	Trees Planted
Basrah	100*	4,000
Muthanna	20	800
<b>Total</b>	<b>120</b>	<b>4,800</b>

\* (including 50 in the marshlands)

The participating farmers can expect that each of their newly planted offshoots will produce an average of 3.5 offshoots in the second year (or 140 per orchard). If these offshoots are replanted, each will begin to produce about 50 kg of dates per year. Thus, when the trees reach the full bearing stage in four years, each farmer could possibly produce 9,000 kg of dates annually, assuming that all offshoots are planted and also producing fruit. A farmer with growing numbers of productive trees, could produce a gross income of \$5,000-\$7,000

per year. In addition, the date palm trees will continue to produce offshoots after the four-year period, which farmers can sell for an average of \$12 each. This will bring additional income to farmers and provide other date farmers with access to high-quality, commercially valuable date palm varieties.

Assuming that the farmers rely on mixed sales of offshoots and fruits, the expected annual increase in farmers' gross income in four years (when trees reach the bearing stage) is \$2,713 from the production of fruit and \$1,512 from the sales of offshoots (new tree seedlings produced by mature trees). Thus, the possible gross income from the project upon maturity is \$4,225 per farmer, or \$507,000 per year for the 120 farmers participating in the project. Extra income will be earned by farmers who plant such crops as pomegranate or other fruits between their rows of date palms.

Local consumers will also benefit from the project, as they will no longer have to depend on dates imported from other parts of Iraq or from abroad. These projects also contribute to the goal of combating desertification in these two governorates, which tends to occur as orchards go out of production.

### SUCCESS STORY

ARDI's date palm restoration project has been enthusiastically received in such governorates as Basrah and Muthanna. A regional coordinator from Muthanna summed up the project thus:

*"We receive each day visits from farmers and sheiks who ask us about the possibility of expanding this project to include more farmers in the future. All the farmers who received the offshoots informed us that this is the first time they have seen such very good quality offshoots distributed by an organization.*

*"At last, I would on behalf of all the farmers who received the offshoots to thank you from the depth of our hearts for this great support that we feel will improve the agricultural situations in the south of Iraq."*



**Date palm destruction in the South.**





## OLIVES

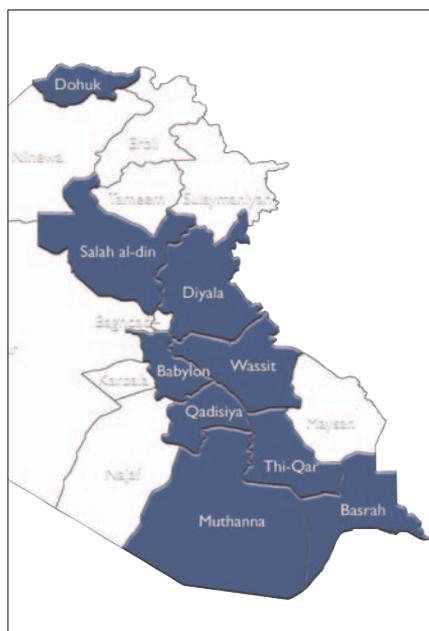


Olives are a lucrative crop for Iraqi farmers. They can grow well throughout the country, and as an essential part of the Iraqi diet they are in constant demand. Olives are sold for around \$2.50/kg in local markets. The production costs of olives are low relative to other fruit tree crops, and yields are high, making them a very economical crop to grow. In addition, planting olive trees can help farmers control soil erosion and be an element of good watershed management practices.

Despite these advantages of olive production, only about one million olive trees are now in production nationwide. This is due to farmers' limited financial ability to purchase trees and their lack of knowledge on how to cultivate olive orchards properly. As a result, most olives sold in Iraq are imported from neighboring countries, representing great potential losses to both Iraqi farmers and consumers.

In order to increase olive production in Iraq and increase farmers' income, ARDI worked with both the MOA and individual farmers to implement olive production programs. ARDI helped the MOA establish 16 demonstration orchards in eight governorates, to introduce farmers to proper production practices and technologies. ARDI also worked directly with 24 new olive producers in northern Iraq to establish orchards and provide technical assistance for olive cultivation.

**Olives are an essential ingredient in Iraqi diets and are eaten with most meals as fruit or oils.**



Governorates where olive orchards have been established.

**OLIVE ORCHARDS**

Two projects helped increase Iraqi farmers' olive production. The first established nursery demonstration programs with the MOA, and the second planted orchards for farmers in Dahuk governorate. Those plantings also helped farmers gain an additional source of income, replace costly imports, and aid in soil erosion and watershed management practices.

**ESTABLISHING HIGH-OIL OLIVE DEMONSTRATION ORCHARDS**

Previously, the MOA had little capacity to work with farmers in testing and demonstrating olive orchard production practices and technologies. It also lacked a model to address these limitations and respond to farmers' needs. The MOA proposed in 2005 to build demonstration orchards, which would enable the MOA to:

- Raise farmers' awareness about the potential for olives as a cash crop;
- Increase the number of olive trees planted to raise production nationally.

ARDI provided assistance to the MOA to establish 16 model demonstration olive orchards in eight central and southern governorates.<sup>1</sup> Each orchard was built on 2.5 ha of land, and ARDI provided a storage room/pump house and a water reservoir for irrigation. Six hundred olive seedlings, procured from MOA olive nurseries, were planted in each olive orchard. High-oil and table fruit varieties were planted where they grow best: table olives in central Iraq and both table and oil varieties in the south.

**TABLE 44 OLIVE ORCHARDS ESTABLISHED**

Governorate	Number of Sites	Number of Seedlings to be Planted
Babylon	2	1,200
Basrah	2	1,200
Diyala	2	1,200
Muthanna	2	1,200
Qadissiya	2	1,200
Salah al-Din	2	1,200
Thi-Qar	2	1,200
Wassit	2	1,200
<b>Total</b>	<b>16</b>	<b>9,600</b>

**RESULTS**

This project met its goal of establishing extension demonstrations in olive oil producing regions of Iraq. It is now up to the MOA to utilize these orchards as they mature to raise farmer awareness about olive production and teach best methods for increased production. The MOA expects that extension projects based on these model orchards will encourage farmers to plant an additional 1 million trees, effectively doubling the number of olive trees in the country.

<sup>1</sup> The original work plan called for 30 orchards in 15 governorates. However, the MOA General Company for Horticulture and Forestry was not able to secure use rights in several governorates, so the scope of the project was revised to 16 orchards in eight governorates.

**ESTABLISHING OLIVE ORCHARDS, DAHUK GOVERNORATE****ACTIVITIES**

Northern Iraq has excellent conditions for producing olives, particularly varieties that are cultivated for fruit. In 2005, ARDI received a proposal from farmers through a local NGO to assist them in establishing olive orchards in upland areas. The governorate of Dahuk had announced plans to use the flatland plots of these poor farmers for housing, prompting the farmers to explore the possibility of reclaiming plots in these upland areas for farmland. Olive orchards are an excellent crop for this type of land.

ARDI worked with a partner NGO to help each farmer select a 0.75 ha plot for the cultivation of an olive orchard. The NGO provided assistance to the farmers to prepare their land, leveling rough areas and clearing land that contained rocks and shrubs. ARDI granted to each farmer 300 seedlings of two high-quality olive varieties (Dogel and Ajrasi) that are well suited to local conditions, and are cultivated for fruit rather than oil.

