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Agricultural development policy in Jordan with full utilization of resources

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by

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I. INTRODUCTION

A. Economic Development Theories

Many economists have been interested in economic development. Most of the world consists of underdeveloped countries, that is, countries with low per capita income relative to the most advanced countries.

The agricultural sector in most underdeveloped countries is traditional; the farmers still use the factors of production that have been used for a long time. The importance of agricultural development in the overall process of economic development is given by Schultz.

> But there are no basic reasons why the agricultural sector of any country cannot contribute substantially to economic growth. True, agriculture using only traditional factors cannot do it, but modernized agriculture is capable of making a large contribution. There is no longer any room for doubt whether agriculture can be a powerful engine of growth. But in acquiring such an engine it is necessary to invest in agriculture, and this is not simple because so much depends on the form the investment takes (17, p. 5).

In a study on the roles of agriculture in the transitional process between a traditional society and a successful take-off, Rostow (15, p. 22) found out that there are three major roles for agriculture. First, agriculture must supply more food. More food is needed to meet rising consumption. Agricultural products are needed to balance foreign payment — either positively by earning foreign exchange or negatively by minimizing the foreign exchange for food. Second, rising real incomes in agriculture, through increased productivity, can be an important market and stimulus to new industrial sectors. And third, agriculture must yield up a substantial part of its savings to be

invested in the modern sector. From his study, Rostow concluded that "Agriculture must supply expanded food, expanded markets, and an expanded supply of loanable funds to the modern sectors" (15, p. 24).

In a study on the interactions between the modern sector of the economy and the traditional sector in the developing countries, Higgins emphasized developing both the industrial and the agricultural sectors as follows:

> Moving large numbers of people from rural to urban occupation requires an increase in the supply of foodstuffs and agricultural raw materials to the industrial, urban sector. If these increased requirements for food and agricultural raw materials are not met by increased domestic production, they must be met by imports, increasing the burden on the industrial sector. Any country that ignores agricultural improvement in the course of economic development does so at its peril, as one socialist country after another has learned. In short, industrialization and agricultural improvement are not alternative roads to economic development, but are completely complementary" (7, p. 326).

All theories of economic development emphasize the need for capital in the process of development. An important difference between agriculture in developed and developing countries is the availability of capital. Capital increases both the productivity and income.

Capital is needed in the industrial sector to increase the employment according to the labor surplus theory by Fei and Rains, as shown in Higgins (7). In Fei and Rains' theory, there are two sectors, the traditional sector and the modern sector. Transformation of the traditional sector into a commercial one requires capital in the commercial sector and a transfer of surplus agricultural labor to the industrial sector. This transformation is important because labor is redundant in the agricultural sector and there are some number of workers in this sector with

zero marginal productivity and they can transfer without a fall in agricultural output. Therefore, the priority for capital is to increase the employment in the industrial sector; then labor can shift from the traditional to the modern sector.

However, there is disagreement with regard to zero marginal productivity of labor in the agricultural sector in developing countries. It is worth quoting Schultz on this theory in India.

> The conclusion with respect to the doctrine that a part of the labor working in agriculture in poor countries has a marginal productivity of zero is that it is a false doctrine. It has roots that make it suspect. It rests on shaky theoretical presumptions. It fails to win any support when put to a critical test in analyzing effects upon agricultural production of the deaths in the agricultural labor force caused by the influenza epidemic of 1918-19 in India (17, p. 70).

It seems that capital is needed in the agricultural sector to increase output and to achieve fuller employment of land and labor available. Capital accumulation is needed for irrigation systems, use of fertilizers and better seeds, land reclamation and roads. Two forms of capital are needed in the agricultural sector. The first one is social overhead capital in the form of roads, dams, irrigation systems and skills. And the second capital is in the form of material inputs such as improved seeds and fertilizers.

In all theories of economic development, capital accumulation and technological progress are both complementary. To introduce technological improvement requires investment. Technological improvement is not possible without investment. Capital accumulation is possible but difficult without technological progress.

