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Jordan Valley Authority
Hashemite Kingdom of Jordan

THE JORDAN VALLEY

Dynamic Transformation: 1973 - 1986

A Study Prepared
by

TECH INTERNATIONAL, INC.

in association with
LOUIS BERGER INTERNATIONAL, INC.

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PREFACE

This report was prepared by an evaluation team composed of the following individuals:

Dr. Steven C. Shepley (Chief of Party); Marcel Bitoun and Drs. David Gaiser, Hind Nassif and V. Schoen

The findings and conclusions contained in this final evaluation report are based on field investigations conducted in Jordan during the period September 29 through December 31, 1987.

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EXECUTIVE SUMMARY

The Jordan Valley
The Dynamic Transformation - 1973 to 1986

Beginning in the early 1960's, the equivalent of $US 773 million has been invested by various donors and the Government of Jordan in the integrated rural development of the Jordan Valley. The USAID has contributed 45 percent of this global investment input (Section VI).

The internal rate of return of the irrigation system investments is 17 percent. This is an exceptionally favorable return when compared to usual rates of return for irrigation projects of 8 to 12 percent (Section III (B)) and the marginal efficiency of agricultural capital estimates of 10.6 percent in Jordan Valley agriculture (Section III (B)). The principal explanation of the favorable rate of return is the rapid transformation (Sections I and II) of Jordan Valley agriculture from subsistence production to dynamic market-orientation, using advanced technology (drip irrigation, plasticulture, and improved seeds, pesticides, and fertilizers). Use of these inputs has increased yields four to six fold on technologically advanced farms and improved agricultural productivity from a weighted average 1 ton per dunum for vegetables and 0.68 tons per dunum for fruits in 1973 to 1.82 tons per dunum (vegetables) and 1.60 tons (fruits) in 1986. (Sections I and II) During this same period, mean agricultural income grew from JD 22 per dunum for vegetables and JD 194 for fruits in 1973 to JD 218 (vegetables) and JD 455 (fruits) in 1986 (Sections I & II). The highly favorable internal rate of return on Jordan Valley irrigation investments resulted from a shift in the farming system from lower-value field crops to higher-value horticultural and tree crops and farmer-adoption of advanced agricultural technology.

The transformation of the Jordan Valley agricultural sector from subsistence to a dynamic market orientation with corresponding rises in productivity and income has been a social magnet. From 1973 to 1986, there was a net inmigration to the Valley. The average natural population growth rate during this period was 3.8 percent per annum. The actual total growth rate was 5.21, for a net annual inmigration rate of 1.41 percent. Between 1973 and 1986, the population of the Jordan Valley grew from 60,000 to 124,000 people.

The reasons for the net inmigration seem clear. From 1978-1986, the weighted mean per capita income increased from JD 270 to JD 426 (the 1973 estimate is not available). In 1979, the national per capita agricultural GDP was JD 188; in the Jordan Valley, the GDP was JD 294. In 1986, the per capital agricultural GDP in the Valley was JD 505, compared with the national average of JD 415. Thus, rural incomes in the Valley have been consistently higher than in other rural areas of Jordan. The income improvement potential of the Jordan Valley, being greater

than other rural areas, has been a positive stimulus of the inmigration process.

Improving income trends have lowered the percentage of the Valley's population below the poverty line (assumed to be JD 150 per capita per year) from 22 to 20 during the past 8 years.

The inmigration of people to the Jordan Valley in search of greater economic opportunity has also created a corollary demand for goods and social services to support the population influx. This growth in corollary demand has produced structural changes in the regional economy. From the early seventies to the present, the economy of the Jordan Valley has progressed from a primarily single sector economy (agriculture) to a more diversified multi-sectoral economic structure wherein the output of non-agricultural services and some goods has accounted for an increasing share of the regional GDP. In 1978-1979, agriculture supplied 51 percent of the regional GDP, compared with agriculture's contribution of 5 percent to the national product. By 1986, agriculture's share of the regional GDP had fallen to 35 percent, compared with the 7.2 percent agricultural contribution to the national GDP (Section V (a) and (b)).

Along with structural changes in the regional economy of the Jordan Valley, there have also been significant parallel changes in the regional employment distribution during the past 8 years. In 1978/79, males comprised 72 percent of the total Jordan Valley work force; 31 percent of these were employed in the agricultural sector, including the majority of hired farm workers in the Valley. In the same year, females comprised 28 percent of the agricultural work force, of which 96 percent were unpaid family agricultural labor (Section V (a) and (b)).

By 1986, the percentage of the male work force in agriculture had declined to 43 percent. For females, the decline was even more dramatic from 96 to 24 percent. Three significant trends in both male and female employment between the two points in time include: (1) the virtual disappearance of native Jordanian males from the hired agricultural labor force by 1986; these were replaced by migrant Egyptian workers; (2) the shift in female employment from predominantly unpaid family agricultural labor in 1979 to paid employment in education, health, commercial, and service professions outside the home by 1986; and (3) the growth in demand for wages among females still working in the agricultural sector by 1986. Between 1978/79, the incidence of non-agricultural employment in the Jordan Valley increased by an aggregate 100 percent, with public sector service employment rising by 78 percent and private commercial employment increasing by 163 percent. During this period, the number of private commercial businesses in the Jordan Valley increased from 489 establishments to 938, an increase of 92 percent in 8 years (Section V (a) and (b)).

A key component of the Jordan Valley Authority's integrated rural development strategy was the inclusion of provisions for social infrastructural development (education, health, public utilities, housing, communications and town planning). Both public and private sector institutions have played pivotal roles in the social service development of the Jordan Valley.

The infrastructural and social service facilities installed in the Jordan Vall from 1973 to 1986 provide levels of service which are at least equ to, and in many instances, exceed those in the rest of Jordan. For example, in 1986, the student teacher ratio in the Valley was 1:21; the national average was 1:25. The number of students per classroom in the Valley was 26.5, compared with the national average of 33.3. In health, there were 2.16 clinics per 10,000 population in Jordan; in the Valley, the ratio was 2.92. For pharmacies, the national average was 1.81 per 10,000 population, while for the Valley, it was 3.39. (Section IV). In 1986, the number of doctors per 10,000 population in the Jordan Valley was 8.89, while for the country, the ratio was 7.52. (Section IV)

Other illustrative indicators of social service development impact include housing spatial density. This indicator increased from 6.2 m2 per person in 1973 to 14 m2 in 1986. In 1973, 10 percent of the residential dwellings in the Jordan Valley had access to potable water and electricity. By 1986, 100 percent of the homes had potable water and 90 percent were electrified (Section V). The number of telephones per 10,000 population in the Valley is currently 66.5 versus the national average of 65.8.

Comparing the time series trends of social infrastructural density in the Jordan Valley from 1973 to 1986, the availability and density of services generally expanded more rapidly than the general population growth for the region (Section I).

The provision of agricultural services in the Jordan Valley has also advanced in concert with advancement in social services. The cutting edge of the agricultural transformation process has been the growth and proliferation of public and private sector institutional credit and input supply facilities. Currently, there are more agricultural credit and input outlets per unit of land area in the Jordan Valley than in the other farming areas of the rest of Jordan. The use of credit and input supply has been expanded by agressive extension efforts. These were fueled in part by the highly successful Jordan Valley Agricultural Services Project and partly by formalized extension programs delivered through parastatal organizations and private sector outlets (Section IV (a) and (e)).

An analysis of social dynamics, contrasted with institutional dynamics, provides a true measure of developmental impact on changes in life quality. In the Jordan Valley, indicators of social change show that society is becoming less tradition bound, more outward-looking and

placing educational achievement and material progress above more traditional tribal values of family ties and conventional male/female roles in the socio-economic order (Section IV).

In the early sixties, most marriages in the Jordan Valley were patrilateral parallel cousin marriages, the traditional marriage arrangement within the patrifocal patrilineal tribal structure found historically in both the east and west banks of the Jordan river. The primary role of women in society was to perform domestic chores of the household and to produce male heirs. The assessment team's random survey of 40 households throughout the valley showed a significant shift in outlook toward the traditional marriage structure is in progress. Over one third of the marriages in the sample were exogamous outside the tribal lineage. The role of women during the past twenty to twenty five years is shifting noticeably from domestic servant and child bearer to a more integrated and fuller participant within the socio-economic structure (Section V(b)).

Presently, there are more Valley females (61.3 percent of the student body) attending school than males. Fifty-five percent of the parents sampled wanted university educations for their sons; fifty-seven percent of the sample desired this level of attainment for their daughters as well. In a single generational span, the average number of years of education for women increased 130 percent, compared with the male average of 91 percent. The sample showed that female literacy during this same generational span increased from 48 percent to 95 percent, while for men in the sample, the rise in literacy from the parent to offspring generation was from 70 to 100 percent (Section V (b)).

Jordan Valley women are spending more years in school, greater numbers are leaving the home for paid professional employment than ever before, and the mean age of marriage in the Valley has increased from 17 to 19 years. This trend shows that there is an increasing tendency of Jordan Valley women to delay marriage to further educational and career goals (Section V(b).

The final indicators of the evolving emergence of women as fuller participants in the Valley's socio-economic structure are the declining female fertility rates (9.97 live births per capita in Jordan vs. 7.97 in the Valley) and rising incidence of contraception practice (23 percent of the sample). Females are having fewer children in preference for educational and career advancement (Section V (b)).

Commensurate with changes in social structures and educational effectiveness, the sample survey also manifested other positive indicators of life quality changes that reflect favorably on the impact of improving health care and rising incomes in the Jordan Valley. In 1961, the life expectancy index for Jordan was 45.8 for males and 46.5 for females. By 1987, the national index had risen to 67 for males and 71 for females. In the Jordan Valley, the index is five percent higher

than the national average. For males the index currently stands at 70 and for females, 75 (Section V (b)).

Other health-quality indicators offer equally convincing evidence of the effectiveness of health services in the Jordan Valley. In 1961, the infant mortality rate for Jordan was 151 per thousand live births. In 1986, the national average for Jordan, including the major urban areas of Amman and Irbid was 60.4. In the valley, which is predominantly rural, the present rate is 55. While statistics for other urban areas of Jordan are not available, it is believed that the infant mortality rate for these areas is lower than that for the Jordan Valley (Section V (b)).

The morbidity incidence for the Jordan Valley is 17 per thousand versus a national average of 18 per thousand. The combined effects of declining morbidity, infant mortality, and rising life expectancy have pushed the average family size from 5.7 in 1973 to 7.5 in 1987 (Section V(b). As the population is expanding through the impact of improving life expectancy declining morbidity, and lower infant mortality, the structure of the demographic profile is shifting toward the lower end of the age spectrum. In 1973, the percentage of the population under 15 was 53.2. By 1987, the percentage had climbed to 59 percent (Section V (b).

The composite picture drawn by these social change indicators is that of a Jordan Valley society that has advanced materially, socially, economically, intellectually, and physically over the past two decades. This mosaic of social evolution offer further testimony to the soundness of the integrated rural development approach.

The only dark clouds hanging over this bright picture of Jordan Valley development are external marketing problems caused by domestic market inefficiencies, expanding production of certain horticultural crops in the presence of falling export demand and prices (Section III (a)).

Domestic demand is both price and income elastic due to the thinness of the population base relative to the total supply of horticultural commodities. Traditionally, Jordan was the major supplier of winter vegetables to the entire regional Arabian Gulf area. Over time, aggressive entrants into the regional market, namely Turkey, Cyprus, and Greece, with lower prices and higher quality have captured an increasingly widening share of Jordan's traditional markets. From 1983/1984, Jordan's volume of exports to the traditional markets has fallen more than 30 percent. This sharp decline in exports has taken palce in the presence of increasing productivity and output from the transformed agricultural sector. (See Section III (a)).

The net result of these structural changes in market dynamics is a widening domestic supply and demand gap for key horticultural commodities (tomatoes, eggplant, squash, and cucumbers). The gap has depressed farm-

gate prices, reduced farmer profit margins, and created farmer liquidity problems as they find it increasingly difficult to meet debt-service obligations incurred to finance advanced agricultural technology (plasticulture, drip irrigation, etc.) (Section III (a)).

The key to overcoming Jordan's current marketing difficulties lies in the implementation of an integrated strategy targeted upon: (1) information gathering, market research, and market information dissemination; (2) encouraging more competitive farmer-oriented marketing outlets; (3) promoting better efficiency in export markets through private/public sector competition; (4) grades and standards development to insure production and transport of internationally acceptable produce; (5) policy review and coordination to insure that policies such as retail price fixing and cropping controls do not constrain market development efforts (6) some possible marketing fee and exchange rate readjustments to enhance the price competitiveness of Jordanian produce; (7) crop diversification to encourage production and consumption of exotic produce (Section III (a)).

The assessment teams's supply and demand analysis for horticultural produce, using various assumptions of GDP and population growth rates and income elasticities of demand, indicates that domestic consumption growth in Jordan could close the supply/demand gap between 1990 and 1995, assuming that the current volume of horticultural crop exports (200 thousand metric tons per year) is maintained. To do this, Jordan will have to stabilize its regional market share and achieve some modest expansion of exports to E.E.C. and the Gulf markets (Section III (a)).

A corollary issue to the marketing bottleneck is agricultural resource use efficiency. The assessment team's production function analysis of Jordan Valley agriculture showed that farmers are over using water, fertilizer, and pesticides by 10 to 20 percent. This overuse or "inefficiency" is caused in part by pricing policies and partly by lack of research-based information concerning optimal dosage and treatment levels. The team calculated the marginal revenue productivity of water at 20 fils per cubic meter; the present water user charge is 3 fils.

Improving the efficiency of agricultural input use on Jordan Valley farms would allow more to be produced with less. An improvement of production efficiency would lower production costs, increase net producer revenues, and help offset the effects of marketing constraints discussed earlier.

This objective can be accomplished by developing crop specific and integrated input application recommendations in concert with market-driven input pricing mechanisms (e.g. water), and technological improvements such as drip irrigation and better systemic and on-farm water management. The need for such an approach has never been greater, given domestic and foreign marketing constraints and their depressing effects on farm revenues.

I. INTRODUCTION AND SETTING

A. The Agricultural Transformation Model

> Plasticulture cultivation systems have dominated investment and production trends since the late 1970's, fueling a fast and extensive transformation of an agricultural area that remained virtually unchanged in the previous several hundred years.(Rami Khouri, 1981.)

The experience in the Jordan Valley is a classic example of dynamic agricultural transformation ([41] Stevens). The model states that changes in agricultural output occur through integrating a whole range of modern science and technology with the agricultural production process. This integration is the source of improving agricultural productivity, the production of more output with fewer resources. In the process of acquiring new technology, the source of agricultural inputs shifts from traditional peasant villages to external suppliers.

The shift to externally produced inputs in the Jordan Valley has taken place because improved science-based technology has enhanced both productivity and profitability (improved seeds, more effective fertilizers, better farm equipment, etc.) and because the new inputs have been supplied in larger quantities and could be financed through credit at lower cost than from traditional money lenders and from banks. In the process of acquiring and using improved technology, small farmers in the Valley have become increasingly dependent on and linked with the rest of the national economy.

The transformation from subsistence to a market-oriented agriculture in the Valley is associated with higher productivity and increased specialization.

The agricultural transformation process was catalyzed by continuously changing disequilibrium in supply and demand conditions in both input factor and product markets.

On the product demand side, major disequilibriating changes included opening up of export markets, transportation improvements (farm-to-market roads, lower transport costs, etc.), and improving market efficiency between the farm gate and the consumer. The outcome of these changes has been, until recently, higher prices paid to farmers and expanded volumes of quantities sold at given market prices. Farmers in the Valley, then, have faced in a dynamic agricultural environment, the need to continuously evaluate changing conditions and to incorporate newly available opportunities into their farming systems. Because of constant readjustment to changing conditions in this dynamic technological and economic environment, modern market-oriented farmers in the Valley can

be said to be economically less efficient in the allocation of their resources than farmers in traditional, subsistence agriculture. The latter achieve technological and economic equilibrium but are beset with constant returns to constant inputs as they have managed to equate their input levels with productivity learned through years of reiterative trial and error experience. Valley farmers have emerged from the technical and economic equilibrium trap of subsistence agriculture and show considerable willingness to test and adopt new yield-increasing technologies in response to price signals and growing demand for agricultural products that improving technology and expanding markets have generated.

Economic efficiency in the context used here is not a negative factor but a descriptive measure of input/output equilibrium. The introduction of new technology and market growth in dynamic agriculture found in the Jordan Valley has upset the equilibrium of traditional agriculture, creating the need for a readjustment to changing conditions. It is this readjustment process that has provided the impetus for expanding productivity and income.

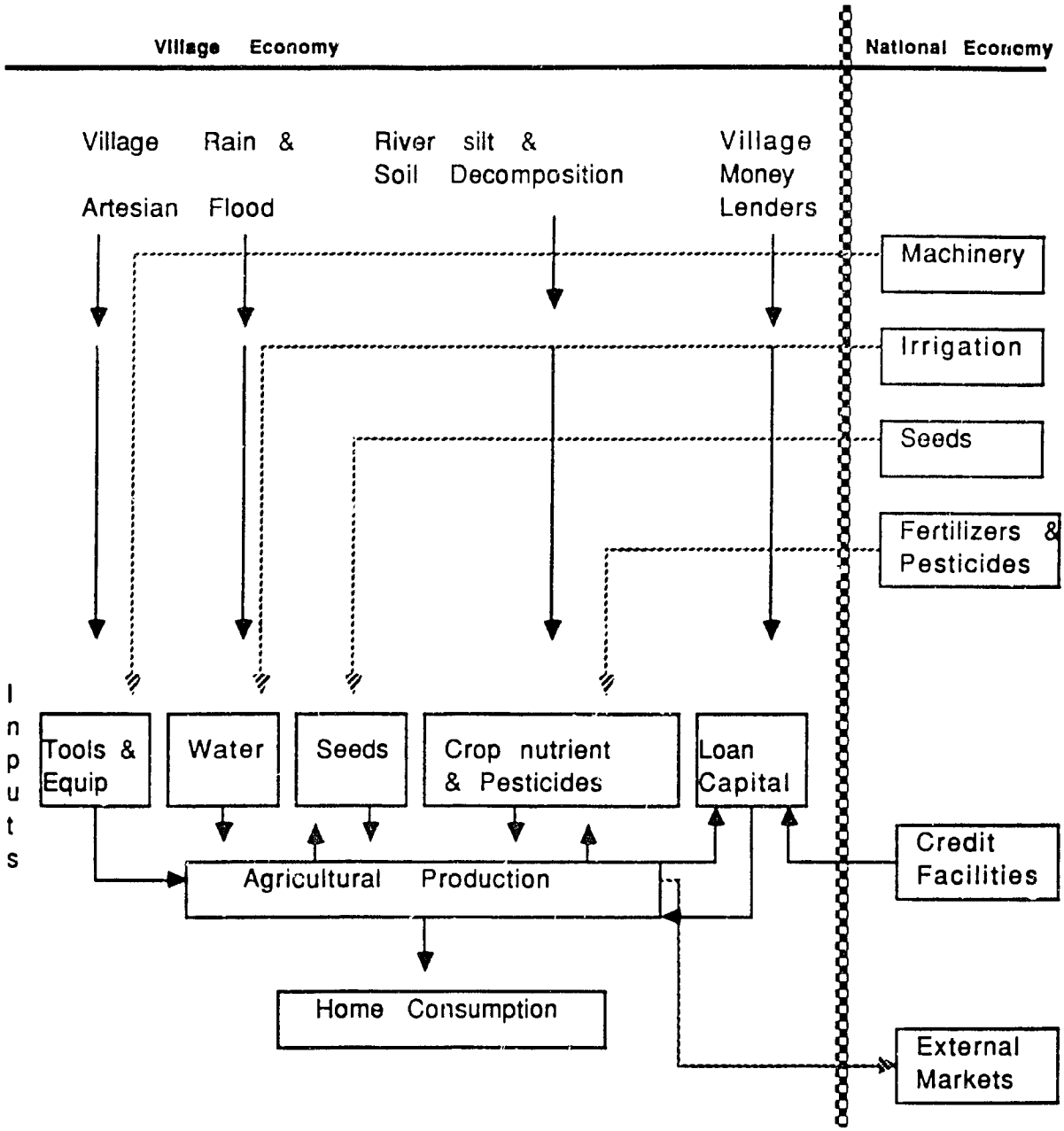
In this changing environment, modern farmers barely have time to achieve equilibrium in product and factor markets before a new set of technologies upsets the input/output balance and the search for a new equilibrium point is initiated. Thus, modern farmers achieve substantial production increases, but not always at the lowest cost or optimal input usage.

Dynamic agricultural producers of the Jordan Valley, in contrast to traditional farmers elsewhere, are continuing to expand output by acquisition and utilization of higher productivity technology. By all measures of performance, dynamic agriculture of the Valley is moving in tandem with technological transformation which allows more to be produced with less yields per unit of land area have been increasing 4 [illegible] fold; productivity per hour of agricultural labor and net farm income [illegible] en rising to levels approaching those of fully developed nations.

The linkage between agricultural transformation and the national economy are shown schematically in Figure I.1. In the dynamic process found in the Valley, traditional sources of inputs and markets (mainly the village economy) are being transformed by growing demand for improved input supply and outputs into a new set of institutional mechanisms for financing and delivering improved production factors and for marketing produce in external markets, both foreign and domestic.

Experience in the Jordan Valley is showing that increasing intensity of agricultural production per unit of land which occurs in the agricultural transformation process is also creating employment opportunities in the agro-business and non-agricultural employment sectors. There appears to be a chain reaction linkage between regional expansion of the agricultural economy, population increase from natural

Agricultural Transformation Model



Key traditional agriculture : Major input flows ⟶

Dynamic agriculture : New or greatly enlarged input flows ⇢

Figure I.1

and migratory growth, and the flow of investment funds to support growing demand for agriculturally related enterprises and non-agricultural commercial infrastructure and services. In the expansionary phase of the transformation process, new wealth has been created, which has become both the catalyst and the outcome of rising prosperity.

The core emphasis of an agricultural development strategy for accelerating agricultural production in the Jordan Valley has been to destabilize the technical and economic equilibrium achieved by small farmers in order to increase their opportunities for higher income.

The first catalyst in this process was the increase in agricultural product prices and the quantity of products demanded at set prices. This change induced farmers to increase output. Related actions to achieve this have included price subsidies, transport cost reduction through improved arteries of communication, and other actions to reduce costs in agricultural marketing systems. In the Jordan Valley, extension of yield-increasing plasticultural techniques, drip irrigation, farm-to-market road construction, and the traditional regional demand for winter vegetables produced in the valley has fueled the transformation process.

The second catalyst has been the provision of adequate low-cost, yield-increasing inputs to small farmers. Installation of relatively efficient modern input supply systems has been launched by considerable government involvement in both establishing input supply and agricultural credit institutions and in creating a regulatory and policy environment which has been conducive to private sector entry into modern input and credit delivery systems. Governmental subsidization of the Jordan Valley Farmers Association, The Agricultural Credit Corporation, and the Jordan Cooperatives Organization together with concessionary import policies with respect to agricultural inputs were the primary instruments used to strengthen and expand the public and private sector delivery mechanisms of input supply and agricultural credit.

The third catalyst has been the development and extension of new, more productive agricultural technology locally adapted to small farm conditions. Formal, informal, and private sector extension efforts were the major tools of this effort and are the cutting edges of the technological transfer process.

With the flow of more productive technology, the installation of an efficient input and credit supply system, and improvements in product marketing, the momentum of agricultural transformation process in the Jordan Valley was set in motion during the mid to late 1970's.

Inextricably linked to dynamic agricultural transformation has been a steady growth in demand and opportunity for more agricultural labor. This growth has fueled increased population inmigration to the Valley and generated a corollary demand for a wide spectrum of goods and services in

both the agricultural and non-agricultural sectors. In the presence of rising prosperity from increased agricultural productivity and income, investement capital has poured into the valley to finance both public sector services and to boost the development of commercial enterprises and private sector services supporting the agricultural and non-agricultural sectors of the Valley's now diversified economic structure.

B. The Present Situation

> The valley is changing quickly. The population is increasing, new government services are available, and new private shops are opening. Before 1972, we didn't have carpentry or steel working shops here. You couldn't change your car's oil or find a qualified auto mechanic. We had to generate electricity from small diesel motors. The way of life has changed today. Women are working in agricultural and non-agricultural jobs. New farming techniques are applied. Many private services are available; but essential social serives, such as electricity and drinking water, are the key to people's decisions to live in the valley instead of somewhere else in the country - a farmer interviewed by Rami Khouri in 1981.

The impact of Jordanian and foreign donor investment projects in the Jordan Valley since 1962 has created a rural development environment which may be unparalleled in the annals of development planning history. As such it may qualify as one of the most interesting experiences in integrated rural development even undertaken.

The major objectives of the Jordan Valley development effort have been to: (1) increase agricultural production and (2) improve the quality of life.[1] As such, development planning for the valley has adopted an integrated rural development approach that links agricultural development with social and other economic development objectives. The thrust of the integrated effort to achieve the twin objectives of improving agricultural production and life quality of valley residents has focused on:[2]

> (1) constructing the physical infrastructure for irrigated agriculture, including dams, canals, and irrigation works needed to expand the irrigated area and increase the intensity and efficiency of cultivation;
>
> (2) constructing the physical infrastructure for utilities and social services, including potable water, electricity telecommunications, housing schools, clinics, roads, etc. required to create a stable environment and to make the valley a pleasant desirable place to live in and to attract the population needed to make optimum use of the land and water resources; and
>
> (3) developing the institutional "software" needed to promote efficient management of the land and water resources to insure equitable distribution of the benefits of development.

By objective, quantitative measures, the development targets of the Jordan Valley initiative have been largely met.

---

[1] Jordan Valley Authority

[2] Quoted from The Jordan Valley Authority. The Jordan Valley Development: the Plans; the Achievements; Future Activities; Amman, February 1987, p. 1.

Table I.1
Jordan Valley Development Indicators

Indicator	1973	1979	%ch	1986	%ch
Agri. Prod. (mt/dun.)					
Vegetables	1.01	1.42	41	1.82	28
Fruits	0.68	1.34	97	1.60	19
Value per dunum					
Vegetables	22	93	322	218	134
Fruits	194	262	35	455	73
Public Sector Employment	1510	4958	228	8822	78
Commercial Employment	1049	1783	70	4690	163
Agricultural Employment	14331	28491	98	10326	-175
Per Capita Income(JD)	na	270		426	58
Population	64000	80000	25	12400	55
Schools		69		170	146
students	12000	19232	60	30813	60
teachers	na	565		1393	146
% of pop. in school	18.7	24	28	25	4
no. of Classrooms	na	828		1164	40
per 10,000 population	na	104		97	-7
av. school distance(km)	29	7	-314	1.2	-483
av. school travel(min)	34	11	-209	5	-120
Housing units	11000	na		26000	136
per 10,000 population	1833	na		2096	14
Health Clinics	9	34	277	34	0
per 10,000 population	1.50	4.25	1178	2.74	-55
Hospitals	na	na		3	
Public Doctors	na	51		75	45
Private Doctors	na	9		35	288
Public Pharmacies	na	na		31	
Private Pharmacies	na	6		11	83
Clinic av. distance(km)	5	2	-150	3.2	60
Clinic travel time(min)	17	8	-113	12	50
Public Utilities					
Potable water services (% of pop.)	10			100	900
Electricity(% of pop.)	10			90	800
Paved roads (km)	60			1600	2566
Government buildings	1			16	1500
Municipal and Village Councils	3	12	300	39	225
Banks	1			13	
Commercial enterprises	100	489	389	934	91
per 10,000 population	17	61	258	78	28

Source: (1) Dajani et al, 1980
(2) JVA. Jordan Valley Development, 1987
(3) Statistical Yearbooks
(4) Ministries of Health and Education
(5) Jordan Valley Authority raw data

The foregoing statistical trends clearly show that the agricultural and infrastructural development goals and expansion of services that these achievements represent have been largely reached. The indicators undeniably support the view that the combined impact of the integrated development package on the Jordan Valley's economy and general quality of life was significant and substantial during the 1973-1986 period. Agricultural productivity increased by 81 percent for vegetables and 135 percent for fruit crops. Agricultural revenues expanded by 890 percent (vegetables) and 135 percent (fruits).

The significant improvement in agricultural income and productivity together with inmigration of new comers to the valley has generated the demand and investment growth to fuel an expanded and diversified economy wherein non-agricultural sectors have begun to compete with agriculture for manpower and resources.

During the period under study, total non-agricultural employment grew by 428 percent. This represents a 347 percent increase for employment in the commercial sector and a 484 percent growth in public sector employment in the valley. During the same period, agricultural employment of native Jordanians declined by 39 percent over the last 14 years. Expansion and growth of the non-agricultural sectors is reflected in the 834 percent increase in private commercial establishments serving the Valley's productive and consumptive needs.

Along with rising trends toward more diversified and remunerative employment patterns, estimated per capita income in the Valley increased by 58 percent from 1978-1986. In terms of regional GDP growth, this represents a 145 percent increase during the last 9 years, or 16 percent per year. This is more than double the national average growth rate for the same period of time.

In the public service sectors, both physical and spatial access have been measurably improved. The supply of public utilities (electricity and water) and housing has expanded from serving 10 percent of the Valley's population in 1973 to approximately 95 percent in 1986. Housing supply per 10,000 population has increased dramatically from 1,833 in 1973 to 2,167 in 1986.

The growth and access to educational facilities had been equally significant. During the 14-year period, the percent of the total Valley population in school rose dramatically from 18.7 to a current level of over 25 percent, compared with the national average of 31 percent. At the same time, the student teacher ratio dropped from over 30 percent in 1980 to 21 in 1986. This is compared with the national average of 25 in 1986.

In the health sector, the growth and expansion of public and private medical facilities has increased both the breadth and depth of coverage in the Valley as reflected in the facilities density index per 10,000 population. In 1973, the index was 1.50 per 10,000 population, while in 1986, the value had increased to 2.74. The national average in 1986 was 1.81.

The distribution of doctors per 10,000 population in the Valley is currently 8.89. The national average is 7.52.

In addition to density improvementss, the spatial distribution of public service facilities has been consistently upgraded over the 14 year period. Mean school and clinic distances and travel access time have declined significantly to the point where both access and travel time have been reduced by an average 132 percent from 1973 to 1986.

This brief discussion of development indicators in the Jordan Valley suggests that socio-economic development there is significant, sustained, and impressive.

As impressive as they are, however, the indicators alone should not be taken as sole measures of program success. In isolation, the indicators represent only physical progress toward stated obejctives. They do not reflect the quality of socio-economic development or adequately address by themselves progress toward the ultimate objectives of equity and efficiency of the integrated rural development system. For this part of the assessment, a more analytical and qualitative overivew is required.

C. Scope of the Present Assessment

The scope of the present assessment is not to reiterate the well-known story of Jorday Valley development. This has been extenssively and brilliantly covered in the Rami Khouri ([24] Khouri) book, the Dajani report ([9] Dajani et al), and by the brief synopsis of development indicators discussed in the previous section. The intent of this report is to update the earlier reports concerning the pace and magnitude of development growth in the Jordan Valley and to identify and analyze specific issues related to socio-economic evolution. The paramount concern is to contribute to a better understanding of the development process and to offer useful recommendations for correcting systemic problems to enhance the potential of an already successful endeavor.

The interim evaluation of the Jordan Valley development program (Dajani et al, 1980) provides a comprehensive description of the Jordan Valley with a detailed historical presentation of its growth and development changes. This reference also supplies an integrated data base from which the many facets of development growth in the valley have been evaluated and assessed. The analysis in this report is supported by qualitative and quantitative indicators of life quality and prevailing conditions and is a highly prized reference for the present paragraphs.

Mr. Rami Khouri ([24] Khorui) has published a flourishing journalistic rendition of the same scenario, using a humanistic and narrative style to capture the essence and flavor of the Jordan Valley's incredible march from historical backwardness to the showcase of Jordan's national development effort.

The intent of the present assessment is not to reiterate these earlier references, but to assess changes that have taken place since these works were published and to identify and analyze specific critical issues which both impede and strengthen the overall effectiveness of the program.

Discussion of these issues serves to explain the agricultural transformation and rural development processes and to provide a more qualitative understanding of the equity and the efficiency of Jordan Valley development is its broadest regional context. Some issues presented herein relate to specific problems which may reinforce and inhibit further development progress. Others help to augment the assessment of Jordan Valley development that statistical indicators alone do not adequately explain. Where previously written historical and descriptive information is needed to provide a suitable setting for the analysis, appropriate references are cited from the literature rather than repeated to avoid unnecessary redundancy.

1. Development Problems and Issues in the Jordan Valley.

a) Marketing of agricultural produce.

The technical success of achieving higher production through expanding cropping areas, higher yields, and technological intensification has been dampened by the inability to market much of the produce. Many farmers have lost money, cropping areas may have declined since 1984, many agricultural loans have been defaulted upon, and government outlays for agricultural subsidies have soared. The range of marketing problems faced--quality, grading, packing, high production costs, falling prices, unfavorable exchange rates, inefficient marketing channels, and lack of strategies for establishing new niche markets--must be ameliorated before the Jordan Valley development can be considered an unqualified success.

b) Comparative pace of social development and rising agricultural production.

Social development indicators such as family size, education, life expectancy, infant mortality, job opportunities (men and women), age at marriage, etc. are compared between 1973 and 1987. Specific "pockets of poverty" and associated problems are identified and discussed.

c) Social integration.

The ways in which local residents may have been "displaced" in recent years, both from land and from agricultural jobs, and the impact of this on their quality of life, income, and social integration are evaluated. The (changing) profile of income and employment distribution of Valley residents--along urban/rural lines, and by ethnic and nationality groups--is assessed, together with changing life styles, attitudes, and community relations.

d) Employment patterns.

Several issues related to employment distribution include: (1) The relative lack of participation of local Jordanian men in the agricultural labor market; (2) the role of local women in the agricultural labor market; (3) the role of migrant workers (Egyptian) in the agricultural labor market; (4) an analysis of labor demand and supply trends for both Jordanian and non-Jordanian workers, and for both agricultural and non-agricultural jobs.

e) Crop management and water management skills are explored. This includes an evaluation of farmer willingness to alter crop mixes; analysis and examples of crop over-production; farmer profits/losses in recent years; and cost trends. Particular attention will be given to discussing the possibility that farmers are using too many pesticides, and certain fertilizers, nutrients, and water.

f) Government agricultural policies.

Cropping controls have been in place only two years, while price policies have taken various shapes over a longer period. Both the economic and institutional impact aspects of these policies are addressed.

g) Quality of government involvement in agricultural research, extension, and irrigation management.

The report addresses the ability of government to evaluate important agronomic and irrigation problems and to transfer findings to farmers. The quality, frequency, and reliability of extension services are examined. Irrigation management issues, such as the impact of distribution channel "head and tail" problems, and the need to increase the overall efficiency of the irrigation system are included in the analysis.

h) Public/private sector participation in marketing, agricultural lending, and input supply.

The report evaluates the effectiveness of governmental and private organizational involvement in (1) exports (AMPCO and private export agents); (2) credit (Agricultural Credit Corporation, Jordan Valley Farmers Association, the Jordanian Cooperative Organization, and private suppliers).

i) The availability and quality of social services.

There is an assessment of the ability of government institutions to deliver services, the appropriateness of services applied to user needs, and a comparison of average service levels with other parts of Jordan. Changes in the structure of municipal and village councils and the Jordan Valley Authority are also addressed.

j) Environmental issues.

The report provides a comprehensive analysis of pesticide use in the Jordan Valley and environmental issues related to on-farm use of this input.

k) Project investment and irrigation O&M cost recovery.

The assessment evaluates recovery of the operation and maintenance of the irrigation system. Full (or at least 'fuller') cost pricing of irrigation water to farmers is an issue explored along with the internal rate of return of the irrigation system to assess overall project worth and viability.

The impact assessment encompasses the combined and cumulative impacts of some 22 donor-financed development projects undertaken in the Jordan Valley since 1973. The impact assessment is not tied in any literal fashion to each of these projects. Rather, each of these projects is briefly described in Section V. Significant gaps, if any, in the "coverage" provided by these projects are noted and discussed.

D. Methodology.

The methodology used in the preparation of this report was a composite of field and organizational interviews, statistical inference from impirical data, literature reviews, and extensive discussion of ideas and issues with knowledgeable persons within the public and private sectors, the academic community, and at the farmer and project beneficiary levels.

Impirical data for the report were collected from: (1) questionnaires enumerated from 40 randomly selected households throughout the three zones of the Jordan Valley; (2) from 25 in-depth farmer interviews; (3) available literature on the agricultural sector in Jordan and in the Jordan Valley; (4) farm budgets of the JVA and JVASP; (5) interviews and discussions with 30 commission agents, retailers, and exporters at the Amman Central Wholesale Market; (6) socio-economic and agricultural data collected by the Department of Statistics, the Ministries of Agriculture, Health, Education, Municipalities Rural and Environmental Affairs, and the Jordan Valley Authority; (7) interviews and discussions with faculty members at Jordan and Yarmouk Universities; (8) interviews and discussions with employees of public and private sector organizations.

The conclusions drawn from the analyses presented in this report reflect the integration of all these data sources with the composite views and opinions of knowledgeable Jordanians within the various disciplines and functional areas investigated.

II. THE AGRICULTURAL ECONOMY

The transformation of traditional agriculture, as espoused by Schultz and extended by Hayami and Ruttan, strongly influences the development of this section. Briefly, the relevant tenets are:

1. Farmers are economically rational decision-makers. This implies that farmers will change production practices if that change will increase net income, given their bias to assume risk as reflected through their perception of uncertainty. Furthermore, an efficient allocation of resources in production will follow as more or less resources become available for use on that farm.

2. Farmers and entrepreneurs in the private sector respond to changes in production technologies and changes in relative prices. Thus, farmers will respond to price incentives in the allocation of their resources.

3. Prior to the introduction of new technology into the Jordan Valley, "state of the arts" remain constant, i.e., preferences and incentives for economic activity have changed little. However, new technological inputs in the Jordan Valley have upset the prevailing economic equilibrium and offered new economic opportunities.

4. The Jordan Valley is not an isolated agricultural entity divorced from the rest of the agricultural economy but responds to changes within the context of the overall agricultural economy.

Within this setting, this section examines:

1. State of the arts and change.

2. Productivity and growth rates over time.

A. AN OVERVIEW

This section highlights the national agricultural base into which the Jordan Valley must be integrated. To place the agricultural sector within the context of the overall economy, the Gross Domestic Product says it all: The agricultural contribution varies in the range of 8% to 11% and is therefore a small contributor to the overall economy.

1. Topography and Climate

Three distinct topographical features influence the agriculture of the Hashemite Kingdom of Jordan: 1) The Highlands, a fairly high plateau, divided by valleys and gorges, and several mountainous areas; 2) the Jordan River-Dead Sea depression, a result of the great geological rift

that extends into Africa, and 3) the extension of the Syrian Desert.

To the west, and within the Jordan River-Dead Sea depression, flows the Jordan River which over the ages has carved a fertile valley that has been a significant producer of Jordan's agricultural fruits and vegetables. The river itself is formed form its principal tributaries the Yarmouk river that flows from Syria and the Az Zarqa river, whose headwaters arise entirely from within the East Bank of the Jordan River. At its southern most extension, the Jordan River empties into the Dead Sea, which occupies the deepest depression on the earth's land surface.

From the northern end of the Valley, the Jordan is approximately 200 meters below sea level and drops to over 400 meters below sea level when it empties into the Dead Sea at its southern end. Within the Valley, this gradient has an important effect upon the micro-climate of the Valley mainly through temperature and relative humidity. Consequently, the moderating effect of temperature, with irrigation from the river, permits an important winter growing season, primarily in fruits and vegetables. In addition land use follows the changes in the gradient: in the north, citrus predominates which is also partly influenced by Lake Tiberas, while in the central and southern region of the Valley vegetables predominate.

Eastward from the Jordan Valley, mountains rise to 800 to 1,200 meters leading to the Jordanian Highlands, a steep country of high, deeply cut limestone plateaus with an average elevation of 900 meters and occasional summits that reach 1,200 meters in the north and 1,500 meters in the south. Thus, this western ridge of the plateau forms the escarpment along the eastern side of the Jordan River-Dead Sea depression. With sufficient rainfall in most years, this region produces most of Jordan's cereal grains. Continuing eastward and south, the great Syrian Desert occupies most of Jordan to the Red Sea. And it is this desert that occupies approximately 90% of the Kingdom's land area.

The major characteristic of the climate is the contrast between a rainy season from November to April and very dry weather during the rest of the year. It is the rainfall pattern (Table II.1), as influenced by the topography, that established the agricultural zones and hence agricultural activities, which varies from irrigated agriculture in the Valley, to dryland farming of the Highlands, and nomadic livestock in the marginal rainfall areas.

Table II.1 Land Area Classified by Rainfall, East Bank

	Average Rainfall (mm)	Area (mn du)	Percent (%)
Arid Desert	100	75.0	81.1
Desert	100-200	9.6	10.3
Marginal	200-300	5.3	5.7
Semi-arid	300-500	1.7	1.8
Semi-humid	500	1.0	1.1
Total		92.6	100.0

Source: Zahlan, A.B. et al. The Agricultural Sector of Jordan: Policy and Systems Study, p126.

Of the 94,800 km2 of the Hashemite Kingdom of Jordan, only 9 percent receives more than 200mm rainfall annually, which can be considered as potential agricultural land. Of the potential cultivated area, approximately 93% depends directly upon natural rainfall. The remaining 7% is irrigated land, which produces approximately 40% of the gross agricultural production and 70% of the gross value of the agricultural sector.

2. National Agricultural Production, 1986

This section reviews the national agricultural economy identifying the contribution of the North Ghors of the Jordan Valley. As an overview to the agricultural sector, several key agricultural development indicators between Jordan and several of her key trading partners are compared. Then national agricultural production is discussed with primary interest devoted to crop production.

a) National Agricultural Indicators

Table II.2 examines key agricultural and development indicators in comparison with several of her traditional trading partners. Except for Kuwait, Jordan has the smallest number of its population dependent upon agriculture. Also, agriculture's contribution to the gross domestic product is only eight percent, a range that has prevailed for sometime. Consequently, both indicate that agriculture is not as an important contributor to national development as is often assumed. Or conversely, the economy has developed more significantly in other areas.

Furthermore, the high agricultural import ratio (agricultural imports to total exports) shows that agriculture is not satisfactorily meeting Jordan's food supply needs. Partly, the continued high importation content of cereal grains is a significant contributor to this gap. Meat-use per person is low, and this is reflected in both meat output and meat yield per head (meat offtake).

Table II.2. Agricultural Development Indicators.

INDICATOR:	JORDAN	SAUDI ARABIA	SYRIA	IRAQ	KUWAIT
A. GENERAL:					
1. Population (mil) (1986)	3.7	12	10	16	1.8
2. Population in Agr. (1981)	23%	58%	46%	38%	1%
3. Agr. GDP (1980)	10%	1%	19%	11%	0.3%
4. Agr. Import Ratio (82-84) (1)	88%	9%	38%	21%	10
B. FOOD SUPPLY (1982-84):					
5. Cereal Use per Person (kg/yr)	226	662	328	350	335
6. Import Content of Cereal Use	89%	86%	34%	71%	100%
7. Meas Use per Person (kg/yr)	25	55	22	28	78
C: FOOD PRODUCTION (1982-84):					
8. Major cereals (2)	w,b	w,s	b,w	w,b	b
9. Cereal Output (mil tons)	0.1	1.0	2.1	1.5	-
10. Cereal Area (mil ha)	0.1	0.5	2.7	2.0	-
11. Cereal Yield (kg/ha)	700	1,900	800	700	3,300
12. Meat Output (1,000 tons)	50	280	210	230	70
13. Meat Offtake (3) (kg/head)	90	110	110	112	200
14. Milk Yield (kg/head)	100	1,130	1,630	750	2,500

Continued. . .

Notes:
1 Ratio of agricultural imports to total exports
2 w (wheat), b (barley), s (sorghum,miller)

TABLE II.2. Continued

INDICATOR	JORDAN	SAUDI ARABIA	SYRIA	IRAQ	KUWAIT
D. FOOD PRODUCTION CHANGE (%/YR): (1972-74 VS 1982-84)					
15. Cereal Output	-8.5	15.9	1.3	-4.7	29.2
16. Cereal Area	-7.1	5.7	1.9	-0.07	24.8
17. Cereal Yield	-1.3	8.9	-1.1	-4.1	3.5
18. Meat Output	5.3	14.4	10.1	5.5	13.4
19. Economic Land (4) in Crops	75%	1%	39%	50%	1%
20. Irrigated Cropped Land	9%	36%	10%	32%	50%
21. Cropped Land/ 100 persons (ha)	10	10	60	40	-
22. Fertilizer Use (5) (kg/ha)	39	178	32	17	500
23. Tractor Density (per 1,000 ha)	12	1.3	6.6	5.5	13

Notes:
3 Slaughter weight divided by number slaughtered.
4 Sum of cropped land, permanent meadows and pastures, forests, and woodlands.
5 Nitrogen, phosphorous, and potassium.

Source: Agricultural Development Indicators, Winrock International Institute for Agricultural Development, Fourth Edition, 1987.

Significantly, all three cereal grain indicators, cereal output, area, and yield, have been declining when comparing the 1972-74 and 1982-84 periods.

A considerably high proportion of economic land (land potentially usable for crop and animal production) is currently in use. Fertilizer input is low when compared to Saudi Arabia, but this probably reflects Saudi Arabia's high irrigation component with an attendant high fertilization requirement.

b) Sector Agricultural Production, 1986.

National agriculture is summarized from a sectoral perspective combining the Ghors and the Highland regions. This involves first an overall comparison followed by specific crop analyses based on region, and season for vegetables.

(1) Overall Crop Production

As an overview, the estimated crop production by region and cropping category follows in table II.3. The Ghors includes both the North and South Ghors. Since the North Ghors represents the focus of the Jordan Valley in terms of this report, it is useful to understand the minor impact that the South Ghors has:

1. Vegetables: 11% of the total Ghors area and 11% of the total Ghors value.

2. Fruit: 1% of the total Ghors area and less than 1% of the total Ghors value.

3. Filed Crops: None

In the 1985/86 agricultural year, vegetables accounted for 65% of the total gross value being generated from 20% of the land; fruit contributed 29% of the gross value from 32% of the land; and field crops 6% of the value from 47% of the land.

From a regional perspective, the Ghors contributed 60% of the gross value from 19% of the total area, while the Highlands delivered 40% of the gross value from 81% of the area. The Ghors provided 65% of the vegetable value and the Highlands 35%. Fruit was more evenly divided with the Ghors producing 55% and the Highlands 45%. But the Highlands produced 74% of the field crop value. Thus, the Ghors predominated in vegetables while the Highlands predominated in field crops, primarily cereal grains.

The following three sections detail the specific crop components that form the basis for table II.3.

Table 11.3. Estimated Crop Area, Production and Value by Region, 1986.

REGION/ CROPS	AREA (Dunums)	%	TONNAGE (M.T.)	%	VALUE (1) (JD)	%
A. GHORS						
1. Vegetables	195,840	62	359,096	64	42,394,174	65
2. Fruit	63,845	13	101,917	62	15,791,913	55
3. Field Crops	33,482	5	18,445	30	1,561,008	26
Subtotal	292,533	19	479,458		59,747,095	60
B. HIGHLANDS						
1. Vegetables	117,881	38	201,159	36	22,626,117	35
2. Fruit	434,746	87	61,346	38	13,000,709	45
3. Field Crops	694,961	95	42,695	70	4,457,140	74
Subtotal	1,247,588	81	305,200		40,083,966	40
C. OVERALL						
1. Vegetables	313,721	20	560,255	71	65,020,291	65
2. Fruit	498,957	32	163,263	21	28,792,622	29
3. Field Crops	728,443	41	61,140	8	6,018,148	6
TOTAL	1,541,121		784,658		99,831,148	

Notes: 1 Based on 1986 Amman Central Market prices.
Source: Derived from DOS, 1936, pp24-50, pp51-70.

(2) Vegetable Production

Tables II-4 and II-5 disaggregate vegetable production into regional, and seasonal crop components. Nationally, the ten most important crops, by value for the 1985/86 agricultural year, represented 84% of the vegetable area, 91% of vegetable production, and 91% of Jordan's total vegetable value (Table II.4). So as a group, these crops can also be considered as representative of overall vegetable production including area harvested and production in addition to value. Moreover, the four most valued crops -- tomatoes, cucumbers, eggplant, and squash-- represented 64% of total vegetable value, 55% of the cropped vegetable area, and 66% of the vegetable production.

Regionally, the Ghors dominated vegetable production contributing 65% of the total vegetable value, 64% of vegetable production, and 62% of vegetable land. In terms of tomatoes, cucumbers, eggplant, and squash, the Ghors contributed 71%, 57%, 91% respectively, and 73% of the overall vegetable values. Only, watermelon and cauliflower predominated in the Highlands while sweetmelons were equally important to both regions.

The seasonal pattern of these ten most-valued crops is shown in Table II.5. The spring season in the Ghors and summer season in the Highlands predominated in nearly the same pattern as the regional distribution: 64% of the vegetable value, 66% of the overall production and 65% of the cropped land was attributed to the spring and summer seasons, which raises the question of regional competition. Due to the climatic differences between the two regions, Highland vegetable production primarily follows the Valley's production thus complementing Jordan's needs rather than being competitive.

(3) Fruit Production

While vegetables contributed 65% of Jordan's total crop value, fruit added only 29%. The cropping distribution by regions and ranking by value is shown in Table II.6. Overall, 55% of the fruit value was attributable to the Ghors predominating in citrus production with lemons, oranges, and bananas with each contributing 12% of the total fruit production value. The Highlands contributed 45% primarily through olives (25%) and grapes (16%). Consequently, the two regions are also complimentary to Jordan's needs and noncompetitive in fruit production.

(4) Field Crops Production

Field crops were of least significance to Jordan's total crop value contributing only 6% of the overall production value (table II.7). Cereal grains accounted for 69% of the overall value with the Highlands providing 92% of this. The two primary field crops, wheat and onions, accounted for 83% of the total field crop value with wheat contributing 56% and onions 27%. Only 6% of the cereal grains and 32% of the field

Table II.4. Estimated Regional Vegetable Production, Area and Value, 1986.

REGION/ CROPS	AREA (Dunums)	%	TONNAGE (M.T.)	%	VALUE (JD)	%
A. GHORS						
1. Tomatoes	57,573	63	156,036	71	14,667,384	71
2. Cucumbers	13,817	63	36,641	57	6,082,406	57
3. Eggplant	24,718	90	45,856	91	4,906,592	91
4. Squash	24,716	77	27,039	73	3,596,187	73
5. Potatoes	12,555	82	18,610	83	2,828,720	83
6. S. Beans	12,884	78	10,124	82	2,146,288	82
7. Hot Pepper	8,441	92	10,432	95	1,929,920	95
8. Sweet Pepper	6,723		9,222		1,623,072	
9. Sweet Melons	6,026		7,726		1,243,886	
10. Broad Beans	5,707		3,869		742,848	
11. Cabbage	4,209		8,537		614,664	
12. Other	18,471		25,004		2,012,207	
Subtotal	195,840	62	359,096	64	42,394,174	65
B. HIGHLANDS						
1. Tomatoes	33,832		64,510		6,063,940	
2. Cucumbers	7,997		27,622		4,585,252	
3. Water Melon	21,506	83	45,086	88	3,832,310	88
4. Cauliflower	11,911	89	21,412	87	2,376,732	87
5. Squash	7,367		9,817		1,305,661	49
6. Sweet Melon	7,565	56	7,451	49	1,199,611	
7. Potatoes	2,679		3,929		597,208	
8. Cabbages	4,281		7,886		567,792	
9. Eggplant	4,712		4,712		504,184	
10. String Bean	3,679		2,236		474,032	
11. Others	12,352		6,498		1,119,395	
Subtotal	117,881	38	201,159	36	22,626,117	35
C. OVERALL						
1. Tomatoes	91,405	29	220,546	39	20,731,324	32
2. Cucumbers	21,814	7	64,263	11	10,667,658	16
3. Eggplant	27,310	9	50,568	9	5,410,776	8
4. Squash	32,083	10	36,856	7	4,901,848	8
5. Water Melon	25,952	8	51,292	9	4,359,820	7
6. Potatoes	15,234	5	22,539	4	3,425,928	5
7. String Bean	16,563	5	12,360	2	2,620,320	4
8. Sweet Melon	13,591	4	15,177	3	2,443,497	4
9. Cauliflower	13,403	4	24,553	5	2,725,383	4
10. Hot Pepper	9,188	3	11,022	2	2,039,070	3
11. Other	47,178	15	51,079	9	5,694,667	9
TOTAL	313,721		560,255		65,020,291	

Source: Derived from DOS, 1986, pp42-50, pp60-70.

Table II.5. Estimated Seasonal Vegetable Production, Area and Value, 1986.

SEASON/ CROPS	AREA (Dunums)	%	TONNAGE (M.T)	%	VALUE (JD)	%
A. AUTUMN (WINTER):						
1. Tomatoes	24,155	26	61,806	28	5,809,764	28
2. Cucumbers	10,421	47	27,205	42	4,516,030	42
3. Eggplant	12,971	48	24,107	48	2,579,449	48
4. Squash	16,136	50	17,710	48	2,355,430	48
5. Potatoes	5,455		10,974		1,668.048	
6. Cauliflower	6,670		12,630		1,401,930	
7. Hot Pepper	5,164		7.060		1,306,100	
8. String Beans	4,041		2,424		513,888	
9. Sweet Melons	75		112		18,032	
10. Water Melons	0		0		0	
11. Other	24,959		28,876		3,209,529	
Subtotal	110,047	35	192,904	34	23,378,200	36
B. SPRING (SUMMER):						
1. Tomatoes	67,250	73	158,740	71	14,921,560	71
2. Cucumbers	11,393	52	37,058	58	6,151,628	58
3. Water Melon	25.952	100	51,292	100	4,359,820	100
4. Eggplant	14,339	52	26,461	52	2,831,327	52
5. Squash	13,947	49	19,146	52	2,546,418	51
6. Sweet Melons	13,516	99	15,065	99	2,425,465	99
7. String Beans	12,522	75	9,936	80	2,106,432	80
8. Potatoes	9,779	64	11,565	51	1,757,880	51
9. Cauliflower	6,733	50	11,923	49	1,323,453	49
10. Hot Pepper	4,024	43	3,962	36	732,970	36
11. Other	22,219	47	22,203	43	2,485,138	44
Subtotal	203,674	65	367,351	66	41,642,091	64
C. OVERALL						
1. Tomatoes	91,405	29	220,546	39	20,731,324	31
2. Cucumbers	21,814	7	64,263	11	10,667,658	16
3. Eggplant	27,310	9	50,568	9	5,410,776	8
4. Squash	32,083	10	36,856	7	4,901,848	8
5. Water Melon	25,952	8	51,292	9	4,359,820	7
6. Potatoes	15,234	5	22,539	4	3,425,928	5
7. String Bean	16,563	5	12,360	2	2,620,320	4
8. Sweet Melon	13,591	4	15,177	2	2,443,497	4
9. Cauliflower	13,403	4	24,553	4	2,725,383	4
10. Hot Pepper	9,188	3	11,022	2	2,039,070	3
11. Other	7,178	15	51,079	9	5,694,667	9
TOTAL	313,721		560,255		65,020,291	

Source: Derived from DOS, 1986, pp42-50, pp60-70.

Table II.6. Estimated Regional Fruit Production, Area and Value by Region 1986

REGION/ CROPS	AREA (Dunums)	%	TONNAGE (M.T)	%	VALUE (JD)	%
A. GHORS						
1. Lemons	14,002		22,722		3,476,466	12
2. Oranges	8,423		18,039		3,445,449	12
3. Bananas	8,952		13,414	a	3,353,500	12
4. Clementines	20,479		24,073		2,696,176	9
5. Mandarin	6,424		20,133		2,194,497	8
6. Grapes	1,777		924	a	193,116	_1
7. Pummelor	547		837		166,563	_1
9. Guavas	981		495		123,750	_1
9. Olives	892		400	b	90,400	_1
10. Grapefruit	165		619		51,996	_1
11. Others	569		261		----	
Subtotal	63,211	13	101,917	62	15,791,913	55
B. HIGHLANDS						
1. Olives	344,034		31,381	b	7,092,106	25
2. Grapes	53,176		22,262	a	4,652,758	16
3. Figs	5,024		1,449	a	405,720	_1
4. Plums/Prunes	4,296		1,357	a	280,899	_1
5. Apples	8,447		1,126	a	231,956	_1
6. Peaches	5,045		725		212,425	_1
7. Pears	662		190		65,550	_1
8. Apricots	2,376		295		59,295	_1
9. Almonds	4,214		504		---	
10. Pomegranate	3,031		929		---	
11. Others	4,441		1,128		---	
Subtotal	434,746	87	61,346	38	13,000,709	45
TOTAL	497,957		163,263		28,792,622	

a - 1985 Amman Market average price.
b - September, 1986, Amman Market price.
Source: Derived from DOS, 1986, pp24-32, pp51-56.