An important element of the ARDI grant was technical assistance and training to teach the farmers how to cultivate olives properly to maximize production. The NGO held a training course for the new olive producers prior to planting the orchard. The course focused on the importance of horticulture, and modern methods of orchard establishment and maintenance, using proper agricultural machinery, pest control, tree pruning, fertilizing, harvesting, and marketing. At the conclusion of the training, each farmer received a basic kit of farm tools necessary to maintain the orchard, including pruning scissors and saws, shovels and pick.

All activities were implemented at no cost to the farmers, but farm families contributed to project activities through planting, maintenance, and seedling protection.

**RESULTS**

Once the trees begin bearing fruit, in 3 to 4 years, the 24 participating farm families will improve their production of olives and have a secure source of income. At an average yearly yield of 12.5 kg, each farmer could potentially harvest about 3,750 kg of fruit per year, which would have a market value of \$2.50/kg. after processing. Using modern techniques introduced by the project, participating farmers also helped to restore plant cover in the areas above their village. The MOA hopes that the replanting of these mountain areas will encourage other farmers to reclaim their upland plots and plant them.



**A farmer prepares his land for planting olive trees in Dahuk**

**TABLE 45 OLIVE ORCHARDS ESTABLISHED IN DAHUK**

Villages Served	Beneficiaries (Families)	Number of Plots	Trees Planted per Farm Family	Total Trees Planted
1	24	0.75 ha	300	7,200



**Clearing the land of stones to permit cultivation of crops and planting of orchards.**

## GRAPES

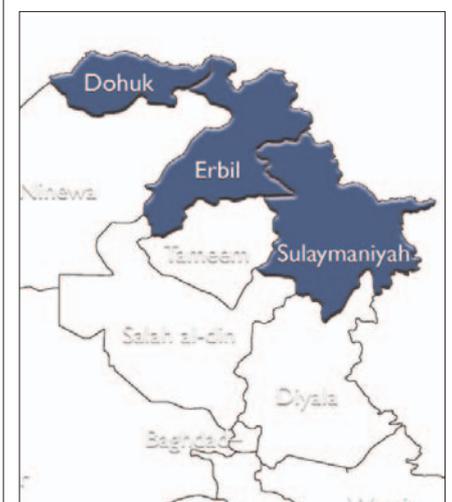


Grapes ripening on the vine.

Grape production is an important economic activity in Iraq that is a source of income for thousands of grape growers, most of whom are small to medium-size farmers. Grape producers sell table grapes, as well as grapes for the production of syrup, raisins, vinegar, and fresh grape juice. Although about 80% of the fruit produced in Iraq is sold in retail and wholesale markets, the quality and quantity of local production is inadequate to meet consumer demand, resulting in the importation of large volumes of grapes.

Most of Iraq's grapes are grown in the semiarid northern governorates (Dahuk, Erbil, and Sulaymaniyah). Roughly 30% of the area planted to grape orchards in the north (nearly 30,000 hectares) is planted on the steep hillsides common in the region, which are generally unsuitable for other crops. Grape production in those regions provides an effective barrier against hillside erosion and loss of valuable soils, and allows farmers to increase the amount of land under cultivation.

A major problem for Iraq's grape farmers is the lack of high-quality planting stock (desirable varieties) needed to replenish their vineyards, plant new land, and improve the quantity and quality of grape production. The MOA's nurseries have been the only significant source of planting stock for producers, but these nurseries have only been able to meet a small fraction of farmer demand. Despite the huge demand for new and improved grape planting material, the



Iraq's grape growing regions.



**Three private sector grape nurseries are now propagating “true-to-type” grape seedlings using modern drip irrigation technology.**

network of private nurseries in Iraq is small and production capacity is limited. For this reason, farmers must rely on cuttings from their own vines, many of which are of doubtful provenance, to replace older plants or plant new land to grapes.

The FAO conducted many grape production surveys and began extension programs that included on-farm demonstrations, assistance to government nurseries, and direct technical assistance to growers. After its abrupt departure from Iraq in 2003, most of the work in producing parent stock was discontinued and field demonstrations were allowed to lapse. With relatively modest investments, ARDI built on that work to encourage investment in nurseries, rehabilitate demonstration projects, and provide technical assistance to farmers wishing to expand production or plant new vineyards.

#### **ACTIVITIES**

ARDI established three private sector nurseries in northern Iraq to provide high-quality planting material and improved varieties of grapes. ARDI first identified and “benchmarked” the best grape vines available in the northern governorates, and then took more than a million cuttings from them to establish three private nurseries, which propagate and increase availability of these varieties. The project also established demonstration plots, which are used to introduce farmers to improved grape cultivation techniques that increase production.



**Farmers at a nursery in Erbil prepare their field to plant grapes**

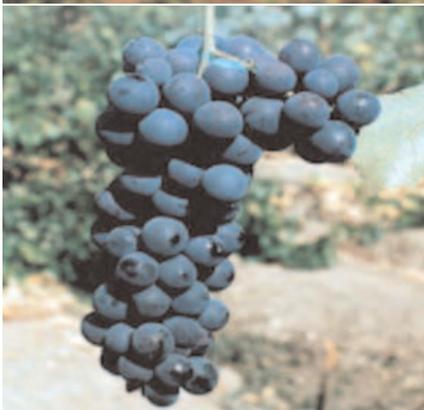
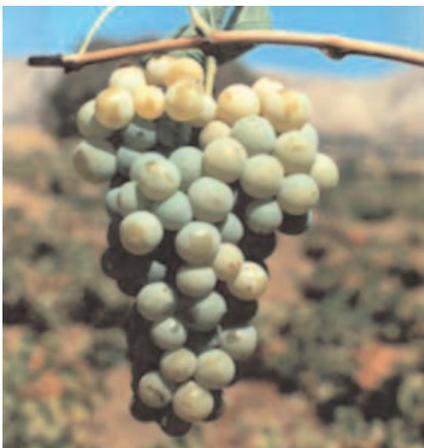
**Benchmarking Varieties.** ARDI contracted with Iraq's foremost grape expert (Ampelographer) to identify the best grape vines in the three northern governorates, based on cluster, color, commercial desirability, resistance to diseases, and leaf shape. This expert trained three teams from a local NGO in grape benchmarking, and under the expert's supervision they visited 71 of the best grape orchards in the area to benchmark 20 varieties and 38,972 vines. Global Positioning System devices were used to record the locations of the benchmarked vineyards. The benchmarked vines, which would serve as the genetic basis for improving vineyards throughout the region, were categorized as "true-to-type" varieties. This designation assured that cuttings taken from these vines would produce exact genetic copies of the identified varieties. This is important to grape producers looking to plant commercially valuable grape varieties, since they must invest in the cuttings, the land to cultivate them, and other inputs before fruiting occurs and they can verify the variety.

**Collecting Cuttings.** A total of 1.2 million cuttings were taken from the 71 farms identified during the benchmarking activity and supplied to the three private nurseries. Not all of the cuttings from Dahuk and Sulaymaniyah were utilized (some cuttings were not suitable due to dryness, infestation with powdery mildew disease, or being pruned too early, although more than anticipated were collected in Erbil). An additional 23,555 cuttings were brought from Baghdad to make up the



Modern grape trellising system

(below) Zarek and Javga grapes.



shortfall. The cuttings were then bunched and stored for distribution.

**Establishing Three Private Sector Grape Nurseries.** The 1.2 million cuttings were used to help establish private sector nurseries and demonstration plots. The nurseries will produce new high-quality true-to-type grape seedlings each year, providing farmers with a reliable source for purchasing plants to replenish their vineyards and plant new land.

Three nurseries were established; one each in the governorates of Dahuk, Erbil, and Sulaymaniyah. Each nursery was supplied with 400,000 cuttings (over 80% of the cuttings were successfully rooted). A modern drip irrigation system was installed at each nursery to improve water management, and owners were trained in rooting and maintaining cuttings (irrigation, weed control, fertilization, etc.). The private sector entrepreneurs who own the nurseries assumed a share of the cost to establish them. Together, the three nurseries will be able to propagate 800,000 to 900,000 “true-to-type” grape seedlings each year, as well as use some of the stock to plant “mother vineyards” from which cuttings will be taken in following years.

ARDI also held field days for farmers who live near the nurseries to demonstrate better production practices. This activity not only trains the farmers, but provides incentives for farmers to purchase improved vines from the nurseries.

**Trellising and Irrigating to Improve Grape Production.** After the nurseries were established, ARDI worked with a local NGO to provide extension in grape production to local producers. The training introduced improved technologies and practices for grape cultivation, primarily in the areas of trellis installation, vine training, and irrigation.

Sixteen demonstration vineyards were set up in the three governorates; each



**Traditional bush planting with drip irrigation system.**

served at least 20 neighboring farmers. The vineyards selected for demonstrations had already been planted with high-quality, true-to-type vines. The project installed drip irrigation systems on about half of the 3-hectare demonstration plots.

ARDI then introduced at least one type of the following technological improvements at each vineyard. Farmers could visit different vineyards in the area to observe the results of all four of the improvements:

- Pergola-type trellising systems with irrigation;
- T-shaped trellising systems with irrigation;
- T-shaped trellising systems without irrigation (rain-fed vineyard);
- Traditional cultivation (“umbrella” vine training with no trellising; however, this type of cultivation benefited from drip irrigation).

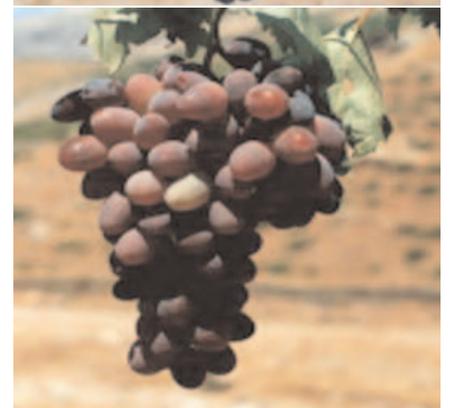
Extension agents from the NGO implementing the project held field days for farmers to demonstrate how the trellises and irrigation systems work, and explain their benefits.

This extension will help grape producers improve their yields, and will also encourage them to invest in improved varieties of grapes from the newly established nurseries to increase their production and income further:

## **RESULTS**

When they mature in three years, the 800,000-900,000 superior-quality vines from the benchmarked plants will strengthen the nurseries' supplies; they will be able to continue supplying stock to further increase the productive value of Iraq's

**(below) Besola and Taefee-Red grapes.**



**TABLE 46 GRAPE REHABILITATION ACTIVITIES**

	Dohuk	Erbil	Sulaymaniyah
<b>Benchmarking</b>			
Benchmarked Vines	23,505	7,795	7,672
<b>Grape Cutting</b>			
Grape Cuttings	589,690	212,266	290,500
Varieties	10	16	12
% utilized	86	102	91
<b>Nurseries Established</b>			
Grape cuttings planted	400,000	400,000	400,000
<b>Trellising and Irrigation Demonstrations</b>			
Farmers Assisted	6	5	5

grapes. New vines will become commercially productive in three years, after which the productivity of Iraq’s vineyards will grow and the area cultivated should increase. There is a very strong demand for high-quality grapes in Iraq, ensuring increases in farmers’ income.

The current price for rain-fed Iraqi grapes is around \$0.13 per kilogram. However, preferred grape varieties cultivated using improved methods can produce grapes with higher sugar content, better color, more uniform bunch sizes, and fewer diseases, and bring this price up to \$0.50 per kilogram. Thousands of farmers throughout northern Iraq can benefit from the increased availability of improved grape varieties and knowledge of improved cultivation techniques.

The assistance farmers received in trellising and irrigation should increase their production significantly in the years to come. In the future, the demonstrations should yield data for recommending the most cost-effective packages for improvements on other farms.

**Construction of trellis system.**



## FRUIT ORCHARDS



**Newly emerged fruits beginning the ripening stage.**

The moderate climate of northern Iraq is excellent for growing such fruits as apples, peaches, and plums, and local demand for this produce is strong. However, the quantity and quality of fruit production in Iraq is low, largely owing to Iraqi farmers' reliance on traditional cultivation methods. Currently, consumers who can afford it prefer to buy higher-quality and expensive imported fruits from as far away as Washington State and Chile. There is an opportunity for Iraqi farmers to improve the quality and quantity of their fruit production through improved cultivation practices, to meet consumer demand, displace these imports, and raise farmers' income.

ARDI worked with local NGOs to provide extension services to fruit producers throughout Iraq. In northern Iraq, ARDI conducted a census of apple orchards. Apples are a significant fruit widely grown in northern Iraq, and the census revealed important information about current cultivation practices and



**New apple orchard.**

challenges that informed ARDI's assistance projects.

In 2005, ARDI implemented extension projects to restore fruit orchards in northern and southern governorates through the provision of inputs, including seedlings and technical assistance from horticulture specialists from partner NGOs. In 2006, ARDI adopted a more participatory extension approach, in line with its efforts to revamp the MOA extension service. ARDI used local, village orchards as extension plots, and invited large numbers of farmers to extension field days on these plots to observe the improved practices and adopt them in their own orchards.

**TABLE 47 MAIN APPLE VARIETIES GROWN IN DAHUK AND NINEWA AND WATERING METHOD**

Apple Variety	Irrigated	Rainfed	Total	Productivity (kg/tree)
Golden Delicious	778,218	5,746	783,964	40.9
Baraway Bala	718,074	3,445	721,519	50.6
Red Delicious	438,483	45	438,528	39.9
Starking	150,579	25	150,604	45.4

## APPLE ORCHARD CENSUS, DAHUK AND NINEWA

### ACTIVITIES

In 2005/2006, ARDI conducted a census of 6,391 farmers in 631 villages in the governorates of Dahuk (3 districts) and Ninewa (2 districts). Teams of enumerators from a local NGO gathered data on over 2.2 million apple trees to determine the number of trees and varieties grown, the types of watering practices employed (irrigated vs. rain-fed), varieties of apples planted, and growing practices.

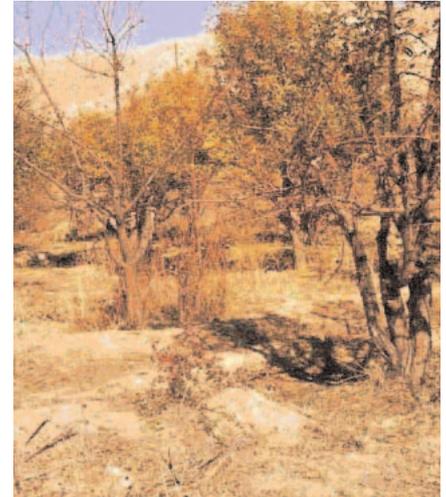
### RESULTS

The census revealed that farmers leave about half their produce in the orchard because they cannot compete with the higher-quality imported apples. The imported apples sell for \$7-15 per 22-25 kg box, while those of Iraqi producers sell for only \$0.66 to \$2 per box. In some cases, the income from apple sales does not even cover the cost of inputs, which discourages production.

Farmers were also asked about the main problems they face in apple production. The census found these to be:

- Lack of knowledge on proper horticultural practices (e.g., many farmers prune shortly before the blossoming period rather than during the winter, making the cut parts vulnerable to disease).
- Poor orchard establishment techniques (improper variety selection, high-density planting, poor availability of pollinator bees).
- Poor maintenance of existing orchards (e.g., practices like tree training, pruning, fruit thinning, irrigation, cultivation, fertilization and pest control are not performed regularly).
- Pest and disease incidences are high and integrated pest management is not used, while pesticides are misused.
- There are shortages of irrigation water; the existing canal system has deteriorated, and irrigation practices are declining, allowing water losses of up to 50%.
- Harvest and postharvest technology is primitive and improper; fruit processing plants and other facilities are absent, and marketing outlets are poor.

The data collected from this census will enhance the MOA's knowledge of the problems Iraq's apple farmers face and will enable it to create effective assistance programs to help improve apple production and farmers' income. Apple farmers, in turn, will greatly benefit from extension services to learn more about proper cultivation and postharvest techniques.



(above) Neglected orchard, (below) properly pruned orchard



**ESTABLISHING AND REHABILITATING PEACH AND APPLE ORCHARDS IN NINEWA AND DAHUK**

Apple production in northern Iraq is well below its potential. The main reason for this is the paucity of apple varieties, which are not well suited for the local climate, soil makeup, commercial desirability, and tastes. In addition, farmers often employ improper cultivation techniques and maintenance methods that do not create the best conditions for tree growth and development.

Peaches are not a principal commodity crop in Iraq, but there is great interest in the fruit and they have significant potential as an income generator for farmers. Production is low in Ninewa, even though peaches are widely grown in the governorate's mountainous areas. The three main reasons for low production are lack of proper cultural practices, the nonavailability of superior varieties/genotypes, and farmers' reliance on traditional orchard maintenance practices. Further, the varieties grown in Ninewa produce peaches that are generally small and have an undesirable taste. Most of them fall from the trees before they are ripe.

**ACTIVITIES**

Two projects conducted in 2005 (one for apple orchards in Dahuk and one for peach orchards in Ninewa) sought to enhance the quantity and quality of fruit

produced in those governorates. These projects directly established and rehabilitated orchard plots for all farmers and provided them with a complete package of inputs.

Two staff from the Dahuk MOA and project managers from a local NGO invited mayors and local leaders of the two governorates to go on field visits to encourage farmers to participate in the project and adopt new orchard cultural practices. They then selected two villages with a large number of apple and peach orchards that were not producing well. The two villages were located near several other villages with similar orchards. The orchards in both villages had been established using traditional methods, and farmers lacked the necessary knowledge and skills for modern agricultural practices (mainly pruning, grafting, and pest control). Twenty low-income farmers in each village elected to participate in the project; all of them wanted to improve their orchards' production and their income.

**TABLE 48 PEACH AND APPLE ORCHARDS ESTABLISHED AND REHABILITATED IN DAHUK AND NINEWA**

Governorate	Participating Farmers	Orchards Established	Orchards Rehabilitated	Indirect Beneficiaries
Dahuk	20	20	20	100
Ninewa	20	20	20	100
Total	40	40	40	200

**TABLE 49 FRUIT ORCHARDS ESTABLISHED IN BASRAH**

District	Participating Farmers	Grape Orchards Established	Fig Orchards Established	Jujube/Mango Orchards Established
Fao	70	30	20	20

Through small one-time grants, project staff selected two 0.25 hectare plots on each farmer's land. One was used to establish a new orchard according to modern methods, and on the other there was an existing orchard that was rehabilitated. The project hired private tractors to plow each demonstration plot and dig holes for planting. Each farmer then planted 2,000 grafted seedlings provided by the project:

- In Dahuk, 1,500 grafted seedlings of Golden Delicious variety and 500 Caville and Star King (most farms were planted with Star King apples) varieties.
- In Ninewa, 500 budded seedlings of the Dextred 6 peach variety (the same variety of trees planted in the existing orchard) and 1,500 seedlings of Cornet "Cubi" (a new variety).

This allowed farmers to see the differences between the old orchards established using traditional methods and the new orchards established with proper scientific methods and sound planning.

For the plots to be rehabilitated, each farmer was given a set of orchard tools (including a shovel, pick, ladder; pruning shears and saws, grafting knife, trowel, iron leveler; sprayer; harrow, brush, and agricultural calendar). Inputs such as fertilizers and pesticides were provided by the farmers. ARDI contracted a



**A newly trained Dahuk farmer demonstrating how to properly prune fruit trees.**

technical specialist to supervise the rehabilitation work, which was carried out by two laborers.

The technical specialists held several demonstrations (field work days) for farmers at these demonstration sites, to address the major horticultural practices related to orchard establishment and maintenance, integrated pest management, weed control, irrigation and other topics. Each participating farmer invited five other farmers from nearby villages to attend these field days in order to encourage them to adopt these practices. The technical specialists also visited the orchards regularly, where they inspected the plots and helped farmers implement appropriate measures like irrigation and weed control to ensure the seedlings' success. At harvest, they arranged for the 20 participating farmers to see the orchards their colleagues developed.



**Farmers were given a bee colony, beehive, clothing and a set of beekeeping equipment.**

Beekeeping plays an important role in enhancing fruit production by increasing the pollination of tree flowers, and the honey produced provides additional benefits to farmers. Each participating farmer was given a bee colony, beehive, clothing, and set of beekeeping equipment to encourage rearing of bees in orchards. ARDI contracted with an apiary specialist to provide training in hive management and inspection for pest infestation, and periodically inspected the colonies. Farmers were expected to invest in additional beehives after seeing the project's results.



## RESULTS

Almost all of the seedlings planted at the demonstration orchards grew normally. Their stems and branches were strong and free of diseases and pests. The trees on the rehabilitation plots of all farmers were found to be improved and pest- and disease-free, owing to better practices. When the new trees mature and begin bearing, they should produce better-quality fruit, while the rehabilitated trees will bear more fruit and enjoy a longer productive life (the productivity of the new apple varieties, for example, should rise from 28,000 kg/hectare to 48,000 kg/hectare).

These projects will help increase income for 40 farmers and their families through improving their orchards and increasing technical skills in establishing and managing orchards. When each of the 40 farmers spread the knowledge and techniques they learned to five of their neighbors, an additional 200 farmers benefit indirectly from the project.

## ESTABLISHING FRUIT TREE ORCHARDS IN BASRAH

This project, which was conducted in 2006, supplied seedlings and training to 70 small farmers in three villages in Basrah. The objectives of the project were to encourage farmers to return to their land, provide them income-generating opportunities, and encourage other farmers in the area to establish more fruit orchards.

**Workers are using a jig to determine correct spacing and depth for planting grapevine cuttings.**



Mature fruit trees which have been pruned correctly.

**TABLE 50 TECHNIQUES TAUGHT AND PRACTICED**

Establishing New Orchards		Rehabilitating Old Orchards	
Month	Activity	Month	Activity
March	Orchard design Pit digging, organic fertilization, planting seedlings	February-March	Pruning, orchard cleaning Spraying with winter oil
May	Irrigation	April	Pest and disease control at blossom
July	Urea fertilization Weed control Soil cultivation around stems	May	Irrigation Fruit thinning
August	Urea fertilization	June	Pest and disease control
		August	Summer pruning
		September-October	Harvesting Grading
		October-November	Spraying with copper sulfate after harvesting

**ACTIVITIES**

Seventy fruit tree orchards or vineyards, each approximately 0.25 hectares in size, were established in the three villages. Thirty orchards were planted with grape seedlings (100 seedlings per orchard), 20 with fig seedlings (100 per orchard), and 20 with jujube and mango seedlings (50 jujube and 6 mango seedlings per orchard). Technical specialists from the NGO that implemented the project trained participating farmers on new planting techniques and the care of seedlings after planting, and visited farms over the 20-day period after the seedlings were planted to monitor their progress and advise farmers.

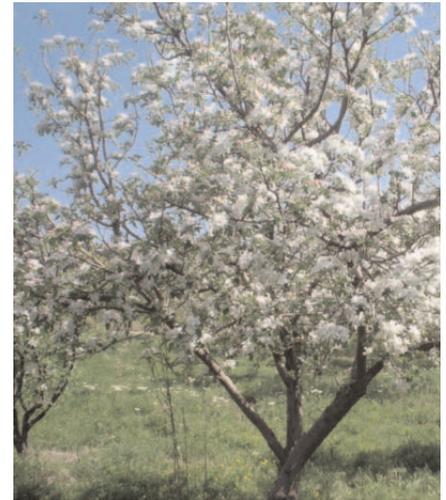
**RESULTS**

This project helped increase the income of 70 farm families in Basrah through the provision of seedlings. It also helped improve their knowledge of modern planting and seedling management techniques.

### ESTABLISHING AND REHABILITATING FRUIT ORCHARDS IN SULAYMANIYAH, DAHUK, NINEWA, AND ERBIL

In 2006, ARDI implemented four activities to improve orchard fruit production in the northern governorates. Rather than supplying all the participating farmers with seedlings for establishing new orchards or rehabilitating all of the orchard plots of each participating farmer, these projects employed a new approach. Farmers came together in groups of 12-15 in the orchards of a group member to learn and practice orchard management techniques under the supervision of an orchard specialist. They then returned to their own farms and put what they had learned into practice.

Unlike earlier ARDI apple and peach orchard projects in Dahuk and Ninewa, which directly established and rehabilitated orchard plots for farmers and provided inputs, these projects relied on a participatory extension approach. Here, agricultural specialists used a small number of orchards as a tool for teaching farmers appropriate horticultural methods. Through a hands-on teaching approach, the specialists demonstrated modern cultivation techniques to farmers.



Flowering fruit trees and well maintained orchard.

**TABLE 51 FRUIT ORCHARDS ESTABLISHED AND REHABILITATED IN DAHUK, ERBIL, NINEWA, AND SULAYMANIYAH**

Governorate / Fruit	Farmers Trained	Plots Established	Plots Rehabilitated
Dahuk (apples)	60	4	60
Erbil (apples, peaches, plums)	90	6	90
Ninewa (peaches)	60	4	60
Sulaymaniyah (pomegranates, apples, peaches, pears)	105	7	105
Total	315	21	315

#### ACTIVITIES

NGOs implemented learning-by-doing projects to help orchard farmers in Dahuk, Erbil, Ninewa and Sulaymaniyah improve the quality of their apples, peaches, pears, plums, and pomegranates. Private orchard specialists from local NGOs provided extension services to help farmers rehabilitate existing orchards and establish new ones.

The NGOs contacted farmers and asked them to participate in the projects. Because the projects did not supply free inputs such as fertilizers and pesticides, some farmers initially declined to participate. The extension agents were largely able to solve this problem by personally visiting the farmers to explain the project's objectives. Where the farmers still declined to participate, alternative villages were found.

The NGOs formed groups of 15 farmers each. The groups attended regular meetings with an extension agent during the year to learn about and practice orchard management techniques in the orchard of one of the group members. The extension specialists used a participatory approach in teaching farmers. They explained and then demonstrated appropriate orchard practices, their

## PHYSICAL AND TECHNOLOGICAL IMPROVEMENTS

advantages, and periods of application, and also compared them to traditional practices.

Farmers then divided into smaller groups of two or three each to practice what they had learned under the supervision of the horticultural specialist. Each full group of 15 worked on one new orchard and one rehabilitation orchard, supervised by horticultural and extension specialists.

These four projects were planned to improve the technical knowledge and skills of 315 farmers. Somewhat fewer orchards were rehabilitated than originally intended, because a few farmers dropped out of the project. Also, the average attendance at the group meetings was 10 to 12 by the end of each project.

This extension program transferred methods of proper cultivation to farmers, which will help form a basis for a long-term solution to the problem of low productivity due to the use of traditional cultivation methods. When their orchards mature, farmers will enjoy higher yields and produce better-quality fruit, and consequently increase their net income. Further, they will pass their knowledge on to other area farmers, resulting in a far larger pool of beneficiaries.

Last, improved fruit production will increase the high-quality fruit available on the local markets for longer periods. Instead of having to rely on imported fruit, local consumers will have a greater choice including better prices.

**Hands on training at the farmer's orchard demonstrated the practical application of classroom lectures.**



## NATIONAL HORTICULTURE CONFERENCE



In 2006, ARDI sponsored a national horticulture conference with stakeholders throughout Iraq. The objective of the conference was to discuss the current horticultural situation in Iraq and find ways to develop a successful horticultural industry, and to:

- Build a common understanding of current production and market structures in Iraq;
- Recommend production and market development priorities for the coming four years;
- Exchange perspectives on the roles and contributions of stakeholders in addressing priorities;
- Identify ways stakeholders could begin working together to address priorities.

### **ACTIVITIES**

The two-day national horticultural conference was attended by 81 representatives of the public and private sectors (MOA horticulture and agriculture specialists, senior MOA officials, and representatives from NGOs, universities, farmers, and the private sector). The 81 people who attended

**TABLE 52 NATIONAL CONFERENCE TOPICS**

<b>Groups 1-4 MOA Agricultural Specialists</b>	<b>Groups 5-6 NGOs, Farmers, and Traders</b>	<b>Group 7 Senior MOA Officials</b>
<ul style="list-style-type: none"> <li>· High-quality plant material</li> <li>· Research and extension</li> <li>· Optimal agronomic practices</li> </ul>	<ul style="list-style-type: none"> <li>· Market structures</li> <li>· Postharvest technology</li> <li>· Horticulture associations</li> </ul>	<ul style="list-style-type: none"> <li>· Zoning</li> <li>· High-quality plant material</li> <li>· Research and extension</li> <li>· Optimal ag. practices</li> </ul>

represented 15 of Iraq's 18 governorates.

Following the opening speeches, stakeholders were organized into seven working groups. Each group was given a questionnaire that listed three or four high-priority topics. Groups were asked to describe the current situation in reference to that topic and agree on three or four recommendations to enhance activities in each area.

**RESULTS**

The strategic priorities developed for 2007-2010 as a result of these recommendations included:

- Horticulture Research and Training: strengthen MOA horticulture and training activities, and horticulture zoning;
- NGOs and Private Nurseries: establish private nurseries in central and southern Iraq;
- Horticultural Marketing: improve the commercialization of horticulture products;
- Post harvest Technology: Assess post harvest needs for horticulture products;
- Horticulture Associations: form associations based on ARDI's approach to honey production.

Horticulture species and variety diversification was also given high priority. Thus, the conferees strongly recommended the introduction/importation of new germplasm. Their recommendations also included:

- Establishing and restoring date palm orchards and nurseries;
- Establishing olive orchards;
- Benchmarking grapes and establishing nurseries and vineyards;
- Developing and improving fruit orchards;
- National horticultural conference;
- Expanding tomato varieties and improving production;
- Improving beekeeping production and extension.

## TOMATOES

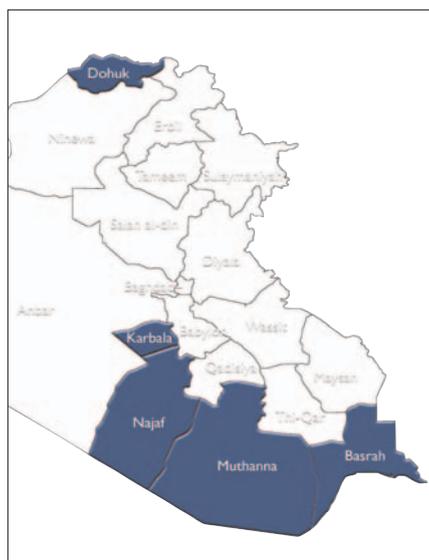


**Fresh tomatoes ready for market.**

Tomato production is a lucrative economic activity for Iraq and has great potential for growth. There is strong domestic demand for tomatoes, but due to the poor quantity, quality, and marketing practices of tomato production, tomatoes imported from Syria, Jordan, and Iran have a strong presence in the Iraqi market and command higher prices than Iraqi tomatoes. In September 2006, the average price per kilogram for tomatoes from Iraq was 350 ID, while tomatoes from Jordan, Syria, and Iran ranged from 375 to 725 ID per kilogram.

There is a great potential to increase tomato production in Iraq to replace these imports and in time enter export markets. Iraq can produce large quantities of tomatoes because they are grown year round in most parts of the country. In the northern governorates, peak tomato production takes place during the hot summer months, while in the southern governorates tomatoes are grown in all but the hottest months.

The MOA took steps to improve tomato production under the previous regime. Beginning in 1996, it directly supported tomato production with a Tomato National Program (TNP). The program was intended to introduce transplanting techniques and provided subsidized peat moss, bioagents to control fungal diseases, fertilizers, and hybrid seeds. TNP monitored production farms, tested new tomato varieties, and provided advice to farmers. However,



Tomato production projects were implemented in these governorates.

budget cuts forced the MOA to drop the TNP as it did not yet generate adequate sales revenue from farmers. As a result, many farmers did not have an opportunity to participate directly in or observe the benefits of the (TNP) program.

ARDI's cooperation with the MOA focused on introducing new methods to improve tomato cultivation, including the use of hybrid seeds, transplant planting, proper fertilization, and covering tomato crops to protect from frost. Tomato production projects have been implemented in Najaf, Kerbala, Muthanna, Basrah and Dahuk governorates.

**2004 - 2005  
SUMMER CROP TECHNOLOGY DEMONSTRATIONS FOR TOMATOES**

**ACTIVITIES**

ARDI began working with the MOA in the summer of 2004 to implement a tomato production program introducing farmers to improved methods of tomato cultivation. This project was implemented in August 2004 in Najaf, Kerbala, and Basrah governorates. A total of eight demonstration plots were established, two per governorate, on which new production technologies was introduced. These technologies included:

- Use of hybrid seeds;
- Transplant production;
- Soil and foliar application of fertilizers;
- Methods to control tomato disease and pests, including pesticide application;
- Methods to protect tomato crop from frost.

Using good planting material is an essential first step to improving tomato production. The demonstration plots were planted with two locally available tomato hybrids, Hatouf, and Dona, which are resistant to Tomato Yellow Leaf Curl Virus (TYLCV). A third, local variety of tomato seed, Super Marmande, was planted as a control. This variety is widely planted by Iraqi farmers, but is not as productive as the hybrid seeds.

Transplant production, which is the process of sowing tomato seeds in peat moss in a tray before transplanting them to fields to increase germination rates of tomato plants, is not widely used in Iraq. The usual practice of Iraqi farmers is to sow the seeds directly into the soil, which results in low initial germination rates, stunted plant growth, and wasted plants from thinning. The demonstration plots showed that the transplant method of cultivation resulted in a much higher germination rate than direct planting. Approximately 90% of the tray-cultivated seed germinated and grew vigorously.

It is important for Iraqi farmers to adopt methods to protect tomato crops from frost. These frosts can kill an entire crop; indeed, in demonstration plots in Najaf and Kerbala, the farmers did not use plastic as instructed covering during a frost and the entire crop was lost. An inexpensive method of frost protection can save the season's crop.



**Individual tomato plants grown in seed trays for transplanting into fields.**

Extension was an important element of the demonstrations for tomatoes. It introduced as many farmers as possible to these improved methods for tomato cultivation. In late December 2004, after the demonstration plots were completely planted, a workshop was held at an agricultural extension center in Najaf. Over 140 farmers attended the workshop, at which representatives from the College of Agriculture of the University of Kufa delivered a presentation on how to protect tomato crops from frost by covering them with plastic to reduce damage. The attendees participated in a question and answer session, followed by a discussion of the new crop protection methods. The day concluded with a tour of the demonstration field to show farmers the differences among the hybrids tested, and the practical application of frost protection for tomatoes, including branch removal and the use of suitable fungicide for restarting the growth and flowering process. The farmers were encouraged to apply these methods to their own tomato fields to increase their tomato production.

The crop from the demonstration sites began producing fruit in December 2005, and harvest continued for several months. One of the advantages of the hybrid tomatoes is that they continue to produce fruit well beyond the fruiting period of the local tomato varieties, and therefore give a greater overall yield and a more steady stream of income to the producer.

## RESULTS

The results of the demonstrations show that the hybrid tomato plants Hatouf and Dona were much more productive than the local Super Marmand variety. The biggest improvement was in Najaf, where the Hatouf hybrid showed an average increase of 228% over the local variety, and the Dona hybrid exceeded the local variety by 578%. In Kerbala, increases were also over 100% for both hybrids, and in Basrah the increases were an average of 61% and 52% for Hatouf and Dona, respectively.

**DONA FI HYBRID**

- Early producing, 60-65 days, planting to fruit.
- Indeterminate plant with large (170 grams) fruit.
- Heavy yields of slightly flattened fruit.
- Preferred for table fruit.

**2005 – 2006 SUMMER TOMATO DEMONSTRATIONS****ACTIVITIES**

In September 2005, ARDI and the MOA implemented a second tomato production program to speed the introduction of improved cultivation practices and increase the quality and quantity of tomato production in Iraq. A total of 80 tomato producers was selected, 20 each in Kerbala, Basrah, Najaf, and Muthanna, to cultivate Hatouf and Dona hybrids on a total of 40 hectares of land.

**TABLE 53 PRODUCTION OF TOMATOES, SUMMER CROP TECHNOLOGY PROJECTS, 2004-2005**

Site	Hybrid	Average Yield, kg/ton	Improvement over Local Variety (%)
Najaf 1	<i>Hatoof</i>	31	228%
	<i>Douna</i>	64	578%
	<i>Super Marmand</i>	9.4	--
Najaf 2	<i>Hatoof</i>	100% Frost Damage	
	<i>Douna</i>		
	<i>Super Marmand</i>		
Kerbala 1	<i>Hatoof</i>	14	117%
	<i>Douna</i>	16	137%
	<i>Super Marmand</i>	1.1	--
Kerbala 2	<i>Hatoof</i>	100% Frost Damage	
	<i>Douna</i>		
	<i>Super Marmand</i>		
Basrah 1	<i>Hatoof</i>	41	69%
	<i>Douna</i>	39	58%
	<i>Super Marmand</i>	24	--
Basrah 2	<i>Hatoof</i>	31	53%
	<i>Douna</i>	30	46%
	<i>Super Marmand</i>	21	--

The MOA, with assistance from ARDI, provided each farmer with Hatouf and Dona hybrid tomato seeds. ARDI provided other production inputs including plastic for tunnels. The farmers used the inputs to establish nurseries with the hybrid seeds, sowing them in trays approximately one month before transplant to the fields. ARDI also provided supplemental labor to each farmer to assist in maintaining the irrigation system, planting, fertilizing, spraying, weeding, harvesting, and grading. The laborers recorded daily activities, which were later used in the economic analysis of the project.

As with the 2004 – 2005 tomato production, extension was an important aspect of this project. Field days were held during the productive season at fields in each governorate. A total of 235 farmers who did not participate in the program were able to observe production and harvest activities, and discuss with technical staff from ARDI and the MOA the economic viability of using hybrids and other improved cultivation techniques to increase production. The field days were quite successful. Field staff reported that the hybrid Hatouf and Dona seeds sold out in many markets.



## RESULTS

The 80 participating farmers observed large increases in production over the use of local varieties, which were estimated to yield an average of approximately 16 tons/ha. The biggest gains were in Muthanna and Basrah, where the use of Hatouf and Dona resulted in improvements of yield of over 200% (in Basrah, only six of 14 fields reported results). In Kerbala, there was a 94% improvement, and in Najaf a 50% improvement. The total yield from these demonstrations (not including 14 nonreporting fields in Basrah) was 4,831 kg, and the total revenue was \$370,100.

\*Production of local variety is estimated at 16 tons/ha

\*\*Only 6 fields of 20 reported from Basrah

## IMPROVING TOMATO PRODUCTION IN DAHUK GOVERNORATE

To increase the production of tomato plants in northern Iraq, in 2006 ARDI partnered with a local NGO to introduce farmers in Dahuk to improved production practices.

**TABLE 54 TOMATO PRODUCTION, SUMMER CROP  
TECHNOLOGY DEMO TOMATOES, 2005-2006**

Governorate	Number of fields	Average Yield (kg/ton)	Improvement over local variety*	Total Revenue (\$)	Total Yield (kg)
<b>Kerbala</b>	20	31	94%	92,500	1,193
<b>Najaf</b>	20	24	50%	71,100	949
<b>Muthanna</b>	20	53	231%	158,500	2,113
<b>Basrah**</b>	20	48	200%	48,000	576
<b>Total</b>	80	--	--	370,100	4,831



**A farmer in a tomato nursery in Muthanna**

**ACTIVITIES**

The NGO selected a 500-square-meter plot of fertile land to serve as the nursery for this project. Laborers leveled the soil, plowed it, and prepared 18 individual plots, each 1 x 7 meters. In March 2006, the NGO planted 300 grams of tomato seeds of the Dona variety, which is famous for its high productivity, taste (its acid-to-sugar ratio is near perfect), color, and good portability and storage characteristics. Two or three seeds were planted per cell in germination trays that contained garden soil, sand, and organic fertilizer; and the nursery was covered with nylon tarps. The project also supplied tools to the nursery, including the tarps, hand watering cans, pickaxes, BRC fencing, curved iron wires, storage tent, organic fertilizer, and sand.

In May, ARDI selected 80 farmers from 20 villages in Dahuk and distributed 1,125 plantlets to each farmer (a total of 100,000 seedlings) at no cost. After the seedlings were planted, the NGO visited the farmers' fields to instruct them in agricultural operations and observe the plants' progress.

**RESULTS**

This project was initiated toward the end of the ARDI program, so its final results were not directly observed. However, the initial results were extremely promising, and suggested a positive conclusion of the project.

All of the participating farmers expressed strong desire to maintain the plantlets provided to them. The plantlets were of very good quality and had grown by over 90% at the time of the NGO's last visit (about 90 days after the project began). Further, the market price of this variety was about 50% more than the price for local varieties.

Thus, this tomato project gave farmers a new source of income from the cultivation of a superior variety of tomatoes, and the income they realize will be almost 50% higher than if they had planted local tomato varieties.

## HONEY PRODUCTION AND BEEKEEPING



Honey production has been an important economic activity for Iraq's farmers for over 5,000 years. Beekeeping is also essential for improved agricultural production, because bees are excellent pollinators, especially of legumes, cucurbits, and fruit trees.

The domestic demand for honey is strong; Iraqis much prefer honey that is locally-produced and sold in the comb. Iraq does not produce enough honey to meet his demand, so consumers depend instead on costly imports from Germany, Australia, Egypt and the Gulf states. There is an opportunity for Iraqi honey producers to increase the quantity and quality of their output to meet this consumer demand.

In the past 20 years, Iraq's beekeeping industry was severely damaged through a combination of widespread violence and population movement, particularly in the northern region. After 1991, the industry recovered somewhat through assistance from humanitarian organizations that distributed beehives and tools.



**A newly established bee colony on fresh wax molds and frames.**



**Recycled traditional woven hive.**

This recovery, however, was hampered by the inappropriate use of insecticides, the introduction of the parasitic varroa mite from outside the country, and the lack of information on modern beekeeping methods, equipment, and medication. In addition, a 2003 fire at the Mishra State Sulfur Plant destroyed nearly all of the beehives in Ninewa governorate.

To improve the quality and quantity of honey produced in Iraq, ARDI coordinated with local NGOs to work directly with new and existing beekeepers to improve honey production. ARDI also trained local carpenters to produce such beekeeping equipment as modern beehive boxes, which had always been imported at high prices from Italy, Turkey, or Iran. Finally, ARDI established or strengthened beekeeping associations and worked with the MOA to better extension services, in order to improve training opportunities for beekeepers.

#### **COMMUNITY HONEY PRODUCTION PROJECTS**

From 2004 through 2006, ARDI worked directly with 368 new or existing beekeepers to improve honey production. ARDI provided technical assistance, modern beekeeping inputs, and training to beekeepers to help them set up apiaries and sell honey.

Many of the hives in the project-assisted villages were destroyed under the

previous regime. For example, two of the villages themselves were destroyed more than once during the previous decades of conflict, and all of their beehives were burned. In the late 1990s, the farmers did their best to start producing honey again, using traditional basket hives made from plaited willow. However, the beekeepers suffered from low productivity, as these traditional hives are much less productive than modern beehives, and because they are closed systems they cannot be checked during the season for disease or other problems. They also must be destroyed to harvest the honey at the end of the season. By the time the ARDI project began, honey production was very low in these areas as a result of disease, lack of information on modern beekeeping techniques, and lack of access to modern beekeeping equipment.



Distribution of materials to new beekeepers.

**ACTIVITIES**

The 2004-2006 projects created new opportunities for villagers – widows and handicapped individuals who were interested in and capable of working with bees, current beekeepers, and poor men and women who owned no land or livestock – to learn about beekeeping, improve the quantity and quality of honey produced, and increase their income.

**TABLE 55 HONEY PRODUCTION BENEFICIARIES**

Governorate	Villages	Widows	Handicapped	Current Beekeepers	Poor Farmers	Internally Displaced Persons and Returnees
Diyala, Tameem, Sulaymaniyah	5	44	41	19	79	--
Erbil	10	2	2	--	--	48
Ninewa	1	20	11	20	--	--
Sulaymaniyah	1	8	11	5	8	--
Sulaymaniyah	2	15	13	18	4	--
<b>Total</b>	<b>19</b>	<b>89</b>	<b>78</b>	<b>62</b>	<b>91</b>	<b>48</b>

Working groups – comprising a village leader, an MOA bee specialist, representatives from local beekeeping associations, and a local NGO – selected farmers to receive assistance for the project. Bee experts from the MOA and local universities gave lectures and hands-on training to farmers for six days on a wide range of topics, including how to set up and maintain an apiary; how to produce honey and other commercial bee products such as royal jelly, venom, wax, pollens, and propolis; the differences between traditional and modern beehives; how to select appropriate sites for apiaries; how to identify queens; and how to protect hives over the winter. Other area beekeepers also benefited by attending the training.

Each farmer then worked with a technical team to choose an apiary location. The project supplied all necessary inputs, including colonies, beehives, smoker, feeder, food, stand, tools, and medication. A week later, the technical team checked up on all beehives in the village to ensure they were in good condition and visited again every month to monitor and supervise beekeeping activities. Every other month, the technical teams held field days at a village training center, where farmers observed and discussed the practices and technologies they had learned with their own hives in the field.



Apiary located in pomegranate orchard.



**ARDI trained 368 beekeepers on modern beekeeping technology in five governorates.**



**Fabrication of hives in local carpentry shop.**

**RESULTS**

These projects provided direct technical assistance and about \$300 in inputs per person to 368 beekeepers in five governorates. In the first year of production, each beekeeper could produce a minimum of 40 kg of honey, which is sold on the local market at \$10 per kg, giving each participant \$400 additional income. In the second year, with the exception of investments for medicine, the beekeepers will have all the inputs they need to produce more honey. Furthermore, the successful colonies will swarm and produce new bee colonies, which the farmers can capture to increase the number of their own hives in succeeding years, or sell to other beekeepers in the area.

The new beekeepers should realize income increases from the sale of their honey production -- those assisted by the project together realized nearly \$155,000 in additional income in their first year of honey production. Their improved livelihoods should serve as a model for other area beekeepers, and the sector will continue to expand as more beekeepers gain access to modern beehives and beekeeping technology.

**TRAINING FOR AGRIBUSINESS ON BEEHIVE MANUFACTURING**

Modern beehives are an essential input to improve the quality and quantity of honey production. These beehives produce about three times as much honey as traditional beehives (about 15-20 kg/box compared to 5-8 kg/traditional hive). Unlike the traditional hives, which are not opened until the honey is harvested, the modern beehives can be opened for feeding, to administer medicine, and to check on the general health of the hive to prevent or treat problems before the end of the season.

Despite the advantages of these modern beehives, they are not widely available to Iraqi beekeepers. They must be imported, and the high cost prohibits many beekeepers from investing in them.

**ACTIVITIES**

In 2005, 12 carpenters from five governorates participated in a four-day training workshop in Dahuk, which focused on how to manufacture beehives to international standards. In addition to the training course, ARDI provided these carpenters with enough raw materials to produce 25 beehives, the sale of which would enable them to invest in additional materials to continue producing and selling beehives. The workshop's topics included:

- The technical skills needed to construct modern beehives
- The types of materials needed in beehive manufacturing (queen breeding hive, wasp traps, queen cell holder frame, etc.)
- Manufacturing beehives with standard dimensions.

**TABLE 56 CARPENTERS TRAINED ON BEEHIVE MANUFACTURING**

	Dahuk	Erbil	Tameen	Ninewa	Sulaymaniyah
<b>Beekeepers Trained</b>	3	3	2	2	3

## RESULTS

These 12 carpenters will benefit from the additional business opportunities they gained as a result of their training. They can now also meet local demand for modern beehives and beekeeping equipment, and at lower cost than for imported equipment (an imported beehive costs US \$45 on the market, while a locally manufactured one costs \$28).

### SUPPORTING MOA EXTENSION

In May 2005, the MOA and ARDI hosted a beekeeping conference that drew representatives from dozens of organizations around the country. This day-long event was an important step toward redeveloping Iraq's once thriving beekeeping sector.

Representatives gave presentations on their work in Baghdad, Basrah, Dahuk, Diyala, Erbil, Mosul, Najaf, Ninewa, and Sulaymaniyah. Participants then discussed the common problems and solutions devised in different parts of the country. Some of the issues highlighted were the impacts of pesticides, how best to make wax foundation (the starting point for the bees to begin making a comb), and finding better access to markets.

### REHABILITATING THE BEEKEEPING LIBRARY AND RESEARCH AND EXTENSION FACILITIES, BAGHDAD.

ARDI helped increase the depth and breadth of training and education available to beekeepers by rehabilitating the Ministry of Agriculture's Beekeeping Library and Research Extension Center in Baghdad. The MOA Bee Department is responsible for reviewing and updating current MOA recommendations for beekeeping, and develops educational materials such as an activities calendar that describes proper beekeeping methods throughout the year. However, the MOA Beekeeping Library and Research Extension Center was damaged and lost virtually all of its educational materials when it was looted in 2003.

An ARDI grant helped refurbish the Center's lecture hall, procured basic equipment for its teaching and research laboratories, and supplied the Center with audio and visual equipment (including Internet capability) for educational purposes. As part of this project, ARDI procured 150 basic books for the library on all aspects of beekeeping, product processing, marketing, and creation of ancillary economic activities. Finally, ARDI purchased two sets of 120 back issues of *The American Bee Journal*. One set was donated to the State Board for Plant Protection Research and Extension Center Library in Baghdad, and the other set was given to the Kurdistan Beekeepers Association.

The improvements will restore the Center's ability to train extension workers and private beekeepers. It trained over 330 people during the first year after renovations. The improvement of beekeeping educational facilities will enhance the quality of extension services nationwide.

### REHABILITATING THE QUEEN BEE APIARY AND RESEARCH FACILITY, KERBALA.

Years of constant inbreeding of bee colonies in Iraq has produced bee populations that demonstrate poor productivity and other undesirable characteristics. In recent years, Iraq has imported some *Carniolan* bees from Italy,

## SUCCESS STORIES

### BEEKEEPERS IN SULAYMANIYAH

In this northern governorate, many beekeepers assisted by the project in 2005 have decided to invest in additional beehives. Initially, the MOA/ARDI gave 62 new beekeepers 182 hives and accompanying inputs. In 2006, these same beekeepers own 567 beehives. These hives can produce 12,750 kg of honey, representing \$127,500 in additional annual income for their owners.

### BEEKEEPERS IN ERBIL

*I have been in the business for 11 years, but it was only after the training I received that I managed to increase my beehives to 250.*

An apiary owner assisted by the project, who was able to produce two tons of honey and 250 grams of royal jelly within a year:

*This is the first time I am taking part in such an activity and hope more women will follow suit to improve their income. This is a good opportunity for me to increase my income to support my children. I hope I can produce scores of beehives from the two provided me by [the NGO].*



Honey stored in inappropriate containers.



**Bees assist in proper pollination for many plants, flowers, and vegetables.**

which yielded hybrid bees that can produce 80 kg of honey per hive under proper management conditions. However, these bees were introduced haphazardly, and while honey production increased overall, there was no research to determine which crosses were preferable.



**Demonstration and training apiary.**

ARDI provided the MOA with a model apiary to produce virgin queen bees from imported queens of standard recommended strains. An apiary site was established in Kerbala by providing electrical hookups to local power sources, a small backup generator, a small water pump, and queen-rearing laboratory equipment. The apiary was then supplied with three strains of bees (Back-fast hybrid, Italian, and Caucasian races), whose queens were mated with local bees.

The queens were distributed to approximately 300 beekeepers in Baghdad, Babylon, Erbil, Sulaymaniyah, and Wassit governorates to mate with local male drones to produce hybrid races of increased productivity, tamer bees, and higher resistance to diseases and pests. The MOA will continue to track the hybrid races to compare their performance and determine the best hybrids for future planning. It will also work closely with the Iraqi Beekeepers Association to ensure the proper distribution of queens and adequate training in hybrid management. In the coming years, this facility will produce enough queens to satisfy the demands of up to 6,000 beekeepers each year.

**Traditional woven beehive from the North.**