In emphasizing the role of capital in the transformation of the

traditional agriculture in developing countries, Schultz (17, p. 89) raised an important point which has been ignored by some economists. Schultz maintains that although this transformation is dependent upon investment in agriculture, it is the form of investment that is most important. Schultz's hypothesis is that the price of additional income streams from agriculture is relatively low and implies that the rate of return to capital is high if traditional factors are replaced by new factors. He labeled the new factors of production that are required to this transformation as "technological change". Schultz (17, p. 103) points out that two types of investment are needed in order to make the new factors available and acceptable to farmers. Investment to produce a supply of new agricultural factors that will be profitable for farmers and investment to improve the capabilities of farmers to use such factors.

Schultz (17, p. 108) found out that supply and demand for the factors of production in the traditional agriculture are in quilibrium. If this equilibrium is disturbed through supplying one or more nontraditional factors of production, there will be a great opportunity for growth in the agricultural sector in the developing countries. With regard to the suppliers and the demanders of new, profitable factors, Schultz concludes:

> The demanders in this case are the farmers in the traditional agriculture. The suppliers are those persons (firms for profit and also nonprifit agencies) who discover, develop, produce, distribute, and thus make available to the demanders the new set of factors of production. What these suppliers do is obviously a production activity whether it entails discovering, developing or producing factors that have been developed,

> or distributing such factors. But it is not so obvious that what the demanders do can also be treated as a production activity based on inputs that entail costs and render returns. The demanders may search for information about these new factors, and the process of searching can straightway be treated in a costs and returns frame of reference. The demanders also learn how best to use such factors which is, however, as a rule less direct than that which is implied by a "search for information". More important is the investment in human beings, through schooling and instruction" (17, p. 144).

Developed countries and international agencies are important in supplying the developing countries with the needed capita. Much technology and many investment funds are available in the developed countries. In addition, capital is needed at the farm level; farmers in the developing countries have such low income in agriculture that they are unable to save enough to invest. Farm credit is very important for economic development. Credit prevents capital from being a restraint. The agricultural bank can meet the farmers' need for credit.

B. Jordan's Natural Resources

Jordan is a small country; it has an area of about 90,000 square kilometers of which 85 percent is desert. Rainfall average is 150 mm per year but varies from year to year, area to area, and falls only during the winter months.

The most important economic problems which are faced in Jordan are: (1) low income per capita, (2) heavy dependence upon the foreign aid, (3) difficulties of balance of trade, and (4) unemployment problem.

Jordan is made up of five regions: western uplands, eastern uplands, southeastern uplands, Ghor area, and the desert. All cultivated land in the first three regions is classified as a dry land area,

which is defined as those nonirrigated areas which receive an average rainfall of 250 mm or more. The dry land farming is about 90 percent of the cultivated land and produces about 65 percent of the country's agricultural product.

Apart from the desert, the soils are a complex of terra rossa and rendzina. Temperatures are too high in the summer months — reaching 38°C — and the summer is rainless. In winter the temperature may drop below freezing.

The irrigated area is estimated at about 40,000 hectares and constitutes only 10 percent of the cultivated area. Water resources in the irrigated land comes from Jordan Valley, run-off water and ground water. Water resources in the dry land comes from water which falls in the form of rainfall. In 1969 about 44 percent of the population was considered urban, 50 percent rural, and 6 percent nomadic.

Jordan has a limited supply of natural resources. Climate, topography and the scarcity of water limit the cultivated area to 25 percent of the total area. In addition to that, the agricultural resources are not fully utilized since the cultivated land is characterized by low productivity and occupied by high population. The dry land farming suffered from soil erosion because of the run-off. Modern methods of production are unusual and uncontrolled grazing are common. And if these problems were to be solved, the agricultural output estimated to increase two-fold or three-fold. In addition, it is found that to overcome the above obstacles the Government of Jordan should solve the problems of land ownership and land fragmentation. In the irrigated

land where the production of out-of-season vegetables is possible, it is found that the Middle East market for such vegetables does not fully exploit the advantage of climate because an oversurplus had occurred.

C. Objectives of the Study

This study will deal with the development of the agricultural sector in Jordan by using more capital and new forms of capital in this sector with the existing natural resources. Examples of the capital to be studied are listed below.

1. Development through application of Mexican wheat

Capital to be used in this case is a form of improved seed and fertilizer for wheat production.

In Chapter II will be presented information about Mexican wheat and an evaluation of those varieties to be used in Jordan with the existing natural resources.

2. Development through land reform in the dry land

Capital is needed in this case is in a form of compensation to the farmer and in a form of payment to the administration. Also, capital is needed after land reform takes place, because efforts to increase efficiency must be applied after land reform takes place.

Chapter III will discuss the disadvantage of present land tenure structures under the existing methods of production and the new methods, and how agricultural outputs could be increased by new innovations.

3. Development through expansion of out-of-season vegetables production for export

Capital is needed in this case in a form of new seeds, investment in human resources, disease control, and improvement in the marketing system.

Chapter IV will discuss the possibilities of out-of-season vegetables production, the economic opportunities for this production, and the market in the Arab and European countries.

II. THE CONTRIBUTION OF NEW TECHNIQUES AND MEXICAN WHEAT IN JORDAN TO AGRICULTURAL DEVELOPMENT

Technological progress can be defined as improvement in the techniques of production. This progress can be made by producing the same output with less inputs, or by producing more output with the same amounts of input. Furthermore, this progress can be attained through introduction of new technology, such as utilizing new seeds and fertilizers. Progress also can be made through improvement in the existing inputs, such as improvement in the water supply or in the human resources.

Technological improvement through the introduction of new improved factors to replace an old one will cause an upward shift in the production function. This source of new production is shown in Figure 1.

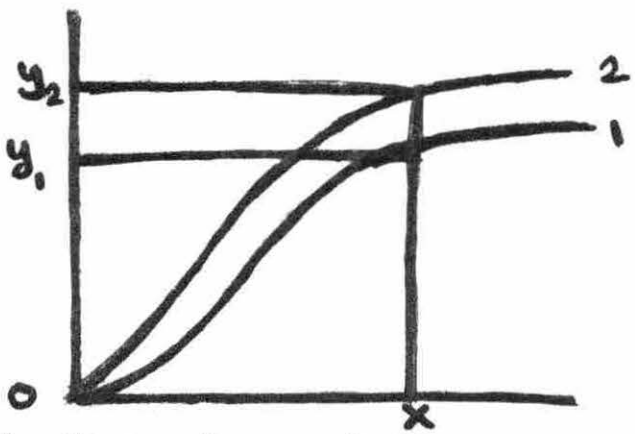

Figure 1. Source of new production

Production function 2 represents technological advancement as compared to 1, since with an input of resources ox, output is oy_2 and oy_1, respectively.

Jordan's agricultural sector today is a mixture of traditional and modern technology. A few of the farmers use machines, fertilizers, pesticides and improved seed, but the majority are still using unimproved seed and animals for several purposes.

Transformation from traditional agriculture to the modern sector requires a package of improved inputs, which can be summarized by improvements in

1. human resources,
2. plants and animals,
3. weed control,
4. disease control,
5. soil fertility,
6. water supply,
7. crop rotation, and
8. mechanization.

This chapter will cover the adoption of new varieties of Mexican wheat and new fertilizer in Jordan.

A. Adopting the Technology of the New Varieties of Mexican Wheat and New Fertilizer in the Kingdom of Jordan

Wheat is one of the most important crops in the Kingdom of Jordan, not only for its value in terms of money, but also as the main food of the people. Wheat production in Jordan depends heavily on the rainfall conditions. Of a total area of 640,000 hectares (one hectare = 2.47 acres), approximately 235,000 hectares receive sufficient rainfall to be cultivated in wheat. While more than one-third of the cultivated land

is planted in wheat, this crop is suffering from two major problems:

1. low yield per unit, and
2. variation in the yield from year to year.

1. Low yield per unit

The yield of wheat in Jordan is very low compared to other countries in the world. This is shown in Table 1.

Table 1. Estimates of yield per dunum of wheat during 1964-1970[a]

Year	1970	1969	1968	1967	1966	1965	1964
Yield (units in kilograms)	27.2	91.6	34.5	86.7	35.6	99.7	99.3

[a]Source: (9, p. 147).

The average yield in the state of Washington in the United States with annual precipitation of 350 mm is about 270-340 kilograms per donum (1, p. 173). When compared with this, the yield of wheat in Jordan is one-third. To obtain higher yields will necessitate the introduction of modern techniques for wheat production.

2. Variation in yield from year to year

The yield variation from year to year in Jordan is due to changes in the amount of rainfall received and is shown in Table 2.

From this table, it can be seen that there are variations between years in the yield due to variations in weather. Also, there are

Table 2. Division of area for wheat production[a]

Type of land	Area (Ha)	Yield in good weather (tons/Ha)	Yield in bad weather (tons/Ha)
Irrigated area	15,000	1.00	1.00
Unirrigated area on the East Bank			
Receives more than 500 mm	70,000	1.15	0.80
Receives between 350-450 mm	40,000	0.95	0.50
Receives between 200-350 mm	30,000	0.60	0.20
Receives less than 200 mm	40,000	0.40	0.00
Unirrigated area on the West Bank[b]			

[a]Source: (9, p. 130).

[b]The estimated area is about 40,000 hectares.

variations in the areas which are planted in wheat according to the amount of rainfall received. In addition, land which is characterized by low productivity is pushed into wheat production in order to meet the rise in demand for wheat as a result of an increase in population.

Jordan, like other countries, has become overpopulated. The government is interested in improving and increasing the production of wheat so as to make themselves self-sufficient. Wheat production can be increased by improving varieties and adopting modern methods of production. Unfortunately, the farmer in the Kingdom of Jordan is still planting inimproved wheat varieties which have no response to fertilizer.

Progress in increasing wheat production has been made in Mexico by developing new varieties. Mexican varieties have high yield, respond to

fertilizer, and mature early. These high yield varieties have been tested in India and Pakistan, where these countries have a climate similar to Jordan's. The result of testing these varieties in India and Pakistan is high yield per unit of land. For instance, the Mexican wheat in India yielded about 5,000-8,000 kilograms per hectare, while the best Indian variety gives only 1,500 kilograms per hectare (28, pp. 199-223).

Recommendations with regard to wheat production in the Kingdom of Jordan were given by several groups of foreign advisors who worked in agriculture. These recommendations can be summarized by the following:

> New varieties applied to Jordanian climate, using more fertilizer, planting wheat only in the areas which have enough rainfall — this will help to increase the production of wheat (1, pp. 133-134).

The conclusion is that rapid increase in wheat production in Jordan and in the other countries in the Middle East can be achieved through introduction of high yielding Mexican wheat; in fact, these varieties have already succeeded in India and Pakistan.

The following points should be added to the above conclusion.

1. Introduction of Mexican wheat varieties in Jordan is a fast way to improve the production of wheat; by contrast, the breeding in Jordan of new wheat varieties would need 15-25 years.
2. Demonstrations should be made in Jordan to test these varieties. These demonstrations will remove the skeptical response of farmers and government officials.
3. Success in the use of Mexican wheat depends upon the use

of fertilizers. Mexican varieties have a high degree of response to fertilizer. The importance of using fertilizer with Mexican varieties leads to the analysis of the economic use of fertilizer. Data used in this study are taken from India.

B. Economical Use of Fertilizer per Unit of Land for Mexican Wheat in Jordan

The determination of optimal use of fertilizer depends upon physical and economic data. Data and information can be obtained, if not available, from other countries that have similar situations. Production function for nitrogen and prices of wheat and nitrogen are needed to determine the economical use of it. In Jordan the information about the production function of nitrogen on Mexican wheat is not available. However, such information about this production function is taken from India.

The following equation (6, p. 1077) represents the relationship between the yield in kilograms per hectare and nitrogen in kilograms per hectare.

$$S6_4: \qquad Y = 1929 + 47.1N - 0.145N^2$$

where

$S6_4$ is Sonora (Mexican wheat),

Y is a yield in kilograms per hectare, and

N is nitrogen in kilograms per hectare.

The task of the above production function is to determine the

optimal use of nitrogen by using the following principles.

Suppose the production function is

$$Y = a + bN - cN^2$$

where

Y is yield per unit hectare,

N is nitrogen per unit hectare, and

a, b, c are constant.

$$Mp_n = \alpha Y/\alpha N = b - 2cN$$

where Mp_n is the marginal productivity of nitrogen, which is defined as the addition to total yield, attributed to the addition of one unit of the nitrogen to the production process.

Maximum profit is the objective of the farmers, and this maximum profit is attained when

$$MP_n = \alpha Y/\alpha N = Pn/Py$$

where

P_n is the price of nitrogen per kg, and

P_y is the price of wheat per kg.

So maximum profit can be obtained by taking the derivative of the production function with respect to N ($\alpha Y/\alpha N$) and setting it equal to the price ratio (Pn/Py).

$$Y = \alpha Y/\alpha N = 47.1 - .29N$$

Price per kg of nitrogen = 124.85 fils.

The average wholesale price of wheat in Jordan from 1961 to 1967 was 36 fils per kilogram and the farmers sold their wheat at 32 fils per kilogram.

$$\text{Price ratio} = Pn/Py = 124.85/32$$

$$= 3.9$$

$$\text{Maximum profit attained when } Y/N = Pn/Py = 47.1 - .29N$$

$$= 3.9$$

$$N = 150 \text{ kg nitrogen per hectare}$$

So the optimum amount of nitrogen which will maximize the profit for the farmers is 150 kg nitrogen per hectare.

1. Yield per hectare

The yield per hectare can be computed by substituting the optimal amount of nitrogen in the production function as follows:

$$Y = 1929 + 47.1N - 0.145N^2$$

where

N = 150/kg nitrogen/hectare and is defined as the optimal amount of nitrogen.

$$Y = 1929 + (47.1)X150 - 0.145X(150)^2$$

$$= 1929 + 7065 - 3262$$

$$= 5727 \text{ kg per hectare}$$

$$= 5.7 \text{ tons per hectare.}$$

The above yield of 5.7 tons per hectare can be obtained if:

1. The farmer will maximize profit. Given the production function of nitrogen and the prices of wheat and nitrogen, the farmer will maximize profit by using 150 kg nitrogen per hectare.
2. The moisture is adequate for wheat production. In general, wheat yield varies among the fields and years depending upon the method of production, the resources, and the climate.

The introduction of this new technique (new variety and heavy use of nitrogen) requires careful study of the national effects before it is undertaken.

C. National Effects of Using This New Technique

The development of wheat production by this new technique will have direct and indirect effects. Some of the gains will be attained in the short run and the others in the long run, because the number of farmers who adopt this technique will gradually increase.

The gains in the short run are reduction in the wheat import and self-sufficiency; while in the long run the gains are double cropping, less land used in wheat production and lower prices to the consumer.

The farmers, the consumers and the public sector will share the gains. This share is very important because the significance of agricultural development, as represented by the development theories, is not only to the farmers, but also to the economy as a whole. The farmers can benefit from wheat production by this new technique, since they can

increase their return. Increased income and improved conditions for producers is one objective in developing the agricultural sector. The consumers can benefit from improving wheat production because, as the supply of wheat increases, the result is lower prices to consumers. Increasing the supply and reducing the price of food other than wheat may be possible as a result of adopting the new technology. Wheat production improvement in Jordan includes the following benefits to the public sector.

1. