
# TOWARD MORE EFFICIENT AGRICULTURAL PRODUCTION AND MARKETING IN JORDAN

**May 2006**

This publication was produced for review by the United States Agency for International Development. It was prepared by Roger Norton and Amer Jabarin of Development Alternatives Inc. under subcontract No. 3240 with the Academy for Educational Development.

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## DISCLAIMER

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# 1. OBJECTIVES OF THE STUDY

The terms of reference for the present study state the following objectives:

- To provide the Government of Jordan with descriptions of policy modifications and regulatory reforms that will encourage farmers to shift production to crops that yield a higher value per unit of water and position Jordanian agriculture to more effectively compete in both local and international agricultural markets.
- Recommend revisions in current policies that will strengthen demand-based agricultural production, and recommend a new policy to improve the quality of agricultural labor to support Jordan's efforts to become more competitive in export agricultural markets. The ultimate objective of these policy recommendations is to create a regulatory environment conducive to improving the economic returns to water use in agriculture in Jordan.

These objectives reflect the inter-linked nature of agricultural development. Water management appears as subtext in both of them, and the regulatory environment and competitiveness concerns are mentioned as well. Throughout the developing world, achieving increases in productivity, competitiveness and incomes in agriculture requires progress in several key areas, including marketing, water management, quality of labor, and credit policy, and other areas. The fundamental thrusts of successful agricultural development are making production more demand-driven, that is, more responsive to markets; and increasing the efficiency of use of the sector's resource base (labor, water, land, financial capital).

This report reviews the issues related to these objectives and the reasons for considering policy reform in each of these areas, and then in the final section it summarizes the proposed new policies in each area are extracted from the text and listed in concise form, along with indications of priorities. A number of specific policy reforms are proposed, but it should be noted that the country is lacking an overall agricultural export strategy with specific actions in support of exports, and it also does not have an integrated plan for greater utilization of wastewater on high-value crops.

# 2. THE POTENTIAL OF JORDANIAN AGRICULTURE

Research and production trends both have shown that Jordan has a strong comparative advantage in the production of fruit and vegetables. For example, Jabarin (2000) calculated comparative advantage indicators in the form of domestic resource coefficients, and they showed a strong comparative advantage for seedless table grapes, green beans and strawberries, in that order. On the contrary, Jordan appears to lack a comparative advantage in field crops such as wheat and barley, in comparison with neighbors like Syria (Jabarin and El-Habbab, 1996).

Agriculture represents only about 9% of Jordan's total exports, but fruit, vegetables and nuts represented 67% of that in the period 1998-2002 (Jaberin and Knapp, 2003). Most of these exports go to United Arab Emirates, Kuwait, Bahrain, Syria, Lebanon, Qatar and Oman, where so far quality and packaging requirements are not as strict as in some other places and where road and air transport is relatively inexpensive. Exports to markets such as Europe and Canada are smaller yet but are growing, in spite of some limitations in the policy framework that are mentioned below. Jordan's comparative advantage is closely tied to seasonal windows. For example, fruit exports to Arab countries are shipped mostly in the two periods November to January and May to July, and fruit exports to Europe (mainly early seedless grapes to Germany and the UK) are concentrated in June and July (Jaberin and Knapp, 2003). Eastern Europe and the former Soviet Union also represent markets of considerable potential for Jordanian produce. It should be noted that it is likely that food quality standards will be raised in the near future in the Gulf markets, so quality is increasingly becoming the key issue for sustaining agricultural export growth.

Currently as many as 20 varieties of vegetables and fruit are being exported, along with cut flowers, olive oil and other high-value products. Tomatoes are the leading export, followed by cucumbers, lettuce, eggplant, potatoes, lemons, sweet peppers, and other products. Certain types of squash and strawberries also are prominent among exports. This success, albeit on a still limited scale, and in spite of loss of the Saudi market from 1995 onward, demonstrates the sector's potential. A detailed French study (Gressard, 2001) found significant potential in *certain seasonal windows* and for *certain varieties* of the following products: strawberries (Camarossa but perhaps also Gariguette and Ciflorette varieties), green beans, snap and snow peas, melons (esp. Galia and Charentais varieties), fresh herbs, and cherry tomatoes. Magnani, Assad and El-Habbab (2004) also have noted the export potential in many of these crops and others such as asparagus and fine green beans.

Table 1 shows the performance of fruit and vegetable exports over the past six years. It can be seen that vegetable and fruit exports have jumped in the last two years and that together they represent almost 70 percent of total agricultural exports.

The potential is clear. The extent to which it will be realized in the future depends on overcoming some key bottlenecks in the production, post-harvest, and marketing stages, and in receiving appropriate policy support in crucial areas. The potential also must be reconciled with the increasing scarcity of water in Jordan and with the quality of the water that is available for agriculture, and the labor force must be capable of meeting the demands for new skills that are generated by modern, specialized agriculture.

**TABLE 1: VALUE OF JORDAN'S AGRICULTURAL EXPORTS, 2000-2005 ('000 JD)**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | Aver. | % of Agr. Exports |
|---|---|---|---|---|---|---|---|---|
| Total Jordan Exports | 1,079,738 | 1,352,371 | 1,556,748 | 1,675,075 | 2,306,626 | 2,558,685 | 1,754,874 | |
| Food, Live Animals | 116,355 | 135,530 | 141,316 | 156,641 | 200,879 | 274,949 | 170,945 | 100% |
| Live Animals | 15,655 | 4,320 | 7,627 | 10,071 | 10,628 | 10,674 | 9,829 | 6% |
| Dairy Prod. and Eggs | 6,488 | 7,167 | 5,646 | 8,044 | 9,243 | 29,435 | 11,004 | 6% |
| Cereals, Cereal Prep. | 2,253 | 2,078 | 1,274 | 2,835 | 6,972 | 7,271 | 3,781 | 2% |
| Vegetables | 59,107 | 82,283 | 95,296 | 99,480 | 127,691 | 158,666 | 103,754 | 61% |
| Fruits and Nuts | 12,740 | 12,110 | 11,744 | 11,508 | 13,358 | 23,924 | 14,231 | 8% |
| Fodder | 12,415 | 15,610 | 8,606 | 6,702 | 10,454 | 6,451 | 10,040 | 6% |
| Other | 7,697 | 11,962 | 11,123 | 18,001 | 22,533 | 38,528 | 18,307 | 11% |

Source: Department of Statistics.

# 3. INCENTIVES POLICIES IN JORDANIAN AGRICULTURE

Jordanian agricultural production, including that which is destined for export, does not receive any policy incentives except the price of irrigation water and the cost of pumping, which are subsidized. An across-the-board disincentive to agriculture arises from the fact that current policy appears to be inclined somewhat in the direction of a cheap food policy and in favor of marketing intermediaries. Indications of this tendency are: i) the real exchange rate appears to have appreciated since the last devaluation in 1988-89, which restrains real agricultural prices and the returns to exports (although the appreciation appears to have slowed and even reversed in recent years); ii) the lack of sustained support for farmers' markets in main cities; iii) the lack of sustained support for building farmers' marketing cooperatives; iv) and the willingness to ban exports temporarily in the face of perceived scarcities on the domestic market. In addition, as discussed below, extra costs on the production and marketing chain are imposed in the form of requirements to use municipal markets, even in the case of exports and even when direct sales to retailers could be made by farmers or farmer organizations.

An alternative to the policy orientation of restraining food prices, for example, could be to increase the direct support payments to poor families and allow farmgate prices to rise in order to raise incentives and incomes for farm families.

As regards the exchange rate, it is unrealistic to expect that the policy would ever be modified on grounds of its effects on agriculture (especially in light of the capital inflows to other sectors of the Jordanian economy), but recognizing that it creates a measure of disincentive to agriculture constitutes an argument for compensating agriculture for this distortion via fiscal mechanisms, because other sectors are benefiting from the exchange rate policy, especially services.

Current import tariff policy encourages resource allocation to crops that represent inefficient uses of water, in terms of income generated per cubic meter of irrigation water: bananas, apples, grapes. Total border protection for these crops is in the neighborhood of 50%. In addition, in the case of apples and bananas at least, it is clear that Jordan does not have a comparative advantage in production. (Syria produces apples of equal or higher quality at a much lower price, and Latin American bananas are more competitive than the domestic ones.)

Offsetting this tariff policy to a degree is the fact that the Government has recently prohibited the use of loans from the Agricultural Credit Corporation (ACC) for growing bananas.

In the past, a policy incentive for over-exploitation of declining aquifers existed in the form of ACC loans for wells at subsidized interest rates. However, this policy also has been changed recently. Nevertheless, electricity is still highly subsidized for agriculture; the sector pays only 45% of the commercial rate for electricity, and this constitutes a powerful subsidy for pumping scarce groundwater for low-value uses. In addition, farmers do not pay a fee for groundwater use although industrial and household users do.

# 4. AGRICULTURAL MARKETING POLICY

## 4.1 MARKETING COSTS AND THE ISSUE OF MARKETING DISINCENTIVES

Marketing costs represent a considerable portion of total costs, even for the relatively short distances that most produce has to travel from the Jordan Valley and upland producing areas to Amman. These costs are especially high for many vegetables (Table 2), and they would be considerably higher if post-harvest product losses were taken into account, often reaching 50% of the farmgate price.

**TABLE 2: DOMESTIC MARKETING COSTS AND FARMGATE PRICES (2003, IN FILS/KG.)**

| Crop | Marketing Costs | Farmgate Price | Marketing Costs as % of Farmgate Price |
|---|---|---|---|
| Sweet pepper | 44.4 | 117.9 | 37.7 |
| Tomatoes | 29.6 | 77.6 | 38.1 |
| Potatoes | 34.6 | 140.9 | 24.6 |
| Okra | 71.2 | 392.0 | 18.2 |
| Eggplant | 33.0 | 75.4 | 43.8 |
| Lettuce | 14.0 | 35.0 | 40.0 |
| Dry onions | 22.7 | 84.4 | 26.9 |
| Sweet melon | 27.2 | 92.9 | 29.3 |
| Oranges | 39.6 | 179.0 | 22.1 |
| Grapes | 40.8 | 191.8 | 21.3 |
| Peaches | 55.9 | 210.6 | 26.5 |
| Apples | 55.9 | 235.4 | 23.7 |

Note: These are averages of monthly figures. Source: Department of Statistics.

For exports, the costs are higher still, especially when the costs of international transportation, certification and obtaining market information are taken into account. Yet the level of Government effort and investment in marketing is much less than the cost share of marketing would warrant, and very much less than the sum of efforts that are devoted to production, including making irrigation available and carrying out agricultural research and extension.

Current policy in Jordan imposes significant costs on agricultural marketing, through taxes and regulations, which other countries in the region do not have. In addition, other countries subsidize part of transport costs or exports, so the combined effect is that Jordan is at a competitive disadvantage owing to these issues. Details of these additional costs in Jordan are as follows:

- Regulations requiring all sales, including exports, to go through municipal markets. That means paying a 4% municipal sales tax, a 4% market tax, a 5% commission agent fee, and a sales tax on the commission of 16% of it. This requirement also affects producers who wish to sell directly to retailers.

- In the case of cut flowers, there is an additional 16% sales tax (over and above the two 4% taxes), the commission fee is 7%, and therefore the tax on the commission fee is also higher. That amounts to a total cost increment of about 28% for cut flowers.

By contrast, Tunisia, Egypt, Lebanon, Syria and Turkey, which are competitors for the export markets, subsidize their exports of fresh produce in various ways. In Tunisia the Government pays 50% of shipping costs and gives a 50% interest rate subsidy to any agricultural marketing business. Egypt subsidizes 30% of airfreight costs, Lebanon provides a subsidy of $800 per 20-ton container, and Turkey provides an export subsidy of $30/ton for fresh produce. In combination with Jordan's

taxes on marketing and appreciated exchange rate, these policies in regional competitors place Jordan's producers and exporters at a significant competitive disadvantage.

In the marketing area, the National Strategy for Agricultural Development recognizes the problem of a "weak marketing system and its failure to direct production towards demand,"[1] but its policy recommendations are limited to concluding bilateral agreements for market opening, utilizing Jordanian Embassies as channels for market information, providing market price information in complementary ways, and ensuring that export farms do not experience shortages of water during the growing season.

## 4.2 TRANSPORT, STORAGE AND PACKAGING ISSUES

Successful exporting requires resolution of a number of issues in the production and marketing chain, from water management, to post-harvest handling, product quality and certification questions, to questions of volume and producer organization, to the cold chain and transportation availability. Transportation is one of the keys:

- "Airfreight rates are not unreasonably high" (Magnani, Assad and El-Habbab, 2004), but some observers state that assured availability of airfreight space on airlines is an issue, and that if a flight turns out to be too full of other cargo or suitcases[2], the airline may refuse to load a shipment of vegetables. It is more an issue for start-up exporters and medium-scale exporters, because a few large exporters successfully ship vegetables by air, one of them to both France and Canada.

- For many exporters and potential exporters, the freight space question can turn out to be an issue because of lack of sufficient volume of product being shipped, or uncertainty that the freight space will be available when needed. It is a circular problem, because the space will not become regularly available if the volumes do not exist. If that is the case, then a policy could be considered of Government (or donor) guarantee of airfreight space in regular flights for a transition period of, say, three years. The guarantor would pay the airline for the space in the event it weren't fully utilized, and this assured availability might convince exporters to plan to use air shipments more frequently and in higher volumes. With growth of shipping volumes, the guarantee could be discontinued. Consultations should be carried out with the Jordan Exporters and Producers Association (JEPA) to determine volumes and the most appropriate route(s) for the space guarantee. On the other hand, some farmers or shippers have made air cargo reservations and then have not used them, without giving prior notice to the airline. A policy of guaranteeing space should be accompanied by a requirement that producers pay a percentage of the shipping fee when reserving space, and that this percentage would be forfeited in the event of not using the space without sufficient advance notification.

- Support for trial shipments may also be considered as a policy measure, to complement the present efforts aimed at taking producers to trade fairs and bringing buyers to Jordan. An agency such as AMO could pay up to two-thirds of the cost of initial shipments of a product by a given exporter, or shipments of a presently exported product to new markets. The Jordan Export Development and Commercial Centers Corporation (JEDCO) should continue sponsoring tours to trade shows.

- Jordan generally lacks sufficient refrigerated trucks of high quality, for use in transporting fresh produce to Eastern and Western Europe. One major exporter has solved the problem by leasing

[1] Ministry of Agriculture, 2003.

[2] Several cargo flights a week are available to European destinations.

about 100 Turkish and Hungarian trucks. Other exporters are likely to have recourse to leasing mechanisms also, given the seasonality of exports, and to purchase better vehicles when exports to regional markets can be combined with exports to European markets.

- Successful exporting needs long-term production, marketing and transport plans, to ensure that the production is demand-driven. Such plans may serve as a basis for obtaining finance (from ACC, for example) for leasing and purchasing trucks. The purchase option would have to be carefully evaluated since, as noted, Jordan exports fresh produce only during certain periods of the year.

- Other countries of the region (including AGREXCO of Israel) have hub space in locations such as Maastricht with cold storage, for receiving exports and distributing them throughout Europe. The Brazilian Government has obtained space in the import center of Miami, where any Brazilian exporter can display trial shipments and make contacts with buyers. It might be worthwhile for JEDCO or JEPA to consider following the Brazilian example, in Maastricht or other suitable European location, and have it staffed by an experienced sales agent, perhaps in the employ of JEPA. In collaboration with this agent, JEDCO or JEPA could assist Jordanian exporters and potential exporters in the development of export plans and transportation arrangements, as well as in forging links to buyers.

- Twenty-six cold storage units exist in Jordan, and there are several pre-cooling units including one owned by JEPA. The cold storage facility at Queen Alia Airport is not used to anywhere near capacity. One of the issues is that it is large, and therefore it is not economic to turn it on for small shipments of fresh produce. Also, the present design does not allow for the temperature to be set differently to meet the differing requirements of various crops (Magnani, Assad and El-Habbab, 2004). It would be worthwhile to investigate the costs of partitioning it, and partitioning the associated cooling capacity, and estimating the investment costs of doing that. Another issue is that produce security inspections should be carried out within the facility, to avoid the problem now experienced of having produce sit on the tarmac for extended periods while awaiting and undergoing inspection.

Developing adequate cold storage at the farm level runs up against the issue of scale, and therefore the question of producer organization, which is treated below.

Jordan has a particular problem with packaging for fresh produce in that the most widely used form of packaging is a polystyrene box. It is fragile and environmentally damaging. It takes 100,000 years to biodegrade. For this reason, it is not acceptable in export markets such as Europe and probably will become unacceptable in other places as well eventually. Modern exporters use cardboard and plastic boxes, but polystyrene containers are the most widely available for small farmers. The Government should simply adopt the policy of banning the polystyrene boxes and encourage wider availability of the other forms of packaging, which are already produced domestically.

## 4.3 FOOD SAFETY CERTIFICATION ISSUES

This is a multi-faceted issue. A question that is gaining importance is the extent to which use of treated wastewater, and blended water, may prejudice the possibilities of certification. Currently a good share of the sensitive produce exports is grown in the areas less affected by water contamination, e.g., the northern part of the Jordan Valley and the uplands, and much of the export produce in the Valley is grown with well water. However, as pointed out below, Jordanian agriculture will increasingly depend on reclaimed water in the future, so the issue cannot be sidestepped.

The main kinds of contamination that are of concern include chemicals and heavy metals, microbiological contamination (especially fecal coliform bacteria and parasites), salinity, and sedimentation. Salinity affects crop yields and sedimentation affects drip irrigation equipment. The first two forms of contamination can generate food safety concerns.

For the Jordan Valley, the main source of irrigation water, and of blended water, is the King Talal Reservoir. Its source of contamination is untreated and partially treated wastewater from Amman, but the current expansion of the treatment plant in Zarqa will drastically reduce the flow of untreated wastewater into the reservoir. Nevertheless, the treatment remains partial (primary and secondary), and there is evidence that coliform contamination increases below the dam of this reservoir, so evidently there is an issue with untreated or imperfectly treated wastes from small towns and rural areas, including livestock waste. The Yarmouk River is relatively uncontaminated, but monitoring has turned up some evidence of various pollutants, including coliform bacteria, in its flows as well, so no part of the Valley is completely free of this concern. To put matters in perspective, in many countries the rivers and reservoirs used for irrigation carry contaminants, so this is not a problem for Jordan alone, but it is unusually important in Jordan.

The importance of the issue of pathogen contamination in irrigation water in Jordan has been aptly expressed by an earlier USAID-sponsored study, in the following words:

> Although, based on available data and FAO/WHO guidelines, it seems that King Talal Reservoir Water can be used for unrestricted irrigation most of the time, the present conditions produce water of marginal quality that raises concerns for public health and safety. *This concern can quickly grow to a lack of public confidence, both nationally and internationally*. In addition the vulnerability of the irrigation supply will increase in the future as larger portions of that supply will be made up of wastewater. There are also signs of secondary contamination in other portions of the King Abdullah Canal, making this parameter a concern throughout the whole Jordan Valley as well as areas irrigated with pure and blended KTR water.[3]

This issue will only increase in urgency. It has been pointed out that "due to the fact that freshwater resources are being used almost to their maximal capacity, it is expected that the total ratio of treated sewage water to freshwater will increase."[4] Table 3 presents projections of future levels of use of treated wastewater.

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[3] FORWARD, a USAID Program, "Assessment of Water Quality Variations in the Jordan Valley, Volume I, Summary Report," prepared for the Jordan Valley Authority and the Water Authority of Jordan, Ministry of Water and Irrigation, Amman, June 2000, pp. 21-22 [emphasis added]. The FORWARD team members were Abdelnabi Fardous, Amer Jaberin, Awni Taimeh, Dennis Westcot, Osama Abu-Rayyan, Raed Daoud, and Steve Grattan.

[4] PA Consulting Group and EcoConsult, under contract with USAID, "Report of Working Group: Water Resources, Supply and Demand and Water Balance, Supplementary Report: Water Quality Issues," prepared for the Ministry of Water and Irrigation, Jordan Valley Authority, Amman, August 2003, p. 25.

| TABLE 3: PROJECTED WATER REUSE IN THE JV AND THE UPLANDS (MCM/YEAR) | | | |
|---|---|---|---|
| **Year** | **Jordan Rift Valley** | **Uplands** | **Total** |
| 1998 | 56 | 11 | 67 |
| 2005 | 65 | 43 | 108 |
| 2010 | 110 | 66 | 176 |
| 2015 | 123 | 84 | 207 |
| 2020 | 137 | 95 | 232 |

Source: The World Bank, 2001.

For the Jordan Valley, *The National Strategy for Agricultural Developmen*t (Ministry of Agriculture, 2003) foresees slightly greater reliance on treated wastewater. It projects an increase in the treated wastewater share of total irrigation water from 16 percent in 2005 to 34 percent in 2020.

The side wadis and springs flowing into the Jordan Valley are principal sources of salinity (because of minerals in the soils) and sedimentation, as well as other forms of contamination from the treated wastewater issuing from eight wastewater treatment plants.[5] Groundwater contamination has been detected also.[6]

In 1995 Jordan lost a major export market for fresh vegetables when Saudi Arabia imposed a ban on all imports of Jordanian vegetables, on the grounds that they are grown with wastewater. However, in the 1990-1995 period only 6% of total vegetable exports to Saudi Arabia were grown in areas where irrigation could have involved treated wastewater. The remaining 94% were grown in uplands and in northern zones of the Jordan Valley where reclaimed wastewater is not used (Jaberin and Knapp, 2003).

The avenues for dealing with contamination issues include: appropriate irrigation technologies and cultivation techniques, training of farm workers in hygienic product handling, monitoring water quality, monitoring produce for contaminants, dissemination of food quality standards and test results, and international certification.

For exports to Europe the Eurepgap standards developed by private retailers have become prerequisites for market access. This certification refers not only to quality, in the sense of testing products for contaminants, but also to processes of production and post-harvest handling, so use of treated wastewater may be an issue even when the products test free of contaminants. It is most likely to be a limiting factor in the central directorates of the JV, where the water quality is lower. As noted, some exporters, such as the Jordan River Company, have avoided the issue for the moment by using well water. At present it is estimated that ten exporters have received Eurepgap certification (which includes HAACP standards), and the number of products covered by these certifications is at least 25.

[5] These plants are located in Kufrinja, Khirbit As-Samra, Baqa'a, Jerash, Abu Nuseir, As-Salt, Fuheis and Wadi Essir (Hanauer, 2005).

[6] "High concentrations of total coliforms and Escherichia coli were detected in all groundwater samples" (op. cit., p. 27).

One avenue of solution is to cultivate crops that bear their fruit well above the ground, such as sweet peppers, tomatoes, some spices and tree crops. Irrigation technology is another promising avenue of solution, with the option of low-pressure irrigation (distinct from drip irrigation), in which the plants are cultivated in a hydroponic (aquaponic) environment. This option may be worth exploring on a pilot scale. System costs could be recovered through increments to water charges. ACC has financed two hydroponic projects already, and in a new pilot the additional irrigation fees could be directed to ACC to ensure loan recovery. This technology also reduces water requirements per unit of production, which is a vital contribution in light of the water scarcity.

Another key facet of the certification issue is training farmers to meet certification requirements (Magnani, Assad and El-Habbab, 2004). It has been suggested that a Jordanian certification board could be established, but it may be more productive to establish a Jordanian pre-certification entity that would work with farmers to bring their practices up to standards prior to inviting an international CB to carry out an audit. Guatemala has successfully established such an entity and has achieved certification for some tropical fruits (e.g., papaya) through its efforts. Eventually, the work of the pre-certification entity can gain enough credibility that its own seal may be accepted by certification boards, at least for certain products. Perhaps JEPA could take on this role of a pre-certification agency, with appropriate institutional strengthening.

Certification is an expensive process, and this argues for both Government support (as one of the offsets to the incentives bias) in training and investment in relevant infrastructure such as a cold chain, and for stronger producer organization. (This latter topic is discussed below.) The pre-certification entity should be private and fee-based, but the Government should subsidize part of its work for smaller farmers, especially the steps leading up to the first international certification.

## 4.4 STANDARDS AND TESTING

Jordan now has laboratory facilities for testing for chemical residues, in Baqa'a. There have been some difficulties in obtaining documentation of the testing results of this laboratory (Fitch and Jaberin, 2001), and that bottleneck needs to be solved. The process of obtaining international certification of the laboratory results needs to be completed, so that importers in other countries do not feel obliged to submit the products to new tests at accredited laboratories. Jordan now has laboratory capabilities for microbiological testing at the Royal Scientific Society and some producers have used that facility. On the basis of this infrastructure, the most urgent needs in this area are the development of a *national set of food safety standards* and obtaining international accreditation for laboratories in Jordan. In addition to European markets, domestic supermarkets in Jordan and importers in Gulf countries are increasingly demanding fulfillment of food safety standards, so a national system that would provide information to producers on this dimension of product quality is becoming urgent.

AMO now carries out weekly tests of produce for chemical residues on a sampling basis, but it does not regularly inform farmers of its test results, nor are the published results associated with particular command areas or farms, so farmers are not in a position to act on the basis of the testing. It is important that feedback mechanisms be developed so farmers can be in a position to take remedial actions.

The existing Jordanian standards 893/95 and 202/91 allow use of treated wastewater in agriculture but do not support its use crops likely to be eaten raw. However, the standards are incomplete and need to be revised and updated. For example, at present the standards do not provide guidelines for crop cultivation with blended water, and hence they are not applicable for the majority of producers in the Jordan Valley. In addition, considerable work lies ahead in disseminating and applying the standards.

## 4.5 PRODUCER ORGANIZATION

The average farm size in the Jordan Valley is 3.5 hectares, and it would be difficult if not impossible for a producer of that size to penetrate sophisticated export markets alone. Jordan has not had very positive experiences with agricultural cooperatives in the past, but in part that may be due to lack of appropriate focus. The most successful cooperatives are dedicated exclusively to marketing (definitely not to production), and also are those that have a more entrepreneurial structure, i.e. with shareholdings. *If and when* producer groups demonstrate interest in forming marketing cooperatives, the Government should try to support them with sound technical advice.

An alternative model for producer organization is already functioning in some cases in the Jordan Valley: the outgrower model, or satellite grower model. Modern Valley Farms exports from both its own production and from that of outgrowers (Fitch and Jabarin). The Jordan River Company has ten outgrowers at the moment (with written contracts) and expects to have ten more in the near future. In these schemes the mother company provides extensive technical advice, and often inputs as well, to the outgrowers, to guarantee that quality standards are met. Investments in the packing plant and cooling and transportation facilities have been made by the mother company, which effectively deals with the issue of economies of scale.

Magnani, Assad and El-Habbab (2004) also mention the Farm Owner's Enterprise that organizes farmers to sell to these central enterprises and supports the costs of preparing for farmer certification. The outgrower model with its variants is perhaps the most promising way forward for increasing production for high-quality export markets.

# 5. AGRICULTURAL LABOR POLICY

## 5.1 AGRICULTURE AND THE LABOR POLICY ENVIRONMENT

According to the National Agricultural Strategy that was approved by the Ministry of Agriculture in 2002, the importance of the agricultural sector stems from the fact that it contributes to the creation of job opportunities. The number of employed agricultural labor increased from 41,000 in 1991 to about 68,000 in 1996 (31 percent Jordanians) and to about 114,000 in 2000 (55 percent Jordanians). Permanent agricultural labor is mainly concentrated in the Jordan Valley areas, where it represents 60 percent of the country's total manual labor, as compared to only 9 percent in the Uplands due to the nature and seasonality of production in the rainfed areas. Within the Jordan Valley, more of the farmers are Jordanian in the northern zone, where the predominant crop is citrus. While Jordanians are still a majority of the farmers in the central and southern zones, there are proportionately more Egyptian farmers and some Pakistanis as well in those areas (Development Alternatives, Inc., 2004).

The Strategy also stresses the important social role of the sector as in limiting migration from rural to urban areas. Agriculture is the core of Jordan's rural-area development, as it is the main source of income for its inhabitants, and creates job opportunities and income generating activities in agriculture and related agribusiness activities. In a dynamic and progressive agriculture, fewer rural people would move to urban areas, thus reducing pressure on city services and minimizing the creation of poverty enclaves within urban surroundings that force the government and society to provide job opportunities.

The strategy adds that agricultural development can effectively contribute to the integrated social and economic development in rural communities by involving community members in planning and implementing the development programs. Such participation will help build readiness to participate in the developmental process, and it will promote the role of rural women in social and economic activities of communities.

Agricultural development would also improve redistribution of the benefits of development in favor of rural people. The subsequent social and economic equity and justice attained through increased income of farmers and agricultural workers will improve their standard of living and provide them with new skills and knowledge that will enable them to more effectively participate in development efforts.

In addition to social considerations, as a more specialized, export-oriented agriculture develops, the need for semi-skilled and highly skilled labor in the sector will increase, and the share of employment represented by purely manual labor will decrease. In Chile in the 1990s, agriculture was the sector that created the greatest amounts of new employment in scientific, technical, administrative, and other professional fields. This kind of creation of demand for skilled labor is already happening in the leading edge of the fruit and vegetable export sub-sector in Jordan. Skilled personnel are being utilized in irrigation engineering, soil sciences, crop research, agronomy, post-harvest handling and crop storage, marketing, food processing and packaging and labeling, transportation, agrochemical management, accounting,[7] business administration, and other fields.

However, the national literature on labor issues indicates that there is no stated labor policy by the government specifically for the agricultural sector. In 1996, the government issued the labor law number 8 for the year 1996 which included 142 articles and in addition 3 annexed tables. This law

[7] In a survey of 795 farmers (Development Alternatives, Inc., 2004), 82 percent reported that they do not keep records.

includes 12 chapters covering the main following issues: 1) Inspection of Workplaces; 2) Employment and Occupational Guidance; 3) Work Contracts; 4) Vocational Training Contracts; 5) Collective Work Contracts; 6) Protection of Remuneration; 7) Regulation of Work and Leave; 8) Safety and Occupational Health; 9) Work Injuries and Occupational Diseases; 10) Labor Unions and Employers Associations; and 11) Settlement of Collective Labor Disputes.

## 5.2 EXISTING VOCATIONAL TRAINING PROGRAMS

The Government of Jordan *has not given the same level of importance* to vocational training in agriculture as it has for other sectors of the economy. In fact, there is virtually no training available for agricultural occupations. At present, the burden of training the kinds of specialized labor mentioned above falls mainly on firms in the sector, but as in all fields of education the training generates externalities which argue for public sector participation in it. Strategies can be designed for vocational training in agriculture that are similar to those that are in place for the other sectors. For instance, the stated strategies of the Vocational Training Corporation (VTC), which is the public corporation responsible for vocational training in Jordan, include:

- Ensure the availability of data and all information related to the requirements of the labor market, quantitatively and qualitatively.
- Provide assistance for small and medium enterprises and training in the field of occupational health and safety.
- Develop programs and curricula for vocational training to meet labor market requirements.
- Preparing vocational guidance and counseling programs so that vocational education and training will be more accepted by society.
- Strengthen opportunities for females in vocational training to increase their participation in the labor market.
- Establish a participatory and active partnership between the Vocational Training Corporation and the private sector.
- Help organize the labor market by classifying positions and workers by occupation.
- Strengthen international cooperation for technical vocational education and training so that the quality of education and training will be improved.

The above strategies also can apply to the needs of the agricultural sector in Jordan.

The VTC has tailored several training programs to meet most of the needs of both private and public sectors. The Vocational Preparation Programs designed by VTC include:

- Training Program for the Semi-Skilled Level
- Training Program for the Skilled Level
- Training Program for the Craftsman Level
- Applied Secondary Education Program
- Safety Supervisors Program

Other vocational programs include what are called “Upgrading Programs,” which include:

- Technical Upgrading Programs
- Instructor Training Programs
- Supervisory Training Programs
- Occupational Safety and Health Training Programs

These programs constitute recognition of the need for training at different skill levels. They aim to train instructors, supervisors and engineers who are working in both public and private sectors.

## 5.3 ELEMENTS OF AN AGRICULTURAL LABOR POLICY

This policy statement follows from the long-term objectives stated in the National Agricultural Strategy and from consideration of the future needs of the agricultural sector. Among the other main objectives, the social objectives included in the Strategy are: 1) Limit migration from rural areas into urban areas; 2) Increase women’s participation in agricultural development; 3) Enhance the capabilities of farmers and agricultural workers, and develop their knowledge base and abilities to effectively participate in the socioeconomic development of rural areas; and 4) Improve health, educational, social services, and living standards for rural people. The proposed new policy is consistent with the National Strategy and is in conformity with its long- and short-term objectives.

Training is needed for all phases of agricultural production and marketing. A wide spectrum of activities is needed to improve the capabilities of working staff at the farm level as well as those working in the area of agricultural marketing.

Consequently, training programs should be designed to meet the needs of the sector for both highly qualified skilled and unskilled labor. Also, educational institutions need to participate in social communications efforts to demonstrate that skilled, remunerative agricultural careers exist and are expanding. The image of the sector as backward and undemanding of skills contributes to the lack of interest in agricultural careers on the part of students.

Several benefits should be attained from providing the proper training, which may include:

- At the marketing level:
  - Improvements in the quality of crops produced for both local and export markets, which will consequently increase the prices attained in those markets.
  - Minimization of pre- and post-harvest losses, which for certain highly perishable products amounts to about 20-45% of production.
  - Increases in the income of all players in the production and export industry.
- At the production level:
  - Improvements in the efficiency of irrigation systems and increases in water savings attained through applying it in accordance with exact water requirements.
  - Reductions in the use of chemicals and increases in the level of safety for both on- and off-farm laborers and end consumers.
  - Improvements in yields and competitiveness of Jordanian products.

- At the level of factors of production:
  - Well-designed training programs would improve the level of experience of both skilled and unskilled laborers, which in turn would improve their chances in obtaining permanent and highly paying jobs in the sector.
  - Another benefit would be the establishment of a trained and specialized professional labor force that will be more adaptable to future economic changes, inside and outside the agricultural sector.

Training should be directed towards Jordanian and non-Jordanian laborers working in the agricultural sector. Most recent statistics show that the total number of workers in the agricultural sector amounted to 73,924 in the year 2004 (Table 4) of which 88 percent are males and 12 percent females. The total number of non-Jordanians amounted to 44,550 laborers representing about 54 percent of the total agricultural labor force in the country. The table also shows that permanent labor of both Jordanians and non-Jordanians represents about 34 percent of the total labor force.

Tables 5 and 6 show the distribution of hired labor in the two main agricultural production regions in Jordan, the uplands and the Jordan Valley, as reported by the DOS in 2004. The tables show that much of the labor force is concentrated in the Uplands with about 76 percent while only 24 percent is in the Jordan Valley.

**TABLE 4: DISTRIBUTION OF HIRED LABOR BY KIND OF LABOR, SEX, NATIONALITY AND AGE CATEGORY IN JORDAN IN 2004**

| Distribution of Hired Labor by Sex and Age | | Permanent Labor | | Seasonal Labor | | Casual Labor | |
|---|---|---|---|---|---|---|---|
| | | Jordanian | Non-Jordanian | Jordanian | Non-Jordanian | Jordanian | Non-Jordanian |
| Male | 12-16 Years | 0 | 0 | 0 | 0 | 0 | 4 |
| | Over 16 | 3971 | 21456 | 134 | 638 | 19595 | 19232 |
| Female | 12-16 Years | 0 | 0 | 0 | 0 | 0 | 0 |
| | Over 16 | 21 | 5 | 0 | 0 | 8653 | 215 |

Source: Department of Statistics, 2006

As a prerequisite for improving labor training in agriculture, a specialized and detailed training needs assessment study should be carried for the agricultural sector in Jordan. The study should analyze the current situation in the agricultural sector and the other supporting sectors. Based on this analysis, the study should determine and propose the proper training programs at all levels in accordance with labor market requirements. However, interviews with some of the key players in the private and public sectors showed that some of the needed crucial training needs may include, but are not limited to, the following:

- Special training on irrigation technologies particularly on new irrigation techniques that improve water management efficiency and meet the strategic objectives and milestones included in the different water and agricultural polices adopted by the government.

- Other tailored training programs should be directed towards improving the skills in plant protection, chemical handling and application, proper use of machinery, proper packing and packaging, sorting and grading, cold storage techniques, shipping and forwarding.
- The implementing agency of the irrigation training or any other types of training should examine the possibility of recruiting additional expatriate staff from countries that have advanced experience in efficient irrigation systems, through technical assistance arrangements.
- Training is needed on cost accounting, record keeping, and farm management.
- The possibility of establishing farmers' schools in which pioneer farmers teach other farmers in their own region, should be explored and may be extended to several regions.
- Any type of vocational or practical training will require well-designed training materials. Trainers should be trained in the preparation and use of training materials.
- The latest technology in delivering training in workplaces such as farms and packinghouses should be utilized.
- A continuous process of evaluation of trainers and courses by participants should be an integral part of the training programs.

**TABLE 5: DISTRIBUTION OF HIRED LABOR BY KIND OF LABOR, SEX, NATIONALITY AND AGE CATEGORY IN THE UPLANDS IN 2004**

| Distribution of Hired Labor by Sex and Age | | Permanent Labor | | Seasonal Labor | | Casual Labor | |
|---|---|---|---|---|---|---|---|
| | | Jordanian | Non-Jordanian | Jordanian | Non-Jordanian | Jordanian | Non-Jordanian |
| Male | 12-16 years | 0 | 0 | 0 | 0 | 0 | 4 |
| | Over 16 | 3221 | 16197 | 0 | 119 | 18938 | 11024 |
| Female | 12-16 years | 0 | 0 | 0 | 0 | 0 | 0 |
| | Over 16 | 21 | 5 | 0 | 0 | 6670 | 146 |

Source: Department of Statistics, 2006.

**TABLE 6: DISTRIBUTION OF HIRED LABOR BY KIND OF LABOR, SEX, NATIONALITY AND AGE CATEGORY IN THE JORDAN VALLEY IN 2004**

| Distribution of Hired Labor by Sex and Age | | Permanent Labor | | Seasonal Labor | | Casual Labor | |
|---|---|---|---|---|---|---|---|
| | | Jordanian | Non-Jordanian | Jordanian | Non-Jordanian | Jordanian | Non-Jordanian |
| Male | 12-16 years | 0 | 0 | 0 | 0 | 0 | 0 |
| | Over 16 | 750 | 5259 | 134 | 519 | 657 | 8208 |
| Female | 12-16 years | 0 | 0 | 0 | 0 | 0 | 0 |
| | Over 16 | 0 | 0 | 0 | 0 | 1983 | 69 |

Source: Department of Statistics, 2006.

Finally, given the importance of non-Jordanian workers in agriculture, consideration needs to be given to improving their juridical status, to give them more secure long-term residence rights and hence incentives to increase their skill levels and to invest in productivity improvements in the plots of land that they are working on their own.

# 6. WATER MANAGEMENT ISSUES IN AGRICULTURE

## 6.1 WATER SUPPLY AND DEMAND IN JORDAN

Jordan is one of the most water-scarce countries in the world. Its supply of renewable water resources, at 153 $m^3$ per capita per year, is extremely low and is not sufficient to meet minimal needs for households, industries, commerce and agriculture. The deficit is being made up by the unsustainable route of drawing down groundwater resources. Table 7 shows one set of projections of water supply and demand in Jordan, where future demand is calculated on the basis of current water use rates in different activities.

**TABLE 7: PROJECTED WATER SUPPLY AND REQUIREMENTS (MCM/YEAR)**

| Year | Municipal and Industrial | | Agricultural | | Total | |
|---|---|---|---|---|---|---|
| | Supply | Requirements | Supply | Requirements | Supply | Requirements |
| 1998 | 275 | 342 | 623 | 863 | 898 | 1205 |
| 2005 | 363 | 463 | 679 | 858 | 1042 | 1321 |
| 2010 | 486 | 533 | 764 | 904 | 1250 | 1436 |
| 2015 | 589 | 639 | 693 | 897 | 1283 | 1536 |
| 2020 | 660 | 757 | 627 | 890 | 1287 | 1647 |

Source: World Bank (2001).

These projections may be contrasted with *sustainable* average annual supplies of water, which are estimated as 715 MCM of surface flows and 275 MCM of sustainable groundwater extractions, for a total of 990 MCM. Clearly water uses are being curtailed and will be curtailed by even more in the future.[8]

It is estimated that, very roughly, extractions from the Disi aquifer could add 100 MCM annually to the available water. This aquifer is not a renewable resource, or renewable at such a slow rate as to be effectively non-renewable, so projections are that it will last approximately 50 years at this rate of extraction. However, Saudi Arabia shares the aquifer with Jordan and increases in economic activity on the Saudi side could reduce the aquifer's lifetime.

The projections underscore the increasing importance of treated wastewater. And since that resource cannot be used for many purposes, irrigated agriculture will become increasingly dependent on it.

[8] Modest increases in the availability of relatively good-quality irrigation water are expected to be provided for the Jordan Valley by the construction of the Wehdeh Dam on the Yarmouk River, the Karama Dam, and dams on Wadi Hasa (Tannur Dam) and Wadi Ibn Hammad (Ibn Hammad Dam).

| TABLE 8: CROPPED AREA BY ZONE AND WATER REGIME, 2004 (DUNUM) | | | |
|---|---|---|---|
| **Crops** | **Total Area** | **Irrigated Area** | **Non-Irrigated Area** |
| **A. All Jordan** | | | |
| Tree Crops | 860,304.8 | 334,291.6 | 526,013.2 |
| Field Crops | 1,479,405.6 | 77,304.7 | 1,402,100.9 |
| Vegetables | 369,041.9 | 349,651.2 | 19,390.7 |
| **B. Uplands** | | | |
| Tree Crops | 92,911.6 | 92,703.6 | 208.0 |
| Field Crops | 22,667.3 | 19,269.2 | 3,398.1 |
| Vegetables | 169,363.6 | 169,303.6 | 60.0 |
| **C. Uplands** | | | |
| Tree Crops | 767,393.1 | 241,588.0 | 525,805.2 |
| Field Crops | 1,456,738.3 | 58,035.5 | 1,398,702.8 |
| Vegetables | 199,678.3 | 180,347.7 | 19,330.7 |

Most of the cultivated area in Jordan is rainfed (72%) but irrigation is essential for some kinds of crops. The overwhelming importance of irrigation for current vegetable production can be seen by the fact that almost all vegetables are grown in the Jordan Valley. Table 8 shows cropping patterns by agricultural zone and water regime. It should be noted that the bulk of the rainfed tree crops are olives, but some of them are fruit and nut trees as well.

Almost all the irrigation in the Uplands, and some of it in the Jordan Valley, is provided by wells. As noted, because of the pervasive water shortages, irrigated agriculture in the Jordan Valley is increasingly dependent on the use of treated wastewater, and on water that is a blend of freshwater and treated wastewater.

## 6.2 OVERVIEW OF WATER MANAGEMENT ISSUES

The Ministry of Water and Irrigation, the Jordan Valley Association, the Water Authority of Jordan, and other institutions have worked for many years to improve the efficiency of water use in the country. One of the many results of these efforts is that the overall efficiency of the system of water storage, conveyance and distribution is “outstanding by international standards” at about 80% (GTZ, 2003). However, given the seriousness of the water situation, and the fact that agriculture uses most of the country’s water, it is important to continue to make progress in reducing water requirements in agriculture. The main needs in this area may be summarized under the following headings:

- Reducing groundwater extractions for agriculture.
- Increasing the value of agricultural output per unit of water used.
- Improving irrigation practices based on wastewater.
- Rehabilitating aging irrigation infrastructure in the Jordan Valley.
- Lowering levels of sedimentation and organic contamination of water sources.
- Improving management of saline water.

These topics are discussed in the following paragraphs in relation to irrigation in the Uplands and in the Jordan Valley, because of the very different challenges posed in these two areas.

## 6.3 IRRIGATION IN THE UPLANDS

In light of the declining levels of both rechargeable and fossil aquifers, it should be a policy objective to reduce and eventually phase out most agricultural uses of groundwater in the Uplands, particularly in the Amman-Zarqa Basin. One aquifer already has been depleted, and urban users of water typically pay ten times what irrigators pay for it, which illustrates the differences in sectoral value of water. Hence these scarce water resources are more valuable to the nation in non-agricultural uses. Rainfed agriculture should predominate in the Uplands, as it has for millennia until recent decades. The appropriateness of depending on rainfall in these zones is indicated by the fact that olives cultivated under rainfed conditions are superior in quality to olives grown under irrigation.

Fitch (2001) pointed out that probable consequences of continuing to irrigate crops with groundwater in the Amman-Zarqa Basin include, by the year 2015, a drying up of the aquifer in some places, the abandonment of 74 wells because of higher pumping costs and increased salinity in the water, and the need to deepen other wells. He measured the gross and net returns to irrigation water and compared them to the opportunity cost of water, as indicated by the annualized capital cost of the Disi Conveyor Pipeline. That cost is JD 0.424 per cubic meter of water. He found that very few crops generate a return to water that is equal to or greater than that cost, cantaloupe and watermelon being two of those few. Olive trees, which represent the largest single use of irrigation water in the Uplands, would lose money if the cost of water were set at its opportunity cost. On the other hand, field investigations carried out for this study suggest that stone fruit cultivation, under advanced technologies, could be profitable if water fees were set at the opportunity cost of water.

A licensing system for wells exists, and an increasing percentage of the wells are licensed. The licenses often carry maximal extraction rates also, but enforcement is practically nil, so in practice there are no controls on groundwater extraction, even. Official policy recognizes the issue,[9] and although mechanisms for enforcement of maximal pumping rates could be strengthened, it is not realistic to expect that use of controls alone could lead to the necessary reductions in well-based agriculture in the Uplands. Regulations for well drilling were updated in 2002,[10] but they do not contain any clauses that constitute recognition of the fact that groundwater reserves are being drawn down. Fees for pumping water for agricultural uses are nominal: zero for up to 150,000 $m^3$, 25 fils per $m^3$ for between 151,000 and 200,000 $m^3$, and 60 fils per $m^3$ for more than 200,000 $m^3$.

A combination of incentives and controls will be needed to achieve a significant reduction in agricultural use of groundwater. The incentives can be both positive and negative from the viewpoint of farmers. They could include:

[9] "Mining of renewable groundwater aquifers shall be checked, controlled and reduced to sustainable extraction rates," Ministry of Water and Irrigation, Jordan's Water Strategy and Policies, p. 6.

[10] Ministry of Water and Irrigation, By-Law No. 85 of 2002.

- Negative incentives
  - Reduction or elimination of agriculture's subsidy for electricity use.
  - Increase in water charges, which currently are at a very nominal rate of JD 0.15/$m^3$.
- Positive incentives
  - Government purchases of well licenses, and closure of those wells or transfer of their operation to a government entity that would supply water to other sectors.
  - Establishment of a formal water rights market to encourage more sales of farm water to industrial and municipal users (probably through WAJ).

The preferred combination of these incentives depends in part on a decision as to *who should bear the cost of saving water for future generations*. Exclusive use of the negative incentives would imply a decision that farmers alone should bear the cost. The option of government purchases of well licenses represents a decision to have taxpayers pay the cost.[11] It could be offered as an alternative to farmers. The last option, of a water rights market, represents a decision to shift the cost to those sectors for which the value of water is highest.

The use of incentives would make the reduction of groundwater use a voluntary decision on the part of farmers, rather than a coercive measure. A combination of different kinds of incentives is likely to be useful. For example, if the electricity subsidy were phased out, then farmers would be more willing to sell their licenses to the government or to enter into sales contracts for water rights with users in other sectors. It can be expected that with an appropriate combination of positive and negative incentives, over the long run only a few irrigated farms would remain in operation in the Uplands, and those few would be concentrated on very high value crops.

If mechanism of government purchases of well licenses is used, it is recommended that at least some of the wells be closed in order to reduce the overdraft of aquifers. It also is recommended that reimbursement to license holders be made in the form of a time stream of annual payments, rather than a lump-sum buyout. The payments would be scaled to the amount of water that normally would have been extracted from the well for farming. In this way, farm families would be more likely to stay in rural areas, as "producers of water," rather than migrate to urban areas, although some of them always would choose the migration option. In addition, measures would have to be taken to stop the digging of new wells in the Uplands, and definitely the policy of continue to issue licenses for new wells should cease.

With either of the positive incentives, it would be essential to recognize formally the water rights that the well owners have *de facto*, including their ability to legally transfer those rights to another water user. Systematic procedures would need to be established for valuing water rights and supervising the functioning of a water rights market. However, there is considerable experience in water rights markets in other countries that could be drawn upon.[12]

If a package of these incentives to reduce agricultural groundwater extractions is adopted, it may be desirable to review the current policy of charging a tax on sales of well water for off-farm uses. That tax constitutes a disincentive to inter-sectoral transfers of water, and the long-term policy should be to encourage them.

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[11] The funding for this option also could be raised in part through increases in water fees for non-agricultural users.

[12] See, for example, Thobani (1997) and the summary of issues concerning water rights markets in chapter 6 of Norton (2004).

## 6.4 IRRIGATION IN THE JORDAN VALLEY

As noted above, the overall efficiency of the Jordan Valley irrigation system is high. However on-farm efficiency is still below 50% in many cases. Policy and programs need to concentrate on improving on-farm efficiencies, and a significant part of such improvements can come from altering cropping patterns in order to concentrate on products that generate higher returns per unit of water used. Table 9 shows how strong the crop variations are in the returns to water.

Two sets of figures are highlighted in the table. Those returns to water that are above the opportunity cost of water for Amman (JD 0.424/$m^3$), as represented by the cost of obtaining water from the Disi Conveyor Pipeline, are highlighted in yellow. Those that are higher yet and are above the approximate average cost of water paid by urban households in Amman (very roughly JD 1.000/$m^3$) are highlighted in red.

Most cropping activities do not reach even the first threshold, and very few reach the second one. However, all of the greenhouse production activities easily exceed the second threshold, along with a few open field crops in some zones, specifically, tomatoes, zucchini, potatoes, eggplants, cabbage, squash and watermelon. It should be borne in mind that these figures are averages (based on a sample of 795 farmers), and that farm-to-farm variations can be significant for the same crop. Therefore, some farmers may be able to extract much higher returns to water from crops that appear unpromising for the sample as a whole. Nevertheless, the table provides an indication of where the Jordan Valley's comparative advantage lies, since water is *the* scarce resource.

It would be important for policy to provide stronger incentives for shifting to cropping patterns that generate higher returns to water. As in the case of the Uplands, both positive and negative incentives can be used. The same four incentives options are applicable in the Jordan Valley, except that use of wells is much more limited, and hence the electricity price will not have as much effect on water availability, and the possibilities of well buyouts are much less significant.[13] Accordingly, water use fees and water rights markets constitute the main policy incentive instruments for the Jordan Valley. In addition, an institutional policy that affects water use rates is discussed below. Attempts to control cropping patterns by fiat should be avoided. Some farmers, with some technologies, may be able to extract high returns per unit of water in crops that are unpromising for others. In addition, it is important that farmers have the freedom to experiment with new crops and new technologies.

Recommendations have been made that irrigation water tariffs rise to at least a level sufficient to cover operating and maintenance costs for the irrigation system, if not the costs of rehabilitation and new investments.[14] To avoid imposing undue hardships on small farmers from such a policy, transition plans and support measures should be developed for groups of farmers to enable them to move into higher-value crops, taking into account the requirements of the marketing chain discussed earlier in this report. Support could be provided in the form of sharing investment costs for improved irrigation and drainage systems, in addition to the options for marketing support mentioned above.

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[13] Given the hydrological interactions between surface water and groundwater, closing some wells in the Jordan Valley could make more water available downriver. The limited time available for this study did not permit investigations of this issue.

[14] According to Jordan's Water Strategy and Policies (Ministry of Water and Irrigation, n.d., p. 32), "the water price shall at least cover the cost of operation and maintenance and, subject to some other economic constraints, it should also recover part of the capital cost of the irrigation water project." In Wadi Musa a full-cost freshwater tariff would be JD 0.20 per m3. Farmers pay JD 0.01 per m3 for reclaimed water, and a full-cost tariff for that water would be JD 0.05 per m3. Returns to irrigation with reclaimed water, for a mixed cropping pattern of fodder, tree crops and field crops, amount to about JD 0.06 at the initial stages of development and rise to JD 0.10 at full development (Jaberin and Knapp, 2003).

**TABLE 9: VALUE OF PRODUCTION PER UNIT OF WATER IN THE JORDAN VALLEY (JD PER 1000 $M^3$ OF WATER, 2003)**

| Crop | Northern JV | Central JV | Southern JV | Southern Ghor |
|---|---|---|---|---|
| Clementine | 171 | 229 | | |
| Orange, sour | 280 | 497 | | 436 |
| Orange, navel | 410 | 620 | 127 | |
| Mandarin | 236 | 266 | | |
| Zucchini | 514 | 2089 | 531 | |
| Tomato | 607 | 1028 | 662 | 1473 |
| Banana | 518 | | 183 | 842 |
| Orange, red | 326 | | | |
| Wheat | 63 | 52 | 69 | |
| Bomely | 185 | 286 | | |
| Lemon | 384 | 344 | 56 | |
| Orange, Shamouti | 295 | 506 | 224 | |
| Orange, Valencia | 338 | | | |
| Grapefruit | 141 | 69 | | |
| Potato | 1494 | 1496 | 757 | |
| Eggplant | 687 | 577 | 755 | 1128 |
| Clover, trefoil | 130 | | | |
| Orange, French | 302 | 414 | | |
| Orange, local | 342 | | | |
| Cabbage | 272 | 2101 | 310 | |
| Broad beans, green | 289 | 992 | 386 | 529 |
| Cauliflower | 305 | 596 | 577 | |
| Sweet pepper | 249 | 995 | | 441 |
| Orange, king | 123 | | | |
| Barley | 38 | 38 | | |
| Maize | 44 | 72 | 77 | 329 |
| Hot pepper | 177 | 834 | 472 | 576 |
| Lettuce | 801 | 835 | 345 | |
| Onion, dry | 199 | 275 | 463 | |
| Cucumber (G) | | 5045 | 4529 | |
| Tomato (G) | | 6940 | 3221 | |
| Cucumber | | 776 | | |
| Squash | | | 1196 | |
| Watermelon | | | | 3000 |
| String beans | | | | 871 |
| String beans (G) | | | | 2204 |
| Cantaloupe | | | | 771 |
| Guava | | | | 275 |
| Grapes | | | | 735 |

(G) = greenhouse production. Source: Development Alternatives, Inc. (2004).

A revised policy on water tariffs could be accompanied by mechanisms to allow farmers to sell their water rights, either to other farmers who could better utilize them, or to other sectors.[15] In effect, having this option would establish a floor on the incomes of farming families, for they would have the option of receiving an annual payment for their water rights in lieu of using the water for farming. However, a limitation on this option is posed by the presence of treated wastewater in the blended water of the Valley's canal system. Therefore, a water rights market may be applicable only in parts of the northern zone of the Valley or in a future scenario in which wastewater receives tertiary treatment. The possibilities for inter-sectoral water transfers, including environmental uses, should be examined systematically.

Water rights are dimensioned according to land area (GTZ, 2003). However, it is reported that in some cases farmers are allocated water according to the needs of crops, i.e., more thirsty crops receive more water per dunum. Making water allocation adjustments to accommodate the needs of cropping patterns can encourage the planting of water-intensive crops, so it would be important to apply the rule of water allocations strictly in proportion to land area –preferably to water user groups instead of to individual farmers.

There is considerable scope for improving on-farm water management techniques as well as modifying cropping patterns. For example, in the 145,000 dunums of the Reclaimed Water Project, 20% of the farmers still use furrow/basin irrigation (Hanauer, 2005). Although most farmers in the Valley now use drip irrigation, there are techniques that hold the promise of being even more efficient in water use than drip irrigation, and more suitable for irrigation with wastewater, where it is important to isolate the crops from direct contact with water. One of these techniques is "low pressure irrigation," which is effectively hydroponic, as mentioned above. It is recommended that pilots be carried out with investments and training in low-pressure irrigation, in order to better evaluate its potential. If investments in low-pressure irrigation were financed by ACC, investment recovery could be practically guaranteed through higher irrigation tariffs.

One of the most important steps to improve the efficiency of water use would be to continue and strengthen the efforts to form water user associations. Although "by mid-2004, 46% of the irrigable area in the Jordan Valley will be covered by water user associations, representing 50% of all farmers in the area" (GTZ 2003), they still do not have a firm legal basis. Rules for government management and allocation of bulk water to the associations, and training of the association members in irrigation management, are also priorities. The national water strategy states, "pilot irrigation areas shall be designated to test the workability of Participatory Irrigation Management (PIM), where farmers will assume the responsibility of water delivery to their farms." However, the experiences of GTZ activities indicate that farmers in the Valley are ready to move beyond the pilot stage, but the appropriate legal and administrative frameworks still have not been fully articulated.

Water user associations formed to date have three forms: Water Committees, Water Councils, and Cooperatives (GTZ, 2003). Most take one of the first two forms, but only cooperatives have a legal basis. There is a need to develop legislation to support Water Committees and Councils, to ensure their sustainability and give them the authority to act against transgressors and manage funds.

Other areas that require strengthened policies and programs include:

- Additional reforestation of wadis to reduce sedimentation. This problem is reducing the usable lifetime of dams and jamming drip irrigation equipment. It is a rule of thumb in watershed management that most of the erosion problems arise from 10 percent of the watershed, so priority

[15] If water rights markets existed, in the long run, it is not inconceivable that some irrigation rights could be purchased for environmental purposes, such as the protection of the Dead Sea.

areas could be defined and reforestation –with community participation—could be undertaken in those areas. The slopes around Tafila and surrounding the King Talal Reservoir demonstrate that reforestation is feasible, but community involvement is essential in order to reduce the threat of forest cutting for fuelwood and the danger of goats eating seedlings.

- Managing desalination. Many farmers are installing their own on-farm desalination devices (using reverse osmosis), and the more that desalination proceeds, the greater will be the issue of disposal of brine. A policy is needed for brine disposal. Inland disposal options are costly (Ahmed, 2000), and trucking it to the sea may be the most viable option, but the issue warrants careful analysis and a policy should be developed.

- On-farm drainage. This is an area that has not received sufficient attention. On-farm drainage structures apparently are often inadequate, and lack of drainage is contributing to increasing salinization of soils. In addition, it may be necessary to set aside more water specifically for the purpose of soil washing, which could have implications for the total amount of irrigable acreage. It is recommended that a policy for irrigation drainage in the Jordan Valley be developed.

- Infrastructure improvement. This topic has not been investigated in the time available for this study, but there are informed reports that the aging irrigation infrastructure requires extensive rehabilitation in some respects. Again, a policy is needed in this area.

## 6.5 ISSUES IN IRRIGATION WITH WASTEWATER

There are 19 wastewater treatment plants in Jordan. Not all of them always comply with Jordan's Wastewater Standard JS 893/2002, which establishes permitted limits for contaminants in water discharged to wadis and water bodies (JVA and GTZ, 2004). In addition, as noted, apparently untreated household and livestock wastes from rural areas and small towns make their way into the King Talal Reservoir.

Standard 893/2002 allows treated wastewater to be used for irrigation if the effluent of the treatment plant complies with Table 3 of the Standard. However, Article 4.3 of the Standard states: "it is not permitted to dilute or mix reclaimed water discharged from wastewater treatment plants with pure water intentionally to comply with the requirement set in this standard." Therefore, at present there is no standard for blended water (JVA and GTZ, 2004).

It is recommended that a new set of standards be developed for use of treated wastewater and blended water in agriculture, and that a framework be established for the kinds of irrigation technologies appropriate to each grade of water quality. Because of the variation of water quality by zone within the Jordan Valley, and the importance of food safety standards mentioned above, it would be worthwhile to issue guidelines as the types of crops and production technologies in each zone that would be consistent with food safety requirements. In short, a comprehensive policy for crop cultivation with treated wastewater is needed that will give priority to food safety and marketing standards. This policy should take into account existing international and Jordanian standards and regulations.

Relevant international standards include those of FAO (1985) and WHO (1989), plus Directive 93/43/EEC on hygiene of foodstuffs, Regulation No. 466/2001 on maximum levels for certain contaminants in foodstuffs, and Regulation No. 2092/91 on organic production. In addition, there are European rules for particular vegetables, and private standards such as Eurepgap, the International Food Standard, and the standards of the British Retailer Consortium.

The relevant Jordanian laws are:

- Administrative Organization Regulation for the MoWI No. 54/1992.
- Jordan Valley Development Law No.19/1988 amendment 30/2001.
- Water Authority Law No.18/1988 amendments 16/1998, 62/2001.
- Law of Agriculture No. 44/2002.
- Environmental Protection Law No.1/2003.
- Public Health Law No. 54/2002.
- Underground Water Control By-Law No. 85/2002.

The relevant Jordanian Standards are:

- Reclaimed Domestic Wastewater Standard No. 893/2002.
- Industrial Wastewater Standard Specification No. 202/1991.
- Sewage Sludge Use in Agriculture Standard No. 1145/1996.
- Drinking Water Standard No. 286/2001.
- Standard on Sampling of Fresh Fruits and Vegetables No. 1239/1999.
- Fruits, Vegetables and Derived Products, Decomposition of Organic Matter Prior to Analysis, Wet Method, Standard No. 1246/1999.
- Fruits, Vegetables and Derived Products, Decomposition of Organic Matter Prior to Analysis, Ashing Method, Standard No. 1247/1999.

Wastewater reuse is also permitted according to Islamic Law (JVA and GTZ, 2004), according to the Judgment regarding Purifying Wastewater, Fatwa, The High Council of Islamic Scholars, Saudi Arabia, 1978, and Edict Number 64 issued on October 25, 1978 (25/10/1398 lunar Hijara calendar).

Farmers' representatives should be involved in developing the policy for irrigated with reclaimed water, and the policy should be widely disseminated. Most farmers using water from the King Talal Reservoir report problems with water quality, from bacteria and bad odors to algae that clog drip pipes (JVA and GTZ, 2004). However, most also have no information regarding nutrients in irrigation water, and even those that have such information do not use it in their fertilization plans.

Systematic water quality monitoring needs to be carried out and the results thereof made public knowledge. The existing published data are not entirely consistent, owing to fluctuations in water quality by season and by zone. Results published in Hanauer (2005) show fairly significant problems with water contamination, but the baseline survey of bacteriological loads on crops showed a total absence of salmonella on crops, E. coli present only once (on mint), and yeast and molds in higher counts only on vegetables with soil contact. According to the Royal Scientific Society it is unlikely that any of these results have a significant effect on human health (JVA and GTZ, 2004).

Baseline analyses of irrigation water showed a total absence of intestinal Helminth eggs but that not all samples comply with WHO regulations for unrestricted use. The results were taken in a cold rainy December (2003), which could have biased the results in a favorable direction. Analysis of water sampling for 40 locations in the King Abdullah Canal, dams and reservoirs, springs, wells, wadis, and the South Ghors was carried out in 2003, and the results were compared with FAO guidelines for irrigation. The results revealed the need for moderate or severe restrictions on irrigation, as a consequence of water quality problems, in at least some irrigation areas with respect to salinity, sodium, chloride, boron, pH values, bicarbonate, and nitrates, with marked seasonal variations.[16]

[16] PA Consulting Group and EcoConsult (2003).

# 7. OTHER AGRICULTURAL POLICY ISSUES

## 7.1 ASPECTS OF AGRICULTURAL CREDIT POLICY

To date ACC has not been involved at all in agricultural marketing, yet it could play a vital role in promoting high-value agricultural exports. It would be important to try to involve ACC in this area, particularly in providing export credit. Equally, it could participate in financing schemes for more efficient irrigation, especially low-pressure irrigation.

At the same time, ACC has structural and strategic issues that need to be addressed. Its management has prepared a proposal for giving ACC administrative autonomy, which is very important for the long-term viability of a financial institution. This proposal should be reviewed and revised as needed, and put into effect. As part of the transformation of ACC, it would be valuable to create a special unit that works on "preparing the demand side" for credit, i.e., working with farmers and agro-marketers to develop cost accounting and business plans, and train them in better credit management, before loan applications are made. The Government could subsidize the operations of this unit. The National Economic and Social Development Bank of Brazil has used this approach with great success, and the arrearage on its loan portfolio is less than that of the rest of the Brazilian banking system. ACC currently has an arrearage of about 25 percent of its loans, which means that under the present approaches regular recapitalization by the Government is required.

With an autonomous ACC, the country will need an explicit risk management policy for agricultural finance, in recognition of the undoubtedly higher risk content of agricultural loan portfolios. Different countries have different approaches to financing this "risk premium," from recurring Government subsidies (Jordan at present and many other countries), to an implicit tax on all borrowers (Panama), to an implicit tax on borrowers and savers (Colombia). One issue is how to make the subsidies consistent with incentives for sound portfolio management. For example, it would be possible to subsidize a stated percentage of loans to agriculture, by any financial institution, on the basis of loan amounts recovered and excluding loans over JD 100,000.

Exploration of the issues involved in improving ACC's operations is beyond the scope of this paper, but the operational point is that there may be an opportunity to get ACC more involved in export marketing and irrigation improvement, in exchange for structural changes and modifications in the lending approach of the institution.

## 7.2 AGRICULTURAL EXTENSION

By all accounts, the public sector agricultural extension system is weak. It may have been fatally debilitated in the eyes of farmers when, in the early 1990s, extension agents were used to enforce Government decisions on cropping patterns. The irrigation advisory service appears to be more effective, at least to a degree.

The main objectives of the Irrigation Advisory Service are:[17]

- To assist farmers to increase on-farm water use efficiency;
- To assist farmers in determining water requirements and the most appropriate;

[17] Ministry of Water and Irrigation and Jordan Valley Authority (2001), p. 4.

- cropping patterns for their circumstances;
- To assist farmers in scheduling irrigation;
- To assist farmers in setting up a record system for agricultural practices;

To this list should be added facilitation of the establishment and training of water users associations.

The Irrigation Advisory Service found that providing better information to farmers on crop water requirements and irrigation practices on 18 farming units permitted water savings of 8% to 47% and increases in crop production from 4% to 23%.[18]

In the Jordan Valley the extension service and irrigation advisory service should be merged, and they should provide farmers with information on linkages to markets and agro-processing industries, and advice on farm management, as well as advice on cultivation techniques and water management. Integrated pest management techniques need to become a major thrust of the extension service, to reduce the dependence on agro-chemicals. In addition, in the Uplands, minimum-till and no-till techniques and methods of utilizing vegetative ground cover need greater exploration and dissemination, especially in areas subject to significant wind erosion.

A fundamental institutional problem in these services is one of distorted incentives for performance. The main incentive for extension agents is to please their superiors in the bureaucratic hierarchy, not necessarily to satisfy the clients the farmers. Alternatives that can be considered include arranging for farmers associations (including water user associations) to hire private extension agents, and have the government pay part of the costs of doing so—all the costs at the beginning and then a progressively lower share of the costs. This approach has been adopted in a number of countries, including Estonia and lander in the former East Germany.

Another approach is to merge extension with research in a participatory approach. This has been successful in several places.[19] Farmers effectively become extension agents under this approach. The KAFA'A project has shown the value of demonstration farms (in both the Jordan Valley and the Amman-Zarqa Basin). This approach can be continued and extended to the use of farmers' own fields for demonstrations, under arrangements for nearby farmers to visit once a week to discuss issues encountered on their farms, i.e., move in the direction of the FAO's successful farm field schools. Whatever the approach finally adopted, it will be important to review and reformulate the national agricultural extension policy.

[18] Op. cit., p. 5.

[19] For example, the international center CIAT, in Colombia, pioneered the approach of Local Agricultural Research Committees (CIALs), and it has been adopted in seven other Latin American countries now. For a full review of this experience and the lessons from it, see J. A. Ashby et al., 2000.

# 8. SUMMARY OF PROPOSED POLICIES

The foregoing review of issues suggests that there is an urgent need to carry out a number of key policy reforms in the areas of agricultural marketing, agricultural labor, water management, and other areas. Those reforms are suggested in this section, accompanied only by very brief comments since the background and basic reasoning for the reforms have been set out in the preceding sections.

Suggested priorities for each policy reform are indicated in parenthesis, the highest being (I) and the lowest (II). However, many priority II reforms are also important, and some are put in those categories simply because they will take longer to formulate. It is stressed that the priorities, and the suggested reforms themselves, are preliminary, and the final decisions on their adoption should be made by others who will be in a better position to do so.

## 8.1 AGRICULTURAL MARKETING POLICY

### 8.1.1. IMPROVE THE INCENTIVES REGIME FOR AGRICULTURAL MARKETING

- Abolish the requirement that all sales of fresh produce go through municipal markets, allowing exceptions for exports and for direct sales to retailers and the public (I).
- Eliminate the market tax of 4%, leaving in place the 4% sales tax and the commission fee (I).
- Reduce the tax and commission rates for cut flowers to the level of rates for fresh produce (I).
- Implement a cost-sharing arrangement for to cover half the cost of trial export shipments, of new products and for new markets in the case of existing products (II).
- Support the reestablishment of farmers markets in Amman and major towns (II).

### 8.1.2. IMPROVE MARKETING CHANNELS AND FOOD QUALITY

- Develop, jointly with producers and exporters, a national agroexport strategy with specific policy measures to promote exports, improve the entire export marketing chain, and ensure that quality requirements are met (I).
- As a part of the agroexport strategy, provide a Government (or donor) guarantee of airfreight space on regular flights for a transition period of about three years. With growth of agroexport shipping volumes, the guarantee could be discontinued. Consultations should be carried out with JEPA to determine volumes and the most appropriate route(s) for the space guarantee. The guarantee of space should be accompanied by a requirement that producers pay a percentage of the shipping fee when reserving space, and that this percentage would be forfeited in the event of not using the space without sufficient advance notification (I).
- Develop and implement a plan for partitioning the cold storage facility at Queen Alia Airport so that it will be economic to turn it on for small shipments of fresh produce and to vary the temperature in different partitions to meet the differing requirements of various crops. Concomitantly, develop a policy of having produce security inspections carried out within the facility (I).
- Continue the program of taking producers to agricultural trade fairs in other countries (I).

- Seek international accreditation for national laboratories that test for chemical residues, pathogens and heavy metals (I).
- Develop and apply a national set of food safety standards (I).
- Develop and apply procedures for regular testing of produce for contaminants and for informing farmers of the results (II).
- Also as part of the agroexport strategy, lease hub space, perhaps through JEDCO or JEPA, in Maastricht or another suitable European location, and have it staffed by an experienced sales agent, perhaps contracted by JEPA. Through this agent, JEDCO or JEPA could assist Jordanian exporters and potential exporters in the development of enterprise export plans and transportation arrangements, as well as in forging links to buyers (II).

#### 8.1.3. IMPROVE FARMER CAPACITY TO MEET EXPORT QUALITY STANDARDS

- Carry out a pilot project to explore the option of low-pressure irrigation (distinct from drip irrigation), in which the plants are cultivated in a hydroponic (aquaponic) environment. System costs could be recovered through increments to water charges (I).
- Legislation should be put in place to ban the use of polystyrene packing materials, on grounds of their environmental damage and lack of acceptance in many external markets (I).
- A Jordanian *pre-certification entity* should be established to work with farmers to bring their production and product handling practices up to standards prior to inviting the international CB to carry out an audit. The entity should be private and fee-based, but the Government should subsidize part of its work for smaller farmers, especially the part leading up to the first international certification. Perhaps JEPA could take on this role of a pre-certification agency, with appropriate institutional strengthening (II).

### 8.2 AGRICULTURAL LABOR POLICY

- Carry out a specialized and detailed training needs assessment study for the agricultural sector in Jordan. The study should analyze the current situation in the agricultural sector and the other supporting sectors. Based on this analysis, the study should determine and propose the proper training programs at all levels in accordance with labor market requirements (I).
- Develop and implement a program of training and awareness-building for safe handling of agrochemicals on the farm and safe disposal of agrochemical wastes (I).
- Develop an agricultural labor policy, covering the areas of training for specialized skills in agriculture; the participation of women in rural labor markets; health and safety conditions for rural labor; and juridical security for farm workers and owners from other countries (II).
- Develop and implement a vocational training curriculum for agriculture and food sciences, with materials on the skills needed in a more specialized, export-oriented agriculture (II). At minimum those materials should include:
  - Special training on irrigation technologies particularly on new irrigation techniques that improve water management efficiency and meet the strategic objectives and milestones included in the different water and agricultural polices adopted by the government.

- Skills in plant protection, chemical handling and application, proper use of machinery, proper packing and packaging, sorting and grading, cold storage techniques, shipping and forwarding.
- Cost accounting, record keeping, and farm management.
- Knowledge of how export markets operate and techniques of obtaining market information and establishing market contacts.

- The latest technology in delivering training in workplaces such as farms and packinghouses should be utilized. A continuous process of evaluation of trainers and courses by participants should be an integral part of the training programs.
- Develop a policy to give non-Jordanian agricultural workers and farmers more secure long-term residence rights and hence incentives to invest in productivity improvements in the plots of land that they are working on their own (II).

Other aspects of farmer training are addressed below in suggestions for the agricultural extension service.

## 8.3 WATER MANAGEMENT POLICY FOR AGRICULTURE

- Develop and implement a plan to phase out the electricity subsidy for agriculture and to increase significantly irrigation tariffs, both for gravity-fed systems and well water (I).
- Develop a plan for either well buyouts in the Uplands or a structured water rights market that would enable agricultural well owners to sell their water use rights for non-agricultural uses (I).
- Develop transition plans for farmers in the Jordan Valley who are growing crops with a low value per cubic meter of water, with provisions for financial assistance to change their cropping patterns and technologies of water use (I).
- Develop and adopt a policy to put all Jordan Valley irrigation in the hands of water users associations, and draft new legislation to recognize the water use rights of farmers, the rights and responsibilities of the associations, and the obligations of government in delivering bulk water to the associations (I).
- Develop, jointly with farmers' representatives, a new and comprehensive set of standards for irrigating with treated wastewater, along with indications of which kinds of crops can safely be grown with each category of wastewater and blended water, under which kinds of irrigation technologies (II).
- Carry out pilot investments in low-pressure irrigation, with water tariffs set at an appropriate level to recover costs of the investments (II).
- Develop a program for afforestation of critical areas in major wadis, in close consultation with communities in the areas (II).
- Develop a comprehensive program for improving on-farm drainage and soil washing to reduce saline content (II).
- Develop a plan for disposing of the brine that results from on-farm desalination activities (II).

## 8.4 OTHER AGRICULTURAL POLICIES

- Develop a program to involve ACC in financing agricultural marketing activities, along with a plan to make the institution autonomous and improve its portfolio management for agriculture. Include in the plan regular government support for the risk premium in agriculture, in a form that encourages better portfolio management rather than in the present form of recapitalizing the institution at intervals (II).
- Develop a new approach for agricultural extension that is more participatory and which provides stronger incentives for extension agents to respond to farmers' own priorities and problems (II).

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