Table II.7. Estimated Regional Field Crop Production, Area and Value, 1986

REGION/ CROPS	AREA (Dunums)	%	TONNAGE (M.T.)	%	VALUE TOTAL (JD)	%
A. GHORS						
Barley	13,465		1,736		130,200	19
Wheat	12,838		1,968		236,160	6
Corn	988		126		10,080	
Cereals	27,291		3,830		376,440	8
Onions	5,242		13,461		1,561,008	100
Other	949		1,154		---	
Subtotal	33,482		18,445		1,937,448	30
B. HIGHLANDS						
Barley	183,284	93	7,268	81	545,100	81
Wheat	453,153	97	28,874	94	3,464,880	94
Corn	1,939		1,652		132,160	
Cereals	638,376	96	37,794	91	4,142,140	92
Lentils	28,322		1,750		315,000	
Other	28,263		3,151		---	
Subtotal	694,961	95	42,695	70	4,457,140	70
C. OVERALL						
Barley	196,749	27	9,004	15	657,300	11
Wheat	465,991	64	30,842	50	3,701,040	58
Corn	2,927	1	1,778	3	142,240	2
Cereals	665,667	91	41,624	68	4,518,580	71
Lentils	28,322	4	1,750	3	315,000	5
Onions	5,242	1	13,461	22	1,561,008	24
other	29,212	4	4,305	7	---	
	728,443		61,140		6,394,588	

Source: Derived from DOS, 1986, pp 33-41, pp 56-59.

crops were attributable to the Ghors. The latter was due to the strong position of dry onions, which the Department of Statistics classifies as a field crop.

(5) Livestock/Poultry

Livestock and poultry currently have little significance to the Valley so they do not materially enter this discussion. Yet in terms of contribution to the agricultural sector, they are not insignificant. Consequently, to complete the national scene it is instructive to understand their importance within Jordanian agriculture. Table II.8 details this.

Table II.8 Value of Production at Current Prices In the East Bank, 1985

	1985	PERCENT
1. Vegetables	48.90	31.07%
2. Poultry	46.30	29.42%
3. Livestock	26.90	17.09%
4. Fruit/Olives	20.50	13.02%
5. Grains/Legumes	10.80	6.86%
6. Others	4.00	2.54%
Total	157.40	100.00

Source: Department of Statistics, Annual Agricultural Statistics, 1986, p98.

The two largest contributors to overall production value were vegetables and poultry being nearly equal followed by livestock and fruits. Livestock was composed of three values: livestock products, livestock sales, and increase in livestock value. Grains were a distant fifth, which reinforces the high cereal grain import content in Table II.2. The "others" category included tobacco, fish, honey and forest products, which were of minor importance.

(6) National Trends

National trends might best be viewed through trends in value of production, total value, expenditures, and net agricultural income (value added). Vegetable value (Figure II.1) has moved upwards approximately 22%. Poultry has climbed 114% to nearly match vegetables. Livestock dropped sharply by 1983 (54%) but has now moved back to 1981 levels. Fruit peaked in 1984 being up 54% but then dropped 20%. Still this is 26% above 1981 levels.

Total value of production (Figure II.2) has risen 36% since 1981, while the value of expenditures rose 24%. Net agricultural income advanced 43%.

B. JORDAN VALLEY: AN OVERVIEW

The impact upon the agricultural sector can be understood from four perspectives: changes in area, tonnage, value, and margins. Thus, agricultural trends in the North Ghors region of the Jordan Valley are now reviewed in this context.

1. Jordan Valley Production, 1986

The topographical and physical characteristics of the valley provides a unique setting for the development of a high-valued and specialized agriculture dominated by vegetable and fruit production. Because of the Valley's protected location well below see level, its production season does not conflict with the other agricultural regions, namely the Highlands. Closely related to market timing within the Valley is the distribution of seasonal temperatures which varies as much as three degrees centigrade between the lower southern part of the Valley to its northern reaches. So within the Valley's micro-climate, seasonal production and cropping patterns follow this temperature gradient.

A) AREA, PRODUCTION, AND VALUE BY REGION AND SEASON

This section reviews the North Valley's (North Ghors) crop production for the 1985/86 crop year based on three geographical divisions: A'Shamaliah, the north; Dair A'lla, the middle; and Shuna Janobia, the south. These data are examined by both region and season.

(1) OVERALL

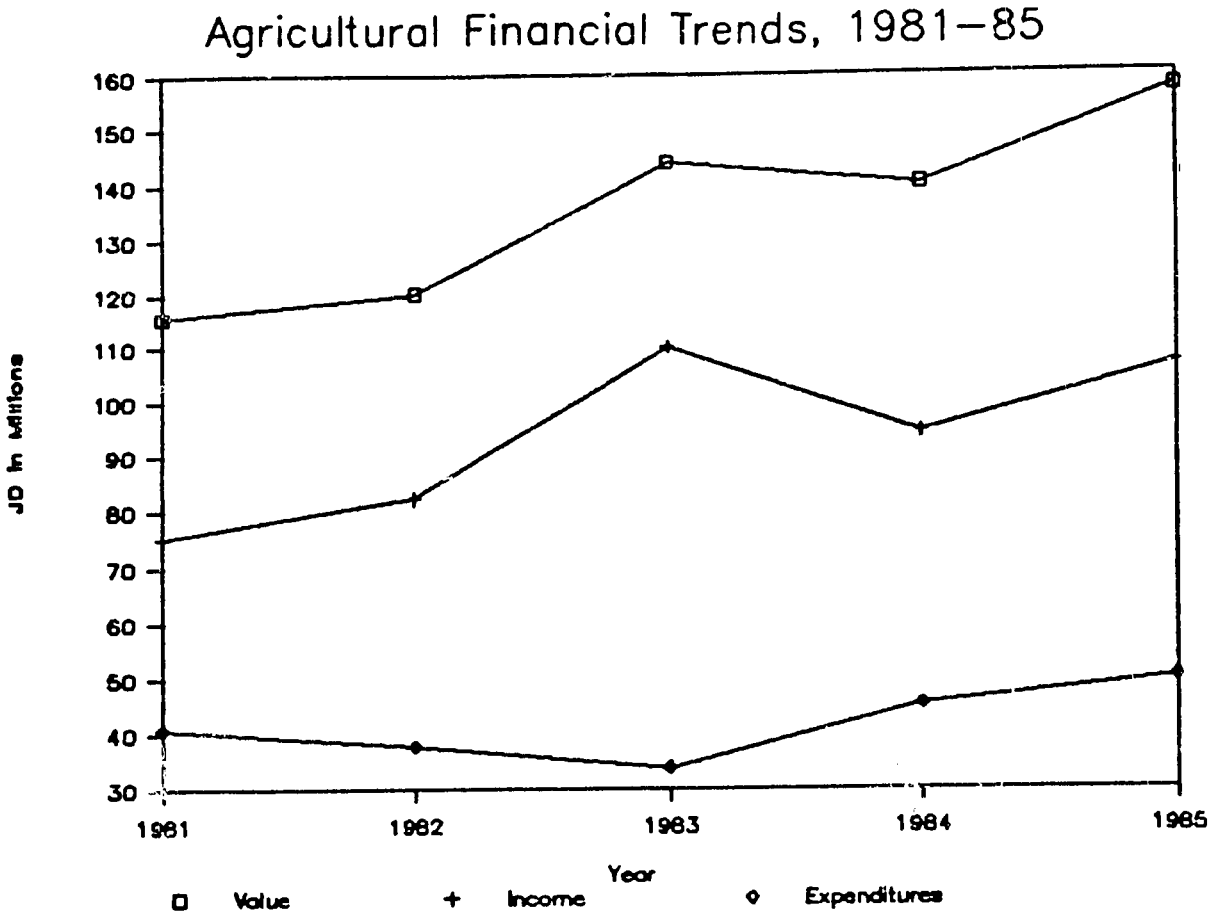
Table II.9 identifies the relative contribution of each region and crop category, i.e., vegetables, fruit, and field crops with respect to total area, tonnage, and value. Overall, vegetable produced 69% of the total value (JD 55.111,751), fruit 28%, and field crops 3%. Of this total, A'Shamaliah contributed 51%, Dair A'lla 25%, and Shuna Janobia 23% indicating the relative regional importance within the valley.

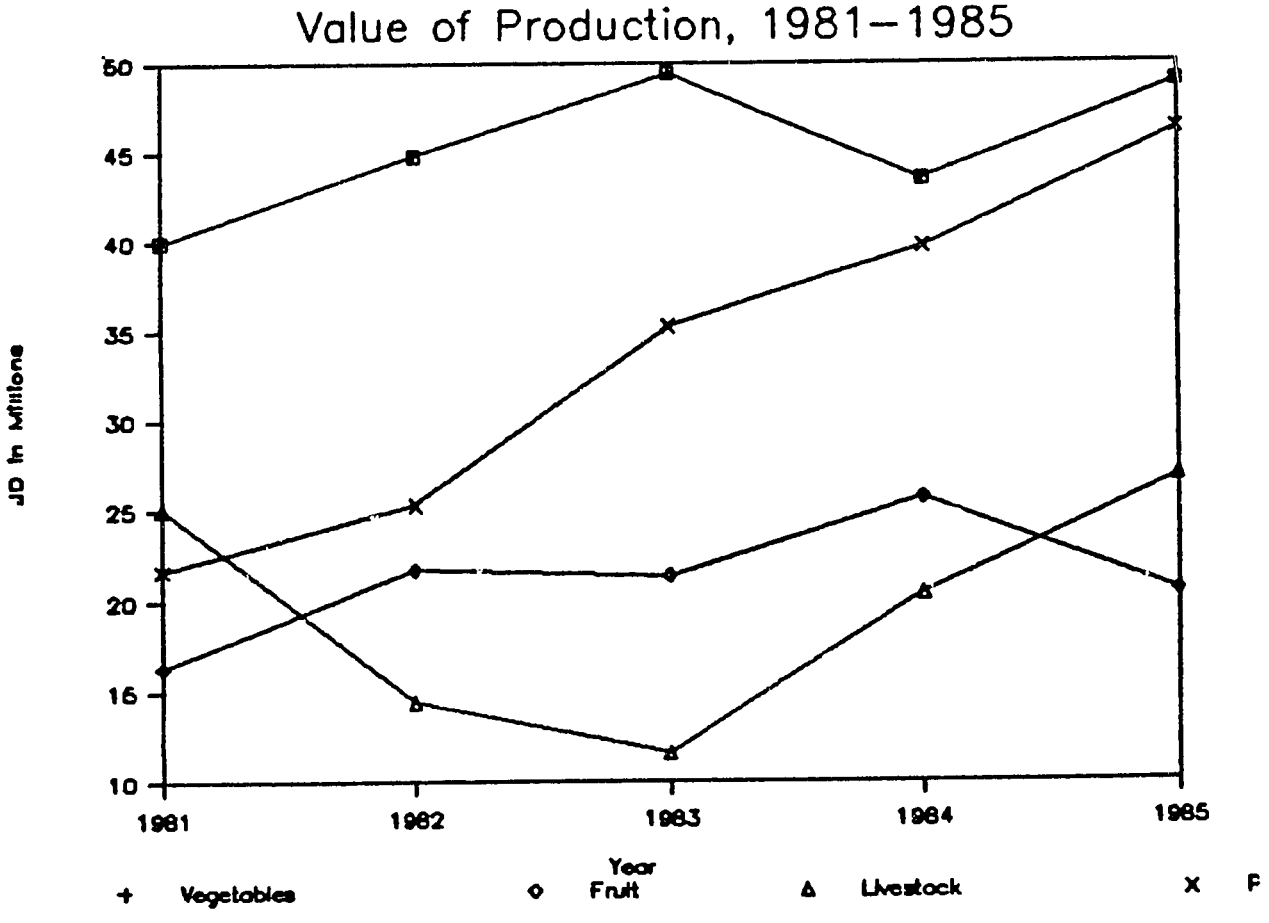
Comparing vegetable values, A'Shamaliah contributed 41%, Dair A'lla 32%, and Shuna Janobia 27% of the vegetable value reflecting a reasonable Valley distribution. However, fruit production was sharply concentrated in the north with A'Shamaliah producing 78% of the fruit value. Field crops were of only minor importance to the overall value at approximately 3%.

Table II.9. Estimated North Ghors Crop Production, Area and Value by Region 1986.

REGION/ CROPS	AREA (Dunums)	%	TONNAGE (M.T.)	%	VALUE (JD)	%
A. A'SHAMALIAH						
1. Vegetables	68,902	40	130,167	41	15,582,215	41
2. Fruit	47,442	75	83,563	83	12,217,324	78
3. Field Crops	17,844	53	6,133	33	516,026	33
Subtotal	134,188	50	219,863	50	28,315,565	51
B. DAIR A'ALLA						
1. Vegetables	57,572	33	95,932	30	12,093,904	32
2. Fruit	6,628	10	5,075	5	922,526	6
3. Field Crops	14,182	42	11,775	64	1,001,758	64
Subtotal	78,382	29	112,782	26	14,018,188	25
C. SHUNA JANOBIA						
1. Vegetables	47,195	27	90,045	28	10,183,673	27
2. Fruit	9,141	14	12,582	12	2,551,101	16
3. Field Crops	1,456	4	537	3	43,224	3
Subtotal	57,792	21	103,164	24	12,777,998	23
D. OVERALL						
1. Vegetables	173,669	64	316,144	73	37,859,792	69
2. Fruit	63,211	23	101,220	23	15,690,951	28
3. Field Crops	33,482	13	18,445	4	1,561,008	3
TOTAL	270,362		435,809		55,111,751	

Source: Derived from DOS, 1986, pp 51-69.


Agricultural Financial Trends, 1981–85
JD In Millions
160
150
140
130
120
110
100
90
80
70
60
50
40
30
1981
1982
1983
1984
1985
Year
Value
Income
Expenditures


Value of Production, 1981–1985
JD In Millions
50
45
40
35
30
25
20
15
10
1981
1982
1983
1984
1985
Year
Vegetables
Fruit
Livestock

As to dunums and tonnage attributable for each category within each region, these closely paralleled the value contribution. However, this does not follow for field crops where 13% of the total cropped area (270,362 dunums) was devoted to field crops but yielded only 3% of the overall value.

The following sections expand on Table II.9 detailing specific regional and seasonal crop contributions.

(2) VEGETABLES

Table II.10 ranks the vegetables in accordance to their contribution to total value. The ten most important crops accounted for 94% of the Valley's overall vegetable value, while the dominate five crops (tomatoes, cucumbers, eggplant, squash, and potatoes) accounted for 75% of overall value, 69% of the area, and 78% of the tonnage. Furthermore, cropped area devoted to vegetable production and tonnage closely paralleled the value ranking. Only with broad beans and sweet melons is tonnage from out of the top ten.

What is the pattern of their distribution? Tomatoes are more heavily concentrated in A'Shamaliah (42%), in Dair A'lla at 24%, and in Shuna Janobia at 34%. Cucumbers predominated in Dair A'lla (48%), eggplant in Shuna Janobia (48%), and squash in A'Shamaliah (51%). Potatoes were heavily produced in A'Shamaliah (71%), string beans in Dair A'lla (73%), hot peppers in A'Shamaliah (54%), sweet pepper in A'Shamaliah (60%), sweet melons in Shuna Janobia (93%), and broad beans in A'Shamaliah (57%). Both area and tonnage closely paralleled value rankings in terms of their percentage contribution.

The seasonal pattern of the Valley is examined in Table II.11. Overall, 56% of the vegetable value, 55% of the vegetable area, and 59% of vegetable production were attributable to the spring season. The dominate spring crops were: tomatoes, string beans, sweet melon, Jew's mallow, and watermelon. While the dominate autumn crops were: cucumbers, squash, potatoes, sweet and hot peppers, broad beans and cabbage. Moreover, the five most-valued crops occupied 29% of the total vegetable land in the autumn and 44% in the spring.

The seasonal distribution for A'Shamaliah (Table II.12), the northern portion of the Valley, closely parallels that of the Valley. A'Shamaliah produced 58% of the spring production value and 42% of the autumn's, as compared to 56% and 43%, respectively, for the Valley as a whole. A'Shamaliah also mirrors the five most valued crops of the Valley but in a different sequence: tomatoes, potatoes, squash, cucumbers, and eggplant. These accounted for 61% of the total vegetable land with 37% grown in the autumn and 63% in the spring. And these same crops accounted for 74% of the total vegetable value.

Table II.10. Estimated North Ghors Vegetable, Production, Area, and Value by Region, 1986.

REGION/ CROPS	AREA (Dunums)	RANK %	TONNAGE (M.T.)	RANK %	VALUE* (JD)	%
A. A'SHAMALIAH						
1. Tomatoes	15,308	1	51,012	1	4,795,128	42
2. Potatoes	8,274	3	13,228	3	2,010,656	71
3. Squash	12,939	2	13,603	2	1,809,199	51
4. Cucumbers	2,178	11	10,783	4	1,789,978	30
5. Eggplant	5,830	4	10,520	5	1,125,640	24
6. Hot Pepper	3,643	7	5,211	8	964,035	54
7. Sweet Pepper	3,666	6	5,390	7	948,640	60
8. Cabbages	3,732	5	7,817	6	562,824	
9. String Beans	2,825	8	2,198	11	465,976	24
10. Broad Beans	2,626	9	1,839	12	353,088	57
11. Others	7,881		8,566		757,051	
Subtotal	68,902	40%	130,167	41%	15,582,215	41
B. DAIR A'LLA						
1. Cucumbers	7,186	3	17,328	2	2,876,448	48
2. Tomatoes	14,970	1	29,808	1	2,801,952	24
3. String Beans	7,687	2	6,567	5	1,392,204	73
4. Eggplant	6,368	4	12,519	3	1,339,533	28
5. Squash	6,321	5	7,674	4	1,020,642	29
6. Hot Pepper	2,916	6	3,557	8	658,045	37
7. Potatoes	2,898	7	3,991	7	606,632	22
8. Sweet Pepper	1,904	8	2,729	9	480,304	30
9. Jew's Mallow	900	11	5,923	6	402,764	
10. Watermelons	1,546	10	2,010	10	170,850	
11. Others	4,876		3,826		344,530	
Subtotal	57,572	33%	95,932	30%	12,093,904	32
C. SHUNA JANOBIA						
1. Tomatoes	16,320	1	41,456	1	3,896,864	34
2. Eggplant	11,350	2	20,977	2	2,244,539	48
3. Cucumbers	4,191	4	7,955	3	1,320,530	22
4. Sweet Melons	2,381	5	5,344	5	860,384	93
5. Squash	5,210	3	5,561	4	739,613	20
6. Watermelons	1,428	6	2,570	6	218,450	
7. Potatoes	1,303	8	1,335	8	202,920	7
8. Broad Beans	846	10	891	9	171,072	27
9. Hot Pepper	950	9	878	10	162,430	9
10. Sweet Pepper	830	11	848	11	149,248	10
11. Others	2,386		2,230		217,623	
Subtotal	47,195	27%	90,045	28%	10,183,673	27

Table II.10 Continued.

REGION/ CROPS	AREA (Dunums)	RANK %	TONNAGE (M.T.)	RANK %	VALUE (JD)	%
D. OVERALL						
1. Tomatoes	46,598	1	122,276	1	11,493,944	31
2. Cucumbers	13,555	4	36,066	3	5,986,956	16
3. Eggplant	23,548	3	44,016	2	4,709,712	12
4. Squash	24,470	2	26,838	4	3,569,454	9
5. Potatoes	12,475	5	18,554	5	2,820,208	7
6. String Beans	10,877	6	9,008	7	1,909,696	5
7. Hot Pepper	7,509	7	9,646	6	1,784,510	5
8. Sweet Pepper	6,400	8	8,967	8	1,578,192	4
9. Sweet Melons	3,188	10	5,739	11	923,979	3
10. Broad Beans	4,205	9	3,244	14	622,848	2
11. Others	20,844		31,790		2,460,293	6
TOTAL	173,669		316,144		37,859,792	

Notes:

* Average Amman Central Market prices, 1986.
  Source: Derived from DOS, 1986, pp51-69

Table II.11. Estimated North Ghors Vegetable Production, Area and Value by Season, 1986.

SEASON/ CROPS	AREA (Dunums)	RANK %	TONNAGE (M.T.)	RANK %	VALUE (JD)	%
A. AUTUMN						
1. Cucumbers	8,484	4	19,062	3	3,164,292	53
2. Tomatoes	10,758	3	29,004	1	2,726,376	24
3. Eggplant	11,497	2	22,190	2	2,374,330	50
4. Squash	15,056	1	16,308	4	2,168,964	61
5. Potatoes	4,960	5	10,273	5	1,561,496	55
6. Sweet Pepper	4,741	6	7,032	6	1,237,632	78
7. Hot Pepper	4,409	7	6,343	8	1,173,455	66
8. Broad Bean	3,287	9	2,595	11	498,240	80
9. Cabbages	3,033	10	6,840	7	492,480	80
10. String Bean	2,575	11	1,550	12	328,600	17
11. Others	8,970		8,330		661,612	
Subtotal	77,770	45%	129,527	41%	16,387,477	43
B. SPRING						
1. Tomatoes	35,840	1	93,272	1	8,767,568	76
2. Cucumbers	5,071	6	17,004	3	2,822,664	47
3. Eggplant	12,051	2	21,826	2	2,335,382	50
4. String Bean	8,302	4	7,458	6	1,581,096	83
5. Squash	9,414	3	10,530	4	1,400,490	39
6. Potatoes	7,515	5	8,281	5	1,258,712	45
7. Sweet Melon	3,113	7	5,627	8	905,947	98
8. Hot Pepper	3,100	8	3,303	10	611,055	34
9. Jew's Mallow	1,012	10	6,271	7	426,428	93
10. Watermelon	3,044	9	4,664	9	396,440	100
11. Others	7,437		8,381		966,533	
Subtotal	95,899	55%	186,617	59%	21,472,315	56
C. OVERALL						
1. Tomatoes	46,598	1	122,276	1	11,493,944	30
2. Cucumbers	13,555	4	36,066	3	5,986,956	16
3. Eggplant	23,548	3	44,016	2	4,709,712	12
4. Squash	24,470	2	26,838	4	3,569,454	9
5. Potatoes	12,475	5	18,554	5	2,820,208	7
6. String Bean	10,877	6	9,008	7	1,909,696	5
7. Hot Pepper	7,509	7	9,646	6	1,784,510	5
8. Sweet Pepper	6,400	8	8,967	8	1,578,192	4
9. Sweet Melon	3,188	10	5,739	11	923,979	2
10. Broad Bean	4,205	9	3,244	14	622,848	2
11. Others	20,844		31,790		2,460,293	6
TOTAL	173,669		316,144		37,859,792	

Source: Derived from DOS, 1986, pp51-69.

Table II.12. Estimated A'Shamaliah Vegetable Production, Area and Value by Season, 1986.

SEASON/ CROPS	AREA (Dunums)	RANK %	TONNAGE (M.T.)	RANK %	VALUE (JD)	%
A. AUTUMN						
1. Squash	8,605	1	8,966	1	1,192,478	66
2. Potatoes	3,608	2	7,815	2	1,187,880	59
3. Sweet Pepper	2,754	3	4,296	5	756,096	80
4. Cucumbers	1,091	10	4,251	6	705,666	39
5. Hot Pepper	2,333	6	3,639	7	673,215	70
6. Eggplant	2,479	5	4,786	4	512,102	45
7. Cabbages	2,581	4	6,140	3	442,080	79
8. Broad Bean	2,178	7	1,525	10	292,800	83
9. Cauliflower	1,018	11	2,363	8	262,293	89
10. Tomatoes	845	12	1,765	9	165,910	3
11. Others	5,387		3,618		333,678	
Subtotal	32,879	48%	49,164	38%	6,524,198	42
B. SPRING						
1. Tomatoes	14,463	1	49,247	1	4,629,218	97
2. Cucumbers	1,087	8	6,532	2	1,084,312	61
3. Potatoes	4,666	2	5,413	4	822,776	41
4. Squash	4,334	3	4,637	5	616,721	34
5. Eggplant	3,351	4	5,734	3	613,538	55
6. String Bean	1,536	5	1,444	9	306,128	66
7. Hot Pepper	1,310	6	1,572	7	290,820	30
8. Sweet Pepper	912	10	1,094	10	192,544	20
9. Cabbages	1,151	7	1,677	6	120,744	21
10. Lettuce	954	9	1,452	8	107,448	55
11. Others	2,259		2,201		273,768	
Subtotal	36,023	52%	81,003	62%	9,058,017	58
C. OVERALL						
1. Tomatoes	15,308	1	51,012	1	4,795,128	31
2. Potatoes	8,274	3	13,228	3	2,010,656	13
3. Squash	12,939	2	13,603	2	1,809,199	12
4. Cucumbers	2,178	11	10,783	4	1,789,978	11
5. Eggplant	5,830	4	10,520	5	1,125,640	7
6. Hot Pepper	3,643	7	5,211	8	964,035	6
7. Sweet Pepper	3,666	6	5,390	7	948,640	6
8. Cabbages	3,732	5	7,817	6	562,824	4
9. String Bean	2,825	8	2,198	11	465,976	3
10. Broad Bean	2,626	9	1,839	12	353,088	2
11. Others	7,881		8,566		757,051	5
TOTAL	68,902		130,167		15,582,215	

Source: Derived from DOS, 1986, p62.

The impact of plastic greenhouse culture is quite evident from the cucumber data: cucumbers ranked only tenth and eighth in cropped vegetable land for the autumn and spring seasons, respectively, but ranked fourth and second in tonnage during these seasons. Thus, the disproportionate relationship between a small land base and a large production base indicates an extraordinary technological change, i.e., plastic greenhouse culture.

Based on value, the principal crops grown in the autumn season were: squash (66%), potatoes (59%), sweet peppers (80%), hot peppers (70%), cabbages (79%), broad beans (83%), and cauliflower (89%). During the spring season, the major crops were: tomatoes (97%), cucumbers (61%), eggplant (55%), string beans (66%), and lettuce (55%).

Dair A'lla vegetable production (Table II.13) was more heavily weighted to the spring season with 65%, 66%, and 62% associated with vegetable area, tonnage, and value respectively. The five most valued crops changed slightly with the replacement of potatoes by string beans. Similar to A'Shamaliah, these five crops represented a significant part of Dair A'lla's vegetable production: 78% of Dair A'lla's crop value, 77% of the total tonnage and 74% of the vegetable area.

Seasonally, the primary autumn crops based by value were: cucumbers (59%), squash (56%), sweet pepper (71%), and lettuce (71%). And the main spring crops were: tomatoes (89%), string beans (88%), Jew's mallow (98%), and watermelons nearly 100%.

Vegetable production in Shuna Janobia (Table II.14 was nearly evenly divided between the two seasons with autumn having a slight edge at 52% of Shuna's vegetable value. The same four basic crops, tomatoes, eggplant, cucumbers, and squash, plus the addition of sweet melons accounted for 88% of Shuna Janobia's total vegetable value, 83% of the vegetable area, and 90% of the tonnage.

The principle crops of the autumn season were: tomatoes (58%), cucumbers (57%), hot pepper (96%), broad beans (91%), sweet pepper (94%), lettuce (69%), and cauliflower nearly 100%. And sweet melons (98%), watermelons (nearly 100%), and string beans (86%) were the main spring crops.

(3) FRUIT

Fruit production in the Valley is examined in Table II.15. Overall, citrus dominated in the Valley producing 75% of the total fruit value with bananas accounting for 21%. Thus, these two categories accounted for 96% of the total. On a regional basis, A'Shamaliah was dominant counting for 75% of the total fruit area, 83% of the tonnage, and 78% of the value. Shuna Janobia is second predominating in banana production while Dair A'lla produced 29% of the Valley's grapes.

Table II.13. Estimated Dair A'lla Vegetable Production, Area and Value by Season, 1986.

SEASON/ CROPS	AREA (Dunums)	RANK %	TONNAGE (M.T.)	RANK %	VALUE (JD)	%
A. AUTUMN						
1. Cucumbers	4,288	1	10,287	1	1,707,642	59
2. Eggplant	3,135	3	6,050	2	647,350	48
3. Squash	3,553	2	4,264	3	567,112	56
4. Hot Pepper	1,162	7	1,859	6	343,915	52
5. Sweet Pepper	1,214	6	1,942	5	341,792	71
6. Tomatoes	1,872	4	3,285	4	308,790	11
7. Potatoes	766	9	1,838	7	279,376	46
8. String Bean	1,235	5	761	9	161,332	12
9. Lettuce	1,150	8	863	8	63,862	71
10. Broad Bean	375	11	263	11	50,496	51
11. Others	1,564		1,393		76,084	
Subtotal	20,314	35%	32,805	34%	4,547,751	38
B. SPRING						
1. Tomatoes	13,098	1	26,523	1	2,493,162	89
2. String Beans	6,452	2	5,806	5	1,230,872	88
3. Cucumbers	2,898	4	7,041	2	1,168,806	41
4. Eggplant	3,233	3	6,469	3	692,183	52
5. Squash	2,768	5	3,410	6	453,530	44
6. Jew's Mallow	723	9	5,809	4	395,012	98
7. Potatoes	2,132	6	2,153	7	327,256	54
8. Hot Pepper	1,754	7	1,698	9	314,130	48
9. Watermelons	1,546	8	2,010	8	170,850	100
10. Sweet Pepper	690	10	787	10	138,512	29
11. Others	1,964		1,421		161,840	
Subtotal	37,258	65%	63,127	66%	7,546,153	62
C. OVERALL						
1. Cucumbers	7,186	3	17,328	2	2,876,448	24
2. Tomatoes	14,970	1	29,808	1	2,801,952	23
3. String Bean	7,687	2	6,567	5	1,392,204	12
4. Eggplant	6,368	4	12,519	3	1,339,533	11
5. Squash	6,321	5	7,674	4	1,020,642	8
6. Hot Pepper	2,916	6	3,557	8	658,045	5
7. Potatoes	2,898	7	3,991	7	606,632	5
8. Sweet Pepper	1,904	8	2,729	9	480,304	4
9. Jew's Mallow	900	11	5,923	6	402,764	3
10. Watermelons	1,546	10	2,010	10	170,850	1
11. Others	4,876		3,826		344,530	3
TOTAL	57,572		95,932		12,093,904	

Source: Derived from DOS, 1986, p63.

Table II.14. Estimated Shuna Janobia Vegetable Production, Area and Value by Season, 1986.

SEASON/ CROPS	AREA (Dunums)	RANK %	TONNAGE (M.T.)	RANK %	VALUE (JD)	%
A. AUTUMN						
1. Tomatoes	8,041	1	23,954	1	2,251,676	58
2. Eggplant	5,883	2	11,354	2	1,214,878	54
3. Cucumbers	3,105	3	4,524	3	750,984	57
4. Squash	2,898	4	3,078	4	409,374	55
5. Hot Pepper	914	6	845	6	156,325	96
6. Broad Bean	734	8	807	7	154,944	91
7. Sweet Pepper	773	7	794	8	139,744	94
8. Potatoes	586	9	620	9	94,240	46
9. Lettuce	1,355	5	1,045	5	77,330	69
10. Cauliflower	84	10	315	10	34,965	100
11. Others	204		222		31,068	
Subtotal	24,577	52%	47,558	53%	5,315,528	52
B. SPRING						
1. Tomatoes	8,279	1	17,502	1	1,645,188	42
2. Eggplant	5,467	2	9,623	2	1,029,661	46
3. Sweet Melon	2,306	4	5,232	3	842,352	98
4. Cucumbers	1,086	6	3,431	4	569,546	43
5. Squash	2,312	3	2,483	6	330,239	45
6. Watermelon	1,428	5	2,570	5	218,450	100
7. Potatoes	717	7	715	7	108,680	54
8. String Bean	314	9	208	9	44,096	86
9. Lettuce	394	8	473	8	35,002	31
10. Broad Beans	112	10	84	10	16,128	9
11. Others	203		166		28,803	
Subtotal	22,618	48%	42,487	47%	4,868,145	46
C. OVERALL						
1. Tomatoes	16,320	1	41,456	1	3,896,864	38
2. Eggplant	11,350	2	20,977	2	2,244,539	22
3. Cucumbers	4,191	4	7,955	3	1,320,530	13
4. Sweet Melon	2,381	5	5,344	5	860,384	8
5. Squash	5,210	3	5,561	4	739,613	7
6. Water Melon	1,428	6	2,570	6	218,450	2
7. Potatoes	1,303	8	1,335	8	202,920	2
8. Broad Bean	846	10	891	9	171,072	2
9. Hot Pepper	950	9	878	10	162,430	2
10. Sweet Pepper	830	11	848	11	149,248	1
11. Others	2,386		2,230		217,623	3
TOTAL	47,195		90,045		10,183,673	

Source: Derived from DOS, 1986, p64.

Table II.15. Estimated North Ghors Fruit Production, Area, and Value, 1986.

REGION/ CROPS	AREA (Dunums)	RANK %	TONNAGE (M.T.)	RANK %	VALUE (JD)	%
A. A'SHAMALIAH						
1. Lemons	12,165	2	21,377	2	3,270,681	95
2. Oranges	6,999	3	16,354	3	3,123,614	91
3. Clementines	19,098	1	23,338	1	2,613,856	97
4. Mandarin	4,635	4	15,717	4	1,713,153	79
5. Bananas a	2,298	5	4,148	5	1,037,000	31
6. Pummelor	500	8	797	6	158,603	95
7. Others	1,747		1,832		300,417	
Subtotal	47,442	75%	83,563	83%	12,217,324	78
B. DAIR A'LLA						
1. Bananas a	856	5	1,455	1	363,750	11
2. Oranges	929	4	1,188	2	226,908	7
3. Mandarin	769	6	770	3	83,930	4
4. Lemons	960	3	460	5	70,380	2
5. Clementines	973	2	577	4	64,624	2
6. Grapes a	1,421	1	262	6	54,758	29
7. Others	720		363		58,176	
Subtotal	6,628	10%	5,075	5%	922,526	6
C. SHUNA JANOBIA						
1. Bananas a	5,798	1	7,747	1	1,936,750	58
2. Mandarin	1,020	2	3,313	2	361,117	17
3. Lemons	877	3	752	3	115,056	3
4. Oranges	495	4	459	4	87,669	3
5. Guavas	144	7	75	6	18,750	16
6. Grapes a	126	8	59	7	12,331	7
7. Others	681		177		19,428	
Subtotal	9,141	14%	12,582	12%	2,551,101	16
D. OVERALL						
1. Lemons	14,002	2	22,589	2	3,456,117	22
2. Oranges	8,423	4	18,001	4	3,438,191	22
3. Bananas a	8,952	3	13,350	5	3,337,500	21
4. Clementines	20,479	1	24,002	1	2,688,224	17
5. Mandarin	6,424	5	19,800	3	2,158,200	14
6. Grapes a	1,777	6	890	6	186,010	1
7. Others	3,154		2,588		426,709	3
TOTAL	63,211		101,220		15,690,951	

*1985 prices.

Source: Derived from DOS, 1986, pp52-54

(4) FIELD CROPS

As seen earlier in Table II.9, field crops were of little importance to the Valley's overall value contributing only 3% of the total. Table II.16 identifies the field crop components. The principal crop was dry onions, which prevailed in Dair A'lla, while wheat and barley were primarily found in A'Shamaliah. Although cereal grains accounted for 82% of the field crop area, they only amounted to 23% of the field crop value, which dry onions dominated.

2. JORDAN VALLEY PRODUCTION TRENDS

Production trends are examined at three points in time: 1973, 1980 and 1986. Trends in crop composition by value, tonnage and yields are identified.

a) Production Trends: Area, Tonnage, and Yields

First, physical production trends are identified through cropped area, production tonnage, and yields for vegetables, fruit and field crops.

(1) OVERALL

Table II.17 identifies the production changes that have taken place at key points in time, namely 1973, 1980, and 1986. These data are based on the Department of Statistic's 1973 and 1980 Agricultural Sample Survey in the Ghors, and the Department's Annual Agricultural Statistics, 1986.

From 1973 to 9186, the reported total land base has not dramatically changed. What has changed is the composition of the cropping pattern between vegetables, fruit, and field crops. The shift has seen a dramatic increase in fruit tree bearing area, 187%, an increased harvested vegetable area of 14%, and a decline in field crop area of 71%. However, this only sets the stage in terms of overall crop composition. The dramatic change lies in the extraordinary increase of total production and yield.

Between 1973 and 1986, overall vegetable production increased 149%, fruit tonnage 546%, and field crops 88%. The greatest change in vegetables occurred between 1973 and 1980 at 110%. During this same period, fruit production increased 194% and 120% from 1980 to 1986. The change in vegetable production from 1980 to 1986 was less dramatic at 19%. Field crops increased a healthy 88%, but this reflects the expansion in dry onions rather than in cereal grains.

Land productivity changes follow much the same pattern as gross production increases. Between 1973 and 1986, vegetables showed a 119% increase, fruits increased 125%, and field crops increased over 500%. But the latter is suspect since 1973 was a drought year.

TABLE II.16 Estimated North Ghors Field Crop Production, Area, and Value, 1986.

REGION/ CROPS	AREA (Dunums)	RANK %	TONNAGE (M.T.)	RANK %	VALUE (JD)	%
A. A'SHAMALIAH						
1. Cereals:						
Wheat	8,756	1	1,462	2	175,440	74
Barley	7,182	2	934	3	70,050	54
Corn	231	4	30	7	2,400	
Subtotal	16,169	59%	2,426	63%	247,890	
2. Onions(Dry)	1,225	3	3,047	1	268,136	23
3. Others	450		660		0	
Total	17,844	53%	6,133	33%	516,026	33
B. DAIR A'LLA						
1. Cereals:						
Wheat	3,814	3	473	3	56,760	24
Barley	5,704	1	730	2	54,750	42
Corn	381	4	50	6	4,000	
Subtotal	9,899	36%	1,253	33%	115,510	
2. Onions(Dry)	3,881	1	10,071	1	886,248	75
3. Others	402		451		0	
Total	14,182	42%	11,775	64%	1,001,758	64
C. SHUNA JANOBIA						
1. Cereals						
Barley	579	1	72	2	5,400	4
Wheat	268	3	33	4	3,960	2
Corn	376	2	46	3	3,680	
Subtotal	1,223	4%	151	4%	13,040	
2. Onions(Dry)	136	4	343	1	30,184	3
3. Others	97		43		0	
Total	1,456	4%	537	3%	43,224	3
D. OVERALL						
1. Cereals:						
Wheat	12,838	2	1,968	2	236,160	15
Barley	13,465	1	1,436	3	130,200	8
Corn	988	4	126	4	10,080	1
Subtotal	27,291		3,830		376,440	
2. Onions(Dry)	5,242	3	13,461	1	1,184,568	76
3. Others	949		1,154		0	
Total	33,482		18,445		1,561,008	

Source: Derived from DOS, 1986, pp57-59.

Table II.17. Overall North Ghors Crop Trends, 1973, 1980, and 1986

	1973-1980	1980-1986	% Change	1973-1986
A. DUNUMS:				
1. Vegetables	152,970	166,990	9	173,669
2. Fruit	22,000	39,329	79	63,211
3. Field Crops	116,110	44,214	-62	33,482
4. Total	291,080	250,533	-14	270,362
B. TONNAGE (M.T.):				
1. Vegetables	126,979	266,313	82	316,144
2. Fruit	15,672	46,070	14	101,220
3. Field Crops	9,653	10,617	10	18,145
4. Total	152,304	323,000	112	435,509
C. YIELD (M.T./DUNUM):				
1. Vegetables	0.830	1.595	92	1.820
2. Fruit	0.712	1.171	64	1.601
3. Field Crops	0.083	0.240	189	0.542
4. Total	0.523	1.289	146	1.611

Source: Derived from DOS 1973 (pp23-28), 1980 (pp16-25), and 1986 (pp51-69).

Overall, these dramatic production changes can be associated with increased irrigation area of the Jordan Valley Authority, implementation of pressurized drip irrigation systems, pesticide control practices, improved fertilization techniques, especially in the area of micro-nutrients, plastic culture for specialty crops, and new varietal selections.

The next three sections review in greater detail the results of Table II.17.

(2) VEGETABLES

As indicated in Table II.18, the ten most planted crops in 1973, 1980 and 1986 represent, respectively 97%, 93% and 90% of the total area devoted to vegetable production. Within this ranking, the top five vegetables represented 86%, 79%, and 69% of the vegetable area in 1973, 1980, and 1986, respectively. At all three points in time, tomatoes, squash, eggplant, and cucumbers were amongst the top five. And except for 1973, these four crops occupied the first four positions. As seen previously in Table II.11, these four vegetables were also in the first four positions for 1986, when ranked by gross value. And as will be seen in the next section, the same relationship holds true for 1980. The second tier has been more variable with only hot pepper and string beans being repeaters in 1980 and 1986, and only hot pepper repeating in all three years.

Land productivity dramatically increased: Although the overall increase from 1973 to 1986 was significant at 119%, the top five crops increased a remarkable 144%. However, averages do mask individual trends such as the leveling-off, or slight decrease, in squash and eggplant yield between 1980 and 1986. On the other hand from 1973 to 1986, tomato yields increased strongly by 259%, while cucumber increased yields an amazing 453%.

Again, the impact of plastic culture on cucumbers is quite evident: from nearly the same dunum base in 1973 (11,602) and 1986 (12,475), gross production increased from 5,585 metric tons to 36,066 metric tons, or more than six-fold. Moreover, Jew's mallow exhibited a similar trend between 1973 to 1980 increasing 70% from nearly the same land base.

(3) FRUIT

Land devoted to fruit production during this period (Table II.19) was straight-forward: citrus and bananas predominated. However, there was an ordering of importance: oranges predominated in 1973 and 1980 but dropped to fourth in 1986 with clementines, lemons, and mandarins moving forward. However, on a relative basis, lemons and mandarins did not change significantly. Bananas went from third in 1973 and 1980 to fifth in 1986. Yet bananas' relative position fluctuated from 20% in 1973, down to 4% in 1980, and up to 14% in 1986.

Table II.18. Valley Vegetable Composition, 1973, 1980, 1986.

CROPS (Dunum ranked)	DUNUMS	%	M.T.	RANK (MT/dunum)	YIELD
1973:					
1. Tomato	60,511	40	44,188	1	0.730
2. Watermelons	25,740	17	34,346	2	1.334
3. Eggplant	18,326	12	13,787	3	0.752
4. Squash	13,321	9	10,891	4	0.818
5. Cucumber	11,602	8	5,585	6	0.481
6. Jew's Mallow	4,754	3	5,748	5	1.209
7. Broad Beans	4,083	3	1,318	10	0.323
8. Hot Pepper	3,312	2	1,515	9	0.457
9. Onion (Green)	2,953	2	3,092	8	1,047
10. Cauliflower	2,503	1	3,492	7	1,395
11. Others	5,865	3	3,017		0.514
Total	152,970		126,979		0.830
1980:					
1. Tomato	54,621	33	92,483	1	1.693
2. Squash	24,743	15	38,095	3	1.540
3. Eggplant	22,563	14	43,749	2	1.939
4. Cucumber	16,649	10	27,024	4	1,623
5. Broad Beans	8,983	5	9,225	7	1.027
6. String Beans	7,248	4	7,439	8	1.026
7. Potato	6,024	4	12,227	5	2.030
8. Sweetmelon	5,217	3	5,278	9	1.012
9. Jew's Mallow	4,576	3	9,802	6	2.142
10. Hot Pepper	4,170	2	4,609	10	1.105
11. Others	12,196	7	16,382		1.343
Total	166,990		266,313		1.595
1986:					
1. Tomatoes	46,598	27	122,276	1	2.624
2. Squash	24,470	14	26,838	4	1.097
3. Eggplant	23.548	14	44,016	2	1,869
4. Cucumbers	13,555	8	36,066	3	2.661
5. Potatoes	12,475	7	18,554	5	1.487
6. String Beans	10,877	6	9,008	7	0.828
7. Hot Pepper	7,509	4	9,646	6	1.285
8. Sweet Pepper	6,400	4	8,967	8	1.401
9. Lettuce	5,921	3	5,353	12	0.904
10. Cabbages	4,209	3	8,537	9	2.028
11. Others	18,107	10	26,883		1.485
Total	173,669	100	316,144		1.820

Source: Derived from DOS 1973 (pp6-20), 1980 (pp16-17), and 1986 (pp60-64).

Table II.19. Valley Fruit Composition 1973, 1980, and 1986.

	AREA	%	TONNAGE (MT/dunum)	RANK	YIELD
1973:					
1. Orange	5834	27	7193	1	1.233
2. Lemon	5798	26	3661	2	0.631
3. Banana	4382	20	1923	3	0.439
4. Mandarin	2104	10	1269	4	0.603
5. Calamandin	1933	9	812	5	0.420
6. Other	1949	10	814		0.418
Total	22000		15672		0.712
1980:					
1. Orange	15716	40	20904	1	1.330
2. Lemon	8579	22	7858	2	0.916
3. Calamandin	6368	16	6195	3	0.973
4. Mnadarin	4435	11	4495	5	1.014
5. Banana	1709	4	5329	4	3.118
6. Other	2522	7	1288		0.511
Total	39329		46069.6		1.171
1986:					
1. Clementines	20479	32	24002	1	1.172
2. Lemons	14002	22	22589	2	1.613
3. Mandarin	6424	10	19800	3	3.082
4. Oranges	8423	13	18001	4	2.137
5. Bananas	8952	14	13350	5	1,491
6. Other	4931	9	3478		0.705
Total	63211		101220		1.601

Source: Derived frm DOS 1973 (pp21-22), 1980 (pp22-23), and 1986 pp57-59)

(4) Field Crops

Table II.20 focuses on field crop land use. Normally, field crops are associated primarily with cereal grain production, as in 1973. But with the inclusion of dry onions in this category, comparative changes can be misleading unless this category is disaggregated. For example, overall productivity of field crop land showed a growth of 555% when in fact the key components, cereal grains and dry onions, have changed 67% and onions 223%. The cereal grain change uses 1973 as the base year while 1980 is the base year for onions since the latter was not a significant contributor until then.

Wheat, based only on 1973 irrigated wheat, changed 51%. However, irrigated wheat area drastically declined from 71% and 68% in 1973 and 1980, respectively, to only 38% of the total in 1986.

b) PRODUCTION VALUE AND MARGIN TRENDS

This section translates the physical production trends into value and margin trends at two points in time: 1980 and 1986.

(1) Trend in Value 1981, 1986

Tables II.21 through II.24 look at the trend in value between 1980 and 1986 from two standpoints: gross value and value per dunum, both of which enter into the farmer's decision process. Gross value reflects production change resulting from both increased acreage and increased yields, while yields primarily represent technological change. Table II.21 summarizes the value trends between 1980 and 1986.

Table II.20. Valley Field Crop Composition 1973, 1980, and 1986.

	AREA	%	TONNAGE (MT/dunum)	RANK	YIELD
1973:					
1. Wheat Irr	82,169	71	8,270	1	0.101
2. Wheat Dry	20,519	18	*		
3. Barley	9,897	8	1,142	2	0.115
Cereals	112,585		9,412		0.084
4. Chick-peas	1,023	1	102	3	0.100
5. Others	2,499	2	139		0.056
Total	116,107		9,653		0.083
1980:					
1. Wheat	30,284	68	6,170	1	0.204
2. Barley	10,476	24	1,409	3	0.134
3. Maize	515	1	426	4	0.827
Cereals	41,275		8,005		0.194
4. Onion (Dry)	2,603	6	2,071	2	0.796
5. Others	336	1	541		1.610
Total	44,214		10,617		0.240
1986:					
1. Barley	13,465	40	1,736	3	0.129
2. Wheat	12,838	38	1,968	2	0.153
3. Maize	988	3	126	5	0.128
Cereals	27,291		3,830		0.140
4. Onions (Dry)	5,242	16	13,461	1	2.568
5. Others	949	3	1,154		1.216
Total	33,482		18,445		0.551

*Drought

Source: Derived from DOS 1973 (pp25-28), 1980 (pp22-23), and 1986 (pp57-59).

Table II.21 North Ghors Total Value Trends (JD), 1980-1986

CROP	1980(1)	%	1986	%	CHANGE
1. Vegetables	34,382,770	82	37,859,792	69	10%
2. Fruit	6,854,161	16	15,690,951	28	129%
3. Field Crops					
a. Cereals	795,932	2	376,440	1	-53%
b. Dry Onion	101,448	1	1,184,568	2	1,068%
c. Others					
d. Subtotal	897,380	2	1,561,008	3	74%
4. Total	42,134,311		55,111,751		31%

(1) Based on 1981 prices.

Source: Derived from DOS, 1980 (pp 16-23), tables 3.3,3.7,3.8.

Vegetable values dominated overall crop values in both 1980 (based on 1981 average prices) and 1986 with a total increase of 10%. In addition, vegetables' share decreased from 82% in 1980 to 69% in 1986. Fruit increased its market share as values rose a significant 129%, as compared to 1980. Field crop values rose 74%, which was due to the increase in dry onion value. Market share continued at a lowly 3%. The cereal grains, however, showed a marked decline in value of 53%.

Overall, value increased 31%. And if field crops were removed, total value would still change 30% confirming the strong influence of vegetables and fruit.

Table II.22 reviews the value changes of the ten top ranked vegetable crops, the top six ranked fruit crops, and the field crops from 1980 to 1986. The vegetable crops represented 88% of the vegetable area in 1986 and 91% in 1980, while the fruit crops represented 95% of the fruit area in 1986 and 95% in 1980.

Table II.22 Comparison of Selected CropValues, 1980 and 1986

1986 CROPS: (Value Ranked)	1980 RANK	1980 VALUE	1986 VALUE	VALUE CHANGE	%
A. VEGETABLES:					
1. Tomatoes	1	11,190,443	11,493,944	303,501	3%
2. Cucumbers	4	4,837,296	5,986,956	1,149,660	24%
3. Eggplant	2	4,987,386	4,709,712	-277,674	-6%
4. Squash	3	4,914,255	3,569,454	-1,344,801	-27%
5. Potatoes	7	1,369,424	2,820,208	1,450,784	106%
6. String Beans	5	1,882,067	1,909,696	27,629	1%
7. Hot Pepper	8	765,094	1,784,510	1,019,416	133%
8. Sweet Pepper	16	175,950	1,578,192	1,402,242	797%
9. Sweet Melons	11	453,908	923,979	470,071	103%
10. Broad Beans	6	1,402,200	622,848	-779,352	-56%
Subtotal		31,978,023	35,399,499	3,421,476	11%
B. FRUIT					
1. Lemons	3	1,194,416	3,456,117	2,261,701	189%
2. Oranges	1	2,633,904	3,438,191	804,287	31%
3. Bananas	2	1,236,328	3,337,500	2,101,172	170%
4. Clementines	4	941,640	2,688,224	1,746,584	185%
5. Mandarin	5	719,200	2,158,200	1,439,000	200%
6. Grapes	8	28,275	186,010	157,735	558%
Subtotal		6,753,763	15,264,242	8,510,479	126%
C. FIELD CROPS					
1. Cereals:					
Wheat		617,000	236,160	-380,840	-62%
Barley		149,112	130,200	-18,912	-13%
Corn		29,820	10,080	-19,740	-66%
Subtotal		795,932	376,440	-419,492	-53%
2. Onions (Dry)		101,448	1,184,568	1,083,120	1068%
Subtotal		897,380	1,561,008	663,628	74%

Source: Derived from DOS 1980 and 1986

Comparing 1980 and 1986 for the first five crops, tomatoes retained their number one ranking on a slight value increase of 3%; cucumbers rose from fourth to second with a value increase of 24%; eggplant dropped from second to third on a 6% value decline; squash dropped from third to fourth on a 27% decline; and potatoes rose from seventh to fifth with an increase of 106%.

In like manner with fruit, lemons rose from third to first with a value increase of 189%; oranges dropped from first to second while value increased only 31%; bananas dropped from second to third although value increased 170%; clementines and mandarins retained their fourth and fifth positions, respectively.

Table II.23 examines the changes in JD per dunum from 1980 to 1986. Vegetable value increased 6%, fruit values rose 43%, and field crops were up 135%. Again, dry onions dominated this latter category.

Table II.23 North Ghors Area Value Trends (JD/Dunum), 1980-1986

CROPS	1980 (1)	1986	CHANG
1. Vegetables	206	218	6%
2. Fruit	174	248	43%
3. Field Crops			
a. Cereals	19	14	-26%
b. Dry Onion	39	226	479%
c. Others			
d. Subtotal	20	47	135%
4. Total	168	204	21%

(1) Based on 1981 prices.

Source: Derived from DOS 1980 and 1986

Table II.24 reflects the change in vegetable and fruit crops based on JD per dunum. Vegetable ranking changed markedly, as compared to past ranking criteria. The first five no longer consisted of tomatoes, squash, cucumbers, eggplant, and potatoes. Only tomatoes and cucumbers remained. Cucumbers were first with a per dunum value of 442 Jordanian dinars followed by sweet melons (JD 290), sweet peppers (JD 247), tomatoes (JD 247), and hot peppers (JD 238), respectively.

Oranges lead fruits with a JD 408 per dunum followed by bananas at 373, mandarins at 336, lemons at 247, clementines at 131, and grapes at 105.

Table II.24. Comparison of Selected Area Crop Values (JD/dunum), 1980 and 1986.

1986 CROPS: (Value Ranked)	1980 RANK	1980 JD/DUN	1986 JD/DUN	CHANGE JD/DUN		
A. VEGETABLES						
1. Cucumbers		1	291	442	151	52%
2. Sweet Melons		11	87	290	203	233%
3. Sweet Pepper		9	135	247	112	83%
4. Tomatoes	5	205	247	42	20%	
5. Hot Pepper		7	183	238	55	30%
6. Potatoes	3	227	226	-1	-1%	
7. Eggplant	4	221	200	-21	-9%	
8. String Beans		2	260	176	-84	-32%
9. Broad Beans		8	156	148	-8	-5%
10. Squash	6	199	146	-53	-27%	
B. FRUIT						
1. Oranges	2	168	408	240	143%	
2. Bananas a		1	723	373	-350	-48%
3. Mandarin	3	162	336	174	107%	
4. Lemons	5	139	247	108	78%	
5. Clementines		4	148	131	-17	-11%
6. Grapes a		6	67	105	38	57%
C. FIELD CROPS						
1. Cereals: c						
Wheat	20	18	-2	-10%		
Barley		14	10	-4	-29%	
Corn	58	10	-48	-83%		
2. Onions (Dry)			39	226	187	479%

Source: Derived from tables 3.11, 3.12, 3.13 and 3.14A.

In addition to changes in production, value changes are also directly influenced by price changes. Table II.25 examines composite price changes as a qualitative indicator of the influence of price fluctuations on value changes.

Table II.25 Composite Price Comparison (JD/kg), 1981 and 1986

CROPS	1981	1986	CHANGE
1. Vegetables	0.129	0.120	-7%
2. Fruit	0.149	0.155	4%
3. Field Crops			
a. Cereals	0.918	0.983	7%
b. Dry Onion	0.720	0.880	22%
c. Subtotal	0.891	0.846	-5%
4. Total	0.130	0.127	-2%

Source: Derived from Amman Central Market price data, 1981 and 1986

Composite price changes do not appear to have influenced the increase in either gross value or value per dunum: vegetable prices, as a composite, declined 7%, fruit prices rose only 4%, while field crops overall suffered a 5% decline. Again, onions dominated the statistics of this group.

(2) Gross Margin

Table II.26 examines gross margins of the ten most valued vegetable crops and the predominant fruits. These margins do include marketing costs, which can be subtracted to find a farm gate margin. However, in many cases, the farmer transports his own products and does retain that part of the marketing expenses.

Sweet melons showed the greatest margin at JD 267 per dunum followed by tomatoes (JD 152), string beans (JD 127), potatoes (JD 116) and broad beans (JD 116). Oranges topped the fruits at JD 294 followed by mandarins at 221, lemons at 132, bananas at 126, and clementines at a lowly 17.

Table II.26. Selected Vegetable and Fruit Gross Margins Per Dunum, 198

CROPS	AREA (Dun)	VALUE (JD)	JD/DIRECT DUN	(1) COST (JD/Dun)	(2) GROSS MARGIN (Dun)
A. VEGETABLES:					
1. Sweet Melons	3,188	923,979	290	22.2	267
2. Tomatoes	46,598	11,493,944	247	94.2	152
3. String Beans	10,877	1,909,696	176	48.2	127
4. Potatoes	12,475	2,820,208	226	110.3	116
5. Broad Beans	4,205	622,848	148	32.4	116
6. Eggplant	23,548	4,709,712	200	90.0	110
7. Squash	24,470	3,569,454	146	57.5	88
8. Cucumbers	13,555	5,986,956	441	384.9	57
9. Sweet Pepper	6,400	1,578,192	247	236.0	11
10. Hot Pepper	7,509	1,784,510	238	236.0	2
B. FRUIT					
1. Oranges	8,423	3,438,191	408	114.5	294
2. Mandarin	6,424	2,158,200	336	114.5	221
3. Lemons	14,002	3,456,117	247	114.5	132
4. Bananas a	8,952	3,337,500	373	247.0	126
5. Clementines	20,479	2,688,224	131	114.5	17

(1) JVA, p43, (2) Excludes marketing costs.

Source: Jordan Valley Authority, 1987.

Table II.27 compares total revenue and gross margins of nine of 1986's more highly valued crops with 1977. Again, marketing costs are not included, but a farm gate margin can be determined by deducting marketing costs. The crops are ranked according to their gross margin. And the percentage of gross margin identifies gross margin relative to total revenue for 1977 and 1986.

Table II.27 Estimated Gross Margin Changes of Selected Vegetables, 197 and 1986.

CROPS	TR (1) (JD/Dun)	COST (2) (JD/Dun)	GROSS MARGIN	MARGIN % TR
1977:				
1. Eggplant	151	56	95	63%
2. Tomato	144	60	84	58%
3. Broad Beans	104	25	79	76%
4. Peppers	123	51	72	58%
5. Cucumber	102	45	57	56%
6. String Beans	89	42	47	53%
7. Potatoes	105	64	40	39%
8. Squash	73	38	35	48%
1986:				
1. Tomato	247	94	152	62%
2. String Beans	176	48	127	73%
3. Potatoes	226	110	116	51%
4. Broad Beans	148	32	116	78%
5. Eggplant	200	90	110	55%
6. Squash	146	57	88	61%
7. Cucumber	442	385	57	13%
8. Peppers	241	236	5	2%

Notes: (1)TR: Market price total Return
(2)1977: Steitieh, et al; 1986: JVA

Source: Derived from Steitieh, Jordan Valley Authority, 1987, DOS 1986

Table II.28 continues the analysis. First, the change in gross margin is compared between 1977 and 1986, which shows a high increase throughout. However, this does not give a true picture of the gross margin change that have taken place. Instead, gross margins are next evaluated relative to their total return. Thus, this comparison shows more vividly what has actually taken place with gross margins. Relative to total returns cucumber, pepper, and eggplant have declined; tomatoes and broad beans have remained the same; and the rest have increased. If marketing costs are considered, the enormity of the problem facing vegetable production in the valley becomes even more apparent.

Table II.28 Estimated Change in Gross Margin, 1977 and 1986

CROPS	1977 GM (1) (JD/Dun)	1986 GM (2) (JD/Dun)	% CHANGE	1977 GM % of TR	1986 GM % of TR	% CHANGE
Tomato	84	152	82%	58%	62%	6%
Cucumber	57	57	1%	56%	13%	-77%
Eggplant	95	110	15%	63%	55%	-13%
Squash	35	88	154%	48%	61%	27%
Potatoes	40	116	186%	39%	51%	33%
String Beans	47	127	170%	53%	73%	37%
Peppers	72	5	-93%	58%	2%	-97%
Broad Beans	79	116	47%	76%	78%	3%

Notes: (1) Gross Margin, Steitieh, et al; (2) JVA

Source: Derived from Steitieh, Jordan Valley Authority, 1987

3. LAND TENURE AND FARM SIZE

A primary objective of land reform is the lessening of differences in owned wealth by individuals. So this section reviews the changes of land holding pattern and the effect of land reforms on productive efficiency as associated with the development of the East Ghor Canal Project. Productivity efficiency of the farming system revolves mainly around farm size and fragmentation. Tenure data is limited so only basic trends can be hypothesized.

It was in the 1950's and Land Law 41 of 1953, when leased state land became available as privately-owned land, thus increasing the amount of private land in the Valley. And in 1959, under the East Ghor Canal Law 41, all lands in the project area, benefiting from irrigation development, became privately-owned land. This was with the stipulation that no landholding should be less than 30 dunums, and limits were set on a full range of land holding sizes. Consequently, these two laws set the process in motion of turning over more irrigated, or potentially irrigated, land to private ownership. Table II.29 summarizes these, and ensuing changes in Jordan's land reform law.

The original 1959 law introduced land distribution related to land productivity classification: class 1 and class 2 land were allocated at approximately 30 dunums while less productive class 3 land was allocated at 50 dunums. The 1960 amendment reduced the scale of expropriation experienced by medium and large landowners. However, the 1962 and 1972 amendments returned the minimum size to 30 dunums and increased further the scale of expropriation.

Table II.30 examines tenure in the Valley. Since these data represent several sources at different points in time, there is often neither a uniformity in survey areas nor in tenure definitions. However, several basic trends that bear on the pattern of land ownership are identifiable and, by implication the pattern of landholding, size, and fragmentation. Although variations in the patterns are large, the proportion of land held by sharecroppers and renters has declined while that of owner-occupied has fluctuated far less and is the dominate tenure form for the last two surveys.

Table II.29 East Ghor Canal Project: Summary of Land Reform Laws, 1959-1977.

IRRIGABLE DUNUMS HELD PRIOR TO PROJECT	NUMBER TO BE ALLOCATED TO HOLDER
A. 1959, Law #14 (Original)	
1. 30 - 50	Allocated in full
2. 51 - 100	50 dunums plus 50% of excess
3. 101 - 500	75 dunums plus 25% of excess
4. 501 - 1000	175 dunums plus 15% of excess
5. Over 1000	300 dunums
B. 1960, Law #13 (Amendment)	
1. 30 - 70	Allocated in full
2. 71 - 100	75 dunums plus 50% of excess
3. 101 - 500	87.5 dunums plus 25% of excess
4. 501 - 1000	187.5 dunums plus 22% of excess
5. Over 1000	300 dunums plus 10% of excess
C. 1962, Law #31 (Amendment)	
1. 30 - 50	Allocated in full
2. 51 - 100	50 dunums plus 25% of excess
3. 101 - 500	62 dunums plus 17% of excess
4. 501 - 1000	130 dunums plus 12% of area exceeding 500 dunums
5. Over 1000	200 dunums (lands planted with trees might be excluded)
D. 1977, Law #18 (Amendment)	
1. 40 - 50	Allocated in full
2. 51 - 100	50 dunums plus 25% of excess
3. 101 - 500	62 dunums plus 17% of excess
4. 501 - 1000	130 dunums plus 12% of area exceeding 500 dunums
5. Over 1000	200 dunums

Source: Anbar, p7.

Table II.30 East Jordan Valley: Percentage Distribution of Agricultural Land by Form of Tenure

OWNERSHIP TYPE	1953(1)	1960(2)	1973(3)	1975 (4)	1980(5)
Owned	54.0	32.5	35.9	37.1	57.0
Sharecrop	--	39.0	47.2	26.1	30.9
Cash Rent	31.0	1.8	2.7	3.9	11.9
Mixed[6]	15.0	23.7	14.1	13.6	0.3
Rent Free	--	3.0	--	0.7	--
Mixed Rent	--	--	--	18.6	--

Notes:
1 UNRWA survey, included east and west banks.
2 DOS, 1961 survey, eastern part of the valley
3 DOS, 1973 survey, East Jordan Valley, north, middle, south
4 DOS, Agricultural Census, 1975
5 Anbar sample survey, East Ghor Canal Project; No. of units, not area
6 Owned plus rented.

Source: Anbar, p18.

The DOS survey of 1960 indicated that 92% of all owners held no more than 100 dunums each, which accounted for 46% of the land. And 0.3% of the surveyed owners held nearly 10% of the land in units over 1000 dunums. Furthermore, it showed that generally farm holdings, including rented land, were larger than ownership units. Average holdings in the project were 62 dunums with the mean at 43 dunums. Also, there were fewer very small farms associated with land holdings that with land ownerships, e.g., only 19% of the land holdings were below 20 dunums compared with 55% of the land ownerships.

The 1973 socio-economic survey indicated that the average ownership size had fallen from 62 dunums in 1960 to 42 dunums in 1973. Twenty-nine percent of the holdings are in the 31 - 50 dunum class, but 58% were still at or below the minimum allowable size.

The 1980 survey also indicated that the pattern of holdings were still dominated by small units: Sixty-five percent were in the 31 - 40 dunum range, and only 14% of the enumerated farms were larger than 50 dunums as compared to 19% in the 1973 survey. Consequently, the general conclusion remains that the size of ownership units have declined over the years.

Information is limited as to farm fragmentation, but the 1960 survey indicated that 27% of holdings consisted of two parcels and 25% had three or more parcels. Seventy-five percent of holdings of 19 dunums or less consisted of single parcels, while holdings of 130 dunums or more consisted of four or more parcels. Anbar observed that by 1975 the average holding consisted of 1.6 parcels, as compared to 2.9 in 1955. Because fragmentation does lead to higher operating costs, the later land refo.ms have been as concerned to control fragmentation as to enlarge the smallest farms.

CHAPTER III - MARKETING CONSTRAINTS AND AGRICULTURAL RESOURCE EFFICIENCY

III. MARKETING CONSTRAINTS AND AGRICULTURAL RESOURCE EFFICIENCY

Market saturation of some horticultural crops and inefficient input use on Jordan Valley farms has caused farm gate and wholesale prices to fall, production prices to rise, resulting in lower farmer profit margins. Improving input resource use efficiency will result in producing more with less, lowering production costs, and partially offsetting the adverse farm income effects of product price declines. Should some of the market bottlenecks be removed in concert with improving input-use efficiency, farm revenues can be significantly increased. A discussion of these related issues follows.

A. MARKET AND POLICY ANALYSIS

1. Supply, Demand and Price Trends.

> If plasticulture continues spreading as it is today, in a few years, we'll have a surplus of cucumbers and tomatoes that will drop the price and ruin many farmers. (Rami Khouri, 1981.)

It is said that Jordan can overproduce anything. Domestic demand for fruits and vegetables, the major outputs from Jordan Valley agriculture, is constrained by the small size of the country's population base relative to total output. This assessment is particularly valid for the post mid-1970's period when technological adaptation and agricultural productivity followed a rate of unprecedented expotential growth.

Domestic demand in Jordan is both price and income inelastic. The estimated income elasticities of demand for vegetables in Jordan range between .2 and .4 while price elasticities fall between .31 and .74.[1]

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[1]Calculated from 5-year price/quantity data provided by the Amman, Zarqua, and Irbid wholesale markets.

Table III.1
Demand-Price Elasticities
in Jordan

	Price Elasticity	Income Elasticity
Tomato	-.56	.33
Eggplant	-.31	.26
Squash	-.54	.29
Cucumber	-.42	.26
Green Bean	-.71	.36
Cauliflower	-.74	.34
Dry Onion	-.76	.41
Cabbage	-.54	.31
Apple	-1.64	1.36
Orange	-.30	.54

Source: Calculated from a five year monthly quantity and price series.

Except for certain high preference luxury imports (e.g. apples), the domestic market can be best described as "thin" with marginally small changes in demand levels from larger movements in both prices and income.

On the supply side, investments in high technology plasticulture with improved irrigation and agrochemical inputs has increased agricultural output to levels far exceeding requirements for domestic markets.

Fortunately, Jordan's traditional role as the major supplier of winter fruits and vegetables to regional markets in Iraq, Syria, Lebanon, and Saudi Arabia siphoned off the increased output from improving agricultural technology. During the late sixties and early seventies, demand for Jordanian fruit and vegetable products was robust and prices were high and stable. Fifteen years ago Jordan was the major producer for these regional markets.

Toward the beginning of the Iran/Iraq war in 1979, structural changes in regional trade patterns began to alter Jordan's favorable position as the primary supplier of these commodities. Factors causing these structural changes include: (1) rising importing country preferences for higher quality produce; (2) upward exchange rate adjustment of the Dinar against other regional currencies; (3) entry of Greece and Turkey with lower and partially subsidized production costs and better quality control; (4) increased competition from domestic production in regional markets; (5) high relative costs of Jordanian agricultural labor with respect to regional labor costs; and (6) political tension. These adverse conditions all combined to suppress regional demand for Jordanian exports at a time when its own agricultural productivity was expanding through technological transformation.

The opposing trends widened the gap between domestic supply and demand, creating market saturation conditions for a number of vegetable products whose total supply was rapidly expanding. Farm-gate and wholesale prices began to level off and actually declined in real terms during the last several years (five-year price, quantity, and export trends at Appendix III.1).

2. MARKET STRUCTURE

a) Policy Environment Affecting Market Efficiency.

Five government policies intervene in the horticultural marketing system; these influence prices and producer margins: (1) cropping pattern and import regulation to control domestic supply; (2) irrigation water and air freight subsidies; (3) import taxation policies to discourage imports of commodity surplus items; (4) implicit subsidization of investment costs and profits through duty-free importation of inputs except for spare parts and non-taxation of agricultural income; (5) administrative regulation of retail prices.

The most controversial of these policies are those related to crop mix mandates, retail price ceilings, and export/import licensing controls.

Beginning in 1984, the government instituted a series of administrative measures to limit production of certain surplus commodities. In 1987, crop mandates and restrictions were applied two the following outputs:

- greenhouse production of tomatoes is forbidden in the Jordan Valley

- area ceilings are set for eggplant, squash, and cucumber production in green houses.

Crop mix ceilings are set annually where producers are given written directives setting forth the administratively fixed limits. Non-compliance subjects holders to fines ranging from JD 25 to JD 50 per dunum. In 1985/1986, the Ministry of Agriculture offered an incentive of 15 JD to tomato producers to keep their acreage within the crop mandated ceiling. This resulted in transfer payments from the national treasury approximately JD 600 thousand in crop mix incentive payments. This practice was discontinued in 1987.

In the Assessment Team's random sample of valley farmers, many were unhappy with government interference in crop-mix decisions. They said this action pre-empted their cropping options and restricted their ability to respond to changing market conditions. However, MOA records

Figure III-1A

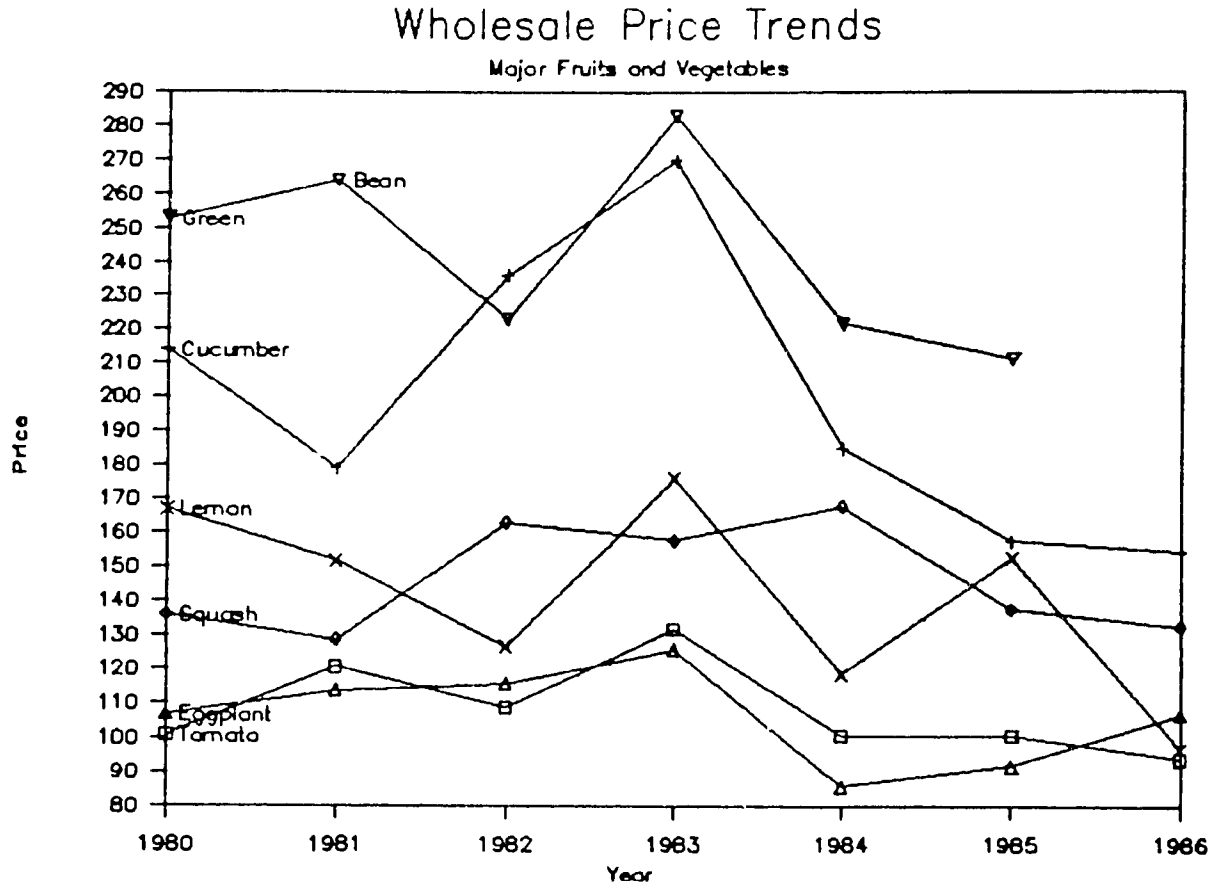
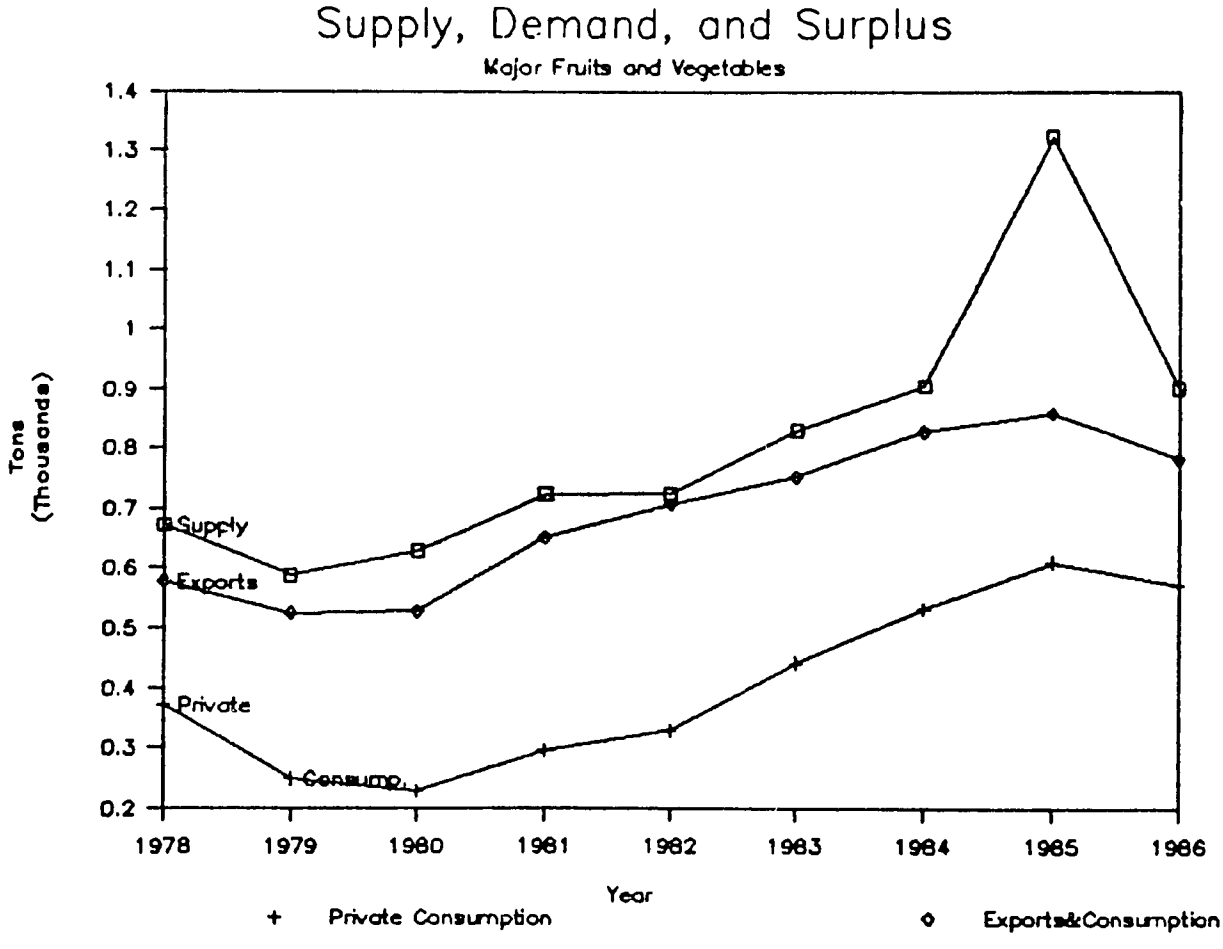


Figure III-1B



very little incidence of violation. Most farmers seemed to abide by the mandates and many planted less than the ceiling.

The obvious intent of the mandates was to set upper limits on production. However, the Team's random sample showed that poor communication flows down through the regulatory system sometimes resulted in misinterpretation. Some farmers and extension agents interviewed believe that crop-mix limits are quotas requiring full land area allocation up to the amount specified even though they preferred to plant less rather than more of the surplus items. The presence of the compliance subsidy for tomatoes in 1986 was probably an inducement to plant more, while market conditions would warrant planting less. Ironically, then, administrative intervention designed to limit production of surplus commodities may have actually increased output through misinterpretation and by the one-year incentive to observe the tomato ceiling. This hypothesis appears supported by actual tomato production figures showing a 17 percent increase in output during the year of the subside (see Appendix III.1).

The Assessment team questions the effectiveness of using other than market forces to regulate agricultural production decisions. A more effective intervention strategy would be to use a combination of import restrictions, improved market information dissemination, and perhaps price incentives to affect changes in producer resource allocation for desired crop-mix realignment.

Although market forces largely determine domestic wholesale prices, these prices are clearly influenced by government price policy in retail markets ([7] Bredahl, p. 12). Daily, a government committee sets retail prices of fresh produce. Prices are set on an average of previous day's wholesale prices, the current day's wholesale auction prices, and the volume of market throughput over a two-day period. Weighing all of these factors, the committee sets the current day's retail prices. In principle, retail prices are fixed at between 10 to 30 percent over the wholesale price level, depending on the product's perishability and other factors. In practice, the variance may range from less than 10 percent up to 200 percent ([13], Enochian, P. 15).

> In periods of shortage, when the markup allowed by the upper price is lowest, some retailers reportedly will hold back the best quality produce for favored customers or sell secretly at higher than the upper price.

It is believed that the practice of setting maximum retail prices has a clear influence on auction prices in the wholesale markets and may discourage adoption of grading standards. Retail outlets tend to charge the maximum allowed, and sometimes more, without quality/price differentiation. In this environment, there appears little incentive

for producers and wholesalers to pay attention to quality differentiation as these efforts would not increase profit margins at either lever ([7] Bredahl et al, p. 12).

Related to the retail price issue is the practice of price subsidization of certain commodities by parastatal procurement outlets (AMPCO). Guaranteed floor prices, pegged above wholesale market levels, clearly play a significant role in expanding production of deficit commodities. Jordan has achieved virtual self-sufficiency in potato production through a combination of price incentives and extension promotion.

In some instances, however, procurement price incentives may contravene other policy instruments. The Team questions the wisdom of offering subsidized procurement prices for surplus commodities. This has occurred with tomatoes and may actually contribute to the surplus at the same time other policies (e.g. cropping mandates) are trying to reduce it. An aim of the tomato processing plant at ARDA is to absorb excess production, but the price subsidy applied to plant procurements may actually increase the surplus that the plant's operation is supposed to reduce. Policy consistency should be a major concern!

The third policy issue requiring comment is the control of import/export licensing by the Ministry of Agriculture. Although monthly quotas are set on the basis of estimated supply and demand factors to regulate prices by controlling the market flow, the actual impact of this intervention appears mixed.

On the positive side, import/export regulation does appear to help maintain some prices stability for surplus crops by easing further downward pressure from uncontrolled imports. Banning imports of tomatoes, cucumber, squash, and eggplant was obviously an important factor in keeping the price slides for these products from being more precipitous during the past two years. Import controls also serve as a stimulus to local production by expanding and maintaining domestic markets (e.g. potato production in the mid 1980's).

Another positive effect of import restrictions and franchised procurement has been the cushioning of farmer revenue losses from falling prices during periods where market prices have fallen below the costs of production, harvesting and marketing as in 1986 for tomatoes. In these years, farmers either suffered negative margins or sold to government (AMPCO) processing centers at support prices. This policy was of definite benefit to small numbers of farmers who were able to sell directly to the government through this mechanism.

The negative side of this policy is the unprofitability of exporting (to Egypt and Iraq) processed tomatoes when a substantial loss is incurred. Local production costs of tomato paste ($1,000 per ton) are

some 32 percent higher than the world market price ($700) received from these transactions [2].

A major limitation of the agricultural trade regulating mechanism is the creation of uncertainty wherein intermediate and longer range projections of producers and traders are hindered by irregularities in timing and magnitude of the import/export restrictions.

Interviews with 30 commission agents, exporters, and wholesalers at the Amman market provided significant indication of considerable relocation of their trading activities to other parts of the Eastern Mediterranean (particularly Turkey and Greece) because of the more favorable regulatory and policy environments in these centers.[2]

b) Market System

> Given the rising cost of intensive irrigated cultivation in the valley, the small scale farmer quickly falls into debt to the commission agent, and remains contractually bound to him, unable to market his produce via any other agent until he pays his debts- Rami Khouri, 1981.

The fruit and vegetable marketing system in Jordan has been extensively described.[3] The following is a synopsis of these references.

Fruit and vegetable produce is usually picked and packed in the field. Little attention is given to grading or container standards. Consequently, there is usually a mixture of sizes, maturities, and qualities in single containers. Producers frequently "top up" their polystyrene or wooden boxes with "eye appealing" specimens covering lower quality produce on the lower layers. Little attention is given optimal

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[2] Discussions with the MOA Agricultural Economics Department, October 3, 5, and 13, 1987.

[2] Discussions with agents at the Wholesale Market, October 21 and 25, 27, and 28, 1987.

[3] Ref 7, Bredahl et al, 1985.

Ref 14, Godwin, 1984.

Ref 13, Enochian, 1984.

Ref 26, Laurent, 1985.

Ref 20, Jordan Valley Authority, 1987.

handling practices, thus containers are usually overfilled and stacked haphazardly in trucks bound for market centers. It is estimated that post-harvest losses approach 15-20 percent from these unsystematic practices ([13] Enochian, p.7).

> Personal observations were made of the way in which products are packed, the condition of some of the containers and operators in both the wholesale and retail markets. These included auctioneers standing on top of stacks of boxes filled with produce, loads of produce left standing in the sun for long periods, and partially rotten products, especially tomatoes for sale in the crowded, unsanitary central retail market of Amman.

After loading at the field site, produce is transported to wholesale markets in Amman, Zarqua, and Irbid for sale by auction. Sixty-two percent of the total produce passes through the Amman Central Wholesale Market with eighteen percent through Zarqua and eleven percent through Irbid.[4] The remaining nine percent of the total produce is marketed at the wholesale markets in the Jordan Valley, principally El Arda (Figure III.2). Much of the annual throughput from markets in the valley not sold directly to the Agricultural Marketing and Processing Company of Jordan (AMPCO) or directly to private exporters passes upward through the chain for marketing at the Amman Wholesale Market and then on to retail and export outlets (Figure III.4).

The majority of the 7,000 farmers in the Valley produce for the Amman market. All of the production from the West Bank and Gaza coming into Jordan (currently the output from 50 percent of the producing area) passes through this facility. Marketing is by auction through a network of commission agents.

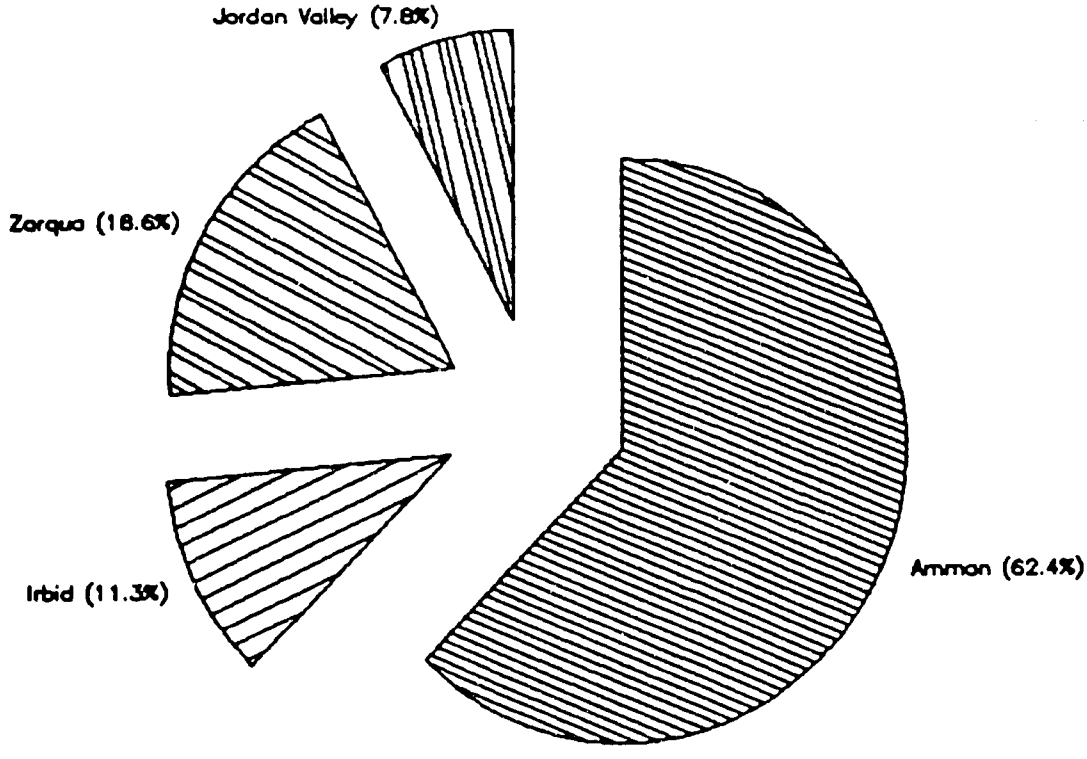
To understand some of the workings of the commission agents and the marketing structure through which they operate, the Assessment Team conducted a series of interviews with 30 agents, exporters, and wholesalers and 20 farmers at the Amman Wholesale Market. The conclusions made in this report summarize the general impressions from these interviews. These conclusions may be somewhat restrictive as they represent the results of a cursory, rather than in-depth study; as such they may not entirely capture the full essence of the complex marketing system found in Jordan.

Altogether, there are 53 agents operating in the market (Figure III.3). About half of these also operate import/export and retail

[4] Ministry of Agriculture. Agricultural Statistics 1980-1985: Amman, 1985.

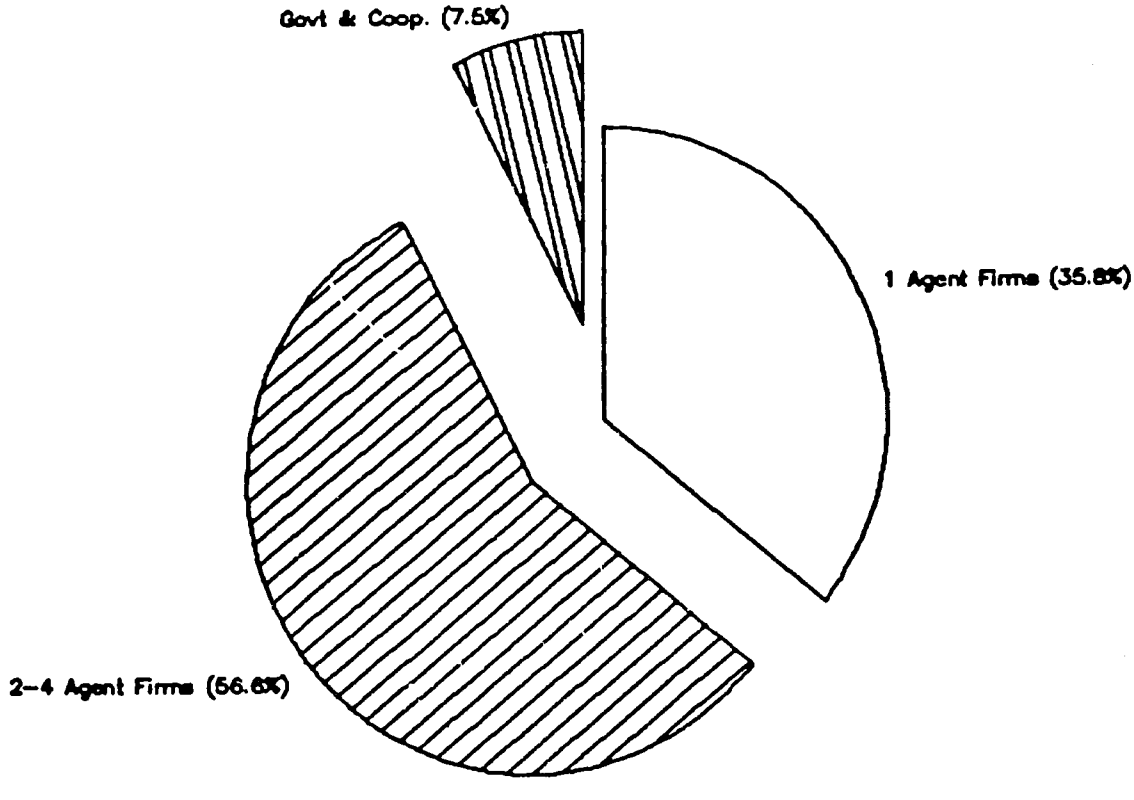
Wholesale Fruit and Vegetable Markets

Comparative Volume Shares



Composition of Commission Agencies

Amman Central Wholesale Market



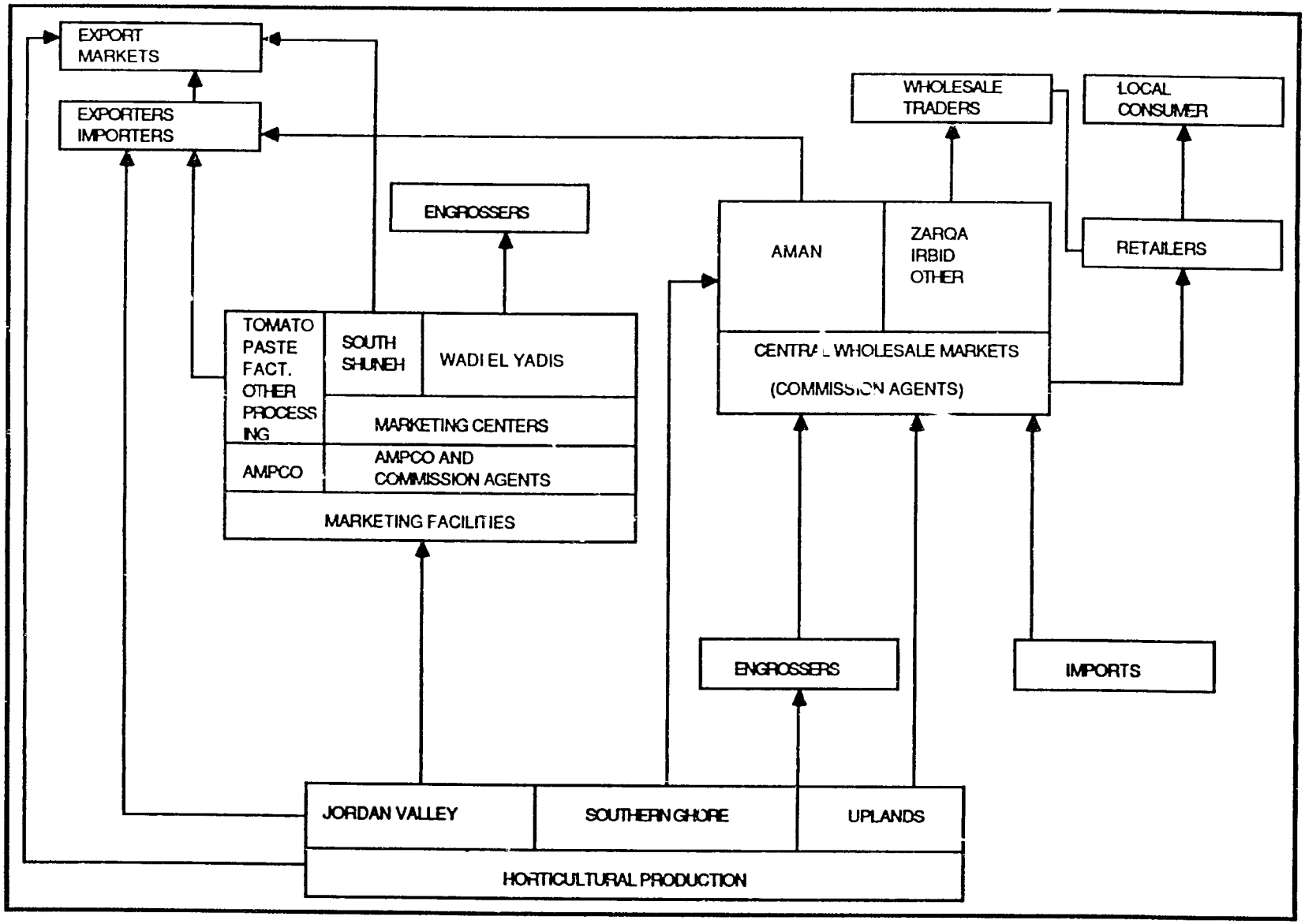


Fig. III- 3 Marketing Channels in Jordan

outlets for fruit and vegetable produce. They appear to have an extensive informational and contact network around the Eastern Mediterranean region.

The market seems dominated by the 30 largest firms with two to four principal agents each (this does not include clerical staff), but the competitive atmosphere that this number suggests may be more apparent than real. Team discussions with agents at the market indicated that six or seven families control most of these larger operations through kinship and personal ties. Thus it would appear that there is an ologopolistic network dominating the market.[1]

The commission agents also seem to have a closely guarded monopoly on the most current information concerning domestic wholesale seasonal and daily price trends as well as timely information on price, supply, and demand trends in other regional markets. This information is closely held and used to manipulate the market by increasing or restraining supplies from established producer-clients. This gives them a highly competitive market informational edge not enjoyed by either farmers, retailers, or other operatives within the marketing system.

Agents interviewed reported a preference for regular producer-clients to casual walk in arrangements. With regular clients, they are in a better position to influence planting, harvesting, and marketing dates to profit from optimal swings in price movements which they have determined through years of experience and intimate knowledge of market dynamics.

There appears to be widespread extension of informal credit facilities by commission agents to regular customers. These include seasonal credits to farmers in cash and kind to be repaid through deductions at 15 percent interest from sale of crop proceeds. Occasionally credit is also extended for non-farm expenditures such as housing and appliances. These are also repaid through deductions from auction proceeds. Debt rescheduling is a common practice, particularly during the past several years of wholesale price decline. Through this mechanism, it appears as though many farmers become linked, through increasing indebtedness, to specific agents in the marketing chain. The net effect of this linkage is the evolution of symbiotic relationships between agents and farmers that recidivism and financial obligations help to forge and maintain.

Commission agents usually charge a flat five percent fee of gross sales. Some report a differentiated fee structure for "preferred" clients. Governmental outlets, mainly the Jordan Cooperative Organization (JCO) attempts to put downward pressure on commission

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1 Wholesale market interviews, <u>ibid</u>.

prices by selling at a four percent brokerage fee. This competitive fee structure level does not, however, appear to have any significant impact on the market. The combined throughput share of the parastatal market outlets is a minuscule 7.5 percent.

After commission agent fees, both buyers and sellers pay an additional 2 percent each of net proceeds to the municipality of Amman for marketing services. This represents a transfer payment from national producers and consumers to the municipality with a net return over costs of 1000 percent ([14] Godwin, P.7).

Other "hidden" costs in the marketing system include: (1) agent markups on container sales; (2) high transport costs; (3) agent commission on container and transport sales. Interviews at the central market showed a growing incidence of agent involvement in transport and packaging. Some agents advance funds to farmers for transport costs (100 fils/20 kg box), replace containers used in the shipment with fresh containers for the truckers' return to the farm gate, and then calculate their 5 percent commission on gross sales plus funds advanced for transport and containerization. These practices apparently arise from farmer liquidity problems and inability of some to finance their own marketing costs. It was learned that an agent operated container cartel is able to sell 110 fil boxes to farmers for 220 fils because alternative supplies are unavailable. While these practices are probably still the exception rather than the rule, there appears to be sufficient activity in these areas to warrant farmer complaints during farmer interviews at both the field and market levels. The existence of these practices were further confirmed by officials at the market during the Team's several visits.

In discussions with economists at the Ministry of Agriculture's Department of Agricultural Economics, the Assessment Team was told that, in 1983-1984, farmer retention of proceeds from auction sales was in the range of 60 to 70 percent. In 1987, this range has reportedly dropped to 30 and 40 percent[2]. Because of the rising marketing costs from commission, transport, and containerization price escalation, many farmers are sufficiently motivated to try alternative marketing systems.

The general practice among fruit producers is to sell their produce on the trees with the buyer doing the picking and packing. Some vegetable farmers report selling their produce by the truck load at the farm gate to commission agents and wholesalers at rock bottom prices to avoid entanglements and rising costs of regular packing, transport, and marketing operations.

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[2] MOA Agricultural Economics Department discussions, ibid.

Other farmers have taken to roadside marketing at production sites and near major cities. This direct method is the only true farmers market found in Jordan. Farmers using this method avoid all commission fees, transport markups, containerization charges, and municipal levies.

Another alternative system is roadside auctioning near production areas or at one of the four modern markets in the Valley under the operational control of the AMPCO. Farmers and buyers using this method avoid the 2 percent municipal fee but not the agent's five percent commission. Prices received using this alternative are lower than in organized markets, although they are not governed by retail price ceilings.

Some farmers contract directly with exporters for certain quality of products meeting buyer specifications. In these instances, the exporter provides containers and packs produce directly at the farm gate from which they are moved to outbound destinations in the importing countries. In all of the farmer interviews, solving marketing problems was cited as the most urgent need and highest priority, dwarfing in importance all of the others mentioned. High marketing costs, inadequate price information, and falling prices are mentioned as the most pressing concerns.

High price volatility is an uncomfortable but real condition in the wholesale marketing structure. Seasonal price swings show variances of over 450 percent (Appendix III.1). Moreover, daily price movements can also vary by 150 percent because trucks from the West Bank must often unload produce at bargain prices to make the return trip before border closure at dusk.[8] In this unpredictable price environment, farmers have little access to reliable price information ([13] Enochian, 1984).

> It would seem that auction prices are determined by competitive bidding and the forces of supply and demand. Such a conclusion could be misleading. The reason is that farmers and retailers have little or no knowledge of volumes of sales in the market and how this relates to price. The only price information that most farmers and retailers have is the previous days's maximum allowable [retail] price that was set by the government based on the auction prices of the day before. On the other hand, exporters who also bid at the auction have information on current auction prices in their export

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8 Wholesale market interviews, ibid.

markets which they receive daily through contacts by telephone and telex in these markets.

3. DOMESTIC SUPPLY AND DEMAND FORECASTS.

Domestic horticultural product demand forecasts were made using four sets of assumptions: (1) population growth rate of 3.9 percent, GDP growth of 5.5 percent, with income elasticities from Table III.1; (2) decline in GDP growth to 3 percent with all other variables constant; (3) decline in population growth to 3 percent; (4) increase in income elasticity of demand two .5 (Appendix III.1).

Table III.2
Domestic Demand Projections
1987-1995
(Tons 000's)

Product	1990				1995			
	a.	b.	c.	d	a.	b.	c.	d.
Tomato	196	173	185	222	283	211	244	368
Cucumber	31	28	29	37	40	32	36	62
Eggplant	34	30	32	41	44	35	39	68
Squash	24	22	23	28	33	26	29	47
Green Bean	9	8	9	10	13	9	14	16

a. GDP growth = 5.5 percent; population = 3.9 percent
b. GDP growth = 3 percent; population = 3.9 percent
c. Income elasticity = .5; GDP = 5.5; population = 3.9

Source: Tables at Appendix III.1

During the projection period, the most likely demand-growth scenario would be some decline in Gross Domestic product from falling exports and rising imports. The population growth rate is likely to continue at the present level of 3.9 percent for the foreseeable future, and there appears little prospect of significant changes in income demand elasticities.

A 1978 study estimated the mean income elasticity of demand for the major horticultural crops in Jordan at .2 ([7] Bredahl et al). The Assessment Team's mean estimate is .3. The difference in estimates may reflect sampling and data base errors rather than a significant shift. Since the Team's estimate may be biased on the high end of the spectrum, demand forecasts using this elasticity probably err on the high side and would tend to overestimate rather than underestimate the demand trend.

From the foregoing discussion, a reasonable case can be made for choosing the mean point between estimates (a) and (b) for comparing projected demand with estimated supply trends and assessing available surplus for export.

On the supply side, it is assumed that supply increases will be generated from both horizontal and vertical expansion of the agricultural base. Vertically, yields are expected to increase 25 percent from improved regulation of quantity and timing of irrigation water delivery following completion of the North Ghors, Middle Ghors, and Adasiya conversion projects in 1991 and 1992 ([20] North Ghors, pp 4-5).

The supply forecasts assume that production in the Southern Ghors will not increase until more water is added to the presently constrained water supply of the Jordan Valley system by completion of the Maqarin Dam ten years hence. A second assumption is that productivity of unirrigated agricultural lands outside the valley will not significantly increase because of seasonal water limitations. Thirdly, it is also assumed that the 180,000 dunums of recently leased land at Disa near the Saudi Arabian border will be used almost exclusively for wheat and fodder production and that there will be significant horticultural crop production increase from this area because of soil productivity and water constraints. Thus, the estimated supply growth for the supply/demand projection of this report assumes the JVA productivity forecasts for the Jordan Valley.

Other changes in supply levels from horizontal expansion will come from adding 23 thousand dunums of new cultivable land following completion of the three conversion projects. ([21] JVA, p. 43).

Taking the present cropping pattern and productivity with estimated production for the new areas with vertical expansion added to current production provides a rough estimate of the total forecasted supply of key horticultural produce.

Table III.3
Supply Estimates
Principal Horticultural Crops
(Tons 000's)

Crop	Current Production	New Lands Area	Yield	Production	Total 1/
Tomato	220	8.28	2.63	21.77	297
Cucumber	64	1.15	3.35	3.85	84
Eggplant	51	2.76	1.81	4.99	69
Squash	37	2.07	1.12	2.32	48
Green Bean	12	2.07	0.87	1.80	17

1/by 1992.
Source: Calculated from data in Annual Agricultural Statistics 1986, Department of Statistics.

Subtracting projected demand (mean of estimates a and b of Table III.2, above) from the projected total supply, the estimated exportable surplus is:

Table III.4
Estimated Exportable Surplus
Principal Horticultural Crops
(Tons 000's)

Product	1990			1995		
	Demand	Supply	Surplus	Demand	Supply	Surplus
Tomato	185	220	35	247	297	50
Cucumber	30	64	34	36	84	48
Squash	23	37	14	30	48	18
Eggplant	32	51	19	40	69	29
Green Beans	9	12	3	11	17	6

A comparison of future agricultural surplus trends with respect to current export levels is shown in the following table:

Table III.5
Present Export Volume Compared
with Projected Surplus
(Tons 000's)

Product	Current Exports	1990 Surplus	1995 Surplus
Tomato	95	35	50
Cucumber	40	34	48
Squash	18	14	18
Eggplant	27	19	29
Green Bean	6	3	6

Source: 1986 External Trade Statistics.
Department of Statistics

From the foregoing discussion, it would appear that Jordan's horticultural crop supply/demand gap can be closed over the next 8 years through domestic consumption growth. This forecast assumes that exports can be maintained at current levels. Ultimate success in Jordan Valley agricultural is inextricably linked to the nation's ability to consolidate and possibly expand its external markets. This may be difficult to achieve. USAID and the Government of Jordan will be making a concerted effort to develop and expand export and other markets through the forthcoming Agricultural Marketing Project.

4. EXPORT GROWTH POTENTIAL.

a) Regional Markets.

The growth of Turkey's export-oriented winter vegetable production has cut deeply into Jordan's regional export market. Extensive use of plasticulture and other advanced technologies at the major production centers of Marcine, Anatol, Antalid, Azania, and Ismir supported by quality grading, cheap labor, and government export subsidies have propelled Turkey to the fifth rank among the worlds major vegetable exporting nations.

In addition, Jordanian exports have also suffered from the effects of an overvalued dinar, rising regional consumer preferences for quality products, and increasing domestic production within the importing countries. All of these factors have combined to severely curtail Jordanian exports at a time when its own domestic production has been expanding through improved agricultural technology.

The current Jordanian export market profile is summarized in the following table.

Table III.6
Volume Share
Jordanian Agricultural Exports

Country	Percent of Total Volume
Saudi Arabia	51.47
Kuwait	20.60
Lebanon	8.62
Bahrain	0.82
Syria	6.53
Iraq	0.16
Egypt	0.01
U.A.E.	8.92
Qatar	2.86
E.E.C.	0.01

Between 1983 and 1986, Jordanian vegetable exports fell by 29.18 percent (calculated weighted mean) and are following a downward trend. The sharp decline of exports to Jordan's largest markets, Saudi Arabia and Kuwait, was the major cause of product saturation and wholesale price decline in domestic markets. The table below summarizes Jordanian vegetable export performance trends in the major markets:

Table III.7
Vegetable Export Trends
Jordan 1983-1986
(Tons 000's) 1/

Product	Destination											
	Saudi Arabia			Kuwait			U.A.E.			Other 3/		
2/	High	86	%	High	86	%	High	86	%	High	86	%
Tomato	59	43	-17	20	11	-46	11	12	+12	86	29	-77
Cucumber	31	18	-44	17	33	-25	6.1	5.8	-04	6	3	-47
Eggplant	10	6	-40	6	9	+34	1.0	1.7	+72	23	10	-58
Squash	15	6	-58	7	5	-24	0.8	0.4	-80	17	6	-66
Greenbean	4	3	-21	1	2	+17	0.8	0.6	-30	2	.5	-55

1/Rounded.
Source: External Trade Statistics
Department of Statistics.
2/Highest volume level in 1983-1986 period
3/Weighted mean decline: 29.18%

Preservation of Jordan's remaining share in regional markets will require a concentrated effort to install adequate grading and standards in its internal production and marketing system. Officially, Jordan subscribes to the Arab League standards but has not institutionalized these in the market place ([7] Bredahl et al, p. 21).

> The absence of any voluntary or involuntary system for developing and enforcing grades and phyto-sanitary standards means that any grading done is haphazard, irregular and unrelated to the generally-accepted grading and inspection practices common in international trade. Any grading or inspection that is done reflects opinion about what attributes make a commodity desirable or undesirable. None of this crudely-graded product would be allowed in any market where generally accepted grades and standards are enforced.

Handling practices also need to be significantly upgraded to reduce topping and overfilling of containers and heat deterioration losses from field to export market ([7] Bredahl et al, p. 21).

> Losses from handling range from 15 to 20 percent . . . . Discussion with exporters in Jordan clearly indicated that produce exported from Jordan was of such poor quality that its price could be discounted by as much as one-third in the external markets.

The general post-harvest handing practices followed by Jordan in grades and standards are of such a low level that products cannot be successfully marketed in countries with internationally accepted phyto-sanitary standards. Even in countries where standards are not systematically followed, market segments such as the supermarket trade in Saudi Arabia often refuse to handle Jordanian products ([7] Bredahl et al, p. 21).

The newly reconstituted Agricultural Marketing Organization (AMO) has been reinvested with the mission of developing internationally accepted grades and standards in Jordan in addition to other market-related regulatory functions. The AMPCO is also attempting to establish quality, grade, and standard compliance through its system of parastatal procurements for both export and domestic market. While these efforts are still in their infancy, they do represent a positive step in trying to upgrade the quality of Jordanian marketable produce. The USAID-financed Agricultural Marketing Project to be launched next year is expected to make a major contribution to this effort.

b) E.E.C. Markets

Some local analysts have great expectations for a significant market expansion within the E.E.C. countries. In 1986, the AMPCO exported some 400 tons of vegetable produce to that destination and has contracted with farmers to supply 7,000 tons for export to the E.E.C. during 1987.[9] This E.E.C. export target, if achieved, would represent 3 percent of Jordan's total export volume for 1986, up from 0.17 percent during that year.

It is reported that Jordanian vegetable products were well received during the 1986 trial year. Export Contracts for 3,500 tons of vegetables, mainly tomatoes, eggplants, beans, sweet and hot peppers, squash, and cucumbers to six West European countries have already been signed. Between November 15, 1987 and end May 1988, the United Kingdom, France, Holland, Belgium, Denmark, and Switzerland will take vegetables worth JD 1.8 million and contracts for a similar amount to Sweden, Austria, and West Germany are due to be signed soon. Transport

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[9] Jordan Times, October 26, 1987 and discussion with the AMPCO Deputy General Manager on October 20, 1987.

arrangements have been made with Royal Jordanian Airlines and Air France. The Company reports requests for 18,000 tons for the coming season, but transport limitations is the major constraint to expanding shipments to this level.[10]

As a measure to steer production and post harvest handling toward an E.E.C. market orientation, AMPCO is using an agricultural patterns system whereby farmers are encouraged to grow certain types of crops with guaranteed markets and profit stability. Pursuing this goal, AMPCO enters into contracts with individual farmers for a specified varietal production levels at guaranteed prices, which are higher than domestic wholesale prices when marketing costs are discounted. AMPCO extension activities instruct contracted farmers in production and harvesting technology to maintain grades and standards of E.E.C. quality. Farmer interviews revealed keen interest in participating in AMPCO procurement contracts because of the higher prices and informational services offered. For most farmers, however, participation is more of a wishful desire than a fulfilled aspiration because of the very low percentage of its procurement level in terms of total output.

In a few instances, a small number of private producers have successfully made the transition from domestic to export market orientation. In such operations, seeds are selected to produce varieties demanded by buyers. These producers also follow technological advice on cultural practices for improved yields and quality. In these operations, over 75 percent of the output is exported, some through supermarket chains in the Gulf region, some to E.E.C. countries. Post harvest handling practices include precooling of fruits and vegetables, where required, immediately after harvest, followed by grading and packing. Products are then kept under refrigeration until transported by refrigerated trucks to export transshipment points. Products going to the E.E.C. benefit from subsidized transport on Royal Jordanian Airlines. These producer-exporters also benefit from preferential tariffs given Jordan by the E.E.C. Such producers avoid marketing through the wholesale marketing system because of fee impositions and questionable agent practices ([3] Enochian, p.p. 9-10). In spite of these private initiatives, it appears that AMPCO holds a monopolistic position with respect to E.E.C. exports.

AMPCO management told the Assessment Team that the organization now controls 100 percent of Jordanian exports to the E.E.C.[11] This appears to contradict statements at the Amman Wholesale Market. Several private

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10 The Jerusalem Star, October 14-16, 1987.

11 AMPCO interviews, ibid.

contacts said they were exporting to the E.E.C.[12] The confusion may lie in the fact that a limited number of AMPCO investors are large commission agent/export firms. In replying to questions about private vs. parastatal exports, it is possible that references made by private exporters could have meant their exports channeled through the AMPCO system.

Availability of air transport is cited as a major constraint to expanding Jordanian shipments to European countries, since profitability depends on access to subsidized transport from Royal Jordanian Airlines. This may be a factor in parastatal domination of the market. In any case, the issue of a possible AMPCO export monopoly to the E.E.C. should be raised with a view to encouraging as much Jordanian competitive participation as possible in this important but difficult market.

Concerning the long-term future growth of Jordanian exports to the E.E.C., the picture is, at best mixed. Bredahl and Hogan ([6]) indicate limited market potential for Jordan in this market. The principal constraint cited is the entry of Spain and Portugal. Prior to entry in 1986, Spain supplied 61 percent of 1.5 million metric tons of horticultural products procured from outside the market and over 40 percent of the citrus.

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12 Wholesale market interviews, ibid.

Table III.8
Trade of Selected Horticultural
Products in the Common Market-1983
(Tons 000's)

Products	Source			
	Intra-EEC	Spain	Other	Total
Tomatoes	488	316	88	892
Potatoes	2208	59	304	2571
Onions	465	256	108	829
Cucumbers	329	44	21	394
Watermelons	106	89	7	202
Sweet Melons	23	82	20	125
Zucchini	14	37	2	53
Eggplant	20	12	6	38
Greenbeans	31	16	21	68
Green Peas	12	3	2	17

Source: Bredahl and Hogan.

Laurent ([26]) reports that, prior to Spain and Portugal's entry into the common market, Market countries had increased their production of horticultural crops.

> the intra-community trade of tomatoes increased from 340,000 mt in 1974-76 to 446,000 mt in 1981-83- an increase of 34%. During the same period, imports of tomatoes from third countries increased from 368,000 to 405,000 mt- an increase of only 10%. The intra-community trade of oranges increased 89%, while imports from third countries actually fell 18%. Imports of potatoes declined 38 percent while intra-community trade increased 68%. It is obvious that farmers in the common market countries are trying to capture as great a share of the market as possible

Although the Assessment Team did not have access to more current statistics, it is reasonable to assume that Spain's entry has allowed it to capture a greater share of the E.E.C. horticultural and citrus market and the total intra-community trade in these products has increased rather than declined. Furthermore, competition for the dwindling 10 percent import share of the total market will be intense as Turkey, Cyprus, and Greece join the Israelis and other quality producers. Thus, the campaign to increase Jordan's participation beyond tokenism in this lucrative, but somewhat closed market will be an uphill struggle with

uncertain prospects for any significant expansion of its market position. ([39] Schermerhorn, p.p. 7-8).

> The portion of imports...coming from outside the E.E.C. is currently about 10 percent of the total and there is intense competition for this market by a considerable number of countries in other parts of the world. It does appear, that at the present time the European market is saturated bringing downward pressure on price. In fact, discussions with Jordanian exporters indicate that current prices in Europe are such that a loss would be incurred if they exported vegetables to that market.

A reasonable target for exports to the E.E.C. is to expand the current contracted volume in 1986 of 3,500 tons (2 percent of exports and 0.9 percent of production to an eventual 20,000 tons).

If this target is achieved, exports to the E.E.C. would constitute some 10.7 percent of 1986 export levels and 5 percent of total production. From the apparent response thus far, this target seems achievable, provided that product quality is improved and exporters gain access to subsidized Royal Jordanian air freight rates.

5. THE NEED FOR AN INTEGRATED STRATEGY.

> In the long run, if the Jordan Valley is to retain, and also profitably sell the added output that will come from new lands and higher yields, it will have to have a disciplined marketing system- (Rami Khouri, 1981.)

Marketing constraints and problems arising from inefficiency, inadequate information flows, public policy disequilibrium, and ologopolistic practices have raised the specter of real economic distress in the Jordan Valley unless positive steps are taken now to redress some of these imbalances. USAID will be implementing an Agricultural Marketing Project, beginning in 1988, which is targeted on meeting these goals. In addition, the Government of Jordan is committed to reviewing its agricultural policies and continuing the policy dialog. It will be hosting a USAID-sponsored policy issues workshop in January, 1988, and will be making a concerted effort to reform those policies which adversely affect production and marketing efficiency.

These requisite remedial steps to increase marketing efficiency and international competitiveness of Jordanian produce include:

(1) information gathering and dissemination; (2) encouraging more competitive farmer-operated outlets; (3) promoting efficiency in export markets through encouraging public/private sector competition (4) exchange rate and market fee adjustments; (5) grades and standards development; (6) policy review and coordination. They are summarily described in the following paragraphs.

A consolidated marketing information system to provide price signals and trends in domestic and export markets, supply and demand trends, and general market intelligence disseminated through television and journalistic media would enhance market understanding and reaction time at all levels of the marketing chain. General dissemination of such information would help to break the informational stranglehold that certain operatives have over the market and foster a more competitive environment.

A comprehensive market research effort would provide more dynamic intelligence on supply and demand trends in export markets and generate feedback on quality preference and other indicators needed to realign Jordanian export production toward importing country requirements. This research is best undertaken through posting of agents in destination countries to maintain a regular information flow on changing consumer patterns and conditions.

Encouragement of cooperative and other farmer-managed marketing structures would allow producers more independent and competitive access to marketing channels heretofore dominated by oligopolistic cartels.

Expanding private sector operations in export marketing and transport would enhance operational efficiency and Jordanian competitiveness in international markets. Encouraging private sector entrepreneurs to exploit profitable opportunities would most likely increase the flow of exports and alleviate air transport constraints.

Institutionalizing internationally-accepted grades and standards would help to put Jordanian produce on a quality par with that of competitor exporting nations. In this regard, standards used by the E.C.C. should be the basis for Jordanian standards development. These will satisfy both the E.E.C. and gulf markets, since consumer preferences in the latter are approaching those of the former.

Some devaluation of the Jordanian Dinar would enhance competitiveness of Jordanian horticultural produce in foreign markets. Devaluation should be undertaken, however, only after an assessment of its impact on the trade balance and the domestic economy.

The present marketing fee structure adds 4 percent above real value added to wholesale and retail prices and does not appear justified by the

social costs of marketing operations. Readjustment of the fee structure to reflect real costs of marketing would realign the pricing mechanism on a more realistic value-added basis and further improve the competitiveness of Jordanian products in export markets.

Finally a coordinated policy review is needed to minimize the risks of government interventions in either production or marketing systems having adverse impacts on producer and market efficiency. The recommended strategy is to rely more on economic forces of supply and demand rather than administrative fiat to affect production and marketing realignments. Specifically the effectiveness and counterproductiveness of policy instruments such as crop controls, retail price setting, export/import regulation, procurement subsidies, and parastatal control over export marketing channels should be realistically assessed to determine whether their combined effects enhance or detract from agricultural productivity, policy objectives of import substitution, and market efficiency.

The overall production and marketing strategy advocated is one of maintaining horticultural production at current levels. Farmer margins should be improved by improving production and marketing efficiency and reducing costs. Aggressive marketing and quality control should be the focal point of a campaign to retain Jordan's share of regional markets and to promote limited expansion of E.E.C. and, perhaps some regional market growth. Efforts to diversify production and consumer preferences in domestic markets would also contribute to narrowing the domestic supply and demand gap. If all these measures are taken in concert, there are reasonable prospects that the supply/demand gap can be closed during the 1990-1995 period, provided current export volumes are maintained.

Only through integrated efforts can Jordan hope to minimize the adverse effects of oversupply in declining markets where severe dislocation of its agricultural economy could result from inflated dependency on capricious export demand.

In conclusion, there appear to be good prospects for significant improvements in both domestic and international markets, given concerted efforts to address and remove the major constraints.

B. AGRICULTURAL RESOURCE USE EFFICIENCY.

> Water was inefficiently used because the land was not always properly levelled. Seeds, fertilizers and chemicals were casually applied by hand, with as much going to waste or flying off with the wind as entered the soil and performed their job. Yet nature, eternally forgiving, compensated for man's inefficiency-Rami Khour, 1981.

1. WATER

Notwithstanding significant improvements in Jordan Valley agricultural productivity and income since 1973, input-resource allocation efficiency has lagged behind technological adaptation.

The single most important input is water. Fifty-five percent of the valley is surface irrigated. The remaining forty-five percent is irrigated by pressurized pipe systems. By 1992, all of the irrigated area will be converted to pressurized systems.[8] Conveyance losses in the aging canal system (about 38%) have further constrained this limited resource. The JVA has opted for a technological intervention strategy of surface system conversion to pressurized systems. This intervention will undoubtedly improve conveyance efficiencies, but physical intervention alone is inadequate to optimize on-farm water use and management practices.

a) Marginal Revenue Pricing

(1) Theoretical Framework

A major weakness in the management of the irrigation system is water scheduling and price policy. The issue is water price and demand interaction. Farmers pay a nominal 3 fils per cubic meter. The weighted mean marginal value productivity of water is presently between 20 and 22 fils/cubic meter, more than 6 times the current charge (Appendix III.2). Under these conditions, economically rational farmers at the canal heads (for the surface irrigated lands) use water up to the point where the marginal productivity of the last unit supplied is equated with the 3 fils per unit user charge. This is their optimal point. In achieving their optimal application levels, the canal head farmers reduce available supply to farmers located further downstream. Since the marginal revenue of water for downstream farmers is significantly greater than 3 fils/cubic meter, they would benefit from paying the canal headers a price for each extra unit supplied. This price is equated with the tail enders' own marginal revenue.

Water reallocation under this hypothesis continues until the marginal revenue of water for the tail-end farmers converges with that of the header group. A realistic charge for water would cause the headers to use less water and the tail enders to use more water up to a point where the marginal revenue of the last unit supplied by each group is equated with the revised per unit water charge.

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[8] JVA. The Jordan Valley Development: The Plans, the Achievements; and Future Activities: Amman, February, 1987 p. 25.

Under this scenario, the price mechanism allocates the constrained water resource more efficiently and more equitably. A revised charge, based on water productivity is, then, imperative for rationalizing water use. Farmers interviewed by the evaluation team, especially those at the canal tails, said they would be quite willing to pay four to five times more for their water, if assured reliable delivery at the time and quantities needed.

(2) O&M Cost Recovery.

Another compelling argument for more economic water pricing policies is the need to recover the O&M cost of the Jordan Valley Irrigation system. The current O&M cost (19 to 23 fils/m3) is 6 to 8 times higher than the present water user charge (ref 8, Keller et al, 1984, p. xv).[9] Given the comparative equilibrium between the marginal value productivity of water and its per unit O&M cost recovery, marginal revenue pricing would permit the JVA to recapture most, if not all, of its operating and maintenance outlay for the system. This would put the irrigation network on a paying basis and reduce the adverse budgetary deficit effects of subsidized water delivery. The current cost of the water subsidy is 1.938 million JD/annum.[10] During the first half of 1987, the Government budget deficit was 169.7 million JD ([15]).

(3) Social Costs of Subsidized Water Pricing.

Inefficient price rationing under the present irrigation water subsidy system has generated significant social costs. Differentiation of Assessment Team water production functions indicates that 1986 farm management survey farmers throughout the valley (ref 6, Dietz, 1987) may be using 10 to 20 percent more water than needed for optimal yields during the winter horticultural cropping season (Appendix III.2).[11] During this period, evapo-transpiration values are lowest with agricultural output and seasonal supply of irrigation water at their highest levels. Some of the apparent excess water use may be caused by soils leaching practices of individual farmers to remove accumulated salts.

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[9] 23 fils per m3 is the estimate of the JVA O&M Directorate provided to the assessment team on October 5, 1987. This value may actually be lower, however, if calculated from actual O&M cost records and water sales for 1984 and 1986. The total O&M cost reported was JD 2,165,000 with a reported volume sold of 114,000,000 m3. This would give a derived O&M cost of 2,165,000/114,000,000 or 19 fils per cubic meter.

[10] 114 million m3 x 0.020-(114 million m3 x 0.003) = JD 1,938,000.

[11] Functions derived from available research data of the Deir Alla Research station.

Table III.9
Crop Losses from Excess Water Application (1)

Crop	Current Water m3/dunum	Present Yield kg/dun.	Optimal Water m3/dun.	Optimal Yield kg/dun.
Potato	327	3.0	297	3.80
Cucumber	700	2.3	474	2.96
Onion	800	2.0	635	2.39

(1) Significant at 90% probability and above

Source: Appendix III.2

The net social cost of water-use inefficiency includes yield suppression of some 7 to 28 percent in winter. Other costs include accelerated soil degradation from high water tables and salinity build up ([18] Hogan et al, p.25) and some water-user inequities for the surface irrigated areas created by farmer identified head and tail-ender conflicts.[12]

Perhaps the single most important social cost is the foregone production of unirrigated farm land that could be reclaimed by diverting recovered water, now wasted in the winter production process, to areas not yet served by the system.

Assuming 15 percent of the water currently applied in excess irrigation is released to downstream unirrigated lands, the marginal 17.1 million cubic meters of water recovered could irrigate an additional 15.8 thousand dunums, at least during the winter season.[13]

Optimal scheduling of irrigation frequencies and quantities is dependent on accurate estimates of water and soil productivity. There is an overriding need for quantitative studies of crop water requirements and yield response information together with soil water holding capacities and depths to provide the basic information farmers require for efficient on-farm water management ([18] Hogal et al, p. 25.)

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[12] The JVA Irrigation Directorate Drainage Projects Section reports extensive salinity problems in the southern valley and significant water table problems in the northern sector.

[13] Derived from systemic water inflow data for 1984 provided by the JVA Irrigation Directorate: .15 x 184 million m3 x an irrigation efficiency of .62 = 17.1 million m3/1,080 m3/dunum - 15.8 thousand dunums.

The development of water effective management parameters (irrigation software) and technology (infrastructure) accomplished in tandem with marginal value productivity pricing of the water input factor are prerequisite conditions to improving water use efficiency. If these measures are taken together with on-going high pressure conversion interventions, the major water constraint to further improvements in agricultural productivity can be significantly alleviated.

The marginal revenue pricing concept establishes a flexible mechanism for seasonal readjustment of the water charge based on variable productivity and price movements. While the present marginal value productivity is estimated at 20-22 fils per cubic meter (Appendix III.2), the level can be expected to fluctuate over time as productivity and output prices vary with changing conditions in the farming and marketing systems. Marginal product pricing rationalizes input consumption by linking use to productivity and price movements. Farmers will use less water under sub-optimal production and market conditions and more during periods of productivity and market expansion. The price rationing mechanism also imposes economic discipline as well as equity upon the system by optimizing consumption while compensating for spatial inequities. The price rationing mechanism, if tied to marginal productivity, would most likely impose a manageable long-term financial readjustment on the majority of the producers through lowering consumption while expanding productivity. The table summarizes the on-farm income effects from a more economically rational water charge.

(4) Income Effects and Equity Issues.

Marginal revenue pricing of water would cause some income disequilibrium during the initial stages of the readjustment process.

Table III.10
Net Profits at Alternative Water
Price Assumptions (1)
(JD 1986/dunum)

Zone Farm Type:	35 dun. average Farm;0.6 dunum greenhouse (2)		35 dunum fruit farm (banana in the South)		35 dunum vegetable farm no greenhouse(2)	
	3 fil	20 fil	3 fil	20 fil	3 fil	20 fil
Northern	131.50	127.38	224.90	199.70	41.00	30.76
(% chng)		- 3.2%		-11%		-25%
Middle	39.90	28.48	63.70	57.09	24.00	13.84
(%chng)		- 2.5%		-10%		-48%
Southern	72.50	63.10	174.90	170.68	59.00	51.64
(%chng)		-13.0%		- 2.5		-13.5

(1) Net income after all costs, taxes, and family subsistence have been subtracted from the gross margin.
(2) Assuming a 15% reduction in water application and a 16% yield increase for winter vegetables.

Source: Calculated from Dietz, JVA, 1987, Tables Annex 2.6.1, 2.6.2, and 2.6.3 (green house) (interest/depreciation based on JD1,000/unit.

Farm net cash income (after deduction of production costs, fixed costs, and family subsistence from the gross margin) would decline by 6 to 28 percent during the first year, assuming a full marginal revenue readjustment of the water charge from 3 to 20 fils per cubic meter. For most farmers, the readjustment would be quite manageable, assuming no further decline in wholesale prices. Those affected the least would be owner-operators of vegetable farms using plasticulture and fruit and banana holdings. Farmers having diversified their cultural practices to include some plasticulture and drip irrigation in addition to conventional surface irrigation of vegetables and fruits would be able to manage the transition, with an estimated net revenue loss of six to seven percent. Most of the cost increase for these two categories of productive units would be recovered by savings from lower water consumption and by yield improvement. Farms in these two categories comprise some 72 percent of the total holdings.[14]

The remaining 28 percent of the holdings, practicing traditional cultivation of vegetables without improved cultural practices, show the lowest net cash incomes, even at the 3 fils water charge. This group would be affected the most by marginal revenue pricing, as they would experience a 28 percent net revenue decline.

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[14] Derived from ref. 4, Anbar, 1984, Table 3 and ref. 10, Dajani, 1980, section 2.4.1.

A plausible case can be made on equity, if not efficiency grounds, to continue some form of transfer payment either in subsidized water pricing or in soft concessional credit for farmers in this category. Dietz argues for two possible approaches to the water pricing issue: (1) a universal price of 10 fils per cubic meter, which he shows is manageable for most holding categories (Table III.10) or (2) a differentiated price of 50 two 100 JD/dunum for tree crops and 10 to 20 JD/dunum of plasticlture ([11] Dietz). The rationale underpinning this approach is preserving equity for the least efficient of the producers while implicity taxing the most efficient through partial redistribution of income from the former group to offset the subsidy costs of the later.

The Assessment Team questions the practicality of a differentiated price mechanism, since this may be administratively and politically difficult to manage. Should political and equity concerns dictate a more gradual movement toward marginal revenue pricing, an initial increase from 3 fils to 10 on the path to full productivity pricing may be an expedient alternative to the quantum jump that strictly economic and producer efficiency concerns would warrant. Whatever the pace and modality of initial price reform, the goal of eventual marginal productivity pricing should be the guiding principle in the interests of a market-driven strategy to improve irrigation water use efficiency.

In this regard, a more practical intermediate solution would be to concentrate on improving the overall efficiency of the irrigation management system to reduce conveyance losses from the present 38 percent and to allow the water-users' charge to gravitate toward the lowered per unit delivery costs resulting from improved efficiency. For example, the unit cost of water, assuming no conveyance loss at the present systemic intake volumes (184 million m3) and O&M cost (JD 2.165 per annum) would be 12 fils. Improvement of conveyance efficiency to say 80 percent (a realistic achievement) would translate into an O&M cost of 15 fils. This might be a useful intermediate target for the increased water users' charge and would constitute considerable progress toward a rational pricing structure while at the same time setting goals for systemic efficiency improvements and full O&M cost recovery.

2. AGROCHEMICAL AND CAPITAL INPUTS.

Two objectives are reached by examining input resource use in Jordan Valley crop production. The first is to obtain empirical evidence on the economic efficiency with which farmers are allocating their crop production resources. If farmers appear to be relatively responsive "economic operatives" in the use of inputs for crop production, the

estimated marginal productivities used in the production process should approximate their input factor costs. The efficient farmer, having knowledge of both product and factor markets, seeks to apply levels of resources to the extent that the marginal productivity value of the last unit of each input supplied equates with the market price of that input. The second objective is to examine probable cause of any identified resource imbalances in the production process.

The interim evaluation of the Jordan Valley development effort referred to evidence that farmers may be applying inappropriate and uneconomic amounts of inorganic fertilizers ([9] Danani et al, pp. 25 and 96). The use of pesticides was also questioned as there was a "noticeable tendency to apply large amounts of chemical sprays without full knowledge of their effectiveness" ([9] Dajani et al, p. 98).

The current Assessment Team tested these hypotheses.

Table III.11
Input Resource Allocation
Efficiency in Jordan Valley
Agriculture (JD/unit)

Input	MVP 1/	MFC 2/	MVP/MFC
Water (m^3)	0.022	-	NA 3/
Fertilizer(kg)	0.040	0.056	0.71
Pesticide(cc)	0.013	0.130	0.10
Capital	0.095	0.106	1.11

1/ Marginal value productivity
2/ Marginal factor cost
3/ Not applicable as water price to producer is subsidized.

Source: Appendix III.2

The test evaluates the magnitude of input price and productivity equilibrium. When cost minimizing behavior is assumed and no resource constraints are considered, each factor of production is used up to the point where the marginal value productivity (MVP) of that resource equals its marginal factor cost (MFC) or the price of that resource. If input restrictions are ignored, a ration of one indicates that farmers have allocated the resource to the point where returns are just paying for its

additional cost. A ratio of less than one indicates excess use of that resource while a ratio of greater than one shows a constraint on that resource preventing optimal levels of use.

The analysis clearly suggests that Jordan Valley farmers may be using both pesticides and fertilizers inefficiently. This finding is paradoxical in light of their historically demonstrated proclivity to respond aggressively to technological innovation and market opportunities. If historical patterns of producer behavior in the Valley accurately reflect the high willingness of farmers to invest and assume the risks of structural changes in their cultural practices, they would be logically expected to maximize returns to inputs, given a market-determined pricing mechanism.

A further check of the resource allocation imbalance, using an independent methodology and data source, provided additional indicators of inefficient producer behavior with respect to fertilizer use.

Table III.12
Fertilization Rates and
Yield Response for Onion and Potato
(kg/dunum)

Input	Onion			Potato		
	Actual	Optimal	%Yield Change	Actual	Optimal	%Yield Change
Nitrogenous	0-25	80	+31	50	36.9	+16
Phosphorous	-	-	-	150	135.8	+12

Source: Appendix III.2

Several factors explain the apparent agricultural input-use inefficiency on Jordan Valley farms. First, economic rationality is contingent on timely and comprehensive knowledge of product and factor markets. While there are many buyers and sellers in the major wholesale markets of Amman, Irbid, and Zarqa, it is generally accepted that these markets are dominated by a small group of large dealers. These operatives are also heavily engaged in the import-export business and are believed to largely determine prices at the wholesale level. Their dominant position in the market is aided by the very limited information available to farmers selling in the wholesale markets. Timely information on quantities, prices, marketing costs, etc. is simply not available to farmers although it is known by the large commission agents who dominate the market.

As most farmers market through the commission agents (see marketing section) and operate under the handicap of scanty information on prices, they are price takers rather than price makers. To compound this apparent oligopolistic position of the few large agents, many farmers become indebted to these market middlemen through acceptance of seasonal credits. In so doing, they lose some of their independence of outlet choice at market time. During field interviews, many farmers complained about having to sell whole truck loads of produce to agents at "bargain basement prices" during the last two or three seasons.

A further complicating factor in the unpredictability of product wholesale prices are wide seasonal price swings with variances often approaching 425 percent between summer and winter for some vegetable crops.

The net effect of all of these influences is the inability of farmers in the Valley to make reliable projections on probable price trends in product markets; hence they are unable to assess with any reasonable degree of accuracy the revenue productivity of their inputs.

Another disequilibriating influence, is the domination of input factor markets and agricultural information flows by private suppliers. These provide as much as 77 percent of the total input supply ([18] Hogan, et al). Aggressiveness of the private sector in the Valley has made it the cutting edge of a well-entrenched input supply and agricultural information mechanism.

> The evidence is not just that the government systems are largely absent but rather that the private sector has made direct investment in this aspect of agricultural development as a feature of the development business. Some firms hire their own agronomists or other types of agriculturalists who work exclusively on input testing and information dissemination to farmers and retailers. Other firms combine input testing, information work and sales efforts.

While this is a very positive trend in the growth of an effective agricultural service system throughout the valley, the absence of reliable, unbiased, information on input applications levels, timing, etc, has clearly given the advantage to those whose profits are tied to the volumes of inputs sold. This phenomenon may partially explain why farmers appear to be using certain inputs in excess of levels required to optimize productivity.

A related corollary to this hypothesis is the practice of parastatal input distribution channels and large private sector operatives, buying in bulk, the price inputs some 15 percent below market. This may also contribute to excess consumption in some areas.

Another significant condition which may also affect the general levels of agro-chemical input use is the high pH of Jordan Valley irrigation water. Field trials conducted by Eastern Company Agricultural Services Division showed that sulphuric acid treatments reduced pH levels from 8 to 6.5 and improved yields by some 50%. Lower pH levels appear to extend field potency life of chemical fertilizers from 10 minutes to several hours. Thus it is possible to improve yields while reducing application levels.[15]

The fourth and final determinant of Valley farmer input-use inefficiency is the virtual absence of an independent adaptive research base untied to commercially vested interests and with linkages to an effective informational delivery mechanism. There is clear and present need to develop crop and area specific integrated input packages to guide farmers in optimizing their water, fertilizer, pesticide, and seed treatments in order to upgrade efficiency and lower production costs.

3. INVESTMENT CAPITAL INPUTS

The efficiency of investment capital inputs to Jordan Valley agriculture was evaluated. The capital investment stream of the Jordan River irrigation projects over the twenty-six year period from 1962 to 1988 was compared with the benefit stream to derive net cash flow and calculate the internal rate of return of the entire irrigation investment package. The benefit stream is the value added from agricultural production from new lands brought under cultivation as various segments of the irrigation were completed during the period in question.

The calculated internal rate of return of the total irrigation system is 17 percent (Appendix III.2). This is 6 percentage points above the marginal efficiency of capital, 10.6 percent, calculated in Table III.11. Comparing this return with the norm for irrigation projects, 9 to 12 percent[16], the Jordan Valley Irrigation system appears to have more than paid for itself over the life of the development program.

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15 Eastern Company Agricultural Services Division, 1986.

16 Gittinger, John P. Economic Analysis of Agricultural Projects: Baltimore. Johns Hopkins University Press, 1984.

A key factor in the relatively high return to investment capital has been the growth of land utilization for high value horticultural crops and decline of lower value field crops in the farming system.

Another important factor includes the transformation from subsistence farming to dynamic market-oriented agriculture, using state-of-the-arts technology, and the impact of bringing large areas of irrigable land into production, and raising the cropping intensity.

While the subsidy on irrigation water has undoubtedly pushed the calculated rate of return one or two percentage points above its real value, there can be no question that Jordan Valley irrigation system investments have been remarkably successful.

4. RECOMMENDED STRATEGY.

Improving the efficiency of agricultural input use on Jordan Valley farms would allow more to be produced with less. Such a change in production efficiency would reduce production costs, increase net revenues to producers, and help to offset the effects of the marketing constraints discussed in the preceding section.

This objective can be accomplished by developing crop specific and integrated input application recommendations in concert with market-driven input pricing mechanisms (e.g. water), and technological improvements (drip irrigation and better systemic and on-farm water management). The need for such an approach has never been greater, given domestic and foreign marketing constraints and declining farm revenues.

The recommendations should be developed as extension packages for individual crops in the farming system. These packages should provide a full spectrum of empirically-tested recommendations on cultural practices, irrigation systems management, crop water response, fertilizer use efficiency, soils information and management, herbicide, and pesticide use, and harvest and post harvest treatments. Until such packages are developed and extended in concert with more competitive marketing channels and marketing information flows to the producer, it is unlikely that input efficiency levels will be significantly improved in the Jordan Valley.

IV. PLANNING AND SERVICE INSTITUTIONAL EFFECTIVENESS

This section of the assessment examines the institutional effectiveness of the planning mechanism which designed and implemented the Jordan Valley integrated rural development program. The evaluation also assesses the efficiency and equity of agricultural and social service systems in the Jordan Valley and the degree to which these services are being utilized by the local population.

A. REGIONAL DEVELOPMENT PLANNING

> The technical studies for water works, irrigation, cropping patterns, agricultural services and increasing yields were available...But never had anybody made a thorough study of the social services needs of the Jordan Valley, and certainly nobody had ever tried simultaneously to formulate and implement large-scale projects in both fields. There was no precedent for organized rural development in the valley. Before 1967, some foreign aid and government funds went to individual projects, but there was always a function division of responsibility among different government agencies. (Rami Khouri, 1981.)

Prior to the creation of the Jordan Valley Commission (JVA's predecessor agency), most development planning and program implementation work in Jordan was carried out either by individual line ministries or by ad hoc working groups established for specific donor-financed projects. The evolution of a permanent and structured development planning body for the Jordan Valley was a major new initiative in the evolution of coordinated, integrated planning not only in Jordan, but in the entire developing world. Realizing that socio-economic growth depends on the linkages between productivity, income expansion, and social development, the planning effort for the Jordan Valley was launched with a clear mandate and commitment to bypass traditional bureaucratic jurisdictions in favor of a multi-sectoral approach, integrating the available development resources in agricultural, irrigation, education, health, transport infrastructure, and public utilities and housing. The overriding goal of the integrated rural development approach pioneered in the Jordan Valley was to improve rural incomes, increase productivity, and upgrade the general quality of rural life. As such, the early Jordan Valley planners blazed a new trail in creating a workable mechanism for simultaneously addressing the full spectrum of socio-economic development needs of their target population.

In 1977, the Jordan Valley Authority was created to carry on the work of predecessor Jordan Valley Commission. As with the JVC, the JVA assumed responsibility for all integrated development planing and implementation. The JVA's mandate included, in addition to responsibilities of the JVC, all land reallocation within the Valley, with provision of requisite social service infrastructure, including housing and public utilities. In this expanded role, the JVA served as the government's overseer of all activities in the valley, including those of official line ministries as well as parastatal organizations.

The JVA was created and institutionalized by recruiting specialized staff from other ministries and from the private sector. Freed from civil service regulatory constraints and endowed with more competitive salary scales, the JVA was able to recruit, hire and reward on the basis of performance and competence. As such it was able to attract the "best and the brightest" of the available talent pool.

Invested with the mandate to perform as a super-ministry with more authority and responsibility than individual line ministries, the JVA had to assume full control over all aspects of life in the Jordan Valley. In assuming this authority, it had to usurp powers normally reserved for the line agencies. The challenge was to do this without friction in order to maintain the viable working relationships needed to enlist ministerial cooperation. In meeting this challenge, the JVA had to instill in existing Valley agencies the ability and desire to eventually reclaim the responsibilities and functions depicted in their original charters.

As in many countries, the creation of ad hoc planning organizations, which cuts across ministerial lines of authority, often tends to provoke bureaucratic infighting for jealously guarded turf. Over time, both the JVC and its successor, the JVA, had to assume more of an implementation role in the development process as many line ministries were either unable or, perhaps, unwilling to implement the JVA plans for their respective sectors.

> The most significant result of the lessons of 1973-1975 was the transformation of the Jordan Valley Commission from a planning, financing, co-ordination and supervision body into a design, construction, operation and maintenance agency. If found itself responsible for all phases of a project, from initial identification, to pre- and final feasibility studies, design work, arranging financing, prequalifying contractors, tendering and awarding construction contracts, supervising

> construction, commissioning, and, finally taking on operation and maintenance. (Rami Khouri, 1981).

In spite of the enormous portfolio which JVA inherited and increasing responsibilities it had to assume through various stages of the development process, the Authority was quite successful in completing its mandated tasks of formulating and implementing integrated programs in the Jordan Valley.

It is important to note that the rehabilitation and development of the Jordan Valley were purely a Jordanian effort. While the planners received assistance from time to time from various foreign experts brought in to advise on specific areas of the plan, the conceptualization and political will to adopt a radically new approach to rural development planning is a tribute to Jordanian foresight and pioneering initiative. The timely and enthusiastic response by which ten different foreign donors committed over $800 million to the Jordan Valley's multi-sectoral development program together with the implementation success of such a diverse development package are testimony to the high calibre and precision of Jordan's integrated rural development approach.

Notwithstanding the JVA's great success in executing the many diverse responsibilities under its mandate, certain weaknesses, are inherent in a centrally-directed rural development program. The single most notable concern in this process was the hierarchical approach used rather than the actual substance of the plan and development program. Plans and projects were implemented from the top downward. There was little or no involvement of the beneficiary population in either setting priorities, organizing the implementation, or evaluating effectiveness.

It can, of course, be argued that the hierarchial nature of Jordan Valley planning was essential to insure that the vast array of projects was completed in a timely and integrated manner. This argument presumes, however, that physical accomplishments take precedence over institutional development objectives. The Assessment Team believes that the institutional goals of the development process are as important as the physical achievements. Since the beneficiaries are the ultimate recipients of any development effort, they must be ultimately satisfied with the results and provide the local input for follow-on operations and maintenance support. furthermore, strengthening grass roots institutional development in the form of encouraging local participation in planning and implementation often produces the added gains of fostering community cohesion and initiative for solving local problems in a local manner. Extraordinary development planning and program organizations like the JVA are never permanently created or endowed with sufficient resources and flexibility to solve local problems in perpetuity. The ultimate objective of development from an institutional

perspective is to instill in local community organizations the will and the way for identifying and solving many of their own problems, long after the umbrella agency, such as JVA, has abdicated or reduced its all pervasive involvement.

The ultimate responsibility for program decision making has rested primarily with the JVA, but the situation is rapidly changing. With the virtual completion of the irrigation and social service infrastructure, responsibility for the Valley's continued development planning has become more unfocused. There is no longer an active regional planning mechanism in place. JVA is still quite active in the day-to-day management of the irrigation system and land allocation, but no longer seems to have an organizational responsibility or institutional interest in the performance and current status of the other sectors. Indicators of this are JVA's substantially reduced staffing levels from the apex of the program implementation years (1973-1982) and the organization's current lack of data and status indicators for other sectors outside irrigation.

Planning and program implementation for the Jordan Valley is currently in a state of bureaucratic transition wherein infrastructural and service responsibilities are being returned to the ministries. For example, the Ministry of Education has set up its own localized administrative structures in all three areas in the valley. Health has one district in the North Shouneh area while the middle and southern areas of the valley are administered from Salt. Many government decisions emanate directly from the Ministry of Municipalities, Rural and Environmental Affairs (MMREA) in Amman, while others pass from the Ministry of Interior through the governorate administrative systems in Balqua and Irbid. Neither the ministries nor Irbid and Balqua governorates, whose individual jurisdictions are spanned by the Jordan Valley, have a regional perspective nor an organizational capacity for continued integrated development.

This situation is not necessarily a limiting factor as it can be reasonably argued that Jordan Valley development program has been largely completed. As such there may be no further need for a regional planning and management overview.

On the other hand, a large infrastructural investment has been made in the valley with a wide proliferation of services that these investments represent. There still seems to be a continuing need to improve and expand these services in view of continued population growth which exceeds the national average by several percentage points. Furthermore, the irrigated farming and land tenure system of the Jordan Valley is a discrete agricultural unit, with its own unique set problems including water and land constraints, cultural practices, and marketing bottlenecks. Also, the lack of full attention to strengthening local grass roots institutions in earlier stages of the development process has created an institutional responsibility vacuum. Until local governments are prepared to assume a direct role in the operations and

management of the infrastructure and services installed by previous development programs, there is an arguable need to continue, or perhaps even further expand the duties and responsibilities of the JVA- with the ultimate intent, however, to enhance the ability of local institutions to plan and implement their own development programs. Where the previous emphasis has been on intrastructural and service saturation to promote growth and upgrade life quality in the valley, the emphasis for the future could profitably be placed on upgrading and strengthening local institutions. This approach would definitely contribute to carrying on the urgent work of development planning and infrastructural maintenance on a recurring basis and provide a mechanism for smoothing the transition from hierarchical management to local initiative.

There have been some very encouraging developments along these lines. JVA presently retains some planning jurisdiction over development of new areas outside of incorporated towns and villages and continues to supply limited support services for these areas as needed. The installation of improved irrigation and drainage systems is a continuing JVA function. Moreover, the Authority is currently in the process of creating eight committees in the Valley to survey the housing needs and to establish criteria for allocation and reallocation of land within the village and municipal areas.

During the past five years, significant momentum has taken place with respect to strengthening municipal governments. By the completion of the interim evaluation of the Jordan Valley Development Effort in 1980, all projected settlements had

> their basic needs taken care of...The communities did not have to plan and to be involved in many of the decisions made, nor did they have to commit any of their resources for obtaining these facilities." Dajani p. 162-63

Since 1980, the local governments at the municipal level have been improving their development activities and responsibilities. Municipal councils have been increasing their revenue collections and have been granted funds by the central government for specific projects selected and planned at the local level. It is important to note that approximately half the population of the valley is represented by these popularly-elected municipal councils. These bodies appear to have acquired a viable degree of autonomous decision making power. This is supported by their authority to retain a considerable portion of their tax revenues for development purposes and discretionary power to approve contracts up to JD 5000. The majority of the eight municipalities in the Valley currently have local development budgets of over 100,000JD (see following chart).

1987 JORDAN VALLEY MUNICIPALITIES BUDGETS AND PROJECTS

Municipality	Total Budget	Lonan	Projects/Services Planned 1987-9
Dier Alla	277,312 JD	93,840 JD	Street paving, gardens/parks, equipment, garbage containers, streetlights, offices, slaughter-house, shaded covers
Kreimeh	86,784 JD	21,905 JD	Streetpaving, sidewalks, indemnifications, public meeting halls, gardens/parks
Maaddi	215,014 JD	100,000 JD	Streetpaving, indemnification, gardens/parks, municipal offices, streetlights, funeral hall, machinery/equipment
Mashare	231,661 JD	142,643 JD	Vegetable market, shops, stores, indemnifications
North Shouneh	375,084 JD	228,478 JD	Commercial complex, street paving, sidewalks, gardens/parks, streetlights, indemnification
Sheikh Hussein	244,677 JD	172,479 JD	Streetpaving, sidewalks, parking, streetlighting
South Shouneh	161,825 JD	51,800 JD	Streetpaving, sidewalks, cemetery fence, gardens/parks, machines, building complex, streetlights, parking indemnification
Waqqas	125,900 JD	18,617 JD	Streetpaving, streetlighting, municipality building, parks/gardens, indemnification sidewalks

Source: MMREA Budget files 1987 MMREA Director of Municipalities' Three Year Plans 1987-1989

1. DECENTRALIZATION.

B. Agricultural Research and Extension in the Jordan Valley

This section discusses the agricultural research and extension systems which exist in the valley within a systems analysis framework. It includes reference to all groups and institutions active in the system on both a formal and informal level: the Ministry of Agriculture (MOA)/Jordan Valley Agricultural Services Project (JVASP), the Jordan Cooperatives Organization (JCO), the Jordan Valley Farmers Association (JVFA), Jordan University Faculty of Agriculture (FOA), as well as the role of the private sector in this system. Agricultural Research and Extension in the Jordan Valley involves several institutions and organizations.

The Ministry of Agriculture has the primary responsibility for providing agricultural services to the Jordan Valley. Prior to the integrated rural development program in the Valley, few resources existed there for agricultural research and extension. As the farmers have become more sophisticated and agricultural needs have become more complex, the importance of research and extension has greatly increased. In response to these needs, USAID financed the Jordan Valley Agricultural Services Project (JVASP). This project has greatly expanded the facilities and has trained a large number of Jordanians in skills specifically relevant to Jordan Valley needs. This has resulted in a pool of highly skilled professionals who are equipped with sophisticated equipment for agricultural research and extension.

This investment in institution building has been successful, as evidenced by both the improvement in agricultural productivity and the rapidity of response to problems as they have arisen over the past seven years. Jordan Valley farmers have benefited from improved pest control techniques, detection of actual and potential problems as well as an increased and improved extension system through a combination of communication techniques (technical data sheets, video tape presentations to farmers, etc.). The impact of the JVASP on agriculture in the valley has been substantial and will be discussed further in this section.

In addition to the Ministry of Agriculture, the Faculty of Agriculture of Jordan University is active i the valley. It operates a University Farm in the valley where it conducts teaching, research, and outreach activities. These activities have become more relevant to the local farmers through a new outreach program which has been financed by USAID (see below). The integration and coordination of research and extension activities in the valley has shown great improvement over the past few years. Much of this is due to shared activities between the JVASP/MOA and the University.

The parastatal organizations, JCO and JVFA are active primarily in complementing the work of the JVASP/MOA and the University through the

provision of agricultural services, including credit and inputs supply with agricultural extension as a by-product of its other functions. Although the private sector has the largest number of trained individuals working in the valley, they are primarily involved in sales with the transferral of relevant technical information as needed for promotional purposes.

1. Agricultural Research and Extension Systems

Agricultural Research and Extension is an essential component of an effective agricultural system which should include:

- agricultural planning (establishment of priorities for agriculture in both a national and international context and continuous evaluation.

- inputs supply (credit, seeds, fertilizer, pesticide, equipment, etc.)

- appropriate information generation/communication/transferral (both technical and systems oriented information)

- institutional development: development of systems which have the capacity to supply the services and support needed to reach the goals/priorities established.

Traditionally, many agricultural research and extension systems are evaluated solely by the effect on agricultural productivity. In the Jordan Valley, this would not be sufficient. Here, the per dunum productivity has greatly increased over the past ten years and according to farmers, the most important factor influencing their current success or failure is marketing. Consequently, marketing, both domestic and international should be addressed in the agricultural research and extension systems.

> Most agricultural technology is generated internationally but must be tested and adapted to each farming locality. In the past, estimates suggest that 95 percent of all agricultural research has been carried out in the more developed nations on temperate climate agriculture ([41] Stevens p. 248)

As technology transfer progresses, countries often go through three phases to develop their own capacities:

> material transfer (Imports of inputs, technology)
>
> design transfer (Systematic testing/selection or technology)
>
> capacity transfer (Production of locally adapted technology) ([41] Stevens p. 249)

Farming in the Jordan Valley is no longer subsistence agriculture, it is agribusiness. Farmers in the Valley have readily adapted advanced agricultural technology: plastic houses, fertilizer, pesticides, improved seed varieties, drip irrigation, etc. Further research needs to address potential productivity in the valley based on soil, (micro) climate and water availability, and develop recommended input packages for optimizing input use.

2. AGRICULTURAL RESEARCH

Over the past six years, the capacity for agricultural research in the Jordan Valley has multiplied. Prior to JVASP, there was a limited capacity for systematic problem solving research to be done in the Jordan Valley. This situation has changed dramatically with the establishment of sophisticated research facilities located in the Valley (JVASSP/MOA). In 1980, almost none of the research conducted in the valley was done on a collaborative basis and communication between the University and the MOA was almost totally absent. Since 1985, these patterns have begun to change and there is optimism for increased coordination and collaboration in the future.

This section briefly summarized Jordanian agricultural research and the changes that have occurred over the past 6 years in the Valley. The two formal institutions involved in research in the Jordan Valley are the Ministry of Agriculture (MOA) and the Faculty of Agriculture of Jordan University (FOA). For the past six years, the MOA research and extension responsibilities for the valley have been organized and financed under the Jordan Valley Agricultural Services Project (JVASP/USAID). In addition to these research activities, the private sector sponsors research which is conducted both on company and individual's farms.

a) FACILITIES

The MOA/JVASP has increased its research facilities significantly over the past five years. Prior to the establishment of the JVASP, there was only one MOA research site in the Jordan Valley and this facility had very limited equipment and qualified personnel. Since then, four

research sites have been established and/or upgraded in the Jordan Valley: Wadi el-Yabis, Deir Alla, Abu Habiel and El Karameh. In each of the four locations there are extensive research facilities available: land (1000 dunums total), irrigation, equipment and 48 plastichouses. Laboratory facilities at the Deir Alla station now include soil and plant tissue testing, IPM/biocontrol, statistics, virology and horticulture. ([50] Youmans, Sept 30, 1987).

Although many of these facilities are only recently fully functional, this is the first time such diagnostic services are available to farmers in Jordan. They have already established a reputation for providing excellent diagnostic services to the Valley farmers. The Soils laboratory, in 1986-87 alone, has analyzed over 1,400 local farmers soil samples for both fertility as well as nematode problems. The plant tissue laboratory has done more than 1200 tests for nutritional deficiencies and diagnosis of pathology.

The Plant virology Laboratory at Deir Alla diagnoses virus and virus-like disease problems on crops. During the JVASP they have discovered new viruses on tomatoes and potatoes and developed appropriate recommendations for improved cultural techniques as well as treatments. In addition to the equipment that has already been supplied under the JVASP project, USAID is planning to expand these facilities with a sophisticated ELISA system for Enzyme Linked Immunossorbert Assays.[1]

In sum, the MOA research facilities in the Jordan Valley are now superior to most facilities in Jordan and compare well to sophisticated systems in other countries. It is important to note that the facilities were planned in response to the current specific valley needs with the capacity to meet future research needs as they arise.

The University of Jordan, Faculty of Agriculture (FOA), research is conducted both in laboratories in Amman and on the University Farm located in the Jordan Valley. The University Farm consists of 1000 dunums of land south of Maadi. Approximately 600 dunums have been reclaimed and of these currently 100 dunums are being used for research. According to the Dean of Agriculture the university farm has a budget of approximately 50,000JD/yr. The University has plans to develop more of this land for production in order to help meet the needs/expenses of the students in the valley. The facilities on the University farm are primarily open fields and 30 of the 60 plastichouses are used for research.

Information on the facilities and personnel involved in research conducted by the private sector is less available. Private dealers have

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[1] A system for diagnosing virus and virus-like disease problems on crops.

approximately 10 farms in the Valley ranging in size from 30 to 350 dunums with up to 100 dunums per farm being used for trials/research. The Eastern Co has approximately 60 dunums allocated to research in the Jordan Valley, the Agricultural Materials Company has one research farm in the valley with a total of 30 dunums, while the Ghadir Agricultural Company has 350 dunums under cultivation in the valley. These are just three of over 37 companies who operate in the Jordan Valley. (Interviews with Company staff)

b) PERSONNEL

Over the past six years, the full time staff at the JVASP research stations has been increased and upgraded. They currently have 1 PhD; 7 MS's and 11 BSc's as well as 9 technicians who work full time in the valley. In addition, there are seven MOA employees from the Jordan Valley currently completing degree programs at the Faculty of Agriculture at Jordan University. Most of the personnel have received long term and short term training as a part of the JVASP Project. The research staff is specifically trained to use the sophisticated equipment/facilities supplied by the JVASP. All of the research staff appeared very motivated and pleased with the improvements that have taken place over the past five years at JVASP. With the return of the remainder of the personnel currently in training programs, the JVASP could be considered a model for appropriately qualified research staff. ([50] Youmans Sept 30 1987, p.2).

The number of University staff doing research in the Jordan Valley fluctuates from one year to another. Although the Faculty of Agriculture does not have full time research staff working in the Jordan Valley, researchers do work on a part time basis conducting and supervising research. Currently, there are two full-time PhD's working at the farm, primarily responsible for the administration and production. There are also an additional 8 BSC's and 15 full time Technicians who work on the farm. In addition, seven of the University teaching staff work on a rotating basis in the valley conducting their own research and supervising the 78 seniors who are on the farm per semester. This number will vary by teaching responsibilities and specific projects undertaken.

> During the period from 1980-85, staff time allocated to research decreased from 34 to 18 full time man year equivalents of Bsc, MS and Phd..Although research constitutes an important function of the Faculty of Agriculture, teaching takes priority over all other functions. ([18] Hogan p. 92) The statistics are for all research done in Jordan, not just the Jordan Valley.)

Information on the facilities and personnel involved in research conducted by the private sector is less available. Of the five farms studied which are owned and operated by private dealers, all have a minimum of one BSc supervising the work. The research conducted on local farmers' property is supervised by as many as 45 different BSc's involved primarily in the extension/sales component.

c) RESEARCH PRIORITIES

The JVASP/Ministry of Agriculture research is organized in three main categories: plant protection, vegetable production, soils and fruit tree production. Approximately 60 dunums are allocated to citrus tree research, 40 dunums for grape production, 24 dunums for plastic house culture and 935 dunums for open field experiments. ([23] Khazawneh) Almost all of this research is responsive to actual Valley farmer problems. it includes inputs testing (seed varieties, fertilizer, pesticides) as well as research which cuts across disciplinary lines. The JVASP/MOA research facilities are unique in their capacity to do research on adaptability of varieties, etc. because of the research stations located throughout the valley. This allows for consideration of the variance of microclimates in the valley.

An excellent example of research which is responsive to farmer needs and which takes into consideration long term environmental effects is the biocontrol program conducted by the JVASP in the Jordan Valley.

In 1984, spherical mealybugs became the number one citrus pest in Jordan. Research staff at the JVASP project proposed biocontrol as an alternative to Dimethoate and Methidathion usage which was no longer effective. Encyrtid wasps (g. Anagyrus sp.) and other natural predator were imported from Guam, Hawaii, India and Pakistan to control the problem and release began in January of 1984. The intervention has been quite effective, since the end of 1985 the mealy bug is no longer considered a serious problem on citrus in the Jordan Valley. ([23] Khazawneh p. and ([45] USAID pp. 1-2)

This program stands out as a remarkable success in the way in which a research program responded quickly, effectively and safely to a pest infestation problem. The mealey bug was out of control and a potential disaster to the Jordan Valley Citrus production. Because of the relevance of research priorities and the increased capacity of research personnel, this problem has been virtually eliminated. The Integrated Pest Management and Biocontrol Unit at JVASP is currently exploring other possibilities for appropriate pest control intervention. This type of research is especially important because it has a long term control effect which is not inhibited by insects resistance to pesticides.

The agricultural research done by the Faculty of Agriculture of Jordan University is primarily disciplinary specific. Given its primary orientation toward teaching and research needs on a national basis, there is only a small percentage of research which is specifically relevant to the Jordan Valley. However, the Valley-oriented research has been relevant to actual farmer problems in irrigation, soils, and pathology ([5] Bakhit).

d) RESEARCH COORDINATION/COLLABORATION

Six years ago there was little if any collaborative or coordinated research among the institutions. Since the inception of JVASP, this climate has begun to change. Several activities have been undertaken on a joint basis in the valley. With the new NCARTT system, this collaboration is even more evident and is being institutionalized through joint participation in research prioritization. The new outreach program for the University of Jordan is an excellent example of activities which encourage collaboration. This is discussed in further detail under the JVASP/MOA section.

e) BUDGET FOR RESEARCH

> "There is no line item for agricultural research in either the MOA or the FOA budgets. Salaries have increased from 68% in 1980 to 74% of the total expenditure in 1985..First, total national research expenditures over the years diminished in real terms despite contributions from USAID, IDRC, France and EEC..Second, the level of expenditure allocated to research from national resources has decreased from a high of .62% 1975-80 to .28% 1983-84. ([18] Hogan p.95-96)

The budget for research at the Jordan University is approximately 100,000 JD per year with funds coming from the University Budget, EEC, USAID and other sources. The amount allocated two Jordan Valley research in 1986-87 was 41,000 JD. This includes the salaries of research assistants, but not those of instructors. ([5] Bakhit, 1987)

MOA has been experiencing budgetary constraints which are already having an effect on the quantity of research being done in the valley. Although certain research inputs are donated by private dealers, the expenses of reagents, viral serum, basic supplies, maintenance and replacement spare parts are not budgeted by the MOA at this point. As plans for the integration of JVASP into the overall NCARTT system progress, the concerns will be eliminated about the adequacy of funds to support maintenance of sophisticated laboratory equipment and research activities.

3. EXTENSION

The major role of the extension agent in an effective research/extension system is to provide a flow of adapted technical information to farmers. The agents must also serve as communication channels to transmit feedback to the research institutions about farmers practices and problems, etc.

In Jordan these agricultural extension activities are the responsibility of the Ministry of Agriculture. The MOA activities are complemented by both private sector and parastatal field work. The Jordan Valley, with the JVASP assistance has been a model for agricultural extension for the rest of the country. Local extension agents are individually equipped with vehicles and video communication equipment. In the past three years, they have received extensive training in both technology and communication techniques. Their training and their linkage with research has been institutionalized by regular weekly meetings or seminars at the Deir Alla Research Station. Their effectiveness has also been enhanced by the JVASP production of bilingual Technical Information Sheets.

In addition to the MOA extension agents, there are approximately 85 field agents doing some form of agricultural field work in the Jordan Valley. Over half of these agents are employed by private enterprise. The content of the extension message and the techniques of transmission vary according to who is doing the extension. General field techniques include individual farm visits, demonstration fields, fact sheets, seminars, free samples/credit for inputs either for individual use or for research. A summary chart follows of extension techniques used by the private sector, the Ministry of Agriculture/JVASP, the JVFA and the JCO follows.

a) MOA/JVASP system

There are currently 10 MOA extension agents who are responsible for the Jordan Valley. They are located in stations spread across the valley, and are each equipped with vehicles/gas allocations to cover from 500-800 farmers. The system is based on the World Bank Training & Visit methodology (T&V System).

Given the sophistication of many of the Jordan Valley farmers, as well as the limited geographical area in the valley, this number of agents appears to be sufficient. As can be seen from the Agricultural Extension Techniques chart, the MOA extension agent are well equipped with brochures, video tapes, equipment and technical data sheets. They are all agricultural engineers (B.Sc) with specific training in valley agriculture. Each agent supervises at least two demonstration programs on farmers' fields in their regions. In addition, these agents assist farmers in obtaining diagnostic testing of soil, water and plant tissue. The fact that the coordination of the extension activities takes place in the same location as the research facilities assists in coordination of activities.

AGRICULTURAL EXTENSION TECHNIQUES CHART

Indicators	Private Sector	M.O.A.	J.V.F.A.	J.C.O.
1. Extension Approach				
a. % time in Ag.ext.	95%	30%	65%	85%
b. problem specific	yes	yes	refer	refer
c. crop integration	yes	some	yes	yes
2. Farm Visits per agent				
a. visitations	1-200 farms	600+farms	on demand	2-300 farms
b. frequency	weekly	irregular	irregular	irregular
c. contact time	flexible hours	govt hours	govt hours	govt hours
3. Incentives				
a. input prices	some discounts	n/a	none	none
b. free samples	yes	no	no	no
c demonstration fields free inputs	all inputs	partial	n/a	wheat only
d. marketing	yes	no	no	yes
e. seed multiplication	?	no	no	yes
4. Inputs				
a. credit	flexible	none	seasonal	seasonal
b. cash	yes	no	no	no
c. materials	yes	no	yes	yes
5. Techniques				
a. demonstration fields	100+	58	no	wheat
b. brochures	company	info sheets		JCI/MOA
c. seminars	no	no	no	yes
d. field days	weekly	3 per season	no	no
e. video tapes	no	yes	no	yes
f. other				
6. Service Delivery				
a. pesticide application	yes	no	yes	yes
b. Experts	yes	yes	no	yes
c. Diagnostic testing	yes	yes	refer	refer
d. machinery rental	yes	no	yes	wheat only
7. Extension support				
a. bonuses/commissions	yes	no	no	no
b. transportation	excellent	excellent	limited	use own car
c. budget	excellent	limited	limited	limited
8. Agent Training				
a. inservice training	yes	yes	no	yes
b. seminars	yes	yes	no	yes
9. Extension/research integration	yes	some	little	little

*This information was collected during a series of Assessment Team interviews with MOA, JVFA, JCO and private dealers personnel.

A new project, Communication for Technology Transfer in Agriculture (CTTA), has recently been funded by USAID to strengthen "all available Jordanian communication channels which can be utilized in delivering messages to farmers; these include extension visits, field days, radio, television, printed materials and other techniques." This project will also assist in the improvement of linkages between agricultural extension and intermediary organizations such as JCO and JVFA. Although these activities will be nation-wide, the CTTA project has already identified specific priorities in the Jordan Valley. This project will further improve the resources available to the MOA extension agents.

Unfortunately, the MOA agents have also been mandated with non-extension duties which have reduced their effectiveness by limiting their capacity to provide services to the farmer. Farmers expressed a high degree of resentment of a recent cropping pattern activity which takes as much as 95% of the extension agents time during some months. When the MOA began the cropping pattern program, it had incentives for farmers who strictly followed the guidelines: a farmer would receive payment for planting as instructed. After the first year was successful in reducing the surplus production of tomatoes and cucumbers, the policy changed and incentives were eliminated. Some farmers continued to believe that they were required to follow these guidelines as mandates as opposed to maximum planted acreage.

In addition to the regular extension agent activities, the JVASP has funded a special collaborative outreach program with the FOA, Jordan University. This is noteworthy in its innovative approach to creating linkages between the MOA, the University and the Valley farmers. The internships are sponsored by a USAID grant which provides small stipends for students, who use these resources to help solve farming problems for participating farmers. The intent of the program is to promote university involvement in private sector agriculture by providing medium level technical advice to farmers and promoting a more acute awareness among academic researchers of day-to-day farmer problems and concerns. The students participating in this program have acquired self-confidence in their abilities to work directly in agriculture and many have expressed strong interest in operating their own farms after graduation.

Prior to participation in the outreach program, most students were planning to work for private agro-chemical companies or for the governmental extension service. This positive change in student's attitudes toward farming is one of the main objectives of the outreach program.

Working with six cooperating farmers, the students are participating in farming decisions, daily farm work, planning and management, and learning first hand about problems ranging from pest and weed control to on-farm water management. Student experiences are brought to the

attention of university research staff through weekly debriefing sessions and monthly reports. This successful effort is providing a very useful vehicle for facilitating communication flows between farmers and university research programs.

In addition to the impact of these pioneering efforts, the system which has been established by the JVASP has greatly improved upon the previous national extension system. There has been major progress toward increased communication between research and extension. However, there is still room for expanding the areas of coordination of extension activities with the parastatal organization and in strengthening farmer participation in this system.

b) Parastatals (JCO,JVFA)

The Jordan Cooperatives Organizations (JCO) and the Jordan Valley Farmers Association (JVFA) are the only two parastatal organizations active in agricultural extension in the Jordan Valley. Both of these organizations have had budgetary problems due to the large number of outstanding loans. Recently they have collaborated with the ACC to share loan repayment information to reduce their loan risks. Although there appear to be plans for institutional changes in these organizations, at the time of this report, no decisions have been announced.

(1) JVFA

The Jordan Valley Farmers Association is a Jordan Valley based organization established in 1974. It wa originally mandated to provide loans, services (pest control, harvesting, transportation, grading), and to purchase and market agricultural produce and agricultural extension services. Over time, the marketing responsibilities were transferred to AMPCO and evertually AMO.

Currenrly, JVFA has over 4500 members organized into 33 Development Area Councils. JVFA has 14 field agents working full time in the Jordan Valley. Extension activities are not separated from credit investigation/supervision activities. The agents are located in the eight branch offices spread across the valley. Many of these offices are close to or shared with MOA extension agents. JVFA has 8 vehicles for all of its valley operations.

In addition to field extension activities, JVFA has 20 tractor/tank sprayers which are rented out to farmers with a driver for 1.5 to 2 JD per tank sprayed. The chemicals and additional labor are supplied by the farmers. JVFA gives credit for inputs supply (no cash credit since 1983). Extension activities are perfunctorily coordinated with the MOA activities by having each MOA/JVASP extension agent serve as secretary to 2-3 JVFA Development Area Councils. Unfortunately, JVFA is operating with extreme cashflow problems which severely curtail many of its extension activities.

(2) Jordan Cooperatives Organization (JCO)

The Jordan Cooperatives Organization serves farmers through cooperatives located throughout the country by providing services and extending credit. JCO supplies inputs including animal feed and certified wheat and barley seed. It also has a limited marketing function where it bypasses the normal commission agent and charges 1% less in fees. Specially funded projects include seed multiplication, range development, aquaculture, food processing and viewing centers.

In the Jordan Valley, there are approximately 4526 JCO members in 47 cooperatives, divided among three sections: North Shouneh, Dier Alla, South Shouneh. Of these cooperatives, 39 are agricultural with a membership of over 4200. Other types of cooperative include housing, marketing and general family commerce. Membership is required for participation in all activities. In cooperative extension, there are 10 full time agricultural engineers (BSc's) for the entire valley. One of these agents is working full time on wheat extension with the certified seed multiplication project.

As with the JVFA, the extension takes place as a part of the credit/input supply system. When a farmer wants a seasonal loan for inputs, he is told how to use the inputs and the extension agent will make regular farm visits to the farmers in his territory. Each agent in the middle region has responsibility for approximately 200-300 farmers.

The materials used for extension include: video cassettes, brochures from individual companies, on-farm visits, as well as training seminars. JCO is the only organization doing extension in the valley which has begun to systematically address the problems of farm management, marketing and cost/benefit analysis of inputs use. In the past year, it has held three seminars in the middle region for approximately 100 farmers each. JCO extension is not limited to members; on an informal basis agents have stated that they regularly share information and advise non-JCO farmers.

c) Private Enterprise/Dealers

Private enterprise extension agents have several advantages over other extension agents; they have more flexibility because they work for small organizations and are not bound by bureaucratic constraints; they have clear objectives and lines of authority; and they are able to devote full time to extension/sales activities. Private agents have special services they can offer to selected farmers: credit (not necessarily limited to seasonal or in-kind inputs supply) and incentives such as free inputs for farmers' demonstration fields, and field days on a regular

basis. Despite these advantages, local farmers are well aware that they are trying to sell them products and are careful in which advice they follow. The comparative advantages of the various agricultural extension services are summarized in the following table.

4. CHANGES ANTICIPATED IN RESEARCH EXTENSION SYSTEMS

Currently, much of the coordination and collaboration is discretionary rather than linked by formal planning and implementation control mechanisms. The problems of coordination among the private sector, the University and the MOA/NCARTT are still not resolved. However, changes are being made on a daily basis with both small scale seminar exchange of information as well as regular communication channels being created. The National Center for Agricultural Research and Technology Transfer (NCARTT) and the newly established Higher Council for Science and Technology (HCST) are just two examples of specific efforts to address these problems.

a) HADP/NCARTT

Major steps have been taken to establish and institutionalize, with USAID support, a national center for Agricultural Research and Technology Transfer (NCARTT) which will have responsibility for overall public agricultural research and technology transfer (ARTT), including the Jordan Valley. The center is designed to be an autonomous organization under a director general who is responsible to a Board of Directors for the management of NCARTT activities and programs as set forth under the goals and objectives of NCARTT. The Board is chaired by the Minister of Agriculture and has membership from public, parastatal agencies and the private sector. The board's responsibility includes the formulation of policy for agricultural research and technology transfer, strategic plans and setting of ARTT priorities. The Board will have standing and ad-hoc committees formed for specific purposes. NCARTT activities will be closely coordinated with those of the MOA district directories of agriculture.

The system under which NCARTT will function will greatly facilitate coordination and linkages within NCARTT, between NCARTT and its regional agricultural service centers (RASC) and between NCARTT and cooperating organizations (local, national and international). A farming systems research approach will be employed to institutionalize a methodological approach focusing on bringing researchers, extension workers, and farmers together for work on identifying and removing agricultural constraints. The emphasis will be given to applied research on farmers' fields and developing specific recommendations for technological and cultural practice improvements.

Currently the approach it does not yet officially cover the JVASP/MOA research and extension facilities in the Jordan Valley, it has

already been determined that the Deir Alla Research Station and its satellite research stations will become the fifth RASC in the NCARTT system.

Another important new resource for Agricultural Research and Extension is the establishment of an Agricultural Development Fund (ADF) co-financed by the Government of Jordan and USAID. This fund is already functioning as a flexible funding mechanism for agricultural research projects and related activities such as on-farm demonstrations, land aggregation, and credit guarantee programs. ([44] Highlands Project p. 13)

b) Higher Council for Science and Technology (HCST)

The Higher Council for Science and Technology is designed to formulate policy, develop strategies and to give direction to Science and Technology institutions in Jordan. The Royal Scientific Society is incorporated under this structure. Since this law was only enacted in November/1987, it is too early to analyze in detail the full ramifications of this policy revision. According to staff involved in the development of this policy, the council is intended to coordinate all scientific research done in Jordan and it is hoped that it will be able to overcome ministerial/institutional bureaucracies by creating a national plan for research. If the Council is able to coordinate/control budget allocations for research, it should be able to influence research priorities. Currently these funds are controlled by the Ministry of Plan and by the other relevant ministries (MOA, Ministry of Higher Education, etc).

5. RECOMMENDATIONS

a) Administrative/Organizational Improvements

(1) Autonomy of Research/Extension System

The Agricultural research and Extension Systems needs to be separated from bureaucratic hierarchies. For this system to be fully effective, it needs to co-ordinate and collaborate across divisions between the private sector, the Universities and the Ministry of Agriculture. The current system allows for institutional affiliations which are competitive, insular and counterproductive. NCARTT plans to establish as a separate entity with linkages through the membership of its Board of Directors a coordinating mechanism for addressing this problem.

(2) Farmer Integration: Research and Extension System

NCARTT should effectively incorporate farmers into the research/extension system. Farmers should be integrally involved in the determination of research priorities as well as the evaluation of its effectiveness in the field. There needs to be more recognition/awareness of the experiments already being independently conducted by individual

farmers (pH rectification, salinity resistant varieties, etc.). This could be done, in part, by having rotating membership in the Board of Directors as well as representatives on the relevant committees.

(3) NCARTT/HCST Clarification of roles

Given the relatively recent creation of both bodies, it will be essential to clarify the roles of the two bodies. Currently, the HCST appears to be primarily concerned with national priorities. The specific manner in which this will affect the NCARTT still needs to be clarified. Hopefully, it will assist in coordinating all of the research done in the country to prevent redundancy and to ensure the needed balance in priorities.

a) University Student Outreach Program

This innovative program is an excellent first step in the improvement of coordination of MOA and FOA activities. It provides a unique opportunity for agricultural students to learn the priorities of the MOA and to have direct contact with the farmers. It serves indirectly as a means of feedback to the University community which hopefully will have an impact on University as well as national research priorities. It would be beneficial to expand this program to include other institutions in Jordan such as Yarmouk and the Jordan University for Science and Technology. This would enable the Jordan Valley farmers to draw upon the extensive experience of the academic and agricultural support professions and students in all of the institutions in Jordan.

b) Research Orientation/Priorities

(1) Farm Management Orientation

There is a need for research which is directly oriented to farm management: this would include planning, questions of effectiveness of pesticides; mixing of pesticides; cost/benefit analysis of various fertilizers/organic matter, use of labor, mechanization, economic viability of various cropping patterns, postharvest handling/grading and marketing.

(2) Team Research

There is a need for research teams which cut across traditional disciplinary divisions and have problem/commodity orientation. This research should include consideration of soil variation, seasonal water supply/consumption, varietal adaptation to specific Jordan Valley growing conditions, Integrated Pest Management (biocontrol/economic thresholds/pesticide use).

(3) Safety/Environmental Concerns

There is a need for research with focus on the long term effects of agricultural technology. This should include analysis of the effects of intensive fertilizer and pesticide use on soil and water quality over time as well as other environmental/ecological considerations (see the discussion on pesticides in Section IV (G)).

C. EDUCATION

> The availability of education in the valley through the secondary cycle may prove to be the single most decisive factor in transforming people's attitudes, aspirations and values in the long term. As it is in all rural areas of the country, schooling is a big attraction for the nomadic population, and is often a key factor in a family's decision to settle down permanently in one village. (Rami Khouri, 1981)

Education is extremely important to all valley residents and the improvement of educational system in the Jordan Valley is remarkable. From 1973 to 1986, school enrollment increased by 120 percent, the number of classrooms was up by 40 percent in the 6 year time span from 1980 to 1986, and the student teacher ratio declined from over 30 in 1980 to 21 in 1986, compared with the national average of 23. From 1973 to 1986, the mean literacy rate increased from 58.7 percent to 96.3 percent.

Although most of the Ministry of Education school structures were completed by 1982, the success of the educational system in the valley is even more evident today. The schools were almost immediately fully staffed and operational upon completion of construction. All of these schools have incorporated "extra-curricular" activities into their programs with a multitude of clubs and sports activities as part of the regular school day. As enrollment has increased, the Ministry of Education has responded to supplementary needs by creating three local directorates in the Jordan Valley. This has increased the administrative personnel and is more responsive to local planning needs.

The demand for education surpasses the formal educational system. Adults are demanding literacy classes and vocational training. The two community development centers in the valley have training classes which are fully attended. In those areas where no vocational training is offered, vocational training classes are being held in private homes.

Although employment for secondary school graduates in the Jordan Valley was plentiful in the early eighties, most of the government posts have been filled and unemployment is currently increasing as it is in the rest of Jordan. Many more of the secondary school graduates are now continuing for further education.

1. FORMAL EDUCATION

a) General situation

The educational facilities in the Jordan Valley have gone from being minimal at best in the early seventies to a showplace for the rest of Jordan. Over 61 new schools have been constructed and there are now over 873 classrooms available in Ministry of Education (MOE) facilities. These facilities are superior to the average Jordanian schools in the modern construction and inclusion of laboratory facilities, libraries and modern audio-visual and computer equipment.

Accessibility and utilization of educational services are consistently high throughout the Jordan Valley. Approximately 75% of the students attend schools sponsored by the Ministry of Education and one third attend United Nations Relief and Works Agency (UNRWA) schools. The MOE schools are almost all newly constructed by JVA within the last seven years, and both the administrative and teaching staff are very satisfied with their facilities. However, the UNRWA schools, which serve the registered Palestinian Refugee population, are almost entirely of older construction and have over 90% double shifting. The UNRWA budget is limited and problems exist with providing adequate maintenance.

From 1978 to today the total number of school children enrolled in schools has increased from 19,345 to over 30,000 in 1987. ([24] Khouri p.170) According to Khouri,

> The increased enrollment is due to three factors: the children of new families moving into the valley, and indigenous families sending their children to school at an earlier age than they had previously done, or schooling them instead of keeping them at home on the farm. (Rami Khouri, 1981)

Relative to the general population, the number of females attending school is high. As can be seen in the following <u>Educational Facilities in the Jordan Valley</u> chart, female students actually outnumber male students in the Valley and eight of the UNRWA schools in the north are for females only. The female population is also staying in school longer and the number of women continuing on to higher education is increasing.

In addition to the formal education systems, women have increased their demand for and utilization of adult training classes. This includes both literacy training as well as vocational training in the two

community centers in the valley. When facilities do not exist, the demand has created training programs which operate out of private homes.

b) Planning/Effectiveness

Since 1985, the MOE has had total jurisdiction over all educational matters without interaction with the JVA and there is no further JVA assistance planned for MOE building construction. However, if the MOE wishes to construct a new school, the JVA and the Municipal Councils still have to be involved for land allocation. Rather than building new schools, most of the expansion in the region has been handled by leasing local buildings and making adaptations if necessary.

Most MOE officials feel that the initial JVA plans and implemented construction of schools was well done. The only problems cited were the lack of paved areas surrounding the schools, settlement cracks in the MOE community center in Maadi and the problems of coordination of school construction plans with UNRWA.

c) Personnel/Staff

Of the 1117 MOE teachers working in the valley, MOE officials estimate that a majority of the male teachers live in the Valley and that most of the female teachers commute from Salt, Irbid and Amman. Although many of the teachers are young, inexperienced, new graduates of Jordan University, the MOE is of the opinion that the level of job satisfaction is high. Part of this may be due to the teacher-student ratio being far better in the valley, 1:21 as opposed to 1:25 in the rest of Jordan and 1:28 in the UNRWA schools. The school buildings are newer and better equipped than those in the highlands. The students are highly motivated and the MOE makes and effort to match assignments to the teachers' areas of origin.

d) Facilities

The Jordan Valley now has 170 schools under the MOE. In addition, there are 20 schools built and run by UNRWA. Over the past three years, the need for expansion of educational facilities is evidenced by the twelve buildings being rented for educational facilities as well as the increasing number of students beginning school in the region. In each valley directorate, the MOE has responded to these needs and is planning to increase the number of classrooms available within the next two years. UNRWA also hopes to build new schools in Waqqas and Karameh and renovate some of the oldest schools.

The population of the Jordan Valley has been increasing, with the need for increased educational facilities differing among the three directorates. The Deir Alla/Maadi directorate has shown the largest population growth as well as an increase in the average educational attainment of both the children and the adult population.

All of the Jordan Valley schools are separated for male and female students after the fourth year. In most cases, the schools are in separate buildings. There are very few cases of MOE doubleshifting in the valley: the MOE has recently made a policy of eliminating all double shifting in Jordan by renting additional classroom space when needed. In the Jordan Valley, the MOE is currently renting approximately 12 buildings: 6 in the North Shouneh area, 4 in the Deir Alla/Maadi area and 2 in the South Shouneh area. The MOE expects to need an additional 25 classrooms within the next year.

The number of women entering the educational system and the number going on for university education has increased greatly in just the last three years. Currently over 20% of the graduating females in the Deir Alla/Maadi directorate receive university scholarships. In the other two directorates, the numbers are also increasing but not as dramatically. The aspirations of girls graduating from secondary schools in the valley has greatly increased.

2. VOCATIONAL EDUCATION

There are two vocational schools in the valley, both for technical education of male students in the Valley. The Mashare Vocational Training Center for Boys offers a three year program with training in carpentry, plumbing, electricity, mechanics and blacksmithing. According to Ministry of Labor and Social Development statistics, the center has approximately 150 students.

The Agricultural Training Center in Wadi El Yabis will be completed in 1988 and will provide agricultural training in fruit and vegetable planting, nursery activities as well as decorative plants and flowers. The center, when completed, will accommodate 120 trainees with a capacity to expand to 240 trainees.

Very little vocational training for women is available in the Jordan Valley. Secondary school girls who prefer commercial or nursing must go to Salt or Irbid for this training.

There are two government sponsored programs in the Jordan Valley which have short term vocational training for adults: the MOE community center in Maadi and the Social Development Center in Kreimeh. At both locations, classes have been held in: sewing, weaving, typing, English, electricity, plumbing, first aid and auto mechanics. These centers have nursery schools/child care centers as well as buses to facilitate transport of children and adult clients.

Other training programs are being conducted by private/charitable organizations in the valley. The Queen Alia Social and Welfare FUND

(QAF) recently graduated 40 young women from a training program at Wadi El Yabis Charitable Society. The students completed courses in typing, dressmaking and hairdressing.

According to the MOE in South Shouneh, other vocational training classes are being held in private homes in El Kaffrein, Al Ramda and Karameh. These are locally organized and the charges are nominal: 2-3JD per course.

Most of the voluntary organizations have not had active programs in the Jordan Valley because of the JVA master plan. Now the most of the "master plan" activities have been completed, the organizations are beginning small scale projects. For instance, Catholic Relief Services (CRS) has planned a project for 1988 in the Maadi area for local women's production of loofahs (sponges made from squash plants). Considering that there are over 378 Voluntary Organizations in Jordan with 38,350 members and an estimated 88,457 beneficiaries, these voluntary programs could greatly assist in the vocational education sphere...([31] Five Year Plan 1986-1990)

3. ADULT LITERACY

The MOE has literacy programs on demand. Whenever there are a minimum of ten to fifteen students who request training, the MOE will establish a class with times and locations arranged to suit the students. The large majority of classes are being held at schools after normal sessions. Currently there are over 77 adult Arabic literacy classes held in the valley with over 1300 students (1070 female and 230 male). The students can continue for the equivalent of 6 years training in Arabic and Mathematics. These classes are entirely free and students are supplied with all books and writing materials needed.

The largest increase in demand for literacy classes has been in the middle region. The increased demand for evening classes, more than 50% in just the last two years, reflects the rapid increase in population in this directorate. There are now 28 evening classes with an enrollment of over 350 students in just the Deir Alla/Maadi area. As a point of interest, the great majority, 82% of students are adult women.

As stated above, the classes are intended for basic Arabic literacy and basic mathematical skills. However, there is potential for improvement of this curriculum by incorporating more functional skills such as household gardening, basic health education and even household maintenance skills. This would serve as motivation especially for the women to continue their training when the literacy programs are finished. Such functional literacy programs have been shown to be effective in income generating activities.

4. RECOMMENDATIONS

(1) Vocational training for secondary school students increased vocational education for women at the secondary school level in the valley is recommended. Currently girls must go to Irbid or Salt for commercial or nursing training. It might also be desirable agricultural training for boys incorporated into the secondary school system.

(2) Adult Education

Additional centers with a flexible vocational training curriculum should be built in the Valley. Currently there are only two centers in the valley for adult vocational training: Kreimeh and Maadi. These centers are well utilized and so many more adults are demanding training that such courses are being held in private homes.

(3) Early Education

Nursery school/kindergarten programs are improved to provide for education over and above basic childcare services. With minimal funding, the teachers could be trained and limited supplies could be made available for improving these programs.

Table IV.1
EDUCATIONAL FACILITIES IN THE JORDAN VALLEY

Ministry of Education	Total	North	Middle	South
Schools	170	74	57	39
Elementary		31	28	18
Preparatory		25	21	13
Secondary		18	8	8
Buildings rented: (Nationally 30.5%)	12	6	4	2
Students	23,119	11,722	7,001	4,396
Male		5,244	4,141	1,913
Female		6,478	3,997	2,483
Teachers	1,117	559	362	256
Male	562	248	163	151
Female	616	310	199	107
Teacher-student ratio: (Nationally 1:25)	1:21	1:21	1:19	1:17
Administrative Staff	169	65	55	49
Number of Classrooms	873	414	286	173

UNRWA SCHOOLS	Total	North	Middle and South
Schools	20	18	2
Students	7,694	6,349	1,345
Male	3,790	3,014	776
Female	3,904	3,335	569
Teachers	276	236	40
Male	145	123	22
Female	131	113	18
Teacher-student Ratio:	1:28	1:27	1:37

Administrative staff: not available
Number of classrooms: not available

Source: Ministry of Education and UNRWA Statistics

D. HEALTH SERVICES

1. Introduction

> It was only in the mid-1950's that doctors and clinics made their first appearance in the valley. (Rami Khouri, 1981).

Prior to that time, all valley residents either used traditional birth attendants, herbal recipes or facilities in the highlands in the case of emergency care. Health services in Jordan have greatly improved over the past thirty years. In the Jordan Valley, health services have increased at a rate much greater than most rural areas in Jordan. Now valley residents have a choice of public and private facilities with specialists available locally. Despite this expansion of health facilities, there is still room for improvement in the quality of primary health care services in the Jordan Valley.

Almost all of the planned health services structures were completed by 1980, with all of these clinics now fully functional. There also are now three hospitals, with the South Shouneh Hospital fully operational as of July, 1987. However, although the valley population has increased from 80,000 in 1978 to over 125,000 in 1987, according to the Dajani statistics and the current MOH data, the total number of clinics has not increased since 1980. As such, from the population statistics, it would <u>appear</u> that health facilities are less adequate than in 1980. However, the types and levels of the health clinics has improved and there is an increased number of Hospitals, Maternal-Child Health Care Centers and outpatient clinics.

Despite the sharp increase in population, the MOH health facilities appear to be underutilized and as such limited improvements are expected in the foreseeable future. As a first step towards comprehensive health planning in the valley, the quality of health care needs to be assessed regularly, with special emphasis on residents' perceptions of these facilities, and on the primary health care needs of the rural populations.

2. PUBLIC HEALTH DELIVERY SYSTEMS

a) FACILITIES

Health facilities in the Jordan Valley include 3 hospitals, one Comprehensive Health Clinic (type A), 13 Outpatient clinics (type B) and 13 Rural Health Clinics (type C). In addition, there are 7 Maternal/child Health Care Clinics (MCHC) which are attached to other clinics. Family planning services are done in the MCHC clinics or directly in hospitals. The health clinics are distributed throughout the three regions in the valley with a total staff of 75 MOH Doctors,

16 certified midwifes, 19 technicians, 10 Registered nurses, 52 assistant nurses, 93 nurse workers/practical nurses and 31 pharmacies. Many of these facilities are built within the last ten years and are furnished with modern equipment for the laboratories and x-ray departments, but may lack skilled manpower.

b) PERSONNEL

As can be inferred from the above personnel statistics, Jordan is blessed with an ample supply of physicians, and other medical experts. However, there is a shortage of qualified nursing staff and technicians both nationally and in the Jordan Valley.

(1) Doctors

Despite the large numbers of doctors in the Valley (75), many are not motivated to work in the Jordan Valley and less than 17% of the MD's assigned to the MOH facilities actually reside in the valley. The present system used is for one doctor to be on call in each district at all times. However, since most doctors live in Salt, Amman or Irbid, the response time is substantial. Currently this does not seem to be causing any problems mainly because of the low utilization rates.

The doctors interviewed complained about the heat in the summer, the isolation from colleagues in the larger cities, and the inadequate pay scale considering their professional status. Yet, the doctors are also aware of the rising national unemployment figures in the medical professions, including MD's and recognize the employment realities.

Another concern voiced by doctors involved the inadequacy of trained staff and inadequate laboratory facilities, and insufficient patients, resulting in a feeling of "being underemployed." The fact that there are rarely lines or extended waiting periods for treatment confirms this impression. As a point of interest, despite the low utilization rate, villagers have complained that there is a lack of personal attention from the doctors. As one valley resident expressed during an interview: "they don't even touch our children, they just look and write out prescriptions."

(2) Support Staff

The support staff consists of four levels of health workers; qualified midwifes, technicians, registered nurses, assistant nurses and nurse workers/practical nurses. Assistant nurses have 18 months of formal nursing training but the nurseworkers (practical nurses) usually only have up to three months training in a hospital and limited practical experience. The nurse workers are paid and treated as unskilled staff and in MOH statistics are counted with the domestic staff and drivers making it very difficult to get accurate numbers for the valley of this category of medical staff.

As can be seen from the health statistics chart, there appears to be an adequate number of staff for the population served. However, during team assessment interviews, the main complaints were about the lack of adequately qualified staff: too many nurse workers and too few registered nurses. Female villagers also complained that there are insufficient qualified female staff to serve their needs. Increased responsibility and authority for trained nursing staff should improve the overall system.

c) UTILIZATION

Interviews with both MOH staff and valley residents tend to confirm Ministry of Plan findings that low utilization of medical facilities and staff may be largely due to:

1. lack of confidence in available services

2. low enthusiasm among physicians

3. failure of mass media and government to educate people on the benefits of primary health care

4. lack of outreach/health education activities

5. limited recognition of early symptoms, postponement of timely treatment and lack of preventative health care approach to medicine in general. ([31] Five Year Plan 1986-90 p.221)

With respect to item 4 above, according to the doctors, there is a greater need for community health education. The people in these rural areas have had little regular treatment in the past and need training to encourage them to use medical facilities on a regular basis. Many of the women still prefer to employ local "dayas" to MOH midwifes for childbirth procedures and trust traditional remedies. The MCHC centers do have excellent outreach plans and materials, but the implementation of programs is often restricted by the lack of regular allocation of logistical support.

With respect to item 5 above, the attitude toward medicine in the Valley is for patients to wait until they are in pain and quite ill and then to see specialists to have medicine which will cure them quickly. There is little awareness of the importance of primary health care/preventative medicine, requiring frequent visits to medical facilities for all members of the family.

d) FAMILY PLANNING

Although none of the Jordanian family planning centers are located in the Jordan Valley, family planning services are available through the MCHC centers and through the hospitals. As can be seen from the chart, Family Planning Patients and Birth Control Distribution for entire Valley except South Shouneh presented at the end of this chapter, only 281 women requested family planning information/assistance at MCHC clinics in 1986. Although the statistics are not complete, this appears to be only a very small percentage of the thousands of women attending the MCHC clinics on a yearly basis, and an even smaller percentage of the total female population in the valley. Family planning information is given on request only and the only contraceptives openly distributed are birth control pills. Tubal ligations, IUD insertions, vasectomies and abortions are not regularly performed in the Jordan Valley hospitals. Government sponsored pill distribution rate is low, however, this may not be indicative of actual use in that some women prefer to go directly to private pharmacies for the medication.

The General Association of Jordanian Women (GFJW) is currently proposing a national program for mobile teams to travel around the country to provide health and family planning information to rural populations. The approach is to emphasize child spacing, prenatal care and breast feeding (Jordan Times, Dec. 1, 1987)

3. PRIVATE DELIVERY SYSTEMS

a) Facilities and Personnel

As can be seen in the chart, MOH Health Facilities and Personnel in the Jordan Valley, located at the end of this section, there are approximately 35 doctors in private practice and 11 private pharmacies in the Jordan Valley. In the Maadi/Dier Alla area alone, there are seven private clinics. According to the MOH hospital staff, they get about half of the clientele. Of the above 35 doctors, only one of them actually lives in the Valley. The number of private doctors' clinics in the valley has decreased as the MOH facilities have become fully operative, however, in certain areas, they continue to serve a large segment of the population. In the valley, the private doctors are handling an average of 5-10 clients per day.

b) Utilization

All of the professional level staff interviewed stated that they go to the local MOH facility for minor ailments and prescriptions. However when any family member is seriously ill, patients only trust private doctors and/or hospitals in Amman and Salt. Of particular concern for serious ailments was the inadequacy of diagnostic facilities in the central region.

Local non-government pharmacies sell a large percentage of the medicine used in the Jordan Valley, much of which is distributed without prescriptions. According to both villagers and to MOH authorities, this poses certain problems: (1) overuse of antibiotics leading to resistance and (2) misuse of prescription medicines including sedatives/pain killers.

4. RECOMMENDATIONS

(1) Periodic assessments should be conducted on the underutilization of the health care facilities in the Jordan Valley.

(2) Given the demand in the Jordan Valley for more care by qualified women, an increased support in the form of training opportunities, transportation and other incentives for women as staff members is recommended.

(3) To insure improved/proper record-keeping, the Ministry of Health needs to have improved management tools, data collection and administrative staff. Computerization is recommended in this process.

(4) Further emphasis should be given to primary health care in the Valley. This should include community health education and preventive health services.

(5) Implement increased outreach programs by midwifes at the Maternal-Child Health Care Clinics. Such programs should include active information distribution on oral rehydration therapy/gastrointestinal tract problems, vaccinations, acute respiratory tract problems, eye infections as well as birth spacing. The programs should also assure consistent budgetary and logistical support for the midwifes.

(6) In conjunction with the above recommendation, further investigation of the family planning education needs in the Valley is recommended. Such an investigation should include analysis of the effects of actual and potential polygamy as well as increased education on the attitudes and behaviors relevant to family planning.

(7) The Ministry of Health needs to have a more integrated planning mechanism for the Jordan Valley. Currently the valley is split into two sections: Belqa and N. Shouneh.

(8) Increased collaboration between the Public and Private Health care facilities in the Valley should be encouraged. Such collaboration should include training programs as well as community health program development.

(9) The MOH should investigate the possibility of inservice training/seminars for Valley doctors, which would provide an opportunity for collaboration and alleviate some of the isolation problems raised

by the doctors. These seminars could also provide specific training on updated medical techniques. In addition, the possibility of increased housing and salary incentives should be considered for doctors and other medical staff.

MOH HEALTH FACILITIES AND PERSONNEL IN THE JORDAN VALLEY

	Total	N. Shouneh	Dier Alla	S. Shouneh
Hospitals	3	2	0	1
number of beds	89	63	0	26
Comprehensive Health Clinics (A)	1		1	
Outpatient Clinics (B)	13	4	4	6
Rural Health Clinics (C)	13	3	4	6
Maternal-Child Health Care Units	7	3	2	2
MOH Doctors	75	38	11	26
no. live in the valley	13	9	1	3
Qualified Midwifes	16	7	2	7
Registered Nurses	10	6	1	3
Technicians	20	11	4	5
Asst. Nurses (18 mo. training)	52	37	4	11
Practical nurses/nurse workers	93	50	13	30
Pharmacies	31	9	9	13

Source: Statistics Department, Planning, Training and Research Division, Minstry of Health

PRIVATE HEALTH FACILITIES AND PERSONNEL IN THE JORDAN VALLEY

	Total	N. Shouneh	Dier Alla	S. Shouneh
Private doctors	35	12	13	12
charges/fees	3 JD to 8 JD's per visit			
private pharmacies	11	3	5	3
"dayas"/licensed midwifes	20	8	6	6
Charges/fees	JD 20 for boys and JD 10 for girls			

Source: Assessment Team Field Interviews

HEALTH SERVICES UTILIZATION

	Total	N. Shouneh	Dier Alla	S. Shouneh
Jan/87 Number of patients in Type A clinic			841 (Maadi)	
Jan/87 Number of patients seen in one (B) clinic/district		606 (Waqqas)	961 (Deir Alla)	673 (Rauda)
Jan/87 Number of patients seen one (C) clinic per district Sukneh)		94 (Balawneh)	69 (Dirar)	5 (Al-Sukneh)
Jan/87 Number of mothers seen before and after births (1 MCH clinic per district)	435	206	214	15
Number of children seen at (1 MCH clinic per district)	909	375	493	41

1986 North Shouneh District Utilization of MOH Health Facilities

	Total	Subsidized (poor)	Unsubsidized	Employees	Government Dependants
Patients	127,861	5,853	37,895	13,393	70,720

Source: Statistics Department, Ministry of Health

Family Planning Patients and Birth Control Distribution for Entire Valley Except S. Shouneh

	Total	N. Shouneh	Dier Alla
1986 number of patients seen	281	227	54
Number of cycles of birth control bills distributed	336	244	92
October, 1987 MCHC Stats. number of patients seen	24	19	5
Number of cycles of birth control pillss distributed	29	16	13

Source: Department of Maternal-Child Health Care (MCHC), MOH

E. Agricultural Credit and Input Supply.

> The farmers of the Jordan Valley have shown they are willing to spend money and take risks - Rami Khouri 1981.

Rapid growth and transformation of the agricultural sector in the Jordan Valley was fueled by the development of a highly effective and extensive network of crop input and credit supply throughout the region. The supply of inputs and credit is channeled through both public and private sector delivery systems.

1. Parastatal Organizations

Supervised agricultural credit is delivered through three parastatal institutions: (1) the Agricultural Credit Corporation (ACC); (2) the Jordan Cooperatives Organization (JCO); (3) and the Jordan Valley Farmers Association (JVFA).

As of May 31, 1987, a total of JD 38,060,326 in loans outstanding for the three institutions was reported in a confidential intra-governmental memorandum. The breakout of this portfolio, according to the memorandum is distributed below:[1]

Table IV.2
Profile of Institutional Agricultural Credit
(JD 000's 1987)

Organization	Term	Seasonal	Total	&	No. Loans	&
ACC	24.37	2.74	27.12	71.33	7,460	46.8
JCO	4.71	5.24	9.95	26.13	7,416	46.5
JVFA		0.99	0.99	2.63	1,065	6.7
Total	29.08	8.97	38.06		15,941	

The distribution of this credit portfolio is given in the next table.

[1]Confidential intra-governmental memorandum read and quoted to the Assessment Team by informants, dated May 31, 1987.

Table IV.3
Distribution of the Institutional
Loan Portfolio
(thousands)

Class	Number	%	Mean Size	Value	%
30	12.62	79.2	1.02	12.81	34
3 5	1.33	0.2	3.24	4.31	11
5 10	1.08	10.8	5.22	5.65	15
10 20	0.53	3.30	10.72	5.63	15
20 50	0.35	2.20	19.83	6.88	18
50	0.04	3.00	67.76	2.78	7

ACC has the largest portfolio of agricultural loans in terms of total value (71%). This is followed by JCO at twenty-six (26%) percent. The JVFA manages the smallest portfolio at 2.76 percent of the total financial value. The largest seasonal loan contributor among the institutional lenders is the JCO with 58 percent, followed by the ACC at 31 percent The smallest of the institutional contributors is the JVFA with 11 percent.

For intermediate and long-term loans, ACC supplies 84 percent of the credit financing with the remaining share (16%) coming from the JCO.

Eighty percent of all loans are for 3,000 JD, or less. It is noteworthy that forty-five (45%) percent of the funds are for eighty percent of the loans (average value 1,227 JD), while the remaining fifty-five percent (55%) of the funds are for twenty (20%) percent of the loans (average value 10,495 JD).

These distributions show that the major share of parastatal agricultural credit financing is channeled into larger investment activities (perhaps for larger producers), while a far smaller share feeds into production capital and on-farm investments for the small farmer. An explanation of the apparent large-farmer bias of the public sector credit system is the extensive collateral guarantees required to secure loans through this outlet.

Supervised credit is secured through two forms of collateral guarantee: (1) land mortgage and (2) signatory. Crop mortgaging, although effective in many countries, is not used by the parastatal institutions. The mortgaging method is, however, extensively used to secure all categories of loans in private sector lending operations.

Credit access through parastatal channels is partially subsidized at 7 percent plus a penalty of 1 percent for late repayments on short-term seasonal loans (9 months) and 8 percent for capital investment (term)

loans (up to 10 year repayment). The mean commercial bank lending rate is 9.38 percent, while the estimated marginal efficiency of capital in agriculture is 10.6 percent.[2]

The growth and evolution of agricultural credit systems (both public and private) in the Jordan Valley have provided the major impetus for transformation from subsistence to dynamic market oriented agriculture through supplying the needed capital flows for investment financing of plasticultural investments and improved irrigation infrastructure. Together with improved input and technological transfers, expanded credit facilities have been the cutting edge of the agricultural transformation process.

In spite of the highly favorable subsidy structure offerec by parastatal institutions, however, dark clouds are gathering on the heretofore bright economic horizon. All three banks report high and increasing incidence of loan default and mandatory debt rescheduling. Payments amounting to JD 19,665,700 are overdue on JD 38,060,326 advanced to farmers nationwide by public sector agricultural lending institutions. Current estimates are that only 38 percent of this amount will actually be collectable within ghe next 12 months.[3] Debt repayment and credit default profiles from the individual organizations seem to confirm these general findings:

Table IV.4
Loan Repayments Overdue Among
Agricultural Lernding Institutions
(JD 000's)

Institution	Seasonal	Term	% Overdue
ACC	2.56	5.82	31
JCO	4.71	1.15	59
JVFA	0.99		100

Credit institution officials, farmers, commission agents, and input suppliers interviewed by the Assessment Team made frequent references to growing debt service burdens and cash liquidity problems among many producers. This situation appears to have evolved from credit financed investments in conversions to plasticulture and drip irrigation during the late 1970's and earl 1980's. During this period, exports were brisk with high and stable prices. As exports and prices began to fall in 1984 and 1985, debt service obligations consumed a growing share of agricultural net revenues to the point where many farmers were no longer

[2]See Section on Agricultural Resource Use Efficiency

[3]Confidential intra-governmental memorandum dated May 31, 1987.

able to meet their scheduled obligations. The Team heard reports of many farmers having to sell their greenhouses at a 60 percent loss to meet rising debt and subsistence obligations. There is currently a brisk trade in exports of used green houses to Saudi Arabia. The farmer liquidity phenomenon appears to be the major cause of declining parastatal lending agency performance and growing unwillinghess of both public and private lending sources to advance further credits to farmers who are in arrears on their payments.

Government reaction to this problem has ranged from debt rescheduling to formulating alternative reorganization proposals for combining the three parastatals under the umbrella of a new Agricultural Development Bank in anticipation of being able to pool the credit risks across a larger resource base and to reduce overhead costs by consolidating staff.[4]

It would appear doubtful, however, that any of these strategies would have much lasting impact on farmer liquidity without a dramatic reversal of farm price trends. The total farmer debt burden nationwide is estimated to be some JD 118 million, including 38 million in public sector credits and an estimated 80 million advanced to farmers by the private sector.[5]

Given the Government's reluctance to foreclose on outstanding obligations because of possible adverse political, social and economic consequences, farmers seem more compelled to honor their private sector credit obligations before meeting their public commitments. This preference is aided, no doubt, by the crop mortgaging system used to secure most private sector loans (see following sections).

Together with credit, two of the parastatals (JVFA and JCO) supply agricultural inputs on both a a cash sales and credit financed basis. Government policy favors agricultural input use through duty free import and a mandated wholesale profit ceiling of 20 percent with a maximum allowable retail markup of 10 percent. In spite of these ceilings, the general practice seems to be one of allowing prices to be set by economic forces.

There appears to be a policy of actively encouraging of more private sector competition with the public sector outlets. Occasionally, however bulk procurements by the public sector agencies permit them to market at some 5 to 10 percent below prevailing retail prices. Chronic public sector supply shortages and its dwindling market share of total input volume appears to neutralize whatever impact more competitive prices on buyer preferences and procurements might have. Between 1980 and 1986, the combined market share of the parastatals declined from

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[4]Discussion with government credit officials.

[5]Credit discussions, <u>ibid</u>.

54.17 percent to 16.12 percent for fertilizer and from 12.38 to 8.28 percent for pesticides.

Table IV.5
Input Supply Distribution
(Tens)

	JCO	%	JVFA	%	Private	%	Total
1980							
Fert.	8061	25.83	8845	28.34	14,300	45.82	31206
Pesticide	152	8.22	77	4.16	1,621	87.62	1850
1986							
Fert.	2770	6.99	4332	10.92	32,554	82.09	39656
Pesticide	43	3.06	73	5.19	952	67.81	1404

Source: (a)Jordan Valley Farmers Association and Jordan Cooperatives Organization records.
(b)Zahlan, A.B. The AGricultural Sector of Jordan: London, Ithica Press, 1984.
(c)Central Bank of Jordan. Monthly Staristical Bulletin: Amman, Vol 23 No. 5, May 1987.

Parastatal input supply and credit delivery in the Jordan Valley is accomplished through regional branches distributed among the 3 zones.

Table IV.6
Public Sector Input and Credit Supply Channels in the Jordan Valley

Organization	JCO	ACC	JVFA
Location			
North	7	1	3
Middle	7	1	3
South	12	1	2
Total	26	3	8

Source: Organizational interviews

2. Private Sector

With the declining public sector share of total credit and input supply volumes, private sector outlets have become the most dynamic outlet for all capital and input supplies throughout Jordan, and particularly in the Jordan Valley. Altogether, private outlets supply about 66 percent of the credit and 80 to 90 percent of the agricultural inputs.

On the input supply side, fertilizers, pesticides, seeds, and farm implements are delivered through a network of some 84 agencies.

Table IV.7
Numbers of Private Input Suppliers

Large companies importing & distributing major agricultural inputs (seeds pesticides, fertilizers, implements).	8
Medium-sized firms selling major agricultural inputs	20
Companies importing and selling concentrated feeds and veterinary supplies.	24
Companies manufacturing & distributing plastic materials, pipes, and installing drip irrigation systems.	10
Large companies importing & selling agricultural machinery	10
Companies manufacturing plastic packing containers	4
Companies selling tree seedlings	8

Source: Zahlan and Qasem. The Agricultural Sector
Jordan: Policy and Systems Studies: Amman, AHSF, 1985

Altogether, there are some 37 dealer agencies in the Jordan Valley and 9 factories making packing containers located in the Jordan Valley. These local stores in rural areas are considered by many of the dealers to be the most effective outlets for their products. Transportation services to these outlets are normally provided free of charge as a method of promoting and increasing sales of the larger firms. Large firms also tend to give discounts of 10 to 20 percent to these small retail outlets for their profit margins.

As a measure to boost sales by developing understanding and demand for their products, the larger suppliers, some of whom have been in the input market for over 20 years, conduct experiments to test new varieties of seeds and pesticides. Most of the testing activity is carried out in the Jordan Valley under the supervision of company agronomists with input and participation of selected farmers; these are usually the early innovators in using new techniques and practices. As a general rule, Valley farmers are unable to finance their working capital requirements and seek payment terms form input suppliers and marketing commission agents using crop mortgages until the harvest season. It is said that

JD 80 million in informal credit extensions are supplied through these mechanisms.[6]

As it has been the general practice for horticultural farmers in particular to depend on middlemen to finance their farming operations through extension of loans in cash and kind, commission agents and other operatives arrange with company clients to supply farmers with necessary inputs at the beginning of the season for repayment at the end. The normal practice is for the middlemen to write purchase orders in the name of specific farmers who take them to the input dealers when collecting their agricultural supplies. It is also reported that some middlemen receive commissions of up to 10 percent from the dealers on these financing transactions.

While there are obvious imperfections in the private supply of inputs and credit, it would appear that this channel is more efficient than public sector outlets because it is more responsive to farmers immediate needs for cash credit and technology and seems to be geared toward responsiveness to farmers problems than the public sector agencies.

The advantage of the informal credit network is the ready availability of services on a crop mortgaging basis without having to meet more lengthy bureaucratic and creditworthiness requirements of the public sector. The disadvantages are that such a system tends to bind the client to his benefctor and limits the flexibility of the former to seek out optimal marketing alternatives.

On the input side, private sector channels can deliver problem-solving technical application packages together with a wide variety of input options not available through public outlets. In this regard, the private channels are the vanguard of technological change. The disadvantage of this system is that the absense of objective recommendations on technology and dosage levels leaves the major initiative of technology transfer to profit motivated agents, who may, at times, be tempted to oversell.

A comprehensive, government sponsored research effort to develop a package of recommendations with respect to inputs usage as recommended in the discussion of agricultural research earlier in this section and in Section III (B) would give farmers unbiased information on input usage. This applied research to develop input package recomendations used in conjunction with the extensive private sector delivery mechanisms would provide Jordan Valley farmers with an almost ideal input delivery system

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[6]Discussions with government credit officials, private input suppliers, and commission agents.

F. THE IRRIGATION SYSTEM: EFFICIENCY, MANAGEMENT, AND ISSUES

1. Competition for Water Supplies between the Agricultural and the Urban Sectors.

Until recently, most of the development of Jordan's water resources was aimed at creating and sustaining an agricultural base in the valley. This followed the general objectives of:

*promoting national self-sufficiency in food production;

*earning foreign currency income from agricultural exports to the Gulf and other markets; and

*improving the socio-economic condition of the rural population.

Diversion of Yarmouk River waters and harnessing of the Zarqa River and side wadis made it possible to supply adequate quantities of water to irrigate increasing areas of arable lands in the Valley. This was carried out successfully and, with the completion of the 14.5km extension of the East Ghor Main Canal (EGMC) in 1988, agricultural production in the Valley is expected to reach an all-time high, and the standard of living of its 124,000 inhabitants will have increased significantly, as documented in other parts of this report.

Previooously, satisfying the demand for water supply to the main towns--Amman, Irbid, Zarqa, etc. -- was relatively easy, given their modest populations and the groundwater resources available from nearby aquifers. However, over the last few years, the popullation of these urban centers rapidly outgrew the groundwater resources, and severe shortages have been experienced on a recurring basis.

In 1986, pumping stations and a pipeline from Deir Alla to Amman with a capacity of 45 MCM/year were completed, and water began being pumped from the EGMC to the Amman water supply system. And, as in many other water-short regions of the world, there is not in Jordan a growing discussion of further transfers of water from the agricultural sector to the urban sector.

Water resources available to Jordan from its position of the Jordan River basin have been developed. in stages, as the irrigable areas in the Valley were being reclaimed and equipped. There are not some 22,800ha irrigable in the Valley, and JVA's supplies amount to about 280MCM/year.[7]

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[7] Including diversions from the unregulated Yarmouk (145 MCM/year), Mukheiba wells (9), regulated Zarqa (54) and 80% of the average flow of the side wadis (72).

The irrigable acreage will be increased to some 28,800ha in 1988, when the 14.5km extension of the EGMC is completed, as shown in Table IV.8. JVA's ability to satisfy the irrigation water demand will be impeded when diversion of the quantities committed to Amman is done on a regular basis, starting in 1988. The situation will imporve somewhat when the 12,000ha currently under surface irrigtion are converted to pressurized service, resulting in a saving that can be conservatively estimated to be at lease 25 MCM per year.

Table IV.8
Irrigable Areas by Type of Services
and STatus of Conversion from Surface
to Pressurized Distribution

Area	Status	Began Operating	Total Irrigable (hectares)	Type of Service Surf. (ha.)	Press (ha.)
Jordan Valley (Presently Irrigable	Operational	1969	22,829	12,434	10,394
Completion 14.km Ext.	Comp. 1988	1988	28,804	12,434	16,369
Middle Ghors Conversion	In progress	1990	29,865	7,171	22,689
North Ghors Conversion	Planned	1992	31,084	-	31,084
Adasya Conversion	Planned	1992	31,084	-	31,084

However, continued growth of Amman's population will increase its municipal and industrial water demand from the present 55 MCM/year.[8] Projections vary according to the different estimates, but this amount can be expected to double before the end of the century. Further water imports from the Valley will then be required, and it is planned to construct a second pipeline from the EGMC with a capacity of also 45 MCM/year.

The main water source, still unregulated, is the Yarmouk River. To provide regulation, constructon of the Maqarin dam, estimated by Harza in

[8]Black & Veatch, 1987, cites the metered consumption in Amman as 27 MCM for 1987, and Sogreah-WCS Operations, 1987, estimates system losses as 51% of production.

the late 1970's to supply an additional 120 MCM/year with a height of 100 meters is, again, under consideration. There is not some uncertainty about the actual increase in water supply that can be realized from Maqarin because of diversions that may have been effected over the last 10 years in the Syrian portion of the waterhsed. In addition, engineering and other issues need to be resolved before construction can start. Thus, a number of years will pass before benefits from Maqarin can be realized, if at all.

Since present policy in Jordan is to give priority to M&I requirements, the amount of water available to each irrigated hectare may well decrease over the next few years.

2. WATER USE EFFICIENCY

Very few data are available on the systemic efficiency of water use in Jordan. However, it appears to be very low in both the M&I and the irrigation sectors.

a) M&I Efficiency

A 1978 study by the Amman Water and Sewage Authority cites losses in the Amman distribution system of 24%, plus another 24% unaccounted for as a result of inaccurate metering. Similar values (26% and 25%, respectively) are stated in the recent (1987) interim report by SOGREAH-WCS Operations Under the sponsorship of the World Bank, the Jordan Water Authority's consultants have started a program of leak detection, and will carry out a hydraulic analysis fo the Amman distribution system. JVA is also in the process of pruchasing new flow meters to increase the accuracy of produced water measurements, and to eliminate as much as possible unaccounted for distributions.

b) Irrigation Efficiency

Conveyance efficiency. The November 1984 report of a Water Management Synthesis Project team ([122] Keller) calculated an average conveyance efficiency of only 64% for the 1978-81 four-year period in the East Ghor Main Canal. Similar (or even lower) values were calculated for 1984 and 1986 JVA as per the following JVA records:

	1984	1986
Volume of water entering the EGMC canal in mcm	184	171
Volume of water sold to farmers, in MCM	115	80
JVA system conveyance efficiency, in %	63	47

On-farm efficiency. On-farm irrigation efficiency was calculated in 1969 by Dar Al Handasah/Nedeco from a single monitoring of surface irrigated field crops (not including the amount pumped to Wadi Arab (9MCM) and to Amman (8MCM). The results varied from 30 to 69 percent. It can be expected that the on-farm efficiency with the newer, pressurized systems is more favorable, although direct measurements have

not been carried out. Conveyance efficiency after conversion of the system to drip irrigation will increase to perhaps around 85%.

It is obvious that substantial improvements in water use efficiency are not only highly desirable, but possible, both in the Valley irrigation systems and in the Amman distribution network. The water losses that would be prevented can then be used beneficially, and will go a long way toward preventing; or at least reducing water shortages. This opportunity has not escaped previous investigators of the water systems, and some attention has been given to improving the efficiency of the systems.

For example, conversion of the surface irrigation systems to pressurized systems was motivated, at least partly by the desire to eliminate losses from open distributory channels and to improve on-farm application efficiency.

However, much still needs to be accomplished, and it is highly recommended that, during the next few years, emphasis should be placed on water management with the view to achieving high-use efficiency in both the irrigation and M&I sectors. Such improvements will allow Jordan many years of development growth from available water resources, using the same distributional infrastructure already installed.

The following lists the specific areas where significant water management improvements can be made.

1. Measurement of water in the irrigation system. Water quantities are not measured accurately in the JVA system. As a result, deliveries are only estimated, and variations can be substantial from area to area. Furthermore, accurate water measurement along the big reaches of the main and branch canals, coupled with seasonal evaporation measurements would pinpoint specific problem areas where water losses due to leakage, spills, dis-proportionate discharges, etc. are excessive. Perhaps an accelerated maintenance/rehabilitation program from such problem areas could be initiated, thus tackling the most serious system inefficiencies.

a. Surface irrigation: Some 5000 ha are currently in process of conversion. These areas probably need not be dealt with as such. However, about 7000 ha will remain under surface irrigation after 1991, unless conversion is started soon. The turnouts from the main and secondary canals should be modified so as to permit more accurate control of the discharges delivered and to make reliable discharge measurement, such as with Parshall flumes or similar measuring devices. Most turnouts, especially farm turnouts are in disrepair, and their gates have been removed. They should be rehabilitated so as to permit accurate distribution at the desired rates of flow and in accordance with the established schedule. Only by doing this will the JVA be able to

administer the irrigation system on the basis of its design perimeters, and apportion equitably its limited water resources with accurate user billings for water services.

b. Pressurized irrigation: Water abstractions from the EGMC are fully controlled at the pumping station intakes. Some of the older pumping stations ae not equipped with flow meters, and these should be installed, together with a recording device. The farm turnouts, as designed, are provided with a pressure regulating valve with flow limiting device and a flow meter. Most devices are now inoperative, as the pressure regulators either have broken down or have been vandalized. JVA has started the replacement of some of the vandalized devices, with a more secure protective housing.

2. Improvement of distribution efficiency in the Amman M&I system

The leak detection program should be implemented throughout the Amman service area in order to locate, and, then, repair those areas of the distribution system where most of the leakage is occurring.

Control of the domestic water consumption by the graduated rate system in force in Amman is at least partly prevented by the inaccuracy of existing water meters and the lack of meters on many service lines. A program of maintenance of water meters will improve the accuracy of metering. An attempt should be made to install individual meters on all service lines.

3. Agricultural Extension and Research:

Significant water savings can be realized through an intensive and comprehensive agricultural research and extension program, with the objective of training farmers in matters such as water application for specific crops, timing of irrigation, determining waterneeds, etc. Such programs would result in increased farmers' awareness of the optimal amounts of water needed for specific crops (especially during the winter months), as well as optimal timing of water application. In this regard, it is important that extension workers by fully familiar, not only with on-farm needs, but also with the workings of the main canal system.

The Ministry of Agriculture (MOA), the Faculty of Agriculture of Jordan University, the Jordan Cooperatives Organization, and the Jordan Valley Farmers Association, all have been active in the farmers' outreach programs. In particular, the highly successful MOA/Jordan Valley Agricultural Services Project (JVASP) financed by USAID would appear to be the appropriate vehicle to spearherad the above issues of on-farm irrigation efficiency.

Thus the following activities should be considered:

* review evapotranspiration data for key crops in the Valley, at various stages of growth;

* study water leaching requirements for Valley soils to prevent salt and alkaline buildup in crop root zones;

* study water losses in unlined on-farm irrigation canals;

* study on-farm irrigation priorities and determine irrigation efficiencies based on type of irrigtion (border, furrow, basin), length of field, points of entry on field or water supply, soil permeability, etc.

Review of the above data would indicate the degree to which farmers would "improve" on the present methods of irrigation. Follow-up intensive training and outreach programs could then assist in making farmers more efficient in on-farm water use, thereby resulting in significant water and cost savings.

4. Water Management in the EGMC

The EGMC has a great length (110km) and a large number of control structures (some 45 checks) with radial gates and flashboards which must all be operated and adjusted manually. Meeting the water demands along the EGMC is a complicated operation. Much irrigation takes place during daytime hours, and efficient use of the canal requires storage of water in the canal during the night. As a result, considerable wastage occurs, as shown by the data presented above.

JVA's ability to manage the canal would be enhanced considerably if the control structure gates were motorized and remotely operated. A computer simulation model of the canal would provide the operator with the data necessary to rapidly adjust the checks for any desired hydraulic configuration. It would be desirable for JVA to undertake this program as soon as possible. This measure would allow:

a) more efficient management of the water resource by minimizing conveyance losses; and

b) improving the distribution along the canal to all main turnouts and pumping station intakes.

In the meantime, an effort should be made by JVA's O&M staff to better operate manually the existing structures.

c. Water Pricing

The rates charged by the Jordan Water Authority for supplying water to its domestic customers were designed to discourage excessive consumption. The principal rate schedule for Amman's residential consumers is as follows:

Quantity metered	Rate, in fils/m3
First 20 cubic meters	120
Next 20 cubic meters	200
Next 60 cubic meters	400
Over 100 cubic meters	500

Although not all oif the water distributed within the Amman supply area is metered, there is a feeling that the graduated formula used is a deterrent to wastage. In any event, further improvements in this area are currently under consideration; a study for establishing water and wastewater tariff systems was submitted in July 1987 by Black & Veatch, et al.

On the other hand, the rate charged to farmers for irrigation water is shown to be well below its marginal productivity value, and it is felt that the 3 fils per cubic meter charged by JVA to Jordan Valley farmers encourages excessive irrigation applications and wastage.

The quantities of water delivered by the JVA to farmers in the Valley are either not measured and only roughly estimated by the ditchriders and other operators, or are measured by faulty meters. Therefore, although JVA possesses some data on its water distribution on the basis of which farmers are billed, those data may not be reliable enough to draw conclusion on water consumption in the Valley for different crops and various methods of irrigation. However, there has been presented some empirical evidence that farmers are over watering winter horticultural crops by some 10 to 20 percent (see Section III(B) of this report). This may happen because Yarmouk water is available in the EGMC in more abundant quantities during the winter months, and

because surface irrigated lands have not been levelled. However, during the remaineder of the year most farmers probably do not receive the volumes of water they require. Orders placed by them are often filled only partially by JVA. This places a general constraint on the areas that can be cropped in the Valley's service area. For example, out of a total of 22,829ha currently irrigable in the Valley (see Table IV.8), the areas actually irrigated during the last three years were as follows:

Year	June and August (ha)	Max. winter month (ha)
1984	9,700 - 9,000	16,400 (Feb.)
1985	10,500 - 7,500	18,400 (Mar.)
1986	9,100 - 7,40	16,700 (Jan.)

It can be expected that, as more acreage is placed under pressurized service, on-farm irrigation efficiencies will improve. On the other hand, new areas will soon come into service, further straining the present limited water supplies.

Undoubtedly, further improvements can be made by better on-farm management practices, and farmers should be taught better practices where appropriate.

To achieve parity between marginal revenue productivity and the user charge, the unit rate would have to be increased considerably over the present value (see Section III (B)) however, full pricing at this rate, while highly desirable, may be socially and politically difficult.

Moreover, users are not free to determine the timing and quantity of water they would apply to their fields as may be indicated by optimum irrigation scheduling techniques. The distribution of water by JVA to its farmer customers is not "on-demand". JVA has the ability to restrict the volumes delivered to each farmer and to control the timing of each delivery. Therefore, in the water-short environment of the Jordan Valley, farmers can be allocated only thos amounts which, in JVA's judgment, are deemed necessary to irrigated their land efficiently, or such prorated quantities from the total amount available during periods of shortage.

From administrative and financial viewpoints, however, it would be desirable to recover from the users' fees sufficient amounts to operate and maintain the irrigation system, exclusive of project investment repayment. Examination of JVA's records showed that the recurring cost of operation and maintenance of its system, quantities of water produced,and quantities billed were as follows during the 1984-86 period:

Year	Vol. Entering EGMC (MCM)	Vol. Sold (MCM)	Cost of O&M JD 1000'S		
			Salary	Maint	Total
1984	184	115			
1985					2032
1986	171	80	1717	448	2165

The average cost of operation and maintenance of the irrigation system is thus on the order of 20fils/m3. A similar value was quoted by the Water Management Synthesis investigators in their November report.

JVA's revenues form the sale of water amount to some JD 300,000 annually. Substantial increases in these revenues would be achieved by improving the system's conveyance efficiency through better management practices (the above data show that in 1984 and 1986 the conveyance efficiency was only 50 to 60 percent). The average unit cost of O&M would be reduced accordingly. But the resulting value (equivalent to $150-177 per hectare commanded) will still be high by any standards applicable to irrigation projects. This is principally because of the large number of employees (1156 in 1986) on the staff of JVA's O&M Directorate. Therefore, if the farmers are asked to cover the expense of operating and maintaining the system, JVA should, in turn, be expected to increase its efficiency, and to substantially reduce the cost of this function. Alternatively, the users would be expected to cover only a portion of the actual costs.

It has been observed in the Valley that the farmers currently have no voice in the operation and maintenance of the JVA distribution system. Policy and management decisions regarding system operation and water distribution are made by JVA's executives without consultaiton of the beneficiaries. Experience elsewhere has shown that successful utilization of irrigation systems requires farmers participation in their management, especially when they are asked to make a significant contribution to the expenses for operation and maintenance. Considered application of these principles in the Jordan Valley should result in improvements of overall performances, including water costs, crop yields, and agricultural production.

In summary, it is recommended that:

1. JVA improve its ability to measure and control water distribution;

2. JVA improve its water management function with the aim of increasing its conveyance efficiency;

3. JVA improve the management and performance of its operation and maintenance function;

4. consideration be given to an increase in the price of water supplied to farmers for irrigation; and

5. the farmers be brought to participate in the decision-making process related to management, operation and maintenance of the system.

G. Environmental Issues: Pesticides

1. INTRODUCTION

Although pesticide usage in Jordan is extensive (more than 1400 tons of 100 different pesticides were imported in 1986), the Ministry of Agriculture must be credited with establishing strict regualtions which are largely effective in preventing major damage to the environment. (MOA Pesticides Division Statistics). These regulations are quite impressive in that they match or exceed both United Nations and U.S. Environmental Protection Agency regulations in many cases. Nevertheless, there are problems of inappropriate pesticide usage which are both economic and environmental: over application, inadequate preharvest intervals, redundancy of application, lack of safety precautions application, storage, and container disposal.

Valley farmers use pesticides primarily to prevent and treat insect and fungal infestations. They apply pesticides both prophylactically as well as in response to specific symptoms of pest infestation. Given the high capital investment of plastichouse culture, and large market price fluctuations, most farmers are willing to spend substantial capital on fungicides and insecticides, resulting in, many instances, overapplication.

These practices may result in excessive levels of pesticide residues in local fruits and vegetables and potential health and environmental problems ([2] Shuraiqi). In order to assist the Ministry of Agriculture

in this major task of pesticides control, this section will delineate some of the problems which still exist with pesticide usage in the Jordan Valley.

2) GENERAL PROBLEMS

(a) High Use

Many of the problems in the Jordan Valley result from pesticide use in plastic houses. Given the high humidity and enclosed conditions, pesticides tested in open fields become more toxic under plastic house culture. With farmers often using more than thirty different pesticides in one season, there are also risks associated with the intentional and unintentional mixture of products. Farmers interviewed by the assessment team reported mixing as many as seven different formulations for simultaneous application. Although the MOA requires compatibility information on labeling, extension agents report that farmers usually do not pay attention to these warnings.

The team has observed double usage of the same formulation sold under different names. According to MOA lists, there are over 175 different brands being sold in Jordan with as many as 16 different brand names for a single pesticide sold. For example, Dimethoate alone is sold under ten brand names including Dantox, Efdacon, Rogor, Roxion, Perfecthion, Poligor, Primo, and Dimefos. Since most of the 'extension' is done in the form of private dealers' promotion of inputs, comprehensive unbiased information for the farmer cannot always be assumed.

(b) Timing of Application

One of the major problems in Jordan is the application of systemics[9] and other pesticides too close to harvest time. For instance, most farmers continuously harvest plastichouse cucumbers over a period of months and during this period they are also regularly applying pesticides. Following the precautions on the labels is not always effective because the European/American growing and testing conditions do not allow for plastic house conditions. The use of certain pesticides within this environment may reduce the rapidity of chemical breakdown and therefore increase the amount of pesticides residues at harvest. Additional research is needed to confirm this phenomenon and to elaborate on the specific chemical processes.

(c) Application Techniques/Safety Equipment

On most farms, there is a lack of suitable application equipment and safety materials for the use of highly toxic chemicals such as methyl

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[9] Pesticides that enter the plant's internal nutrient circulatory system

bromide, aluminum phosphide and methomyl. However, adequate equipment does exist in certain locations in the valley. JCO, JVFA and some private dealers rent appropriate application equipment with staff at a reasonable cost. Nevertheless,the use of backpack sprayers or other inadequate equiment still persists.

(d) STORAGE CONDITIONS

Farmers often store the toxic products directly in the fields or the plastic houses. Even in cases where storerooms are used, the team has observed pesticides being stored with food products and in close vicinity to the living quarters of laborers.

3) ENVIRONMENTAL/HEALTH CONCERNS

> "Proper pesticide use is almost unknown. Major errors are being made in sales, transport, storage, mixing, application and container disposal. It appears that while some laws to regulate pesticides, few people are aware of their existence...There is a need for extensive safety training of everyone involved in the pesticide industry in Jordan from suppliers to workers." (Final Report, Extension Pesticide Specialist T. Smith WSU/JVASP June 2, 1987 p.1)

Farmers rarely use recommended safety precautions. Although there appears to be a high awareness of the dangers of Methyl Bromide in the application stage, there is little or no awareness of other dangers associated with pesticides. Farmers rarely wash hands, bodies or clothing after pesticide application. There is little attention paid to the risks of inhalation or dermal contamination. For instance, during the team's stay in Jordan, there were 14 cses of suspected meghyl bromide poisoning which resulted in hospitalization in the Jordan Valley. (AlRai-local Arabic newspaper). Local doctors stated that some of these patients were repeat victims. According to the MOH staff, most of the patients diagnosed with pesticide poisoning have been Egyptian laborers who are responsible for most of the pesticide application.

Although there is a concern in the literature that pesticides are regularly misused in Jordan, the extent of the potential long term environmental problems is <u>not</u> clearly documented. Preliminary pesticides residues information is available, but extensive monitoring/investigation of the environmental and health problems is lacking.

Although Jordan has effectively limited all U.S. banned pesticides, it imports at least nine pesticides which are on the restricted list in

California: Aluminum Phosphide, Azinphosmethyl, Carbaryl, Carbofuran, 2,4,D, Endosulfan, Methomyl, Methyl Bromide, Mevinphos. These pesticides are restricted because of direct dangers to humans, animals and to the environment. In the case of azinphosmethyl, agricultural workers should not enter the fields within 7 days of usage. For mevinphos, the safety period is 48 hours. These restrictions are also intended to ensure that the people using the pesticides have had sufficient training to prevent misuse. ([48] Weinstein, p.V.6,1984). Similar restrictive measures are recommended for Jordan.

The awareness of the pesticides health problem dates from approximately 1979 when the Department of Community Medicine did a study of pesticides poisonings in Balqa Governorate. Although hospital records were ofter inadequate, this report showed 6 deaths and 51 pesticide poisonings in 1979. ([34] PMW, 1985) the 1984 Ministry of Health national survey of chemical poisonings found that pesticides were the main group of chemicals responsible for poisoning in 1982, while drugs overtook pesticides as the major diagnosed cause of poisonings in 1983-84. "Although banned 1980, Parathion and organochlorines were responsible for most of the cases reported in both studies. ([34] PMW, 1985)

4. PROGRESS MADE OVER LAST 5 YEARS

Over the past five years, the awareness of the potential problems of pesticide misuse has greatly increased. The pesticide import regulations have been strengthened and a Pesticides Residue Laboratory has been built near Amman. These are excellent first steps in regulating a constantly changing process. The existence of a separate division in the Ministry of Agriculture also attests to the significance Jordan attaches to controlling the risks associated with pesticides.

a) Regulations

The Ministry of Agriculture has placed strict regulations on pesticide importation based on both United Nations (WHO and FAO) and American Environmental Protection Agency standards. If a pesticide is forbidden by either of these agencies, it is also automatically forbidden in Jordan. In addition, all pesticides must have a certificate to assure free sale and usage in the country of origin. The government takes immediate measures to remove a pesticide from sale when it is informed of new limitations. This has resulted in the timely removal of several highly toxic pesticides from the market (i.e. parathion, endrin, plictran). However, some of these pesticides continue to be smuggled onto the market by both individual farmers and private dealers. (Farmer interviews and direct Assessment Team observations)

The regulations for pesticides labeling include Arabic application and antidotal information. But danger of pesticides residues still exist partially because of continued use of toxic pesticides and, more importantly, because of the misuse and overapplication of pesticides such

as Zineb, Cymbush and Dimethoate. These types of infractions are very difficult to control since they require on-farm training, monitoring and enforcement. The latter, enforcement of proper pesticides use, is difficult in that the Pesticides Division of the MOA consists of only three full time qualified staff in Amman. The responsibility for enforcement falls on local MOA staff who are alredy overburdened with administrative duties.

b) Facilities

Given the newly established Pesticides Residues Laboratory outside of Amman, the Ministry of Agriculture now has the means to determine on a preliminary basis the amount of pesticide residues in both imported and domestic commodities. The Pesticides Residues laboratory is financed in part by the GTZ and is staffed by trained Jordanian personnel. However, it does not have the capacity to do widespred testing on a regular basis and can handle approximately only 10 samples a day for screening of all imported and locally produced crops.

Over the past two years, pesticides residues have been found to exceed the maximum level by as much as thirty times. According to research, the rate of residues directly correlates with the rate of usage in plastic houses. ([2] Shuraiki)

In the Jordan Valley, the plastic house environment combined with excessive application rates and insufficient preharvest intervals have resulted in over 40% of the Jordan Valley agricultural samples tested having a range of 2-30 times the maximum residue levels of GYMBUSH (cypermethrin) or dithiocarbamates (Zineb) on cucumbers, peppers and green beans grown in plastic houses. In, for instance, W. Germany only 2-3% of the total samples exceed permitted levels.

One of the problems the Pesticides Residues Laboratory faces is that it is not possible to complete the analyses before the end of normal Jordanian working hours (2PM). This makes enforcement especially difficult in the Amman market where produce is moved within hours onto the retail market. Currently, when excessive pesticide levels are found, the farmer is informed and fined, but the crop may still end up in the marketplace for consumption.

Within one year, this laboratory will also have the capacity to test pesticide formulations. According to preliminary studies, many of the formulations which arrive may be ineffective because of original production/quality control deficiencies or expiration of validity dates. Furthermore, as part of the JVAS Project a video cassette was produces on pesticide safety. This will be used for the training of both extension personnel and farmers.

The above actions are just preliminary steps in finding effective systems to control the misuse and to prevent both short and long term health and environmental problems, especially at the farmer level.

5. RECOMMENDATIONS

a) Regulations/Training/Information Supply

Many of the above problems can be addressed by adequate enforcement of current government regulations so that the risks and penalties are better pbulicized. In addition, it is essential to provide adequate training of agricultural workers, dealers, and health officials in the Valley. Farmers used to be kept well informed by impartial sources about the actual cost/benefit of prophylactic pesticide usage, the alternatives possible (IPM/biocontrol) as well as the redundancy of certain applications. Unfortunately, private dealers and their field agents do not appear to have a vested interest in reducing pesticide usage.

b) Research

Research into the effect of using highly akaline canal water to mix pesticide formulations may produce recommendations which would reduce the amount of pesticides needed. Preliminary farmer and dealer experimentaiton has shown that usage of phosphoric or sulfuric acid to rectify the pH from 8.0 to 6.5 (of the water used to mix/apply pesticides) can double the effectiveness of certain pesticides under Jordan Valley conditions. Systematic research is needed to verify and clarify this interaction effect. (Local farmer interviews, discussions with JVA and MOA research staff)

Biocontrol is being used in highly successful campaigns in the Valley to control the spherical mealybug where pesticides had failed. Additional research emphasizing Integrated Pest Management (IPM) could produce information on appropriate application timing/preharvest intervals and economic thresholds for pesticide application. This would improve the availability of relevant adaptive research-based information to farmers. Hopefully this research could provide the research necessary to enable the MOA to advise such recommendations as:

- more specific as opposed to wide spectrum pesticides

- use of the most toxic pesticides in early stages of growth, pyrethroids later in cycles

- appropriate watering procedures to reduce likelihood of fungal contamination...i.e. water in the mornings in plastichouses and increase ventilation

- appropriate timing of insecticide application given the economic threshold parameters.

- appropriate preharvest intervals under Jordanian conditions with specific emphasis on plastic house culture.

- specific resistant seed varieties (to fungi, viruses, insects and salinity). This could in turn reduce the need for pesticide usage.

c) Pesticides Restriction

Given the difficulty of on-farm regulation of pesticide usage, the MOA should investigate the possibility of a system of restricted usage of certain dangerous pesticides (especially methyl bromide, aluminum phosphide, lannate). This could be done by certifying agents at JCO, JVFA or private contractors to supply pesticide application services. This is already being done by some larger farmers in the Jordan Valley. JCO and JVFA have some of the equipment necessary for such services which is currently rented out with operators. The system would simply require such certified services when there is a high danger of pesticide exposure for untrained personnel. The training of JCO/JVFA equipment operators could be done at a relatively low cost and recuperated from charges for such service.

d) Health Testing/Information/Training

A limited survey of pesticide residues in mother's breast milk and/or blood of agricultural workers would help to assess the extent of the problem which currently exists in the Valley.

Preparation of a chart (in Arabic) of pesticide names by brand and commodity, symptons of poisoning and antidotal information would be useful. It could then be made available at all health centers.

V. SOCIAL DEVELOPMENT AND INTEGRATION

> It is a bold experiment in social engineering, and as such it has unleashed forces of change that were not always anticipated...it has undeniably ushered in a new era of development and metamorphosis in the Jordan Valley that is most meaningfully reflected in the lives of its inhabitants. (Rami Khouri, 1981).

The enormous expenditure of resources, time, and energy that converged on a unique 100 kilometer long strip of land between Lake Tiberias and the Dead Sea were targeted on a single ultimate objective--transforming the quality of life of its resident population. The vast array of infrastructure and proliferation of services extended to the Jordan Valley was but a means to an end -- the end of which was to transform an impoverished, tradition-bound tribal society into a modern outward-looking social structure integrated with the rest of Jordan and which provides opportunities and encourages its individual members to seek a better life for themselves and future generations.

The better life is one in which the doors of opportunity and upward mobility are opened by rising income standards, access to knowledge and learning, improved living conditions, reduced mortality/morbidity and expanded life expectancy, in the ultimate pursuit of human advancement and aspirational fulfillment. The previous sections of this report address productivity and institutional dynamics as indicators of program efficiency; this section provides an assessment of social dynamics as the real indicators of program and institutional effectiveness.

A. POPULATION, MIGRATION, EMPLOYMENT, AND INCOME DISTRIBUTION

> The availability of government and private jobs has been a strong factor drawing people into the valley. Even for the sons and daughters of native valley bedouins, whose lives take them in and out of the valley every year, the permanence of a civil service job often brings with it a stronger awareness of the valley's economic potential..(Rami Khouri, 1981.)

The most recent socio-economic survey conducted in the Jordan Valley was in 1978. Lacking a current statistical base for making inferences with respect to population, migration, employment, and income distributional changes since 1980, the Assessment Team has had to deductively reconstruct an estimated time-series evolution of these changing demographic patterns.

Where possible, the Team has drawn its analytical base from recently collected information by the Jordan Valley Authority and has integrated these references in a logical manner to provide a rational framework for estimating quantitative trends. The results have been cross checked with informed persons to provide qualitative, if not quantitative verification.

1. POPULATION AND MIGRATION TRENDS

In 1986, the total population of the East Jordan Valley was 124,715.[1] The population growth rate for the period 1973 to 1986 has exceeded the actual national rate of growth by one to two percentage points.

Table V.1
Population Growth in the East Jordan Valley

Year	Jordan Valley	Growth Rate	National Growth	Net Inmigration
1973	64,012	4.54%	3.34%	1.20%
1974	66,919	4.54%	3.34%	1.20%
1975	69.958	4.54%	3.34%	1.20%
1976	73,135	4.54%	3.92%	0.62%
1977	76.456	4.54%	3.92%	0.62%
1978	79,928	4.54%	3.92%	0.62%
1979	83,557	4.54%	3.92%	0.62%
1980	88,486	5.88%	3.98%	1.90%
1981	93,695	5.88%	4.01%	1.87%
1982	99,210	5.88%	4.00%	1.88%
1983	105,050	5.88%	4.00%	1.88%
1984	111,234	5.88%	3.99%	1.89%
1985	117,782	5.88%	3.79%	2.09%
1986	124,715	5.88%	3.80%	2.08%

Sources. (a) JVA. The Jordan Valley Development: The Plans; The Achievements; Future Activities: Amman, Feb. 1987
(b) Statistical Yearbook, 1984. Department of Statistics

From the table, the population of the Valley grew by an average 5.9 percent between 1979 and 1986, while the mean national average for the nation was 3.9 percent. Net inmigration to the Jordan Valley has actually increased by two percent annually over the past two years.

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[1]Collected from the Civil Registration Directorate, Ministry of Interior and cited in: JVA. Jordan Valley Development: The Plans; The Achievements; and Future Activities: Amman, February 1987, p. 18.

The increasing inmigration has coincided with the completion of irrigation projects, expansion of the irrigable land areas, redistribution of lands under the various land reform efforts, and with the completion of the Village Development Program (ref 13, JVA, 1987, p.19).

Dajani ([9] Dajani et al, pp 114-117) refers to the more rapid rate of population growth in the Middle zone of the Valley between Kreimeh and Karama. This is attributed to the growth of economic opportunities made available through expansion of irrigated agriculture by 68,000 dunums. The validity of these observations continues for the 1980-1986 period as supported by the following trends of population growth rates among the three zones.

Table V.2
Zonal Population Growth
in the Jordan Valley 1979-1986

Region	Boundaries	1979	1986	%
North	Yarmouk-Rajib	43,870	56,252	3.62
Middle	Rajib-Abyad	21,594	39,535	9.02
South	Abyad-Dead Sea	18,093	28,928	6.93

Source: JVA. The Jordan Valley Development: The Plans; The Achievements; Future Activities, Feb, 1987

The higher growth rates in the middle and southern zones cited by Dajani in 1980 appear to have continued during the first half of the decade. In these two areas, the average growth rate has exceeded both the national average and the rate for the northern zone as well.

> The southern section grew fairly rapidly and appears to have had net inmigration. In contrast, population growth in the north was slow and net outmigration was experienced. This is to be expected, since the north represents a more stable agricultural economy, with an outmigration of young upward mobile and educated sons and daughters.

The middle and southern zones appear to have attracted the largest number of migrants because expanded irrigation has increased the demand for agricultural labor. The growth of public services has stimulated inmigration of public servants to the valley. Furthermore, linkages between expanding economic opportunity in the agricultural sector, with rising population and income, have created a secondary demand-pull effect for goods and services. The accelerating demand growth in the goods and services sector has catalyzed the growth and proliferation of small businesses which has, in turn, provided further stimulus to inmigration. Expanding economic activity is both the cause and the effect of inward migration. These trends in the Jordan Valley appear to confirm the

conventional wisdom that economic opportunity is the primary catalyst for voluntary migration.

Table V.3
Commercial Infrastructural Density Index

Category	I	II	III	IV	V	VI	VII	Total	
Zone/Year									
1980:									
North	0	0	49	171	10	5	20	255	
Middle	0	0	23	79	14	5	14	135	
South	0	0	51	20	21	1	6	99	
Total	0	0	123	270	45	11	40	489	
1986:									% Chng
North	3	4	94	202	12	57	25	3973	56
Middle	6	2	71	171	37	29	40	3563	164
South	4	3	65	31	40	24	18	1853	87
Total	13	9	230	404	89	11	83	938	92

I Banks
II Factories:wooden boxes, polystyrene boxes, bricks
III Food-related commercial establishments: butcher, stores, bakeries, cafes, restaurants, green grocers.
IV Small commercial establishments: electrical supplies, general stores, novelty shops.
V Services-related establishments: gas stations, radio/tv repair shops, auto repair, buta gas distributors, barbers, video rentals, photographers, driving schools.
VI Agriculture-related establishments: nurseries, input suppliers.
VII Construction-related establishments: building material suppliers, blacksmiths, carpenters.
VIII Poultry and dairy farms: 11 in valley, but location unspecified.

Source: Jordan Valley Authority and Dajani, 1980.

Between 1980 and 1986, the number of private commercial establishments in the valley increased from 489 to 938 for a net increase of 92 percent. The most rapidly developing area was the central zone (164 percent), followed by the southern zone at 87 percent. Commercial business growth in the northern zone was third at 56 percent. The Team was able to calculate a rough income elasticity of commercial growth from changes in weighted per capita income and the commercial density index. The estimated value is 0.76, meaning that a one percent growth in per capita income has induced a 0.76 percent growth in the commercial sector. As such, this estimated value approaches unitary elasticity.

The dynamic growth of private enterprise in the Jordan Valley over the past six years reflects both the favorable economic climate that the integrated rural development effort has helped to create and the increasing shift from a primarily agricultural economy to a diversified one wherein the impetus for growth has generated its own self-sustaining momentum. This phenomenon has produced dramatic changes in the employment distribution pattern.

2. EMPLOYMENT AND INCOME DISTRIBUTION

Two significant demographic shifts occurred during the early to mid 1980's. These are: (1) the rapid growth of non-agricultural employment; and (2) replacement of Jordanians by non-Jordanians in the agricultural labor force.

a) Agricultural Employment

Between 1975 and 1978, paid agricultural employment increased by an average 4 percent per annum while non-agricultural employment grew by about 12 percent ([9] Dajani et al, p. 118). By 1978, the total farm labor force (excluding holders) was 21,505. Fifty-six percent were paid, forty-four percent were unpaid family farm labor. Of this total, 13,545 (63 percent) were Jordanian males, 2,275 (10.6 percent) were foreign agricultural male workers, and 5,690 (26 percent) were Jordanian females ([9] Dajani et al, p. 119). At this point, agricultural labor accounted for 27 percent of the total population of the Jordan Valley. When foreign labor is subtracted, the total agricultural labor share of the population was 24 percent.

By 1986, this distribution had undergone considerable change. At this point, the total agricultural labor force had increased to 25,340. Of this number, 22,000[2] were expatriate Egyptian male workers[3] with most of the remaining 3,340 supplied from the Jordanian female farm population for paid seasonal harvesting and weeding inputs. By this time, the incidence of unpaid family farm labor had virtually disappeared. The percentage of foreigners in the agricultural labor force had increased from 10.6 percent to 87 percent and agricultural labor's total share of the population had declined from 27 percent to twenty percent.

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[2] Estimate based on a statistical correlation between irrigated land area cultivated and the weighted mean input labor demand (JVA and JVASP farm budgets) and projected to reflect growth from increasing the land area under cultivation. The estimate was compared with an estimate of 25,000 for the Jordan Valley provided by the Ministry of Agriculture. See Table V.4.

[3] Jordan Valley Authority count (ref 13, p.19)

Subtracting foreign labor, the Jordanian agricultural labor share of the Valley population (excluding holders) is a meager 2.7 percent of the total.[4]

Table V.4
Jordan Valley Agricultural Labor Force Estimates

Year	Egyptian Workers	Jordanian Workers	Unpaid	Total (1)	Cultivated Area
1978	625	12,180	9,325	22,130	193,715
1979				23,126	208,339
1982				24,896	224,286
1984				25,340	228,286
1986	22,000	3,340		25,340	228,286

(1) Permanent and casual hire.

Regression Output:

Constant	3489.072
Std Err of Y Est	175.3536
R Squared	0.989167
No. of Observations	5
Degrees of Freedom	3

X Coefficient(s) 0.095469
Std Err of Coef. 0.005768

Sources: (a) JVA. The Jordan Valley Development: The Plans; the Achievements; and Future Activities, February, 1987.
(b) Ministry of Agriculture
(c) Dajani et al, 1980.

The dramatic shift from a primarily Jordanian to a non-Jordanian farm labor force appears to have emanated from rising educational levels and affluence of the indigenous population, producing an ensuing supply/demand gap for agricultural labor. In classical examples of agricultural labor shortages, a shortage is defined as the excess of quantity demanded over quantity supplied at any price lower than that required to bring the market into equilibrium.

During the late 1970's, the prevailing median agricultural wage of 82.5 JD per month ([9] Dajani et al, 1980, p. 125) was apparently at a level which equated supply with demand.

By 1986, the Jordanian Agricultural wage rate of JD 80 to 90 per month no longer provided adequate compensation as other alternative employment in the public and private sectors caused a net outward

[4]Jordan Valley Authority, and Ministry of Labor Foreign worker registration data.

migration from agriculture to other sectors of the Valley's economy in response to increasing opportunities in non-agricultural employment. Farmer interviews showed a general inability to recruit Jordanian farm labor, even when offered a 38 percent premium over the prevailing wage rate for imported Egyptian labor (JD 65 per month). Thus, the shift in employment patterns from Jordanian to non-Jordanian labor in agriculture does not imply labor displacement or increasing unemployment. The trend does show an outward migration of Jordanian labor to other sectors in response to educational achievement and better paying jobs for Jordanian nationals in the non-agricultural sectors to meet rising aspirations for improved living standards.

Egyptian farm labor, though receiving lower wages than either indigenous male or casual hire female labor, has substantial incentive for outward migration from the Egyptian farm sector since wage rates in Jordan are 3.2 times higher than wages received at home for comparable work.[5]

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[5]Compare the Jordanian daily wage (JD65/month/26=2.53) $7.50 with the Egyptian agricultural wage (LE 5.00/day/2.14) of $2.34.

Table V.5
Agricultural Net Cash Income Matrix
(JD 1986)

	Owner Oper.	Share Croppers	Tenants	Hired Labor Egyptian	Hired Labor Jord.	Hired Labor Female
Per Dunum						
-North						
(1)	137	68	107			
(2)	230	115	200			
(3)	47	23	17			
-Middle						
(1)	45	22	15			
(2)	69	34	39			
(3)	25	12	-4			
-South						
(1)	79	39	49			
(2)	180	90	150			
(3)	65	32	35			
Per Hour				0.27		0.38
Per Day				2.17(4)		1.5(5)
Per Month				65		
Per Annum	3266	1633	2266	585		
Per Cap(7.1)	(6)			83		
Per Cap(5.2)	628	314	436			
National Avg: (Agriculture)	415					
Percent of Pop.	57	31	12	(ref.d)		
No. Workers	3990(7)	2163(7)	833(7)	22000(8)		3340(8)
Total pers.	20748(7)	11248(7)	4332(7)	22000(8)		3340(8)

(1) Average farm; greenhouse.
-35 dunum; 0.6 dunum greenhouse: NORTH
-35 dunum: 1.5 dunum greenhouse: MIDDLE
-30 dunum: 1.4 dunum greenhouse: SOUTH
(2) Average fruit farm
-35 dunum: NORTH
-35 dunum. MIDDLE
-30 dunum: SOUTH
(3) Average vegetable farm; no greenhouse
-35 dunum: NORTH; 35 dunum: MIDDLE; 30 dunum: SOUTH

(4) 8 hour day
(5) 4 hour day
(6) Dependency ratios
(7) Based on plot density of 7,000 and dependency ratio of 5.2 per worker.
(8) Table V.4

Source: (a) Dietz, June 1987[6]
(b) Central Bank of Jordan, Monthly Statistical Bulletin, vol 23 No. 5, May 1987.
(c) Farmer and household interviews.
(d) Anbar, Ali. Changing Land Tenure Patterns in the East Jordan Valley: Amman, February 1984.

[6]Revised to calculate interest and depreciation on current greenhouse cost of JD 1000

b) Non-agricultural Employment

As mentioned previously, the growth rate for non-agricultural employment in the Valley was 12 percent per year from 1973 to 1978. It is evident that rate of growth has been maintained and perhaps surpassed during the 1979 to 1986 period, given the 49 percent increase in population, the dramatic outmigration of Jordanians from the agricultural labor force, and the 92 percent growth in private commercial business activity during this period.

While no employment distribution data are available for the Valley, estimates of the current situation were made by applying Dajani's population distribution percentiles ([9], p.117) to the present population, by subtracting the estimated agricultural labor force from Table V.5, and by subtracting the projected commercial sector labor force derived from correlation of employment and commercial sector density trends from the total.

The estimated labor distribution of the Jordan Valley from 1978 to 1986 is shown in the following table.

Table V.6
Estimated Distribution Trends
Jordan Valley 1978-1986

Category	1978	Percent	1986	Percent
Agriculture owners, tenents	28491	80	32326	72
sharecroppers:	6986	19	6986	15
farm labor	21505	61	25340	56
Commercial Sector	1783[1]	5	4690[2]	10
Public Sector incl. military)	4958	14	8822[3]	17
Total Labor Force:	35232[4]		45838[4]	

1Mean 3.6 employees per establishment.
2Mean 5 employees per establishment.
3Estimate verified by partial head count of ministerial employees showing approximately 8,500.
4Includes foreign agricultural workers.

Source: 1978 (Dajani et al, 1980)

The estimate appears to confirm the distributional shift away from agriculture toward non-agricultural employment in the early to mid-1980's.

c) Income Distribution

Income data for the Jordan Valley are not available. However, the Assessment Team was able to reconstruct an income distribution matrix on the basis of current farm management information ([11] Dietz, 1987), supplemented by field surveys of commercial establishments, governmental departments, and foreign workers. The results of these investigations have been summarized in the income distribution matrix.

To provide a valid comparison between 1978 and 1986 income distributions, the Team has retained the general employment classifications used by Dajani in the interim assessment ([9]).

Table V.7
Estimated Income and Poverty Levels

	Agricultural Workers				Non-Agricultural Workers		
	Foreign	Female	Tenent	Share	Owner	Public (10)	Private
Number	22,000	3,340	833	2,163	3,990	3,822	4,690
Income[3]	585	936[5]	266	1,633	3,266	1,764	3,150
Per Capital[4]	83		436	314	628	339	605
Average[6]	415		415	415	415		
Average[7]						577	577
Percent JD150[8]	100%[9]	20%	20%	25%	20%	20%	20%
Numbers	22,000	3,340	4,332	11,248	20,748	39,811	24,388

1 From Table V.5 Agricultural workers.
2 From Table V.6 Commercial sector workers.
3 Annual income from Table V.5 and household surveys.
4 Annual income divided by dependency ratio of 5.2 for Jordanians and 7.1 for Egyptians.
5 Annual equivalent of hourly wage 375 fils.
6 National per capita agricultural income.
7 National per capita income.
8 Poverty line assumed to be JD 150 per capita.
9 Poverty line estimates from household survey data distribution. Note that 100% of foreign farm workers are below Jordanian poverty line but not below that of home country.
10 Mean value based on monthly income range of JD 250 to JD 470 for professionals with doctorate, JD 100 to JD 240 for skilled workers at B.Sc. of M.Sc levels, and JD 75 to JD 110 for unskilled workers. Salary levels vary according to longevity and educational level. Most employees are in the skilled and unskilled categories.

Comparing estimated income levels of 1978 with 1986 shows a distinct upward trend during the last six or seven years. In 1980, the weighted per capita income was JD 270. By 1986, this had risen to JD 426, not including the Egyptian labor force, and to JD 352 when the foreign labor force is included [7]

For tenant farmers, income appears to have increased from JD 231 per capita to JD 436, which is just above the per capita income for Jordanian agriculture (JD 415).

For share croppers, no data were provided in the interim report. The team's estimate of JD 314 is some 20 percent lower than the per capita income and may reflect the prevailing economic distress that this category of agricultural holders universally voiced in the farm and household interviews. The burden of increasing marketing costs has fallen most heavily upon this group of producers. Their real income has declined because of their half share of farm revenues while bearing full marketing costs. Sharecroppers are the least well off of the major farm tenure groups.

The most advantaged of the agricultural tenure groups are the owner-operators whose per capita income increased from JD 462 to JD 628 during the seven-year interim from 1978 to 1986. This amount is considerably higher than both the national agricultural and general per capita GDP and seems to reflect the high economic returns that irrigated farming in the Jordan Valley offers to those who have outright ownership of the production factors

The fact that sixty-nine percent of the Valley's agricultural producers (owners and tenants) show income levels that are higher than the national average, even in the face of agricultural price decline, must be partially attributed to the low opportunity cost of imported Egyptian labor, the 85 percent subsidy on irrigation water, and high intensity cultivation of horticultural crops. The agricultural income profile is quite sensitive to changes in either of these input variables and any upward adjustment of labor and water costs and the cropping pattern could be expected to have a significant impact.

Also, an unknown, but probably significant variable of the income model is the impact of the looming liquidity pressure on disposable income. As discussed in Section II, many farmers have had to borrow heavily from both public and private credit sources to finance investments in plasticulture and drip irrigation infrastructure. Recent wholesale price decline from shrinking export markets has lowered farmers' ability to meet debt service obligations. Consequently, disposable income may have declined in real terms over the past couple of years. A growing liquidity crisis, if not checked by a turn around in agricultural product prices, could cancel many of the economic gains achieved over the past 8 years.

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[7] Calculated from Table V.5 and Dajani Table 3.9, p. 28.

The lowest on the income pyramid are the Egyptian farm workers. Using a monetary value per unit of labor input measurement, the hourly wage of 270 fils (Table V.5) is even lower than the wage level for female Jordanian workers (375 fils). However, these are relative values and must be viewed in the context of the wage premium Egyptian agricultural migrants to the Valley enjoy over comparable salary levels found in the Egyptian agricultural sector ([40] Shepley, 1984).

Moving to the non-agricultural sectors, it would appear that the exponential growth of private commercial enterprises in the valley can be attributed in part to the attraction of high returns on investment and working capital offered by this alternative to agricultural employment. For shop and plant owners, the mean per capita income has increased from JD 462 to JD 605 during the 8 year interim. The present level is some 5 percent higher that the national per capita GDP. This is in part attributed to the growing demand for goods and services that both the population and agricultural expansion have generated. A major impetus in the growth of commercial sectoral income, however, has been the extensive proliferation of institutional and informal lending facilities and influx of remittance from abroad. The extent to which the commercial expansion has been built on a pyramid of debt is unknown, but could be considerable. However, casual observations of inventory levels and business volume would seem to indicate heavy effective demand for existing goods and services. This should continue, assuming further population expansion and continued growth of the regional economy.

There are some indicators that the rate of growth in non-agricultural employment may be declining or levelling off. Job placement to employment application ratios in the Ministry of Labor's employment office in the Valley have declined from 98 percent in 1983 to 18 percent in 1986. While the number of applicants involved was small the trends suggest that jobs may be harder to find and that there may be increasing unemployment[8]. The households surveyed unanimously say that jobs are now much harder to find than they were four and five years ago.

Semi-skilled and unskilled workers in the commercial sector appear to receive salaries comparable to their cohorts in public sector employment. At the lower end of the scale, drivers and day laborers receive JD 60 per month, which translates into a per capita income of JD 138, just below the assumed poverty level of JD 150[9]. There are an estimated 4,000 of these casual hire workers spread across both the private and public sectors. The estimated numbers of persons deriving income from this category of employment is about 20,000 (dependency ration of 5), or about 20 percent of the total estimated population.

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[8]Ministry of Labor, Annual Yearbook

[9]60 x 12 / 5.2

The household interviews identified pockets of poverty in all categories of the employment distribution. An estimated 20 to 25 percent of the income frequency distribution of these employment classes show annual per capita incomes of less than JD 150. As a general rule, inhabitants of the class C villages with less than 2,000 residents have lower access to social services and economic opportunity than in other areas. Many residents of such villages show income levels below the assumed poverty line 150 JD per capita.

Moving higher up on the public sector skills ladder, trained workers such as agricultural engineers (mohandes rai) are able to achieve annual levels of income, depending on educational level and years of service, which approach those of the land-owning agricultural class and commercial business owners. The salary level of this group can reach as high as JD 250 per month, or JD 3,000 per year, for a per capita income of JD 576, depending on longevity, education, and family size. About 96 percent of the public sector employees in the valley fall into the skilled and unskilled worker categories.

At the top of the public sector salary pyramid are the highly skilled professionals and administrators with advanced graduate degrees; they comprise some 4 percent of the work force. With a mean monthly salary of JD 342.5, this group has the highest annual (JD 4,110) and per capita income (JD 790) of all workers in the valley.

Many public workers and land-owners with tenents and sharecroppers tend to reside in Salt or Amman and commute to the valley in private cars and buses provided by their respective agencies. It is estimated that about 43 percent of the landowners (3,000) and about 60 to 70 percent (5,700) of the public sector employees (1,600) live outside the valley[10]. The most frequent reasons given for not living in the valley include inadequate and insufficient housing, dislike of hot summers, summer water shortages, and isolation from professional colleagues.

The extent that absenteeism and non-residency may affect the equity and efficiency of the regional economy of the Valley is unknown. These trends can be expected to rise, however, as limited available land area becomes fully utilized by agriculture and the non-agricultural sectors, assuming continued natural growth of the population and net inmigration. In addition, it would be expected that rising educational levels and incomes would cause further outward migration of employment from agricultural to the non-agricultural sectors both in and outside the valley. These phenomena would likely increase the absentee and non-residency incidence.

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[10] Discussions with informants.

In summary, the regional economy of the Jordan Valley is in a state of dynamic fluctuation. Rapid growth of incomes and diversification of the economic base have been a positive catalyst for significant improvements in both the quality and quantity of living standards during the past 6 to 8 years. While these favorable trends may continue for some of the Valley's population over the next several years, exogenous factors such as export market and price decline, farmer and entrepreneurial liquidity problems, land and water resource constraints have begun to cloud the economic landscape. The continued growth of any and all of these adverse factors could easily reverse the favorable evolution that has taken place and should be closely monitored. Marketing problems and remedial recommendations are discussed in Section III.

B. THE INDICATORS OF SOCIAL CHANGE

The following is an examination of the key indicators reflecting life quality improvement in the Jordan Valley from 1973 to 1987. The data for this analysis are far from complete in that there has been no organized social research in the Jordan Valley since 1978.

The Institute of Anthropology and Archeology of Yarmouk University in Irbid will be filling this informational gap through a planned comprehensive research program in the Valley, beginning in 1988. However, it will take several years for the results of these investigations to be tabulated and analyzed.

Consequently, for the present assessment, the team has had to rely primarily on secondary source data collected from the literature [11] supplemented by data derived from interviews conducted during a random selection of forty households.

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[11] a) Azar, Wasef. The Social and Economic Survey of the East Jordan Valley, 1973: Amman, Department of Statistics, 1973.

b) Dajani et al. An Interim Evaluation of the Jordan Valley Development Effort: Amman, USAID, August 1980.

c) Khouri, Rami. The Jordan Valley: Life and Society Below Sea Level: London, Longman, 1981.

This field survey, conducted from November 1, to November 30, 1987 was a random selection of households from five randomly selected villages of types (A), (B), (C)[12]. The villages were chosen from each of the three Jordan Valley zones (north, middle, and south) and is statistically reliable at 95 percent probability.[13]

The questionnaire (Appendix V.1) enumerated data in the following classifications: (1) demography; (2) housing and utilities; (3) infant mortality/morbidity; (4) education; (5) labor and employment; (6) attitudes, aspirations, and opinions.

Comparing the survey results with the baseline year (1973), there has been a steady evolution of Valley social structures over the past 14 years and a perceptible improvement of its quality of life index. As social development is an evolutionary rather than revolutionary process, the ability to detect changes within the relatively short time span of a decade and a half reflects positively on the pace and magnitude of Jordan Valley development.

The population of the valley has been growing at an average rate of 5.9 percent a year compared with the national average of 3.8 percent. Since the natural rate of population growth in the Jordan Valley is equivalent to that of the rest of Jordan, there has been a steady and continued net migration into the area of over 2 percent annually (discussed in Section V(A), above.

The reasons for this steady influx of migrants to the Jordan Valley are not difficult to identify and explain. Per capita income in the Valley has followed a rising upward trend. Between 1978 to 1986, there was 58 percent increase in per capita income ((7.24 percent per year).[14]

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[12] Type (A) Village has over 8,000 people; Type (B) has between 5,000 and 8,000; and Type (C) less than 5,000 inhabitants.

[13] Stratified random sample wherein four villages each were randomly chosen from types (a), (b), and (c) categories in each of the three Jordan Valley zones (4 x 3 = 12 villages). In each village, 3 households were randomly chosen from the village registration sampling frame. Four additional households were added to the sample in the northern zone because of its higher population density. Sample variances from the 1973 socio-economic survey of the Jordan Valley were used to calculate the required sample size for the 95% confidence level according to the formula: $S=1.96\ (S^2)/H^2$; where 1.96 is the 95% confidence, coefficient for the normal distribution, S^2 is the sample variance, and H^2 is the square of the half-width interval. The required sample size form this procedure was 32, a total of 40 households were sampled.

[14] See discussion in Section V (A)

During the same period, the region's gross regional product (GRP) grew by 16 percent a year[15] with employment up by 28 percent (3.5 percent per year), not counting foreign migratory workers, and by 146 percent if foreign workers are included. This dynamic growth and diversification of the Jordan Valley's economy has created opportunities, which in many cases exceeded the national average.

For instance the national average agricultural GDP for 1986 was JD 415. This is compared with JD 505 in the Valley (when foreign workers are excluded) and JD 354 with foreign worker incomes averaged in.[16] Even occupying the lowest rung on the income ladder, foreign agricultural worker incomes in the Jordan Valley are three times greater than in their home countries (see discussion in Section V (A), above. The numbers of Valley residents with per capita incomes below an assumed poverty line of JD 150 per annum has decreased 22 to 20 percent since 1978. Consequently, by any standard of measurement, the Jordan Valley has been an actively growing area offering attractive economic opportunities and financial incentives to those who wish to work and benefit from its dynamic and diversified economic growth.

Changes in income and employment have clearly altered the perceptions of Valley residents with respect to their goals and aspirations. In 1980, there were approximately 28 thousand native Jordanians working in agriculture, including some 9,000 unpaid family workers. By 1986, the number of native Jordanians in the hired agricultural labor pool had declined to about 3.5 thousand as foreign workers replaced Jordanians in this occupational pursuit (see discussion in II (a), above).

Another major trend during this period was the disappearance of unpaid Jordanians from the agricultural labor force. These trends show a clear preference for native Jordanians in the valley for non-agricultural employment and their requirement for wages when agricultural employment is practiced. A third significant change in employment preferences in the Valley is the virtual disappearance of full-time Jordanian workers from the agricultural labor pool. Where Jordanians are still engaged in the hired labor force, this engagement is by women on a part-time basis as there are increasing and competing demands for their services at home and in other employment modes.

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15 Estimated from employment and income distribution estimates of Section V (B)

16 Calculated from data in Central Bank of Jordan, Monthly Statistical Bulletin, Vol 23 No. 5, May 1987 and income estimates in Section V (a.).

In 1973, some twenty-two percent of the Valley population were in the total agricultural labor force. This percentage had dropped to 8 percent by 1986. In 1973, some 28 percent of the labor force was female. Ninety-six percent of these were working in agriculture without pay. By 1986, the ratio of females to the total labor force remained basically unchanged from the previous period, but the percentage of working women in agriculture had dropped dramatically from 96 to 24 percent. The growth of female non-agricultural employment has increased from 4 percent to 76 percent since 1973. Working female employment is distributed among the following professions: (a) agriculture (24%); (b) nursing (5%); (c) secretarial (10%); (d) JVA (5%); (e) headmistress (25%); (f) teaching (30%); (g) seamstress (10%); (h) commerce (11%).[17] The role of women in the Jordan Valley is definitely changing from domestic servitude and child production to fuller integration with the socio-economic life of the region.

Males comprised some 72 percent of the total Valley work force in 1973 and still retained the same distributional level in 1986. In 1978, Jordanian male workers in the agricultural sector comprised some 81 percent of the total male work force. By 1986, this percentage had declined to 43 percent. The number of Jordanian males in the hired agricultural labor pool had approached zero by 1986 as foreign workers, mainly from Egypt, took their places (see Section IIa), above.

The growth of non-agricultural employment for males was as dramatic as for females. Male employment distribution by 1986 was: (a) agriculture (43%); (b) public sector wage earners (22%); (c) private sector wage earners (12%); (d) self-employment (18%). Males, like females, then, have shown a rising preference for the upward mobility, monetary incentives, and prestige gains offered by non-agricultural employment.

These shifting patterns of employment preference will most probably continue as reflected in interviewed parents' educational preferences for their children and expressed desires for their children's future careers. Eighty percent of those interviewed said that they wanted high levels of education for their children to allow them access to professional careers e.g. teaching, engineering, medicine, etc. The same 80 percent linked these occupational choices to potential for income advancement. Fifty eight percent cited community status improvement and prestige as corollary reasons for their educational and professional aspirations. Forty-seven percent listed improved living for their children as an important additional reason for educational and career preferences.

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[17] Assessment team household survey and the 1973 socio-economic survey.

Fifty-five percent of the households wanted their male offspring to have university educations and fifty-seven percent wanted this level of academic achievement for their daughters as well. Only five percent favored agricultural training for their sons and none of the respondents wanted this kind of training for their daughters. These indicators clearly show that traditional values with respect to occupational roles (farming and housewifery) of the sexes in the socio-economic structure are undergoing a perceptible metamorphosis toward a more outward-looking and less traditional orientation. As such, the aspirational values of Jordan Valley residents are becoming more similar to and integrated with the value system of urban residents in the rest of the country.

Other indicators support the above hypothesis. The analysis of changes in generational educational achievement levels revealed a significant improvement in educational access over time.

Table V.8
Comparative Generational Educational Achievements in the Jordan Valley
(Mean Years of Schooling)

	Males	Females
Parents	5.4	3.7
Offspring	10.3	8.5
% Change	91%	130%

Source: Team Survey

These indicators show that the preferences for educational advancement expressed by parents are being realized in the actual achievements of their sons and daughters.

The improving position of Jordan Valley females noted in the educational statistical trends is further substantiated by a significant rise in the mean age of marriage. The female parent generation showed a mean age of 17.7 years, while the mean for their female offspring was 19.1 years, an increase of 8 percent. This statistic is a further indicator of rising preferences among parents and daughters for increased female offspring education with a growing tendency to postpone the heretofore most important traditional event in a female's lifetime to achieve this relatively recent aspirational goal.

Age of marriage for males has also risen significantly from 21.9 years for male parents in the sample to 24.3 years for their sons. This trend shows the growing importance of advanced education for male children and may also indirectly reflect changes in male marital practices that female status changes with respect to educational and non-household career advancement are forcing on the social structure. Thus, it may be that changes in female societal roles reflect both a cause and an effect of changing male behavioral patterns within the traditional social order.

In the traditional tribal patrilocal and patrilineal society that was found in the Jordan Valley at the onset of the development effort, the apparent trends toward female advancement represent a major and highly significant break with the past. There are clear indications of attitudinal changes that are upsetting previously ingrained cultural constants. As the trends toward greater female emancipation from their traditional roles as wives and mothers continues, there will undoubtedly be significant structural changes in the traditional social order which could have far-reaching consequences:

(1) increasing university education for females is likely to accelerate their entry into professional careers outside the home;

(2) more economic independence for females acquired through advancing formal education and employment outside the home environment will likely encourage greater independence of thought and action with resultant higher status in the family and communal structures;

(3) a higher brideprice for salaried and educated females will be demanded by both brides and fathers, thereby further delaying the age or marriage and reinforcing the female emancipatory trends now in progress;

The impact of these dynamic changes in the female societal position is reflected in the declining female fertility rate in the Jordan Valley and the favorable comparison of the regional rate with the national average. In 1984, the national average for rural females was 9.97 live births per capita.[18] The assessment team sample survey showed a mean value of 7.97, a decline of 2 percent. The decline in female fertility and comparatively favorable position of the Valley with respect to the national average lends further verification of the female's rising status and life quality improvement. Continued progress along this trend line should slow the abnormally high rate of natural population growth in the Jordan Valley and enhance the accessibility of finite social services to its population.

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[18] Ministry of Health data.

By far the most dramatic indicator of education institutional effectiveness and change in the role, status, and opportunities for females is the generational literacy rate improvement. Female parents in the statistical sample were 47.5% literate; their daughters had achieved 92.5% literacy in a single generational span. This is a 95% improvement. For males, surveyed fathers were 70 percent literate, while their sons had achieved 100 percent literacy, a 30 percent gain, over this same time frame. This clearly shows that the educational system has accomplished its primary objective, full literacy attainment, and that it has carried out this mandate with equanimity and freedom from traditional social and institutional bias toward the male sex.

The final indicator of evolving changes in social structure of the Jordan Valley is the declining incidence of patrilateral, parallel cousin marriage and growing use of contraception among the female population. Patrilateral parallel cousin marriages (Bint El 'Amm) has been a traditional and almost universal practice among the indigenous nomadic, tribal groupings originally found in both the East and West Bank of the Jordan River. These structures place high value on kinship grouping, lineage (hamula), and the extended family wherein the extended family, the nucleus of Arab tribal organization, consists of several generations of parents and children who trace their descent through the male line.

The marriage pattern (first cousin marriages) is practiced to guarantee retention of family wealth, property, land, and cattle within the patrilineal structure. Arranged marriages between first cousins serves both to retain tribal and family wealth and helps to reduce bride prices and other financial obligations of the marriage arrangements. Such arrangements may also constitute a stabilizing influence by minimizing divorce and facilitating understanding between daughters and mothers-in-law, who are from the same kinship structure. This practice is time-honored, traditional, and inhibiting of female growth achievement. The evolutionary movement away from endogamous (dakhil al 'ahsira) toward more exogamous (kharej al 'ashira) marriage arrangements is another important indicator of social change.

With evolving female educational achievement, entry into non-household salaried employment, and advancing status within family and communal structures, the marriage pattern is beginning to decline in favor of exogamous arrangements. The incidence of exogamous marriages in the sample survey was 33.3 percent. Twenty and thirty years ago, most of the marriages in the valley were patrilateral parallel cousin marriages. This incidence exogamous marriages is rising and will most likely continue over several generations until it eventually dominates the social structure.

Contraception is practiced by 22.5 percent of the females in the sample survey. Twenty years ago, neither exogamous marriages nor contraception were practiced to any extent. Both of these indicators confirm fundamental changes in social values with respect to female mobility and reflects and evolving trend toward greater female liberation, personal growth, and ameliorating status.

Closely linked with identified changes in educational development, female status, and social values is a dramatic improvement in health conditions among the Valley's resident population. In 1961, the overall national infant mortality rate was 151 per 1,000.[19] The Jordan Valley rate for 1987 was 60.4 per 1,000 (team survey). In 1986, the child mortality rate of all of Jordan was 55 per 1,000. This latter rate was an average of both urban and rural areas, while the Jordan Valley rate is predominantly rural. These comparisons confirm the general effectiveness of mother and child health care services in the Valley and the rest of Jordan and suggests that the quality care in the Jordan Valley is at least equivalent to that for the rest of the country and may actually exceed the care available to rural inhabitants of the highland regions.

A second indicator of health care effectiveness in the Jordan Valley is the significant reduction of the morbidity/mortality incidence and favorable comparison of Valley's general health status with that of the rest of the country. In 1961, the national average morbidity was 19 per 1,000. The value from the sample survey was 17 per 1,000. The national average for Jordan is 18 per 1,000[20], suggesting that the level of health care in the Jordan Valley is at least comparable to, and may even surpass that of the rest of the country. The quality of health care services in the Valley probably exceeds that of national health care services in rural areas of the inhabited highland zones in that the current morbidity rate for Jordan cited above is an average of both rural and urban areas.

The crowning achievement of the health care system's effectiveness is the substantial increase in the life expectancy index. The index in 1961 for Jordan was 45.8 for males and 46.5 for females. In 1986, the national average was 67 for males and 71 for females. The life expectancy in the Jordan Valley from the sample survey was 70 for males and 75 for females, a five percent improvement over the national average. The dramatic increase in life expectancy and the Jordan Valley's favorable life expectancy index position with respect to the national average reflects the overall quality of life and health care in the Jordan Valley, the growing affluence of Jordan Valley residents, and dietary improvements from agricultural expansion, productivity and diversification.

As in all developing areas, health care improvements have aggravated a trend that should be slowed -- the high population growth rate. The Jordan Valley average family size increased from 5.7 in 1973 to 7.5 in 1987.[21] More children are surviving into adulthood and more adults are living longer, creating upward pressure on the natural population growth rate which may later place increasing burdens on public service facilities unless expanded further to keep pace with the increasing

[19] Jerusalem Star, November 26, 1987

[20] Department of Statistics, 1986 Yearbook.

[21] Sample survey 1987 and Socio and Economic Survey of the East Jordan Valley, 1973.

population growth. The life expectancy and morbidity/mortality trends are working in the opposite direction from the declining female fertility rate discussed above. In 1973, the percentage of the Valley population under age 15 stood at 53.2. In 1987, the percentage had climbed to 59 percent, meaning that improving child and general health care is skewing the population age distribution toward the lower end of the scale. This trend will put further pressure and demand on social services in future years.

All of the above indicators clearly show that Jordan Valley health care services have been very effective in improving the general physical health of the region's population.

Together with improving health care, educational development, and changing social values brought about by economic growth and institutional effectiveness, improving housing conditions have also made significant contributions to a general amelioration in the region's quality of life index.

In 1973, there were a mean 4.3 persons per occupied room of residential dwellings. By 1987, this had declined to an average 2.4. In 1973, the residential population density index was 6.2 m3 per person; in the 1987, the living space per person had increased to 14 m3. This is a 126 percent increase in available per capita living space and represents a significant advancement in the quality of general living conditions. This evolutionary growth in living standards has allowed fewer people to occupy more residential space.

Together with ameliorating spatial equity in Jordan Valley residential conditions, the quality of residential environments has also greatly improved. In 1973, very few houses had public utilities (water and electricity). By 1980, one hundred percent of the dwellings had access to potable water, and 57 percent had electricity. By 1987, 90 percent of the valley homes had been electrified. This growth in rural electrification has produced a proliferation of labor-saving and recreational appliances shown in the following table.

Table V.9
Residential Appliances and Equipment in Jordan Valley Homes (1987)

Item	Percentile
Gas Cooker	90%
Washing Machine	80%
Refrigerator	90%
Television	90%
Telephone	33%
Automobile	33%
Radios	85%
Fans	85%
Cassette Recorders	85%

Source: Sample Survey

In 1973, seventy-eight percent of Jordan Valley residents owned their own homes. By 1987, this percentage had risen to 90 percent. Also the number of residential renters in the Valley had decreased from 14 percent in 1973 to less than 10 percent in 1987.

The composite picture drawn by all of these social indicators is that of a Jordan Valley society that has advanced materially, socially, economically, intellectually, and physically over the past two decades. This mosaic of social evolution offers further testimony to the soundness of the integrated rural development approach used to transform the Jordan Valley from undeveloped, under-utilized region in the early 1960's and 1970's to a flourishing prototype of a fully integrated and prosperous socio-economic unit in the 1980's.

The following paragraphs of this section provide a glimpse into Valley resident's attitudes and aspirations and show through a selection of case studies from the sample survey how the lives of typical residents have been affected by the dynamic socio-economic transformation of the Valley during the past fifteen to twenty years.

C. Attitudes, Expectations, and Case Studies

> Social services just touch the skin of what we are trying to do in the Valley. It is easy to build new buildings but what is more difficult is social engineering and the betterment of the human being. The heart of social development lies in the change in people's attitudes and expectations. Signs of these are multiple in the Valley for "forces have been unleashed, incentives created, resources harnessed, ingenuity sparked and hope stimulated, in an area that has tried unsuccessfully to do these things for at least the past 10,000 years" (Rami Khouri, 1981.)

One of the household heads in the sample summed up his condition by saying, "God's bounty has been bestowed upon me and my family, what else could we wish for!." He also said, "I succeeded in farming, my sons are all doctors in Amman, my grand-daughter is a headmistress of a school, my wife has started literacy classes and I am at peace with my neighbors and community."

Another example of fulfilled aspirations came from the case of a 57 year old middle zone Valley woman. She was proud, she said, because she had just finished the Elementary cycle by attending literacy classes. She wants to go on until she obtains the "Tawjihiyya" (High-school diploma). In her own words she had realized her "life-long ambition

of being able to read like her husband and children and of being aware of what was happening in the world."

A young Valley woman who makes her living from sewing wants to run for Parliament. She said, "come back five years from today and I will be sitting in the Parliament House in Amman, not at this sewing machine."

A young male employee of tribal origin (he belongs to the Ghanayem tribe) is studying for his Masters degree in Administration at the Jordan University. He has to commute three times a week by bus to Amman. He said "my younger brother is at Alexandria University in Egypt studying to become a lawyer, and my parents want me, their eldest son to do better."

A young man in his middle teens said, "my outlook on life is different from my father's who is too old to work. I have tasted a better life and my hope is for my children to have beautiful homes and careers, to be in good health and never be in debt."

A twenty-one year old university student told the interviewer that he is expecting to get his Masters degree in Administration from the Jordan University in a year's time. He commutes to Amman to attend his courses. He said "my 57 year old mother is following the literacy courses offered in M'addi and wants to go on to secondary level after she finishes the elementary level at the end of this school year. If an old lady like her is so motivated, why can't I be?"

Thirty two (80%) participants in the sample declared emphatically their refusal to migrate out of their villages. Some said they would not "know how to live elsewhere". Sixty-seven percent declared they were "happier than ten years ago".

Of the sample surveyed twenty (50%) would allow their sons to migrate in search of education and better jobs although 90% of the home owners of the sample were unable to live elsewhere and want to die in their place of birth.

Even if they do not own land in the Valley the 90% who own their homes there want to die in them. Twenty (50%) entertained the idea of their children migrating in search of better jobs and better education, but returning later to live and work in their place of birth.

These are just a few of the many vivid examples of how people living in the Jordan Valley are expressing their unbridled optimism about their lives, their opportunities, and their ambitions, and the resounding endorsement they are giving to the quality of life between Lake Tiberias and the Dead Sea. To fully appreciate the social dynamics which have taken place in the Valley over the past 15 to 20 years, the Assessment Team has included specific case studies from the sample survey to add a humanistic flavor to the dryer statistical trends.

The Upwardly Mobile Migrant

The Egyptian migrant farm laborer, Hassan, came to the Jordan Valley nine years ago. He is thirty-nine years old and looks very much like Omar Sharif, the Hollywood actor, he himself says it when you first greet him.

He and his Jordanian wife have four children, two of whom are boys, aged eleven and nine, and go to the village primary school very close by. The two younger children, six and four, stay with their mother who tends the newly opened family store.

It was in front of this store that everyone sat talking. Awatef, Hassan's wife is in charge of selling vegetables, soap imported from Palestine (the west Bank) and Moroccan imported cans of sardines. She explained that the soap was olive-oil based and had no chemicals and was used by the women of the village for bathing and hair washing.

While the interviewer sat talking to Hassan and Awatef, village farmers passed by in their pick-up trucks asking if Hassan needed eggplants or cauliflower. Awatef politely refused saying "you can see I haven't finished selling what I have! The next time you pass, I might need some of your produce.." Another farmer came by and stopped. All went to see what he was trying to sell. He had big jars of "good quality honey" he said. Again Hassan and his good-looking wife declined saying they really had opened their store to sell chicken.

They consider themselves lucky since they have been lodged for the last five years for free by a very kind Jordanian family close by. They have one bedroom-living room, a kitchen and a bathroom. They have not yet been hooked to the electric line of the village, but they expect this any day. They are happy with the social progress they have made in the last few years rising from just a farm laborer to a store owner thus acquiring more status in the village. In Hassan's words, "farm-labor is a lowly occupation especially if one is an immigrant. However, it has nonetheless allowed me to raise my family, visit Egypt from time to time and save enough just to start this new business. I feel that I am on my way to a better life with the opening of my store. It will allow my wife to work and help improve our economic condition. In my opinion it will mainly help us raise our children giving them a good education, I want my boys to be better than me. As for my girls, I want them to know how to read and write because it is a shame for girls not to be educated, in my opinion".

One thing bothers Hassan about life in the village in the Valley; the fact that there is no health clinic in his area. Every time he needs health care, he has to take the bus and travel about ten kilometers

before he can reach the closest one in Maddi or Sawalha. However, he declared his preference for the private or hospital doctor nearby. The private doctor has been observed to examine a sick person carefully and gives better medicine even though it is costlier than the medicine coming out of the clinic's pharmacy. Hassan needed tooth care very recently. He said he went to the dentist in the hospital in South Shunah and had to dish out 4 J.D.s plus the time wasted on the bus and the bus fare.

Asked if she had any chances for acquiring other skills beyond her primary school education, Hassans' wife wished some training could be offered in the village such as sewing, weaving, embroidery, etc., so she could learn something useful for her family in the little spare time she has. But the new store is going to keep her "happy" she said. She is going to make then piastres on each chicken she sells! Her life is going to be O.K. This is a case of a migrant farm-laborer who has settled in the Valley for good and is asking for Jordanian nationality next year.

Self-Made Moussa

Fifty-year old Moussa lives in the Valley in an ethnically homogeneous community of 2000 persons according to his and other villagers'estimates. When he first settled in the Valley, he lived in a goat-hair tent. In the space of a decade, he has made a hugh leap to a new ten-room house (which he owns) that cost him 20,000 JDs to build. He possesses every material comfort including a T.V., a telephone, a refrigerator, a gas stove, consuming up to twenty gas bottles a month, a washing machine, and beautiful furniture. He has a bathroom and a kitchen with clean safe drinking water on tap even though only two years ago, water in his village was still unsafe and polluted.

Houses for many village residents are tiny and made of traditional materials. Fifty percent of them still have no electricity and a number of families still live in goat hair tents. Moussa's village now has a factory for making plastic white boxes used by farmers to haul their fruits and vegetables to the market. This has given jobs to a number of the village's young men.

Inspite of this industrial progress, the village does not yet have a health clinic. It does not have a preparatory school for girls which is needed according to Moussa, to prevent girls from "being alone on the roads walking to the nearby school" in the next village.

Moussa complains about the absence of the health clinic in bitter terms saying, "I have lots of sickness in my family especially amongst those who are under fifteen! I have 19 of them. I am ashamed of being seen by the other villages passing by in my car carrying 6 or 7 children at one time going to the health clinic and returning from the health clinic in Sawalha which is at least 14 kilometers from here!"

Moussa farms two units of 35 and 30 dunums. His three married sons all work with him. He pays a thousand J.D.s rent for each of his units and pays each of his sons two and a half J.D.s daily wage.

He explained that he buys his family food in bulk and no less than two boxes of apples at a time so as to keep his family in good health. But inspite of the good food he buys, six of his children died years ago of diarrhea-dehydration which he attributes to illiteracy, lack of awareness, laziness, and lack of cleanliness on the part of their mothers.

Moussa has an honorific position in his village; he is its "Mukhtar" (Mayor), elected by the other villagers. These all belong to his tribe "Al-Taamrah". They are mainly refugees from Jerusalem who migrated and settled in the Valley after the 1967 war.

Inspite of his rise in social status and secure economic situation, Moussa remains very tradition-bound. He has four wives, has lost another one, has divorced a sixth one, and has a total of 27 children who are still living; six other died along the way.

On the one hand he had made big strides, but family-wise he remains a "bastion of tradition". His "women" (wives and daughters), in his own words, "will never get his permission to work outside the home even if he has to beg!" He prefers to "kill himself" rather than allow his daughters to work. "Girls are made for marriage at about the age of 15-16," he says, "Agricultural labor is 'shameful' for them! Wives are to be chosen from one's own tribe, preferably first cousins and daughters are not to be given to outsiders".

The Farmer Willing to Live Like a King

Mohamed is a middle aged high school graduate who farms in the southern Jordan Valley. He was first a government official, but after eighteen years of sitting in an office in the big city and earning a "miserable monthly salary", he gave it all up, took early retirement and went back to full time farming.

Mohamed has, as was expected of him, married a close member of his tribe the Adawen. He has seven children under the age of fifteen and the eighth is on the way. Four of his children go to a private school because "they get a much better education there and the school bus transports them safely leaving me to attend to my business and not waste time driving them back and forth". He refuses to allow his daughters to walk alone to school and he is willing and able to pay 168 J.D.s per child which, in his opinion, is "worth it".

He is at the moment building a nine-room house on a seven Dunum plot of fruit-tree filled land. His house is almost finished. It has three bedrooms, one very big living room, a spare room for guests and, of course, a separate kitchen. But Mohamed stressed that fact that it will have three separate bathrooms, one for the girls, one for the boys and one for him and his wife.

Mohamed is, from now on, a permanent settler in his village, will never leave it, nor does he want his children to leave it. His daughters will be married to cousins or close relatives of his tribe. His sons will do the same and will settle, with his help, either in farming or in private self employment in the same village. "Government jobs pay such small salaries and limit one's changes for upward mobility and economic improvement," he says. "My daughters are doing very well at school earning very high grades close to ninety-six over a hundred", he proudly beams.

Mohamed owns a 34 Dunum unit which he devotes entirely to growing bananas. He grew vegetables a few years back and ritually ended up with a loss, so he had to switch to bananas. In 1981, there was enough rain and water for him to make a 20,000 J.D. profit. But the problem since has been water shortages! Bananas require much water and he is only allowed twenty-four hours of water every five days which cost him fourteen J.D.s. The amount supplied is not sufficient. There is a great need for artesian well digging in his area. "If the government gives me enough water, I am ready to live like a king!" If only they will allow me to dig my own well and leave me in peace. Even if the process might cost me about ten thousand dinars, I am ready to start the digging". What is needed, "he goes on to say," is a dam in this area." He says he has avoided trouble as a result of cropping patterns imposed by the government. "Nobody is following cropping patterns! Farmers go to jail and pay high fines of ten dinars per Dunum but plant what they want. My major problem as a farmer is marketing. There is no well organized system and we are in need of foreign markets to absorb our produce. I am not in need of government aid. I am doing very well thank God, if only I can get the water I need!"

The Emancipated Housewife

Ajayeb is a forty year old housewife and mother of twelve children, the youngest of whom is eight years old. Her husband is a successful farmer in the Southern Valley zone. She is the cousin of her husband and they belong to the 'Udwan tribe', the most tradition-bound in the southern zone. Both she and her husband decided it was time for them to stop having more children; so she is using "a safe birth-control method", according to her. All her children are in school. One of her daughters is a staff nurse in Amman earning 180 JDs monthly. She drives her young children to school and considers herself "well informed about what takes place around her". She said her greatest pleasure is reading the daily Arabic newspaper and holding a discussion about the news with her husband and eldest son.

This mother of twelve children proudly displayed her books, and a sample or her composition and calligraphy. At the end of the interview, she affirmed she was not stopping her literacy classes until she obtains her "Tawjihiyya" (High-school diploma) and be, in her words, "the equal of my eldest daughter!"

From School Maid to School Teacher

Born 37 years ago in M'addi, Souriyya is a high-school graduate, widow, and mother of two boys, now aged 22 and 18. At the age of fourteen, Souriyya was withdrawn from preparatory school in order to marry in compliance with family and local customs. Three years and two sons later her husband died leaving her to care for the children.

"My family tried to remarry me, but I vehemently refused and decided to raise the children myself. I used the last few dinars to buy a second-hand sewing maching and became a seamstress overnight."

The eight following years were a constant struggle to make ends meet. The back breaking work day after day and the insufficient income I was able to earn from it made me want to change my life.

After examining all the options open to a young widow in M'addi, my only way out was to take on the job of an "athina" (maid) at the local girl's school. There I would not earn much more but the most important point was that I could go on to study and finish my secondary schooling to obtain my Tawjihiyya (High-school diploma).

Through sheer determination and steadfastness, Souriyya realized her wish in six years. From then on nothing could stop her. With the opening of the Rural Development Centre in M'addi, she decided to take typing and secretarial courses which carried her till 5:00PM on most week days for three months.

"After my degrees and certificates, I decided to ask the Ministry of Education to upgrade my job from a simple school maid to a secretarial and typing teacher at the Rural Development Centre. I fought for a whole year, wrote many letters to many people unitl I was able to raise my status from a school maid to a school teacher".

"I settled in my new position with pride filling my heart. All those who knew me congratulated me and I felt satisfied and happy for myself and my children. Now I felt I could really give them what they needed and concentrated on their education and their future careers. I was further emboldened by my past successes and felt there was nothing I could not overcome in life; so I found myself studying again and obtaining a certificate in teaching methodology. I also took a course in the repair of electrical appliances and cars, thus I greatly improved my economic situation. I enlarged my house, painted it myself, furnished it and planted a garden with several kinds of fruit trees around it.

"My oldest son has now graduated from secondary school and is in the Military. He wants to become an officer. My youngest son is finishing his Tawjihiyya this year.

The news of Souriyya's success reached the Ministry of Labor and Social Development which selected her as the Jordan Working Mother of the Year and Queen Nour herself journeyed to M'aadi to decorate Souriyya in the presence of all to see with a medal and a certificate to mark her extraordinary achievement.

VI. PROJECT SUMMARY

The following summarizes the individual projects, by sector, of the integrated rural development program for Jordan Valley from 1962-1987. This integrated effort, affecting both the physical and social environment of the valley emanated from a succession of planning activities and a large number of external donor financial and technical commitments. The total investments for this effort had reached JD 280.7 million ($US 800 million) by the end of 1985; USAID provided 45 percent of this input.[1]

In addition private capital investments for on-farm agricultural improvements and housing have been estimated at JD 74.1 million ($US 211 million) composed of JD 12.0 million from parastatal credit institutions, JD 37.5 million from banks and suppliers promoting input sales for improved agricultural technology, and JD 24.6 million for other miscellaneous self-financing commercial ventures.[1]

The planning process began as an effort to realize the vast agricultural potential of the Jordan Valley and to raise farmers incomes and living standards. In 1972, the Jordan Valley Authority was established to coordinate the integrated planning for the valley.

A three year plan for the Rehabilitation and Development of the Jordan Valley (East Bank), 1973-1975 was prepared and used as the basis for soliciting Jordanian and external participation. A number of donor agencies were attracted and the plan lead directly to the design and implementation of many of the development projects.

Soon after the plan had gotten under way, it became apparent that achievement of various targets and objectives were much too ambitious for the time-frame originally specified.

Subsequently, a second plan was developed, the Jordan Valley Development Plan, 1975-1982, to integrate all activities of the previous 3-year plan and to increase the supply of water through further expansion of the irrigation works. The plan is commonly referred to as the Stage II development plan.

Since 1972, the philosophical underpinning of the Jordan Valley development effort has been a fully integrated social and economic development approach with the following targets:

> to rehabilitate the Jordan Valley by restoring the infrastructure damaged in the 1967 War.

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[1] JVA. The Jordan Valley Development: The Plans; the Achievements; Future Activities: Amman, February 1987.

- and to promote further development of the Valley to increase its contribution to and integration with the national economy by expanding irrigated agriculture, creating job opportunities, and promoting social development to make the Valley an attractive region for human habitation.

All of the development plans, therefore, centered around key goals of water resources development, expansion and improvement of irrigation systems, a village development program that included town planning, school construction, health centers, local government buildings, training facilities, community development centers, and land redistribution.

The effort also included provisions for public utilities in water supply and electrification, telecommunications, arteries of communication, farm-to market roads, and village streets. The plans further incorporated plans for agricultural support infrastructure including grading, packing, and marketing centers, tomato processing plants, marketing container factories, seed reproduction centers, and soil and water laboratories.

Stage I irrigation projects encompassed all irrigation areas receiving water from the unregulated flow of the Yarmouk River together with the free and regulated flow of the side wadis between the Yarmouk River and the Dead Sea.

Stage II projects included unfinished activities of Stage 1 and added projects to use the regulated flow of the Yarmouk River through construction of a Dam at Maqarin. In addition to unfinished Stage I projects, Stage II added the following components to the system.

Construction of the Maqarin Dam with a live storage capacity of 388 MCM;

Extension of the East Ghor Main Canal by 14.5 km with an expanded distribution network for irrigation of another 10,000 ha of new lands;

Pressure pipe conversion of 12,000 ha of gravity irrigated areas, primarily in the northern valley. These are the areas that were irrigated by the East Ghor Canal Project (1961-1967) and the 8 km Canal extension that was completed in 1969.

Upgrading and maintenance of the East Ghor Main Canal of related hydraulic

structures that were constructed in the early 1960's.

This program further included the construction of domestic water supply systems for Amman and Irbid. Under this effort 120 MCM of Jordan Valley water resources were supplied to the Urban population living in the highlands in the northeastern sector of the country.

In subsequent years, the Plans were modified to reflect current realities. Failure to proceed with the Maqarin Dam required full dependency on existing Jordan Valley water resources to meet agricultural and urban consumptive requirements. This necessitated the following modifications to the original plans:

The Wadi Arab Dam was raised to increase its storage capacity to 17 MCM to reserve additional water for domestic purposes;

The East Ghor Main Canal was extended by 14.5 km with a land area reduction from 10,000 to 6,000 ha to be developed in the southern valley for winter vegetable cropping;

The King Talal Dam was raised to increase its storage capacity to 82 MCM and allow diversion of the desert catchment in Qa'Khanna to the Zarqa River.

All elements and projects of the Stage I plan have been completed and are in operation.

Stage II projects are in the following stages of completion:

The Wadi Arab Dam was finished in 1985;

Construction of the 14.5 km extension of the EMGC to irrigate 5,975 ha and installation of pipe networks was started in 1984 and will be finished in 1988;

Construction of the Middle Ghors Conversion Project for 5,257 ha and development of 1,062 ha of new lands began in January 1977 and is scheduled for completion in 1989.

Two major domestic water projects were

completed in 1985. One supplies Irbid and Mafraq with 20 MCM of domestic water; the other supplies 45 MCM to Amman, Balqa, and Zarqa all from Jordan River Valley water resources.

The following is a synopsis and assessment of the individual projects comprising the Jordan Valley integrated rural development scheme.

A. LAND AND WATER SECTORS.

Modern planning for the development of the land and water resources of the Jordan Valley started at the turn of the century. Successively, several investigators, engineers and promoters formulated various plans of development, some modest, others more ambitious. An exhaustive enumeration and description of these plans is contained in the recent book by Rami G. Khouri, and this chronology -- although interesting-- will not be repeated here in the interest of avoiding repetition.[2]

The present development of the east bank of the Jordan Valley originated with the Baker-Harza studies carried out in 1953-55 by the associated firms Michael Baker Jr., Inc. and Harza Engineering Company. Their eight volume report contained the results of a very comprehensive land classification survey of the Jordan Valley, and a plan for irrigating its arable lands using water from the Yarmouk River and from the side wadis.

Recognizing that the agricultural development of the Valley would require a long period of time, the plan was implemented in several successive stages. This had the advantage of minimizing the capital investment to be made at any one time, while permitting an orderly development process. Figure VI.1 shows the location of the various elements of the project. Table VI.1 presents summary data on the various stages that were carried out over the past 25 years. The following paragraphs describe these stages.

1. THE EAST GHOR MAIN CANAL

Construction started in 1962 on the East Ghor Main Canal (EGMC), designed to convey up to 20 m3/s of the unregulated Yarmouk River from an uncontrolled diversion located near Adasiya to the irrigable lands of

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[2]The Jordan Valley, Life and Society below Sea Level, by Rami G. Khouri, Longman, London and New York., 1981, pp. 43 - 72.

Figure VI-1

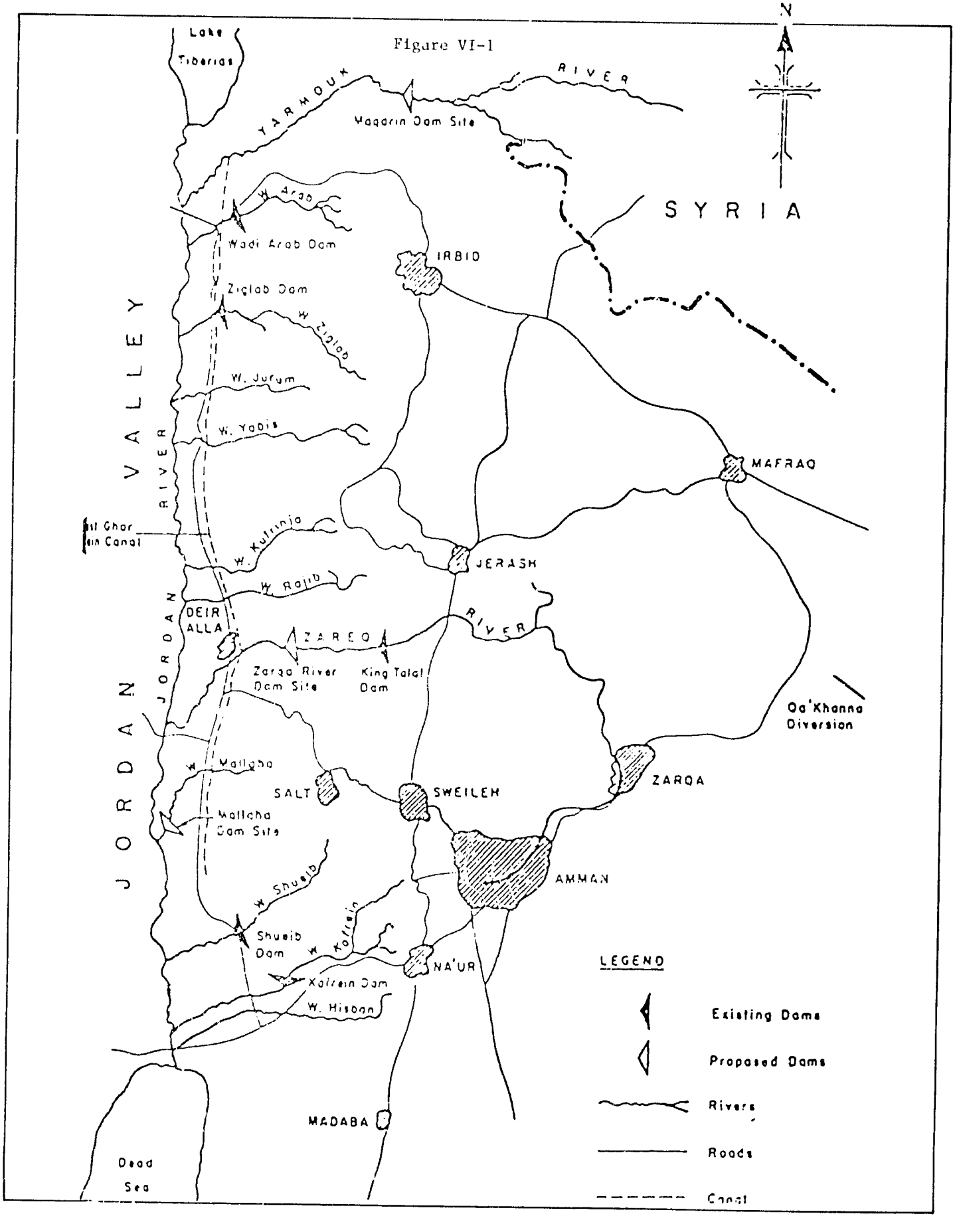

N
Lake Tiberias
YARMOUK
RIVER
Maqarin Dam Site
SYRIA
W. Arab
Wadi Arab Dam
IRBID
Zi'lab Dam
W. Zi'lab
W. Jurum
W. Yabis
JORDAN VALLEY
JORDAN RIVER
MAFRAQ
Al Ghor Canal
W. Kufrinja
JERASH
W. Rajib
DEIR ALLA
ZARQA RIVER
Zarqa River Dam Site
King Talal Dam
Qa'Khanna Diversion
W. Mallaha
SALT
SWEILEH
ZARQA
Mallaha Dam Site
AMMAN
W. Shueib
Shueib Dam
W. Kafrein
NA'UR
Kafrein Dam
W. Hisban
MADABA
Dead Sea
LEGEND
Existing Dams
Proposed Dams
Rivers
Roads
Canal

Table VI-1 - Summary Data on the Jordan Valley River Projects

Projects	Function	Consultants	Contractors	Dates of Implementation	Project Cost millions J.D.	Project Cost millions equiv. U.S. $	Funding Institution	Contribution millions Orig. Curr.	Contribution millions Equiv. $
East Ghor Canal Project									
1. Original EGMC (69 km)	irr. 12,000 ha.	Baker-Harza	Impresit	1962-69	6.8 M	$22 M (+)	USAID	$12 M	
2. 8-km extension	" 1,300 ha.	" "	"	1966-69	0.9 M		Kuwait Fund		
3. 18-km extension	" 3,650 ha.	Dar Al Handasah	Cho Suk	1975-78	5.6 M	$15 M	USAID	$10.0 M	
4. 14.5-km extension	" 6,000 ha.	" " "	J. Riepl, GmbH	1984-88	11.0 M		KFW	DM 101.5 M	$60.8 M
Zarqa River Complex									
1. King Talal Dam	store 48 Mm3 irr. 5,076 ha. + 1,300 ha.	Energoprojekt	Planum, Yug.	1972-79	16.2 M	$46.4 M	Abu Dhabi Fund Kuwait Fund	Dirhams 21.5 M K.D. 6.482 M	
2. Zarqa Triangle Irrigation	irr. 1,500 ha.	Dar Al Handasah	Cho Suk	1975-76		$ 5.8 M	USAID	$4.5 M	
3. Raising of King Talal Dam	store 82 Mm3	Harza	Hanbo	1983-87	20.0 M*		Kuwait Fund	K.D. 10.0 M	$36.3 M
Northeast Ghor Complex									
1. W. Ziglab Dam & W. Jurum irr.	stor. 4.2 MCM irr. 2,760 ha. incl. 1,000 ha. conv.	Dar Al Handasah	Cho Suk	1969 (W. Ziglab Dam) 1976-79		$13.0 M	I.D.A. OPEC	$7.5 M $1.65 M	
2. W. Arab Dam & irrigation	store 20 MCM irr. 1,250 ha.	Nippon-Koi	Hanbo	1982-85 (dam) 1983-85 (irr.)	dam JD 17 M irr. JD 4.5 M	$52.J M ?	Japan Govt.	Yen 7,000 M	$52.0 M
Southeast Ghor Complex									
1. Katrein Dam	store 4 Mm3	McDonald	Cho Suk	1966-68	2.9 M	$ 9.6 M	U.K.		
2. Hisban-Kafrein Irrigation	irr. 1,550 ha.	" "	" "	1976-78			KFW	DM 14.9 M	$ 7.2 M
Water Supply Projects									
1. Deir Alla-Amman Water Carrier	45 MCM/year domestic water to Amman.	Stanley-Boyle	Mothercat/ Hanbo	1982-85	52 M	$155 M	USAID Saudi Fund	$24.0 M Riyals 117.05	$31.4 M
2. Irbid Water Supply	distribution & collection			1981-86	28 M (?)		USAID	$23.5 M	

* Estimated. Final Cost pending.

the Ghor. A 960 - meter tunnel carries water thus diverted from the Yarmouk to the beginning of the EGMC. The canal itself, with its total length of about 10 km, was constructed at different times, in 4 successive sections.

The first two sections were constructed from 1962 to 1969: first the initial 69 km from Adasiya to the vicinity of Deir Alla and soon thereafter, an 8-km long extension from Deir Alla to the vicinity of Damya Junction (see Fig. VI.1). The canal, trapezoidal in section with a 3-meter width, was lined with concrete so as to carry up to 10 m3/s within the limits of the lining. This was sufficient to surface irrigate some 11,700 hectares located within the command area. The canal excavation was designed so that the concrete lining could be extended at a later date. This was actually implemented in 1966-68. The lining was extended on both sides by 50cm, permitting immediately the surface irrigation of an additional 1300 ha and ultimately the conveyance of up to 20 m3/s from the Yarmouk at Adasiya.

The EGMC was further extended by 18 km in 1975-78 to irrigate by pressurized pipe systems an additional area of 3650 hectares, and finally by 14.5 km starting in 1984. This last extension, with a capacity of 5.7 m3/s will serve under pressure 6000 hectares located south of the town of Karama. The construction work is currently in progress, and is scheduled for completion in mid-1988. This will complete the canal as the main water carrier serving about 23000 hectares irrigated from north to south in the East Ghor of the Valley.

(1) Irrigation from the EGMC

Irrigation of the approximately 13,500 ha within the command area of the East Ghor Main Canal was intended to be done by gravity, and the initial 77 km completed in 1969 were provided with gated regulators. There are 35 check structures consisting each of a 3-meter wide, manually operated radial gate with symmetrical side overflow weirs, two on each side of the gate, for a joint crest length of 3.7m. Flash boards are used to adjust weir overflow heights. Other structures include 11 siphons and 3 flumes across wadis, several wasteways for flushing and numerous side drainage overshots and bridges. There is one 3-bay trapezoidal weir measuring structure towards the northern end of the canal. Many submain and lateral turnouts are installed directly on the main canal. These turnouts have steel gates varying in width from 110 to 120 cm. The gates are manually adjusted by the ditchriders. The turnouts serving a concrete-lined open channel distribution system to the farm units. Each farm unit turnout is equipped with a constant head orifice flow gate. Surface irrigation methods practiced on the first 13,000 ha include the zig-zag furrow method for vegetables, the basin irrigation for citrus, the big border method for bananas and alfalfa, and the wild flooding method for cereals.

Unfortunately, most farm parcels were not leveled, and surface irrigation application has not been uniform in many areas. As a result, water-use efficiency and crop yields in some locations have left much to be desired.

The later canal extensions (18 and 14.5 kms --- as well as all irrigation projects implemented in the Valley after 1975) were planned to correct this deficiency by adopting a newer technology permitting more efficient irrigation on sloping terrain -- sprinkler irrigation. The distribution systems were designed and constructed with pumping stations drawing water from the EGMC and discharging into pressurized pipeline networks. Farm connections were designed to provide water under pressure to actuate sprinklers. Each farm is equipped with a turnout structure and buried pipeline with hydrant outlets along its edge. Each farm turnout is also provided with flow and pressure regulators, an isolation valve and a flow meter. The JVA purchased portable pipes, sprinklers and associated fittings to equip some 2,800 farm units, with the intent of supplying them to farmers on a long-term credit basis.

However, Valley farmers supplied with water under pressure showed little interest in sprinkler irrigation, and, instead, adopted the newer drip-irrigation methods. In addition to permitting high irrigation efficiencies, drip irrigation led to the achievement of high yields for cash crops grown by the farmers, and this irrigation method, often associated with plasticulture, is gaining increasing popularity in the Valley.[1] However, accumulation of salts in the vicinity of plants irrigated by drip methods require occasional leaching, and Valley farmers are experiencing the side effects of salinity buildup. To address this problem sprinkler systems could be leased for a season once every 3-4 years to remove salt deposits from the soil.

Consultants:	Baker Harza	
	Dar Al Handassa	
Contractors:	Impresit	
	Cho Suk	
	J. Riepl, Gmbh	
Cost:		
Original EGMC	-AID Loan	JD 4.2 million ($12 mil)
8 km Extension	-Kuwait Fund	JD 0.9 million
18 km Extension	-Aid Loan	JD 3.5 million ($10 mil)
14.5 km Extension	-KFW	JD11.0 million

[1]JVA data indicate that during the 1983-84 winter season, out of 15,400 hectares irrigated in the Valley, 9,500 ha. were irrigated by surface methods, 5,000 ha were irrigated by drip methods, and less than 1,000 ha by sprinklers.

2. THE ZARQA RIVER COMPLEX

This scheme was designed to regulate the flow of the Zarqa River, a tributary of the Jordan River, and allow the use of that water to irrigate by sprinklers 5,076 ha in the Zarqa triangle. The project was also designed to supply 1300 ha located immediately downstream from the section of the EGMC completed in 1969, and not heretofore irrigated.

Regulation is provided by the King Talal Dam on the Zarqa River. The original structure was completed in 1979 with a height of 92.5 meters and a live storage capacity of 48 MCM (million cubic meters). The dam was recently (completion 1986) raised by 15 meters and its capacity increased to 82 MCM to capture and store most floods.

A diversion weir across the Zarqa in the vicinity of Deir Alla leads the regulated releases from King Talal into a system of pressure pipelines that irrigate some 1550 ha that comprise the Zarqa Triangle Irrigation Project.

The area actually served from the Zarqa River is smaller than originally intended because, about 1980, it was contemplated to reserve some of the water stored in the King Talal reservoir for municipal water supply to Amman. This scheme was subsequently abandoned, and the water regulated by the King Talal Dam is now conveyed to the EGMC in replacement of water pumped from the EGMC to Amman by way of the Deir Alla-Amman Water Carrier Project, described in a later section.

Consultants:	Energoproject, Yugoslavia Dar Al Handasah Harza		
Contractors:	Planum, Yugoslavia Chosuk Hanbo		
Cost:			
King Talal Dam		JD 16.25 mil	($46.4 mil)
-Abu Dhabi Fund			($ 5.6 mil)
-Kuwait Loan Fund			($16.8 mil)
Zarqa Triangle Irrigation		JD 1.58 mil	($ 4.5 mil)
-USAID Loan			
Raising King Talal Dam		JD 6.99 mil	($20.0 mil)
-Kuwait Fund			

3. THE NORTHEAST GHOR COMPLEX

The Northeast Ghor Complex, constructed in two successive stages from 1976 to 1987, captures flows from the three northern most wadis -- Wadi Arab, Wadi Ziglab and Wadi Jurum. The first two are now regulated by dams, while the project uses unregulated flows from Wadi Jurum.

The Wadi Ziglab dam, completed in 1967, is a homogeneous earth fill dam with a height of 47 meters. Its live storage capacity is 4.4 MCM, and it has a gross yield of up to 10 MCM.

The Wadi Arab dam, is now (1987) essentially completed. It is an earth rockfill dam with a height of 80.5 meters and a live storage capacity of 20 MCM. This dam replaces an older dam with a storage capacity of only 6 MCM and a diversion weir. Wadi Jurum flows are controlled by a simple diversion weir.

The complex, interconnected by pipelines, irrigates a total of 4010 hectares stretching over a distance of about 31 km along the Northeast Ghor, from Wadi Ziglab in the north to Wadi Rajib in the south as follows:

	From Wadis Ziglab and Jurum	From Wadi Arab	Total
New lands located above the EGMC, ha.	1760	430	2190
Areas within the EGMC command area, converted from surface to pressurized irrigation, ha.	1000	820	1820
Total	2760	1250	4010

Service to the irrigated areas is done from main distributing pipelines crossing the service area along its length. These mains have a total area of 41.3 km with diameter from 900 to 200 mm. Distribution to the farm connections is by a network of pressure pipes with an aggregate length of 414 km, with diameters ranging from 100 to 250 mm. A pumping station provides adequate pressure to the higher portions of the pipe network.

Consultant:	Dar Al Handasah		
	Nipon-Koi		
Contractors:	Cho Suk		
	Hanbo		
Cost:			
Wadi Ziglab Dam and			
W. Jurum Irrig.	JD	4.56	($13.0 mil.)
-I.D.A.			($ 7.5 mil.)
-O.P.E.C.			($ 1.65mil.)
Wadi Arab Dam & Irrig.	JD	21.50	($52 mil.)
-Japan Government			

4. SOUTHEAST GHORS COMPLEX

This complex uses the flow from Wadi Kafrein, regulated by the Kafrein dam and reservoir constructed in 1967, and the unregulated flow of Wadi Kisban, controlled by a diversion weir and diverted into the Kafrein reservoir by a carrier pipe. The facilities, completed in 1978, supply water to 1550 ha of lands located above the EGMC command area for pressurized irrigation by means of a pumping station and a 63-km network of pressure distribution pipes.

Consultant:	McDonald
Contracter:	Cho Suk
Cost:	
Kafrein Dam	
Hisban Kafrein Irrigation	JD 2.9 mil ($7.2 mil.)

5. THE SUB-SURFACE DRAINAGE PROJECT

Salinization of the soil over some 3200 hectares has occurred as a result of inadequate natural drainage and accumulation of water in the ground during the years of irrigation. The groundwater table elevation is monitored regularly by JVA, and those areas most urgently in need of drainage have been identified.

The JVA procured perforated PVC drain pipes (flexible as well as rigid), a trenching and drain pipe laying machine, dump trucks and shovel loaders, and is installing drains at the rate of 800 ha per year (75 km of drains). By the end of 1985, the drainage of some 1800 hectares had been completed.

Consultants:	Harza
Contractors:	JVA Force Account
Cost:	JD 1.0 million

6. THE DEIR ALLA - AMMAN WATER SUPPLY PROJECT

The project, also called "North Jordan Domestic Water Supply Project" is a new water supply system for the City of Amman and adjacent areas in Jordan with a maximum capacity of 45 MCM/year. Started in 1982 the project was completed in 1985. The total cost amounted to JD 52M, partly funded by several institutions: USAID ($28.5M)[4], the Kuwait Fund and the Saudi Fund. Consultants were Stanley Consultants and Boyle Engineering Corporation. The principal contractors were Mothercat Ltd and Hanbo General Construction Co. Ltd. While the system's capacity is 45 MCM year, it is expected that it will be used mostly during the summer months, when some 15-20MCM will be pumped.

The project draws from the East Ghor Main Canal water which is pumped into a pipeline to Amman. An intake pump station is located at the East Ghor Main Canal some 8 km upstream from the Zarqa River siphon. The pipeline extends south-easterly towards Amman, passing through four high lift pump stations to a water treatment plant adjacent to the Zai Forest. It further extends though another high lift pump station to a terminal reservoir located near Suweileh then continues to the existing AWSA Kharabshe R-14 reservoir and ultimately terminates at the Azraq pipeline near Ain Ghazal.

The pipeline varies in diameter from 600 to 1200mm with a combined length of 49 km. It is a welded steel pipeline with coal tar epoxy lining, and is coated with a fusion bonded epoxy.

<u>The Intake pump station</u> is provided with a traveling waterscreen and four vertical pump units, each having a rated capacity of 1317/m3/hour at 19 m of head and a 125 horsepower motor.

<u>Four high lift pump stations</u> are each furnished with 4 horizontal pumping units. Each pump has a rated capacity of 1317 m3/h at 286 m of head and a 1750-HP motor. Each of these stations have forebay reservoirs. The final high lift pump station at the water treatment plant is also furnished with four horizontal pumping units, each having a rated capacity of 1283 m3/h at 197m of head and a 1250HP motor.

[4]This amount included $24.0 million for the Deir Alla-Amman Project proper, plus $4.5 million for expansion of the water supply, water distribution, sewerage, and sewage treatment for Amman.

The water treatment plant, with a nominal capacity of 1.43 m3/s, includes a raw water regulating reservoir and clearwell storage facility. The physical treatment unit process at the plant consists of rapid mixing, flocculation, sedimentation, sludge removal, filtration, filter backwash system, metering and controls, and standby engine generator. The chemical treatment process includes facilities for coagulation, color control, odor control, disinfection and pH adjustment.

The concrete terminal reservoir has 3 compartments with a total capacity of 250,000 m3 equivalent to two days of storage.

A control and telemetry system provides for control of all pumping equipment, operational sensing and read-out for automatic functions, operator monitoring and a voice communication system. The master control center is located at the water treatment plant.

An electrical supply system with 33-kv transmission lines extends from Pump Station No. 5 and the Intake Pump Station. These lines deliver the power to the six pump stations and the water treatment plant, using JEA's Subeihi Substation (132/33kv) as the source of power.

The Deir Alla-Amman Water Supply Project was planned and constructed by the JVA, and turned over to the Water Authority of Jordan upon its completion. It became operational in 1986 when 8 MCM were pumped to Amman. In June-July of 1986, water originating from King Talal Reservoir was accidentally released from irrigation conveyance canals located above the EGMC in the Zarqa Triangle. This water, containing treated effluent from the Amman sewage system, entered the Deir Alla-Amman water carrier, and contaminated the water supply system. Pumping from the EGMC was interrupted since, pending the results of a technical investigation by experts from the Thames River Authority to determine which measures should be taken to prevent a recurrence of the accident.

Project plans included the construction at a later date of a second pipeline with pumping facilities to convey another 45 MCM/yr from the EGMC to Amman. However, the Maqarin Dam project has become reactivated, and it is possible that future water supply increments will be conveyed to Amman directly from the Maqarin Reservoir.

Consultants:	Stanley Consultants
	Boyle Engineering
Contractors:	Mothercat Ltd and Hanbo General Construction Company
Cost:	JD 52 million
USAID	JD 8.42 million ($24.0 mil)
Kuwait Fund & Saudi Fund	JD 8.25 million($23.5 mil)

7. THE IRBID WATER AND SEWERAGE PROJECT

Irbid, one of the three cities in Jordan with a population in excess of 100,000, has been growing at an annual rate of more than 5%. Irbid's water supplies consist of 5000 m3/day from its three well fields of Summaya, Dhuleil and Azraq; 1500 m3/day from the Water Supply Corporation; and 750 m3/day obtained from the Rahoub and Khreiba springs. The Water and Sewerage Project was designed to improve water distribution within the town, and to provide a first-stage wastewater collection system for 7500 household connections, previously unsewered.

The water distribution system consisted of about 50 km of polyvinly/chloride (PVC) and ductile iron pipe and associated valves to improve the distribution of the WSC supply from groundwater sources. The sewerage system consisted of about 113 km of concrete pipe for sewage collection and 7.8 km of large interceptor sewers to collect sewage from smaller lines and direct it to the treatment plant. The project also included an extended aeration waste treatment plant, with one aeration tank and two clarifiers, all with provisions for future expansion. The Project was constructed from 1981 to 1986 at a cost of about JD 28 million with financial assistance from USAID in the amount of US $23.5 million.

8. Land Redistribution

In concert with the development and extension of the East Ghor Main Canal Complex, the Jordanian Government implemented 5 major land redistribution programs. These are summarized in the following table.

Table VI.1
East Ghor Canal Project
Land Redistribution Criteria Under
Various Land Reform Statutes
(1959-1977)

Irrigable dunums held prior to Project	Allocation to Holder
(a) 1959, Law 14 (Original Law)	
30 -50	Allotted in full
51 -100	50 d. + 50% excess
101 -500	75 d. + 25% excess
500 -1000	175 d. + 15% excess
over 1000	300 dunums
(b) 1960, Law 13 (Amendment)	
30 -70	Allotted in full
71 -100	75 d. + 50% excess
101 -500	87.5 d. + 25% excess
501 -1000	187.5 d. + 22% excess
over 1000	300 d. + 10% excess
(c) 1962, Law 31 (Amendment)	
30 -50	Allotted in full
51 -100	50 d. + 25% excess
101 -500	62 d. + 17% excess
501 -1000	130 d. + 12% excess
over 1000	200 dunums
(d) 1977, Law 18 (Amendment)	
40 -50	Allotted in full
51 -100	50 d. + 20% excess
101 -500	62 d. + 17% excess
501 -1000	130 d. + 12% 500d.
over 1000	200 dunums

Under the original law of 1959, applicants for redistributed land were put into one of five priority classes. These were:

first priority: the smallest land holders who operate their own lands in the project area

second priority: absentee landowners whose land was used by tenants and share-croppers in the project area

third priority: other farmers in the project area

fourth priority: other farmers in surrounding districts

fifth priority: other farmers from other parts of the country

The land reform program appears to have been effectively executed. The mean size of ownership and holdings declined from 62 dunums in 1960 to 35 dunums in 1973 and the number of farms on the better land increased and were smaller over this time frame. Much of the decrease is attributed to the effect of the land reforms, especially as the number of large landowners and large farms hand fallen so markedly over the years (ref 1, Anbar, 1985).

Jordan Valley records show that the land areas owned by 5,304 persons of which 1,297, or 24.5%, entirely relinquished their lands in the project area for compensation. From 1960 to 1986, the number of farms increased from 4,475 to 7,000. During this period, the percentage of owner-operators rose from 32.5% to 57%; the number of sharecroppers declined from 39% to 30.9%.

B. PUBLIC UTILITIES SECTOR

Included in this sector are the Jordan Valley Electrification Project and the Domestic Water Supply Project.

1. Electrification Project

This project was designed to supply electricity to the Jordan Valley with a total distribution length of 65 km, and an inter-valley high tension of 33 kv line 110 km long extending between Adasiya in the North and Sweima on the north shore of the Dead Sea in the south.

Also included are low voltage networks and 54 transformers serving eight pumping stations and 26 villages. The number of house connections as of 1980 was 8,500.

The second phase of construction began in 1980 and was completed by 1982. This phase includes a fourth 33 kv feeder line from Ajlun in the highlands to Kreimeh in the valley with a length of 20 km. This phase also includes low voltage networks and transformers to supply electricity to the agricultural research station of the Faculty of Agriculture and to five villages in the valley.

By 1986, 12,000 households and 90 percent of the population in the valley were receiving electric power from this effort.

Consultants:	Lahmeyer International, Germany	
Contractors:	High Tension: Elektrim, Poland	
	Electric Poles: Jordan Elec. Auth.	
Cost:	JD 5.4 million	($15.39 million)
-KFW		($ 8.30 million)

2. Domestic Water Supply

The goal of this project was to supply potable water to the Jordan Valley villages from spring and tube well sources. Planned for implementation in phases. The first phase included supply and installation of pumping stations, chlorinating units and main pipelines, and construction of reinforced concrete reservoirs.

Phase I installed works in 14 villages between Khazma and Dharat Al-Ramil in the middle sector. These were completed in 1983 together with a JVA 6 km line to two other villages in this sector.

Phase I also installed works in four villages in the southern sector between Karama and Rauda. These were completed in 1979 and were subsequently extended to a fifth village.

The final installation of Phase I was for 10 villages between Adasiya and Sleikhat in the northern valley. These were begun in 1979 and completed in 1980.

The second phase of the project included supply and installation of smaller diameter pipelines (75 mm) and house connections with water meters. Work on this phase was completed in early 1982.

Before the initiation of this program, only two valley villages had improved domestic water supplies. By 1980, this number had increased to 17 and potable water was available to almost all valley settlements by 1982. To date, almost 100 percent of the valley residents have access to potable water, although not all have metered service.

Consultants:	Phase I & II VBB, Sweden	
Contractors:	General Contracting Co., Jordan	
	Cho Suk Construction Co., S. Korea	
Cost	JD 5.5 million	($15.68 mil)
-KFW		(3.4 mil)

C. Transport Sector

Activities under this project include rehabilitation of the Dead Sea-Yarmouk Road and upgrading farm-to-market roads.

1. YARMOUK-DEAD SEA ROAD.

This 105 km road with a 7.2 meter carriage way traverses the Jordan Valley from north to south. The project consisted of the following:

- Widening of 44 km from a 3,4 and 5 meter width to a uniform width of 7.2 meters with a 2 meter shoulder on each side.

-New construction of 7.8 km between the village of Joufa and the sea level market on the Amman-Jerusalem highway.

-Hot mix asphalt surfacing of the entire length of 105 km.

Work on this project began in 1975 and was completed in 1977. This is the principal farm-to-market road in the Jordan Valley. As such, its upgrading has had a highly beneficial impact on increasing travel volume and reducing travel time and maintenance costs. Dajani ([9]) has estimated the internal rate of return for this project at 8 percent, using only quantifiable benefits. This estimate does not include any of the intangible benefits such as improved access to social services and infrastructures.

Consultants:	De Leuw Cather International, U.S.A
Contractor:	Shahin Engineering Co., Jordan and Force Account of the Ministry of Public Works
Cost:	JD 2.25 million ($6.4 million)
-AID Loan	($3.9 million)

2. Upgrading and Maintenance of Farm Roads

This project upgraded and added 1,600 km of farm all-weather roads to the Jordan Valley road network. The project also paved over 300 km of village streets.

The project included construction of a 5 meter carriage way with one meter shoulders with a base course, a prime coat, and a bituminous seal coat to provide an all weather surface. All of the work was completed in 1979.

Cost:	JD 421 thousand	($1.2 mil)
-AID contribution		($0.6 mil)

3. MARKETING INFRASTRUCTURE

Marketing centers were constructed in Wadi Yabis, Arda, and South Shuneh to provide farmers' markets in the northern, middle and southern regions of the valley. Following completion, these facilities were placed under the operational jurisdiction of the AMPCO. After startup of these centers, AMPCO decided to concentrate the auctioning of the Valley's agricultural produce in the centers at Wadi Yabis and Arda only with all exporting activities being reserved for the South Shuneh center.

AMPCO is responsible for the operation of two box making factories and for a 1,000 ton capacity cold storage facility constructed under the project. AMPCO also operates two additional wooden box factories and two plants for processing tomatoes into tomato paste and juice.

Consultant:	Jordan Engineering Consortium Covell Mathews Partnership, U.K.	
Contractor:	Jordan Development Company	
Cost:	JD 6,900,000	($19,320,000)
-wooden box plants	JD 700,000	
-Arda market	JD 1,400,000	
-Tomato plant	JD 1,800,000	
-Wadi Yabis market	JD 2,400,000	
-Cold storage	JD 600,000	
-Netherlands grant		($ 2,100,000)
-ODA loan		($ 2,900,000)

4. SOCIAL INFRASTRUCTURE

In formulating plans for the development of the Jordan Valley, the Government of Jordan recognized the need for an orderly development of communities to support both current residents (as of mid 1975) and a growing population attracted by new agricultural and other employment opportunities. Adequate availability of social and public services to meet their basic needs was considered vital.

The needs were readily apparent. The standard of living for valley inhabitants was low in comparison to national standards. There was much illiteracy, and school facilities were generally inadequate. Health standards were inferior, and health facilities and staffing were totally inadequate. Housing was generally of poor quality, unsanitary, and crowded.

An AID loan, primarily for infrastructure construction was extended in June 1975 as Village Development I. The initial amount $8.65 million was soon increased to $14.15 million to provide for rapid inflation, to expand certain elements of the project, and to include some items originally to be funded by other donors. This phase was funded through 1977.

During the first phase, 26 schools with 274 classrooms, accomodating 9,864 students were constructed and staffed. The schools included 25 libraries with reference books and materials, 26 chemistry labs, 9 physics labs, 12 home economics rooms, 14 handicraft rooms all equipped and furnished with high standard equipment and furniture. The schools also included 25 stores with modern athletic tools and uniforms, 26 school administrative buildings with refrigerators, TV sets and stereo equipment. Playgrounds were levelled and water and electrical connections were made.

In the health sector, a total of 10 health centers were built, equipped, and furnished. These included 3 type "A" centers with areas of 2,311 sq.m. each with outpatient clinics, inpatient service and operating theaters, dental clinics, maternal and child care wards, X-Ray facilities, laboratories and pharmacies, and administrative offices and waiting halls.

Three type "B" health centers, each with an area of 443 sq.m., were also constructed. These were equipped with outpatient clinics, maternity and child care wards, pharmacies, and administrative offices and waiting halls.

Finally, three type "C" health clinics with an area of 182 sq.m. each were constructed, equipped, and staffed. TheSe were established to handle emergency cases in transit to other centers. As such, they were equipped with basic medical necessities only.

Another important component of the first phase of the Village Development program was an effort to construct housing for government employees. Altogether, 295 units were constructed and allocated. Each unit is composed of two bedrooms and a porch with a total area of 93 sq.m. The allocation was completed by 1981 according to the following distribution:

North Shuneh	80	Wadi Yabis	50
South Shuneh	75	Arda Triangle	20
Dbab	70		

The final element of the village development package in phase I included the construction and furnishing of seven local administration buildings and one community center. The six smallest local administrative buildings age 414 sq.m. and the seventh is 1,650 sq.m. These buildings are being used as office space and facilities for governmental departments in the valley.

The community center began operation in 1979 with training given to females in sewing. Training in other skills for males and females. Additional courses have been established for electricians, plumbing, and home economics. The center includes sports facilities and a meeting hall for various community functions.

A second phase, involving an $8.0 million AID loan was inaugurated in 1978 to finance housing mortgage loans ($2 million) and the construction cost of 29 schools with 379 classrooms for 13,644 students, 4 health centers, 3 government administration buildings, 9 km of village streets and 42 km of farm roads (Village Development II). Total construction of this second stage was approximately $15.2 million. Construction of Village Development II facilities was completed by June, 1982.

The novel feature of this program was the addition of a housing loan program. Under this part of the effort, housing loans up to JD. 2,500 were extended to individuals in the valley to finance the construction of new houses, improvements and/or expansion of existing houses. Beneficiaries were selected on the basis of: (1) land ownership; (2) having obtained a building permit; and (3) inclusion of a bathroom and a kitchen. The housing bank, acting as administrator for JVA funds, appraised applications and extended loans following the recommendation and approval of the JVA. Mortgage loans tended to move slowly because applicants seldomly had title to their land or the proposed site was owned jointly by several people.

A total of 1,888 houses were built between 1973 and 1980. Following the initial effort, land was distributed to eligible applicants, who built their own houses. This change in the program emphasis appears to have been more successful than the housing mortgage system because recipients were free to design their own houses rather th.n have an external design imposed upon them.

A third stage, involving a $7.0 million AID loan was initiated in 1979 to finance construction cost of schools, administration buildings and health centers in Southern Ghors, Wadi Araba and Jordan Valley. The cost of construction amounted to about $11.8 million.

Twenty (20) kms of access roads, and water supply lines to all facilities in the Jordan Valley were included in this program. Construction of Village Development III facilities were also completed in June, 1982.

In a total of 28 villages, 46 schools were constructed for boys and girls, with a total of 612 rooms, some of which serve as libraries, chemistry, physics, handicraft and home economics laboratories. This 3-phase project was instrumental in developing adequate public services and in improving living conditions for Valley residents. In addition, an unplanned consequence of the Village Development program has been its significant contribution to the development of private enterprise in the Valley by creating a demand for construction services.

In terms of impact, the school program appears to have been the most successful as the growth of new schools has kept pace with the population growth rate. The development of medical facilities, on the other hand, had lagged behind the population growth rate and, in 1986, there were fewer health services per capita than in 1980.

The housing program has been the least successful of the social infrastructural efforts. The major problem with it has been public disinterest in the prototype designs and the locations. This is not a serious deficiency, however, since most of the housing (some 25,000 units) was constructed and marketed by and through the private sector. Thus, the government's share of the total including government employee housing, was only 8.4 percent.

Cost Summary	Total Cost ($ million)	Aid Contribution ($ million)
V.D.I	16.0 (?)	14.15
V.D.II	15.2	8.00
V.D.III	11.8	7.00
Total (1975-82)	$43.0 mil.	$ 29.14 mil

D. INSTITUTION BUILDING

1. Jordan Valley Farmers Association Project

The Jordan Valley Farmers Association (JVFA) Project is an institution building project. JVFA received assistance from USAID through 2 projects: (1) a technical assistance (grant) involving a fairly heavy participant training program project; and (2) a credit project for JVFA (loan).

Law 19 of 1974 established JVFA and entrusted it with a very ambitious portfolio. JVFA was organized in 1977. It started with a skeletal staff of only 20 employees and the services it provided at the start were very modest. It experienced predictable difficulties and delays. Its staff was insufficient and only partly trained. Some of its activities were postponed, and others, such as marketing and agri-business were abandoned.

It experienced management problems. JVFA's operations picked up momentum in mid-1978 with the assistance of the two AID - funded projects, and grew substantially since then. Its staff grew to over 100 employees, a membership of over 4700 (1985) and 7 branch offices through which it extends services to Jordan Valley farmers. The credit input supply schemes have been effective in making JVFA visible, though not viable; a high rate of delinquency in loans has been experienced, and JVFA has been charging below market prices of input supplies sold to farmers. In spite of these difficulties the JVFA is an established institution which is recognized by farmers.

JVFA is in the process of establishing a fertilizer blending plant, in partnership with the Agricultural Credit Corporation and the Industrial Bank of Jordan.

USAID provided 66 person months of technical assistance by 3 resident consultants in the areas of overall management, agricultural credit, and farm management guidance and information. USAID also provided 19 person-months of short-term consultants, and funded 14 person-months of participant training.

	TA	Credit
Project Cost:	$1,770,000	
Funding Institution	USAID	
AID Contribution:	$1,161,000	$1,500,000
	Total $2.66M	

The distribution between credit and TA is

($000's)	AID	GOJ	Total
T.A.	1,161	347	1,508
Credit	1,500	1,974	3,474
Total	2,661	2,321	4,982

The credit component included:

a) A seasonal loan revolving fund consisting of aid loan proceeds of $1.5M, a GOJ contribution of JD 576,000 ($1,974,000) as well as the sales proceeds ($112,500) from 500 Tons of FAO-donated fertilizers:

b) The services of an agricultural credit advisor and training for the credit staff.

JVFA personnel, administrative and operating funds, supplies, services in the supplies and marketing area; and Ministry of Agriculture extension personnel.

2. Agricultural Services Project (1982-88)

The objective of the Project is to increase the Jordan Valley's agricultural productivity, primarily of vegetables and fruit, for local consumption and export, through increasing farmers' access to inputs and services. The project involves institutional development, research, and technology transfer.

A research team was assembled to start work on some of the immediate problems facing farmers in the Valley, as well as to test and introduce new crops. At the same time, an effort was made to build an extension team capable of transferring information to farmers.

The research phase has focused on developing the facilities at the Deir Alla Action, including Pest Management, and Soil, Water and Tissue Analysis laboratories. It has also involved establishing three research sub-stations -- in the southern part of the Valley (Karameh), one in the middle (Dier Alla) and one in the northern part (Wadi Yabis/Abu Habil). Plastic greenhouses and other agricultural infrastructure were installed at these substations.

A part of the research (and extension) effort was a program for the biological control of the spherical mealybug. Jordanian personnel were trained both in the U.S. and at the Deir Alla Station in the techniques required. They have successfully developed parasites that control the pest. This phase of the project will continue in order to expand the area of control.

Much of the institutionalization process has been accomplished, and will continue in some areas that need additional assistance in order that the persons involved become fully able to take over the required functions, i.e. in the operation of the Soil and Water Laboratory, and in the work in virology. In addition, the project activities now emphasize the extension function, including transfer of technology, rather than the heavy emphasis on research that was done at the beginning.

The project provided a total of 270 person months of technical assistance.

Future project activities will be incorporated into the NCARTT

Project Cost: $11.96 M
Funding Institution: USAID
AID Contribution: $6.42 million

3. Water Management Technology Project

This project (WMT) was designed to provide technical assistance, training, and equipment related to sprinkler irrigation, and was tied in to the Portable Sprinkler Farm Equipment Project also funded by USAID. The main thrust of the WMT effort was to facilitate the introduction of sprinkler irrigation into the Jordan Valley. A training component and a research component of the project were targeted to this objective.

The project was less than successful, principally due to the near absence of institutional involvement by the Ministry of Agriculture and the Faculty of Agriculture (University of Jordan), and due to other external factors including problems encountered in the distribution and utilization of the AID-financed sprinklers in the Jordan Valley. This is despite the fact that over 2000 farmers were trained in the mechanics of sprinkler irrigation in the early stage of project implementation. An extended drought prevailed from 1977 through 1979, and there was insufficient water to deliver through the pressurized system which had at that time been newly completed in the Valley.

At the same time, Jordarian farmers adopted drip irrigation at an unexpectedly accelerated rate. This resulted from the demonstrated benefits of drip irrigation, at least in the short run, and from aggressive marketing by private sector firms that actively introduced drip irrigation under greenhouses, tunnels and open fields in combination with plastic mulch.

In 1984/85, it was estimated that over 5000 ha were under drip irrigation, while only 150 ha were irrigated by sprinklers.

The WMT project provided 2 long-term advisors: a research advisor, and an extension/training advisor. Six JVA engineers attended training courses in Utah and Colorado during 1982 and 1983.

The stated purpose of the project, to "upgrade agricultural productivity in the Jordan Valley by systematically raising the efficiency of water utilization", was partially achieved, but not through the introduction of sprinklers but rather through changing water management technology (e.g. drip irrigation).

Project expenditures were $1,320,000, including $806,000 for commodities. These consisted of computers for design, drainage equipment (a trencher and an excavator), and irrigation equipment spare parts with valves and control systems.

An unplanned side-effect of the WMT project has been the training of over 1800 farmers in the techniques associated with scientific tomato growing. This included yield potential, effective use of fertilizer and water, and reduced labor through the proper use of mulch and irrigatio

E. Summary of External Assistance

Most of the Jordan Valley projects carried out in over the last 25 years were funded partly by the Government of Jordan, and partly with the financial assistance from external sources in the form of loans or grants. Table VI.2 presents a summary of the external assistance received by the Government of Jordan in connection with most of these projects.

For the reader's convenience, a table of exchange rates of US dollars with the various loan currencies as of November 6, 1987 is provided. However, it is to be noted that these loan or grants listed were made at different periods, and the exchange rates at those times may have been substantially different.

Table VI.2
External Assistance to the Government of Jordan for Jordan Valley Development

Project	Currency	Amount (millions)	Source
East Ghor Canal			
1. Original EGMC (69km)	$US	12.0	USAID
2. 8-km extension	KT. Dinars		
3. 18-km extension	$US	10.0	USAID
4. 14.5-km extension	DM	101.5	KFW
Zarqa River Complex			
1. King Talal Dam	Abu Dh Dhiram	21.5	Abu Dhabi Fund
2. Zarqa Triangle Irrigation	$US	4.5	USAID
3. Raising King Talal Dam	KD	10.0	Kuwait
Northeast Ghor Complex			
1. W. Ziglab Dam & W. Jurum Irrigation	$US	7.5	I.D.A.
2. W. Arab Dam & Irrig.	Yen	7000.0	Japan
Southeast Ghor Complex			
1. Kafrein Dam			U.K.
2. Hisban-Kafrein Irrig.	DM	14.9	K.F.W.
Other Projects			
1. Portable sprinkler farm equipment	$US	4.5	USAID
2. Subsurface drainage			
3. Land redistribution			
4. Jordan Valley Ag. Services	$US	6.4	USAID
5. JVFA	$US	2.7	USAID
6. Water Management Tech	$US	1.3	USAID
7. Village Dev. I,II,III	$US	29.2	USAID
8. Valley Domestic Water Supply	DM	6.3	KFW
9. Rural Electrification	DM	16.3	KFW
10. Housing Project	DM	1.0	KFW
11. Packing & Marketing Centers	FL	10.0	Neth.
	$US	2.9	ODA
	DM	15.0	KFW
12. Yarmouk-Dead Sea Rd.	$US	3.9	USAID
13. Farm Roads	$US	0.6	USAID
14. Maquarin Dam Studies	$US	16.0	USAID
Water Supply Projects			
1. Deir Alla-Amman Water Carrier	$US	24.0	USAID
	Riyals	117.1	Saudi Arabia
2. Irbid Water Supply	$US	23.5	USAID

APPENDIX

AIII.1 AND AIII.2

APPENDIX III.1

AIII.1-1
Wholesale Price Trends
Major Fruits and Vegetables
(Fils/kg)

	Tomato	Cucumber	Squash	Eggplant	Lemon	Green Bean
1980	101	214	136	107	167	
1981	121	179	129	114	152	253
1982	109	236	163	116	127	264
1983	132	270	158	126	176	223
1984	101	185	168	86	119	283
1985	101	158	138	92	153	222
1986	94	155	133	107	97	212

Source: Amman Wholesale Market Data.

AIII.1-2
Domestic Supply, Demand, and Exports
Major Fruits and Vegetables 1978-86

	Supply	Total 1/ Consumption	Private Consump. 2/	Exports	Private Consumption & Exports
1978	671.65	374.13	280.60	297.52	578.12
1979	588.33	250.41	187.81	337.92	525.73
1980	628.81	230.29	172.72	355.43	528.15
1981	725.59	296.87	222.65	430.24	652.89
1982	726.48	330.84	248.13	461.03	709.16
1983	831.76	442.78	332.09	421.85	753.94
1984	906.32	533.93	400.45	429.73	830.18
1985	1324.13	610.71	458.03	402.57	860.60
1986	903.38	573.68	430.26	353.44	783.70

1/ Production + imports - exports.
2/ Total consumption - 25% losses

AIII.1-3

Hashemite Kingdom of Jordan

Major Fruit and Vegetable Commodity Balance:1978

(Tons 000's)

	Domestic Output	West Bank/ Gaza Inflow	Imports	Total Supply	Exports	Consumption
Tomato	201.51	4.81	0.51	206.83	82.91	123.92
Potato	10.21	0.91	14.11	25.23	1.21	24.02
Cucumber	22.61	4.61	0.21	27.43	14.71	12.72
Squash	21.41	0.21	0	21.62	14.61	7.01
Eggplant	48.61	0.7	0.11	49.42	16.41	33.01
Onion	8.01	1.11	8.91	18.03	3.71	14.32
Green Bean	6.81	0.03	1.81	8.65	5.01	3.64
Sweet Melon	5.1	0.61	0.71	6.42	2.51	3.91
Apples	2.31	0	23.01	25.32	0.91	24.41
Citrus	67.81	148.42	0.71	216.94	138.81	78.13
Caul/Cabb	27.71	0.01	0.91	28.63	12.41	16.22
Grapes	30.71	5.21	1.21	37.13	4.31	32.82
Total	452.81	166.63	52.21	671.65	297.52	374.13

Population: 2057.5

GDP: 781000

Per Capital Income: 379.59

Sources: (a) Statistical Yearbook 1978.
Department of Statistics.
(b) Monthly Statistical Bulletin, Vol 23 No. 5.
Central Bank of Jordan.
Department of Research and Studies.

AIII.1-4

Hashemite Kingdom of Jordan

Major Fruit and Vegetable Commodity Balance:1979

(Tons 000's)

	Domestic Output	West Bank/ Gaza Inflow	Imports	Total Supply	Exports	Consumption
Tomato	171.8	4.51	0	176.31	105.51	70.8
Potato	6.51	0	25.31	31.82	0.11	31.71
Cucumber	20.11	3.91	0	24.02	17.11	6.91
Squash	27.51	0.04	0	27.55	18.11	9.44
Eggplant	53.11	1.61	0.03	54.75	31.71	23.04
Onion	4.31	0	15.61	19.92	5.11	14.81
Green Bean	4.21	0.02	0	4.23	2.71	1.52
Sweet Melon	9.11	0.21	1.31	10.63	1.41	9.22
Apples	2.31	0	23.01	25.32	0.91	24.41
Citrus	28.61	35.6	90.2	154.41	139.11	15.3
Caul/Cabb	24.22	1.21	5.21	30.64	9.51	21.13
Grapes	23.11	4.91	0.71	28.73	6.61	22.12
Total	374.92	52.02	161.39	588.33	337.92	250.41

Polulation (Millions) 2057.5

GDP (JD 000's) 753000

Per Capita Income: 365.98

Sources: (a) Statistical Yearbook 1979.
Department of Statistics.
(b) Monthly Statistical Bulletin, Vol 23 No. 5.
Central Bank of Jordan.
Department of Research and Studies.

AIII.1-5

Hashemite Kingdom of Jordan

Major Fruit and Vegetable Commodity Balance: 1980

(Tons 000's)

	Domestic Output	West Bank/ Gaza Inflow	Imports	Total Supply	Exports	Consumption
Tomato	162.92	3.25	0	166.17	110.31	55.86
Potato	12.85	0.94	31.03	44.82	0.83	43.99
Cucumber	33.08	0	0	33.08	24.86	8.22
Squash	44.04	0	0	44.04	21.73	22.31
Eggplant	52.37	1.76	0	54.13	27.38	26.75
Onion	3.46	0	13.56	17.02	4.99	12.03
Green Bean	8.09	0.11	0.21	8.41	4.65	3.76
Sweet Melon	8.21	1.51	0.41	10.13	4.31	5.82
Apples	0.47	0	25.43	25.9	0.12	25.78
Citrus	42.91	36.41	83.71	163.03	128.61	34.42
Caul/Cabb	32.42	0.21	5.71	38.34	21.83	16.51
Grapes	18.21	4.81	0.71	23.73	5.81	17.92
Total	419.03	49	160.77	628.8	355.43	273.37

Population (Millions)	2233
GDP (JD 000's)	984300
Per Capita Income:	440.80

Sources: (a) Statistical Yearbook 1980.
Department of Statistics.
(b) Monthly Statistical Bulletin, Vol 23 No. 5.
Central Bank of Jordan.
Department of Research and Studies.

AIII.1-6

Hashemite Kingdom of Jordan

Major Fruit and Vegetable Commodity Balance: 1981

(Tons 000's)

	Domestic Output	West Bank Inflow	Imports	Total Supply	Exports	Consumption
Tomato	204.51	7.27	0	211.78	127.97	83.81
Potato	7.41	1.61	40.11	49.13	1.91	47.22
Cucumber	43.68	2.91	0	46.59	43.26	3.33
Squash	46.18	0	0	46.18	26.54	19.64
Eggplant	58.91	4.71	0	63.62	33.61	30.01
Onion	1.26	2.76	17.16	21.18	7.69	13.49
Green Bean	5.96	0	0.31	6.27	6.21	0.06
Sweet Melon	12.61	3.91	0.09	16.61	7.11	9.5
Apples	0.21	0	27.31	27.52	0.21	27.31
Citrus	44.31	41.73	69.71	155.75	139.3	16.45
Caul/Cabb	48.73	0	0	48.73	29.72	19.01
Grapes	25.81	6.11	0.31	32.23	6.71	25.52
Total	499.58	71.01	155	725.59	430.24	295.35

Population (Millions)	2322.3
GDP (JD 000's)	1164200
Per Capita Income	501.31

Sources: (a) Statistical Yearbook 1981.
Department of Statistics.
(b) Monthly Statistical Bulletin, Vol 23 No. 5.
Central Bank of Jordan.

AIII.1-7

Hashemite Kingdom of Jordan

Major Fruit and Vegetable Commodity Balance: 1982

(Tons 000's)

	Domestic Output	West Bank Inflow	Imports	Total Supply	Exports	Consumption
Tomato	195.31	15.21	0.11	210.63	152.31	58.32
Potato	7.61	2.51	42.41	52.53	1.21	51.32
Cucumber	55.02	2.28	0	57.3	54.74	2.56
Squash	41.21	0	0	41.21	37.05	4.16
Eggplant	45.41	7.1	0	52.51	37.6	14.91
Onion	0.81	2.76	19.56	23.13	4.3	18.83
Green Bean	8.09	0	0.05	8.14	5.96	2.18
Sweet Melon	12.91	3.02	0.41	16.34	5.11	11.23
Apples	0.21	0	40.61	40.82	0.31	40.51
Citrus	37.84	39.13	92.33	169.3	142.44	26.86
Caul/Cabb	21.41	0	0	21.41	13.59	7.82
Grapes	26.79	6.11	0.26	33.16	6.41	26.75
Total	452.62	78.12	195.74	726.48	461.03	265.45

Population (Millions)	2415.2
GDP (JD 000's)	1321200
Per Capita Income	547.04

Sources: (a) Statistical Yearbook 1982.
Department of Statistics.
(b) Monthly Statistical Bulletin, Vol 23 No. 5.
Central Bank of Jordan.
Department of Research and Studies.

AIII.1-8

Hashemite Kingdom of Jordan

Major Fruit and Vegetable Commodity Balance: 1983

(Tons 000's)

	Domestic Output	West Bank Inflow	Imports	Total Supply	Exports	Consumption
Tomato	212.34	10.72	0	223.06	125.52	97.54
Potato	19.04	3.87	26.46	49.37	2.44	46.93
Cucumber	74.71	0.47	0	75.18	59.11	16.07
Squash	44.04	0	0	44.04	32.57	11.47
Eggplant	90.45	2.28	0	92.73	28.46	64.27
Onion	3.85	1.47	19.55	24.87	4.15	20.72
Green Bean	12.11	0	0.05	12.16	7.99	4.17
Sweet Melon	23.96	7.26	0.41	31.63	14.84	16.79
Apples	1.15	0	45.99	47.14	0.21	46.93
Citrus	41.91	107.29	1.02	150.22	109.21	41.01
Caul/Cabb	57.41	0	9.44	66.85	31.56	35.29
Grapes	8.61	5.79	0.11	14.51	5.79	8.72
Total	589.58	139.15	103.03	831.76	421.85	409.91

Popuilation (Millions)	2495.3
GDP (JD 000's)	1422700
Per Capita Income	570.15

Sources: (a) Statistical Yearbook 1983.
Department of Statistics.
(b) Monthly Statistical Bulletin, Vol 23 No. 5.
Central Bank of Jordan.
Department of Research and Studies.

AIII.1-9

Hashemite Kingdom of Jordan

Major Fruit and Vegetable Commodity Balance: 1984

(Tons 000's)

	Domestic Output	West Bank Inflow	Imports	Total Supply	Exports	Consumption
Tomato	298.98	20.15	0	319.13	134.01	185.12
Potato	16.75	4.96	20.58	42.29	5.8	36.49
Cucumber	99.14	0.25	0	99.39	58.27	41.12
Squash	45.53	0	0	45.53	22.05	23.48
Eggplant	73.68	1.71	0	75.39	37.51	37.88
Onion	8.88	4.57	12.96	26.41	3.75	22.66
Green Bean	15.86	0	0	15.86	7.66	8.2
Sweet Melon	34.66	8.55	0.33	43.54	16.15	27.39
Apples	3.03	0	31.69	34.72	0.29	34.43
Citrus	95.21	123.42	0.21	218.84	120.65	98.19
Caul/Cabb	88.85	0	0	88.85	29.72	59.13
Grapes	38.74	6.03	0	44.77	4.88	39.89
Total	819.31	169.64	65.77	1054.72	440.74	613.98

Population (Million)	2595.1
GDP (000's)	1499400
Per Capita Income	577.78

Sources: (a) Statistical Yearbook 1984
Department of Statistics.
(b) Monthly Statistical Bulletin, Vol 23 No. 5.
Central Bank of Jordan.
Department of Research and Studies.

AIII.1-10

Hashemite Kingdom of J

Major Fruit and Vegetable Comm 1985

(Tons 000's)

	Domestic Output	West Bank Inflow	Imports	To St		Consumption
Tomato	412.27	21.7	0	43	9	329.48
Potato	26.19	4.38	11.61	4	9	33.49
Cucumber	204.75	0.17	0	20	8	143.34
Squash	49.52	0	0	4	3	23.22
Eggplant	76.23	1.8	0	78	.5	40.53
Onion	13.56	4.57	8.07	2	15	22.05
Green Bean	20.49	0	0	20.	.79	12.7
Sweet Melon	51.64	7.59	0.65	59.8	2.06	47.82
Apples	3.03	0	53.12	56.1	0.29	55.86
Citrus	158.27	111.21	0.64	270.12	37.47	132.65
Caul/Cabb	64.33	0	0	64.33	29.72	34.61
Grapes	52.63	7.93	0	60.56	2.01	58.55
Total	1132.91	159.35	74.09	1366.35	432.05	934.3

Population (Million)	2693.7
GDP (000's)	1573300
Per Capita Income	584.0665

Sources: (a) Statistical Yearbook 1985.
Department of Statistics.
(b) Monthly Statistical Bulletin, Vol 23 No. 5.
Central Bank of Jordan.
Department of Research and Studies.

AIII.1-11

Hashemite Kingdom of Jordan
Agricultural Commodity Balance: 1986
(Tons 000's)

	Domestic Output	West Bank Inflow	Imports	Total Supply	Exports	Consumption
Tomato	220.56	21.81	0	242.37	94.97	147.4
Potato	18.98	3.93	13.37	36.28	1.77	34.51
Cucumber	64.26	0.41	0	64.67	39.65	25.02
Squash	36.85	0	0	36.85	18.02	18.83
Eggplant	50.67	3.31	0	53.98	26.99	26.99
Onion	8.01	5.44	14.36	27.81	2.06	25.75
Green Bean	12.36	0	0	12.36	5.85	6.51
Sweet Melon	12.61	4.79	0.35	17.75	8.44	9.31
Apples	2.01	0	34.13	36.14	0.67	35.47
Citrus	87.36	111.22	0.65	199.23	137.47	61.76
Cauk/Cabb	40.97	0	0.28	41.25	16.47	24.78
Grapes	7.97	5.21	0.12	13.3	1.08	12.22
Total	562.61	156.12	63.26	781.99	353.44	428.55

Population (Millions)	2796.1
GDP (000's)	1613600
Per Capita Income	577.09

Sources: (a) Statistical Yearbook 1986.
Department of Statistics.
(b) Monthly Statistical Bulletin, Vol 23 No. 5.
Central Bank of Jordan.
Department of Research and Studies.

AIII.2-1
Economic Analysis
Jordan Valley River Project Investments
(Jordanian Dinar)

Year	Investments	Project	Project	Project	Project	Project	Area Served	Value Added 3/
1962	850	EGMC 1/						
1963	850	EGMC						
1964	850	EGMC						
1965	850	EGMC						
1966	2041	EGMC	8km ext	Kafrein D 2/				
1967	2041	EGMC	8km ext	Kafrein D				
1968	2041	EGMC	8km ext	Kafrein D				
1969	1075	EGMC	8km ext				101080	30
1970							101080	33
1971							101080	32
1972	2314		KTD/ZTI 4/				101080	37
1973	2314		KTD/ZTI				101080	38
1974	2314		KTD/ZTI				101080	41
1975	3714	18km ext	KTD/ZTI				101080	45
1976	5357	18km ext	KTD/ZTI	HsKafreinWZDWJI 5/			101080	48
1977	5357	18km ext	KTD/ZTI	HsKafrein WZDWJI			101080	46
1978	11025	18km ext	KTD/ZTI	HsKafrein WZDWJI		W.ArabDam	140600	55
1979	10542		KTD/ZTI		WZDWJI	W.ArabDam	161880	59
1980	5667					W.ArabDam	161880	61
1981							183806	65
1982							183806	68
1983	4950	KingTalal(raising)				W.ArabIrr	183806	72
1984	7300	KingTalal		14.5 km ext		W.ArabIrr	183806	79
1985	7300	KingTalal		14.5 km ext		W.ArabIrr	183806	82
1986	7300	KingTalal		14.5 km ext		W.ArabIrr	183806	86
1988	3250			14.5 km ext		W.ArabIrr	238906	93

Internal Rate of 0.169906

1/ East Ghor Main Canal.
2/ Southeast Ghor Complex- Kafrein Dam and Hisban Kafrein Irrigation.
3/ Crop weighted.
4/ King Talal Dam and Zarqua Triangle Irrigation.
5/ Wadi Ziglab Dam and Wadi Jurum Irrigation.

Economic Analysis
Jordan Valley River Project Investments
(Jordanian Dinar)

Year	Investments	Project	Project	Project	Project	Project	Area Served	Value Added 3/
1962	850	EGMC 1/						
1963	850	EGMC						
1964	850	EGMC						
1965	850	EGMC						
1966	2041	EGMC	8km ext	Kafrein D 2/				
1967	2041	EGMC	8km ext	Kafrein D				
1968	2041	EGMC	8km ext	Kafrein D				
1969	1075	EGMC	8km ext				101080	30
1970							101080	33
1971							101080	32
1972	2314		KTD/ZTI 4/				101080	37

AIII.2-2

Weighted Mean Marginal Value Productivity of Irrigation Water

Jordan Valley 1986/87

Crop:	Net Water Rqmnt(m^2/dun.)	MVP (JD/m^2)	Planted Area(dunum)	%	Weight
Strawberry gr'h	800	1.571	100	0.04	0.000063
Broadbeans	342	0.994	4650	1.89	0.001882
Cucumber gr'h	518	0.921	4240	1.73	0.001590
Onion/Garlic	634	0.362	7225	2.94	0.001065
Peppers gr'h	1192	0.261	1785	0.73	0.000189
Cauliflower/Cabbag	1050	0.223	5430	2.21	0.000493
Orange	1700	0.218	47050	19.16	0.004177
Potato	327	0.203	10220	4.16	0.000845
Cucumber OF	802	0.201	8665	3.53	0.000709
Squash	800	0.197	18530	7.55	0.001486
Tomato	1052	0.192	39735	16.18	0.003107
Grapes	1324	0.184	4265	1.74	0.000319
Eggplant	1340	0.171	13430	5.47	0.000935
Mulokia gr'h	968	0.154	3350	1.36	0.000210
Green Beans	837	0.151	7855	3.20	0.000483
Banana	2769	0.137	10585	4.31	0.000590
Melon	800	0.114	14645	5.96	0.000679
Peppers OF	1127	0.102	21855	8.90	0.000907
Sweet Corn	900	0.086	1460	0.59	0.000051
Cereals	742	0.021	14315	5.83	0.000122
Leaf Vegetables	1000	0.085	6130	2.50	0.000212
			245520		0.020124

20.1 fils/m^2

Source: Calculated from Tables (2.3 & 2.4) of Dietz, 1987

AIII.2-3

Input-Use Efficiency of Jordan Valley Farms
1986

(1) Methodology:	(2) MVP Values:	(5) MVP/MFC	(3) Means / (4) Input Price
Cobb-Douglas Production Function			W=671.39m C=65.99JD F=110.12k P=458cc/d
$y = aW^a C^b F^c P^d$			
where:			
y=net revenue/dunum			
a=constant			
W=water input in m^3/dunum	0.0221	NA	NA
a=production elasticity of water			
C=working capital input in JD/dunum	0.1063	1.11	0.095
b=production elasticity of capital			
F=fertilizer input in kgs/dunum (av.)	0.0398	0.71	0.056
c=production elasticity of fertilizer			
P=pesticide input in cc/dunum (av)	0.0125	0.07	0.131
d=production elasticity of pesticide			

$$y = 14.75W^{0.0812} C^{0.4008} F^{.0241} P^{.0314}$$

NA=not aplicable because of water subsidy.

$$r^2 = .73$$

The first derivative of each term is taken while marginal value productivity (col. 2) of each input using mean values from the sample (col 3).

Marginal Value Productivity/Marginal Factor Cost ratios (input priceat column 4) indicate input-use efficiency. Value Productivity/Marginal Factor Cost (input price) ratios indicate input-use efficiency.

Ratios(column 5) less than one show excess use; ratios above one show a constraint; and ratios equal to one show optimal use.

Source: Derived from farm management data of the JVASP.

AIII.2-4

Water Response Function
Cucumber-Open Field
Jordan Valley 1987

Function: $y=0.3093 + 0.0112x - 0.000011809x^2$

y= yield (tons/dunum); x= water application(m^3/dunum)

Optimal Water: $-0.0112/2*(-0.000011809)=474 m^3$/dunum

Actual: $700 m^3$/dun.(Dietz, JVA, 1986)

Optimal Yield: $0.3039 + 0.0112*(474)-0.000011809*(474^2)=2.96$ tons/du

Actual Yield: 2.3 tons/dunum (Dietz, JVA, 1986).

Water Excess: 28.6%

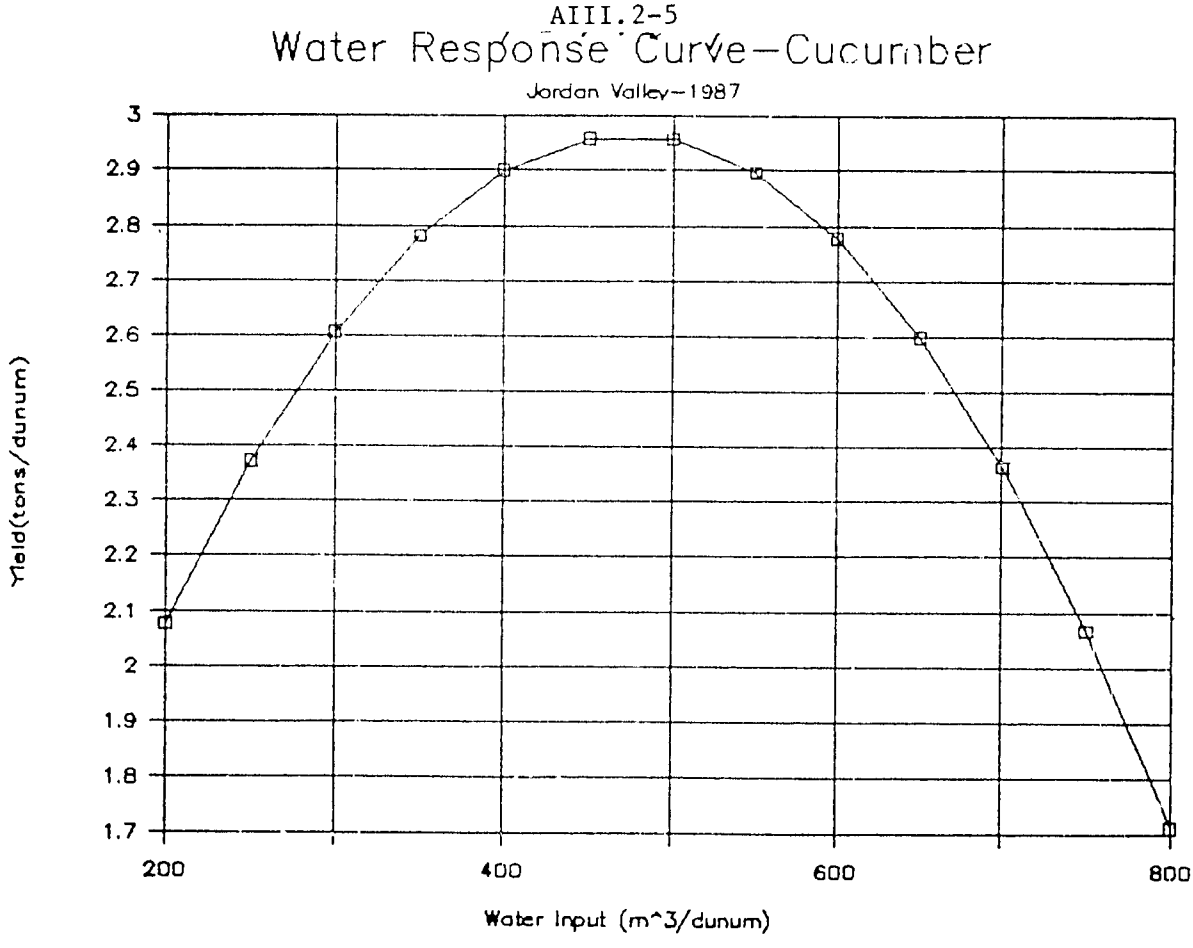
Significance: 90.0%

Curve:

Water	Yield
200 m^3/dun.	2.08 tons/dunum
250 m^3/dun.	2.37 tons/dunum
300 m^3/dun.	2.61 tons/dunum
350 m^3/dun.	2.78 tons/dunum
400 m^3/dun.	2.90 tons/dunum
450 m^3/dun.	2.96 tons/dunum
500 m^3/dun.	2.96 tons/dunum
550 m^3/dun.	2.90 tons/dunum
600 m^3/dun.	2.78 tons/dunum
650 m^3/dun.	2.60 tons/dunum
700 m^3/dun.	2.36 tons/dunum
750 m^3/dun.	2.07 tons/dunum
800 m^3/dun.	1.71 tons/dunum

Source: Fitted to Deir Alla Research Station data, 1986.

AIII.2-5


Water Response Curve—Cucumber
Jordan Valley—1987
Yield(tons/dunum)
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
200
400
600
800
Water Input (m^3/dunum)

AIII.2-6
Water Response Curve-Onion
Jordan Valley 1986

Function: $y=-66.8262+3.31937x-0.02614x^2$

y=yield in tons/hectare; x=water application in cm

Optimal Water: (-3.31937/(2*0.02614))*10=635cubic meters per dunum.

Actual: 800m^3/dunum (Dietz, JVA, February 1987)

Optimal Yield: -66.8262+3.31937*(635)-0.02614*(635^2)=2.39tons/dunum.

Actual Yield: 2 tons/dunum (Dietz, JVA, 1987)

Water Excess: 21%

Significance: 95%

Data:

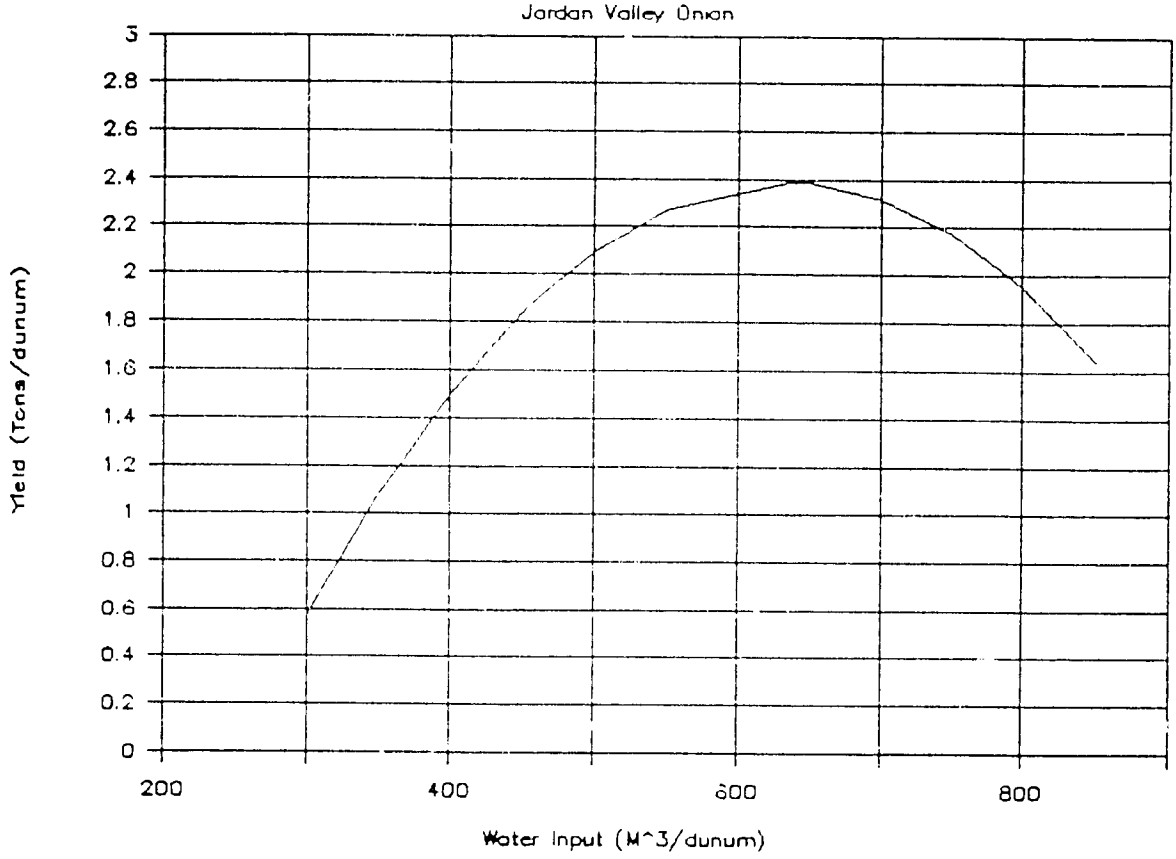
Water	Yield
300 m^3/dun.	0.572191 tons/dunum
350 m^3/dun.	1.074475 tons/dunum
400 m^3/dun.	1.495725 tons/dunum
450 m^3/dun.	1.835940 tons/dunum
455 m^3/dun.	1.865505 tons/dunum
500 m^3/dun.	2.095122 tons/dunum
550 m^3/dun.	2.273270 tons/dunum
635 m^3/dun.	2.390148 tons/dunum
650 m^3/dun.	2.386463 tons/dunum
700 m^3/dun.	2.321509 tons/dunum
750 m^3/dun.	2.175521 tons/dunum
800 m^3/dun.	1.948498 tons/dunum
850 m^3/dun.	1.640442 tons/dunum

Source: Response curve plotted on Deir Alla 1986 research data.

AIII.2-7

Water Production Function

Jordan Valley Onion



AIII.2-8

Water Response Function-Potato
Jordan Valley 1987

Function: $y=2.2553 + .0109x-.000018349x^3$

y= yield (tons/dunum); x= water application(m^3/dunum)

Optimal Water: $-0.109/(2*-0.000018349)=297 m^3$/dunum

Actual Water: $327 m^3$/dunum (North Ghors Conv. Project,JVA, 1987)

Optimal Yield: $2.2553 + 0.0109(297)- 0.000018349*(297^2)=3.8$ tons/dun

Actual Yield: 3 tons/dunum (Dietz, JVA, 1987).

Excess Water: 10%

Curve:

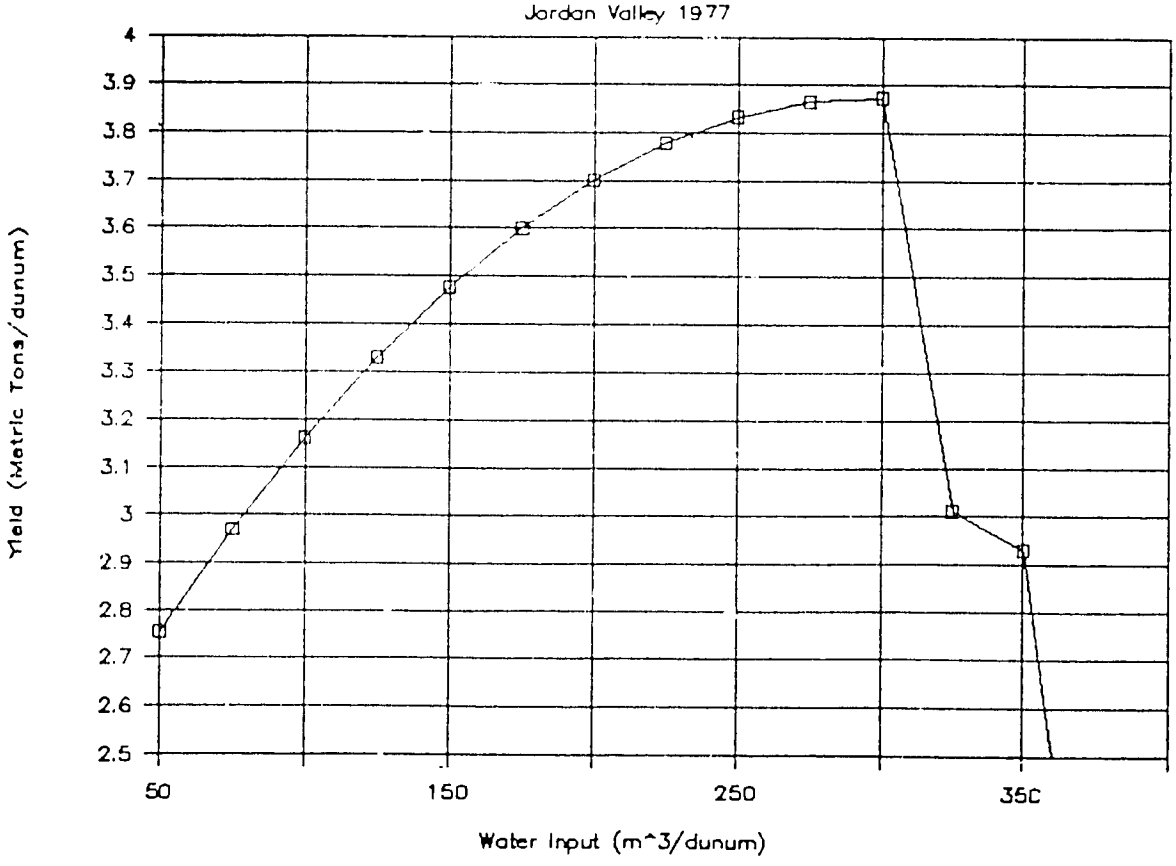
Water	Yield
50 m^3/dun.	2.75 tons/dunum
75 m^3/dun.	2.97 tons/dunum
100 m^3/dun.	3.16 tons/dunum
125 m^3/dun.	3.33 tons/dunum
150 m^3/dun.	3.48 tons/dunum
175 m^3/dun.	3.60 tons/dunum
200 m^3/dun.	3.70 tons/dunum
225 m^3/dun.	3.78 tons/dunum
250 m^3/dun.	3.83 tons/dunum
275 m^3/dun.	3.87 tons/dunum
300 m^3/dun.	3.87 tons/dunum
325 m^3/dun	3.01 tons/dunum
350 m^3/dun	2.93 tons/dunum
375 m^3/dun.	1.86 tons/dunum
400 m^3/dun.	1.72 tons/dunum

Source: Derived from water and crop response data provided

AIII.2-9

Potato Water Response Curve

Jordan Valley 1977



AIII.2-10

Fertilizer Response Curve
Jordan Valley Potato-Nitrogen

Level: (kg./dunum)	Output: (tons/dunum)
0	2.44
10	2.49
20	2.53
37	2.55
40	2.45
50	2.21
60	2.05
70	1.97
80	1.65
90	1.21
100	1.10
110	0.97
120	0.82
130	0.66
140	0.47
150	0.28
160	0.06

Model:

$y = 2.4354 + 0.0062x - 0.000084069\ x^2$

where:

y=yield in ton/dunum

x=nitrogen input kg/dunum

Actual: 50 kg./dunum (JVASP)

Optimal: 37 kg./dunum

Actual Yield: 2.21 tons/dunum (JVASP)

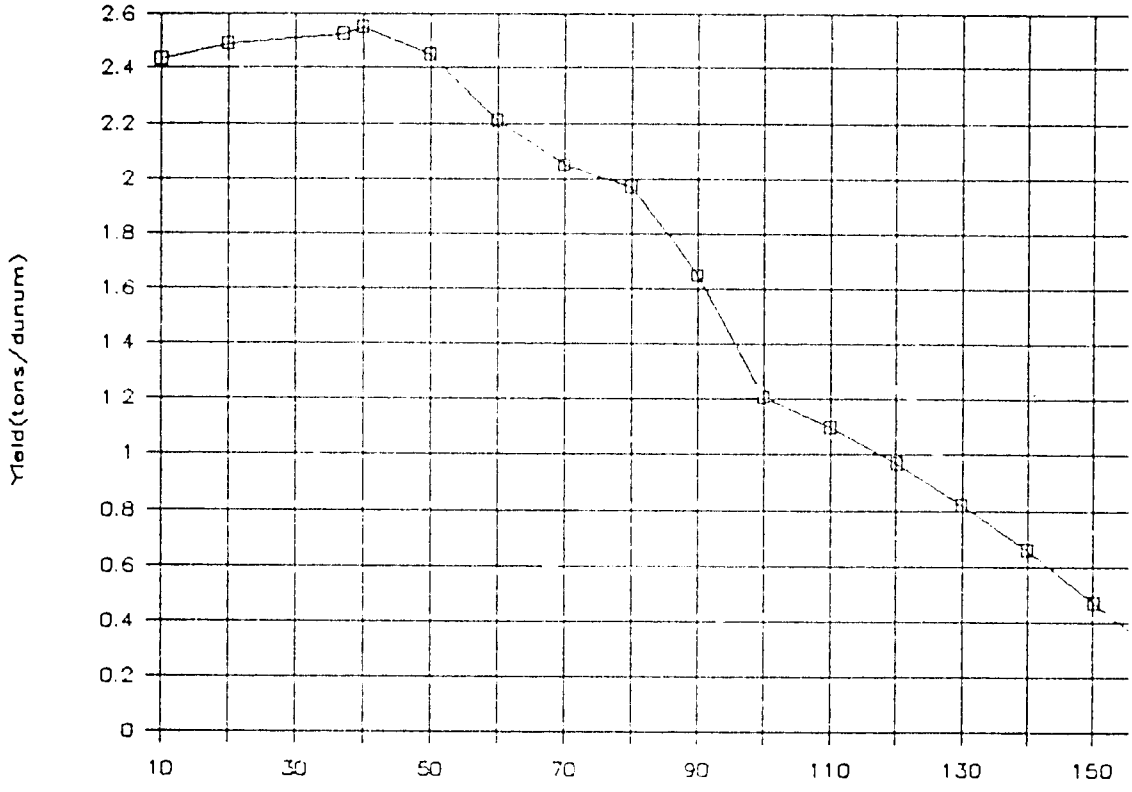
Optimal Yield: 2.55 tons/dunum

Source: Fitted to 1986 Deir Alla Research Station data.

AIII.2-11

Nitrogen Fertilizer Response Curve

Jordan Valley Potato



AIII.2-12

Fertilizer Response Curve
Jordan Valley Potato-Phosphate

Level: (kg.)	Output: (t./dun.)	Model:
0	1.92	$y=2.4407+0.000471749x-0.0000017377x^2$
31.3	2.25	
62.5	2.59	
125	2.97	where:
250	2.67	
500	1.95	y=yield in ton/dunum
750	1.59	
1000	1.23	
		x=nitrogen input kg/dunum

Optimal level: -(0.0000471749)/(2*(0.0000017377))=135.79kg/dunum

Actual: 150kg/dunum (JVASP)

Optimal yield: 2.47ton/dunum

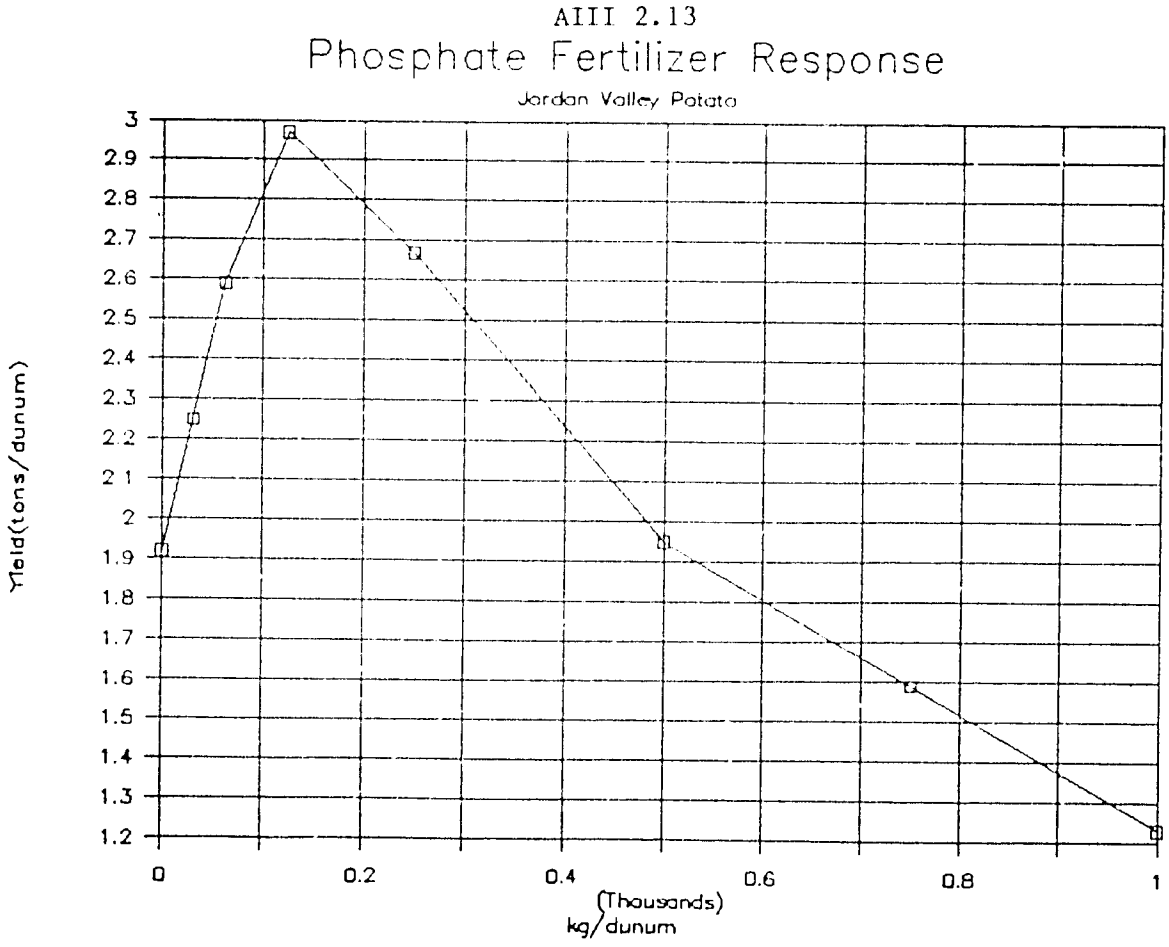
Actual: 2.2ton/dunum (JVASP)

Significance: 90%

Curve:

x-axis	y-axis
50	2.010
100	2.350
136	2.473
150	2.200
200	1.973
250	1.862
300	1.748
350	1.501
400	1.219
450	1.113
500	0.905
550	0.661
600	0.547
650	0.493
700	0.342
750	0.261
800	0.153
850	0.139
900	0.076
950	0.041
1000	0.017

AIII 2.13


Phosphate Fertilizer Response
Jordan Valley Potato
Yield(tons/dunum)
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
0
0.2
0.4
0.6
0.8
1
(Thousands)
kg/dunum

AIII.2-14

Fertilizer Response Curve
Jordan Valley Onion-Nitrogen

Level:	Output:	Model:
0	1.65	
10	1.81	$y=2.6542+0.0159x-0.000098821x^2$
20	2.21	
40	3.18	where:
80	3.29	
100	3.21	
120	2.78	
140	2.72	
160	2.69	y=yield in ton/dunum
		x=nitrogen input kg/dunum

Optimal level: -(0.0159)/(2*(-0.000098821))= 80.45kg/dunum

Actual: 20kg/dunum (JVASP, 1986 farm budegts)

Optimal yield: 3.29ton/dunum

Actual: 2.5ton/dunum (JVASP 1986 farm budgets)

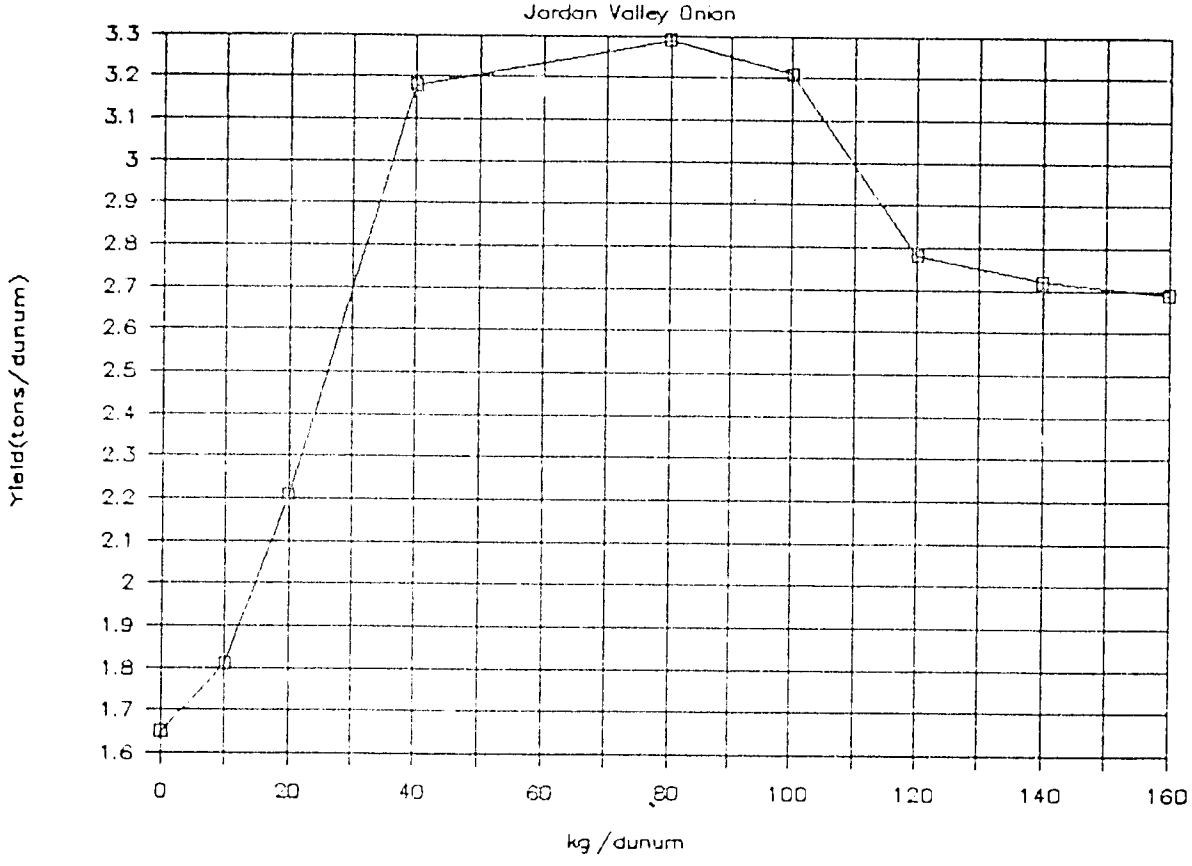
Significance: 95%

Source: Fitted to 1986 Deir Alla Research Station data.

AIII.2-15

Nitrtogen Response Curve

Jordan Valley Onion



ANNEX
DEMOGRAPHIC BACKGROUND
OUTLINE OF QUESTIONNAIRE

I. DEMOGRPAHIC BACKGROUND
Outline of Questionnaire

Visit / First Visit / Second Visit(if needed)

Date of Visit:

Village name and zone:

	Name	Birthdate/Age
1. Head of household:		
Wife(ves):		

2. Number of Children: _____

3. Names, sex and age of living children in descending order.

	Name of child	Sex	Age
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			

4. Number of children who have died

	Name	Sex	Age	Date of Death
1)				
2)				
3)				

5. Household members' martial status (single,married,divorced,widowed)

Order of family member/Martial Status/No. of Spouses/Age Status Occured

1) Father _____
2) Mother _____
3) Son _____
4) _____
5) _____
6) _____
7) _____
8) _____

6. Desired age at marriage for eligible 1)Daughters _____ 2)Sons _____
Patril. par cousin _____ Endogamous _____ Exogamous _____

7. Number of children under 15 years: _____

8. Age of household members above 65:

Name	Relationship to Head of Household
1)	
2)	
3)	

9. Do you desire more children? yes_____no_____how many_____preferred sex_____

10. Do you use any birth control?

II. HOUSING AND UTILITIES

11. Do you own or rent this home? 1) own_____2)rent_____

12. Total number of persons living in it right now?_____

13. Price paid or cost of building your house
    1) amount of total cash payment_____
    2) monthly mortgage rate_____
    3) inherited, no payment_____

14. Monthly rent _____ 15 Yearly tax _____

15. When did you move into this house? _____

16. Previous address _____

17. Ethnic background of head of household_____

18. Ethnic background of other residents of the village:

    1)same as you_____2)other_____(Specify)_____

19. Number of rooms _____

20. Size of house in square meters _____

21. Do you have the following? (List the number)
    1)Bedrooms_____2)Living Room_____3)Separate Bath_____
    4)Separate Kitchen_____5)Othter_____

22. Assets

1) Gas stove	2) Electric Stove	5) Washing machine
4) Refrigerator	5) T.V.	6) Telephone
7) Automobile	8) Other _____	

23. Monthly cost of gas bottle/s used _____

24. Monthly cost of electricity_____/_____

25. Drinking water:
1)private tap 2)common tap 3)tank 4)well
5)Spring 6)River/canal 7)Other

26. Do you plan on migrating to
1) another village 2) a big city 3)a foreign country/neighboring
Reasons_____

27. Do you think your children would like to leave the village to go to live in the city? Yes_____ No_____
Reasons_____

28. Do you want to settle in this village permanently? Yes_____ No ____
Reasons: 1) born in it 2) amongst your people 3) own your own house 4) don't like life in crowded city
5) other _____

29. Why would you like to settle somewhere else:
1) lack of vital services 2) lack of good or well paying jobs
3) lack of freedom/privacy 4) lack of entertainment
5) lack of pleasant social environment 6) Other_____

30. What do you really want most for yourself?
1) _____
2) _____

III. HEALTH

A. INFANT MORTALITY

31. Name and age of children you lost in the last seven years who were below the age of five.

	Name	Age at Death	Cause of Death
1)			
2)			
3)			

32. Which of the following is the most frequent cause of the death of your children? 1)Diarrhea-dehydration 2) pneumonia 3) measles
4) accidents 5) other _____

33. Who of the following gave the exact cause of death of your infants?
1) doctor at local clinic 2) Private doctor 3) Midwife
4) grandmother 5) neighbor 6) Other_____

34. Which of the following factors could have preventedthe death of your infants: 1) money for a private doctor 2) closer private doctor 3) closer health clinic 4) doctor at clinic when infant was brought there 5) immunization 6) dependable transportation 7) other _____

35. Distance in kms and time it takes to go to your nearest:
1) Health clinic _____/_____ 2) Hospital _____/_____
3) Private doctor _____/_____

36. Which transportation do you use most often to get health care?
1) Bus _2 Taxi _____ 3 Horse or Donkey _____
4) Walking _____ 5) Hitchhiking _____

37. Cost per visit: 1) Health clinic_____ 2) Hospital_____ 3) Private doctor_____

38. Cost and name of medicine prescribed for your infants for:

	Medication	Cost
1) diarrhea		
2) pneumonia		
3) measles		
4) colds		
5) other		

39. Which treatment do your prefer for yuor infants?
1) Home remedies_____ 2) Clinic_____ 3) Private doctor_____

40. When your children died, did you feel you had to replace
1) the sons 2) the daughters 3) both
Explain why_____

41. What do you think should be done to prevent infant mortality
1) by you: _____
2) by the authorities: _____

B. MORBIDITY

42. Frequency of sick days last month for family members:

1) under 5 years	M _____	F _____
2) between 6-14	M _____	F _____
3) between 15-20	M _____	F _____
4) adults	M _____	F _____

43. Has the frequency of illness gone up in the last five years?
Yes _____ No _____

44. What causes the rise in sickness? 1) lack of safe water 2) no pharmacy 3) ignorance of some mothers 4) other _____

Children under the age of five taken to health clinic

45. Males 1) whenever sick 2) never

46. Females 1) whenever sick 2) never

Adults visit the clinic

47. Males 1) whenever they are sick 2) never

48. Females 1) whenever sick 2) never

49. Is your family on the whole in good health? Yes _____ No _____
Why?
1)_____ 2)_____ 3)_____

50. Do you think your family eats a balanced diet? Yes _____ No _____
Why?
1)_____ 2)_____ 3)_____

IV. EDUCATION

51. Years of schooling for all family members:

Family member	Number of years	Last Class
1) head of household		
2) wife/s		
wife No. 2		
3) children in descending order		
a)		
b)		
c)		
d)		
e)		
f)		
g)		
h)		

52. How far do you want your children to continue after primary school:
Males 1) secondary 2) vocational 3) University
Females 1) secondary 2) vocational 3) University

53. Do you want yuor children to get agricultural training?
Yes_____ No_____

54. Distance of school from your home 1)primary school_____kms
2)preparatory school_____kms 3) secondary school_____kms
4)vocational training center_____kms 5)University_____kms

55. Time spent commuting to school hours/minutes
1) primary_____ 2) preparatory_____ 3)secondary_____
4) vocational training center _____ 5) University_____

56. Type and cost of transportation (per day/per person)
1) bus(public)_____ 2) taxi_____ 3) schoolbus_____

57. Other means of going to school for your children
1) walking 2) hitchhiking 3) Horse/donkeyriding 4) other_____

58. Monthly school fees per child
1) primary_____ 2) preparatory_____ 3) secondary_____
4) vocational training_____ 5) University_____

59. Is the education of your child worth this cost to you?
Yes_____ No_____

60. Why or why not?_____

61. What are your hopes for yuor children's future?
1) improve their income 2) imporve status 3) become professionals
4) have beautiful homes 5) other _____

62. What are your aspirations in life? _____
_____
_____

V. LABOR AND EMPLOYMENT

63. Numbr of household members in the labor force: M_____ F_____

64. Type of employment for males:
1) farm 2) public sector 3) private sector 4) self-employed

65. Type of employment for females:
1) farm 2) public sector 3) private sector 4) self-employed

66. JOB INFO: Age began/ type of job / location / wages / duration
1) husband_____
2) wife no. 1_____
3) wife no. 2_____
4) daughter: a_____
b_____
c_____
5) sons a_____
b_____
c_____

67. Training obtained for the job 1)husband_____
2)wife no. 1_____ 3)wife no. 2_____
4)daughters a.)_____ b.)_____
c.)_____ 5) sons a.)_____
b.)_____ c.)_____

68. Is it easier to find jobs now than it was five years ago?
Males Yes_____ No_____ Females Yes_____ No_____

69. Are you satisfied with your work? Yes_____ No_____
Why or why not? _____

70. Do you wish to migrate so as to get a better job? Yes_____ No_____

71. Where would you like to migrate in search of a better job?
1)big urban center in Jordan 2) neighborhing country_____

72. If you employ laborers, which do your prefer and at what daily rate?
1) Pakistanis_____ 2) Egyptians_____
2) Indians_____ 4) Jordanians_____

73. Reasons for your preference_____

74. What does the future hold for you?_____

VI. OPINIONS, ATTITUDES AND ASPIRATIONS

75 In your opinion, has there been improvement/progress in the following

Type of Service	Degree of Improvement much / little / none
1) agricultural	
2) industrial	
3) commercial	
4) housing	
5) health	
6) education	
7) roads	
8) socio/cultural	
9) rural/municipal	
10) women's	
11) water	

76. Which of the following hurts you? Yes No
1) lack of cooperation amongst citizens
2) landowner exploitation of sharecroppers
3) lack of sufficient irrigation water
4) my opinions/suggestions not called for
5) difficulty ni obtaining advice
6) insufficient income

77 To whom do you voice yuor complaints
1) to the rural council 2) municipal council 3) JVA 4) Court
5) Other/s_____

78. Which of the following services are lacking/unsatisfactory?
1) Housing 2) Health, childcare, family planning 3) education
4) family counselling and uspport 5) job opportunities
6) entertainment/recreation/cultural services 7) other_____

79. What constrains your success in life?

1)_____
2)_____
3)_____

80. If your opinion, projects executed by the councils are based on
1) villagers/peoples suggestions 2) council members suggestions
3) Government instructions 4) _____

81. Do you know the following?

	Yes	No
1) dates and times of municipal/rural council meetings		
2) last decision made by council		
3) village organization responsible for social development planning		

82. In your opinion, people in your community:

	True	False
1) rarely read the newspaper		
2) are well informed about what takes place		
3) can afford to buy more essential goods now than they could five years ago		
4) can find all they need locally		
5) are healthier than they were ten years ago		
6) are happier than they were ten years ago		

83. Do you take part in the following?

	High degree	Low degree
1) defining local problems		
2) defining priorities for projects that touch you		
3) offering suggestions to the authorities		
4) participating in the execution of local plans and projects		

84. What important changes would you like to make which would make you and your family more happy?

_____
_____
_____
_____

85. Has there been any noticeable improvement in your life in recent years? Yes_____ No_____List the top two areas of progress made
1)_____ 2)_____

86. What plans do you have for the future?

_____
_____

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REPORT DEBRIEFING

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A formal debriefing on the Jordan Valley impact assessment report made on April 4, 1988. The following officials attended the riefing session at the Jordan Valley Authority:

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2. H.E. Dr. Mohamed Beni Hani, President, JVA.
3. Jim Dempsey, Chief Project Development Officer, USAID.
4. Fuad Qushair, ARDO/USAID.
5. Randall Cummings, Chief, USAID/Agriculture & Rural Development.
6. Peter Ohlmeyer, Advisor to the JVA.
7. Steven Shepley, Chief of Party, Jordan Valley Impact Assessment.
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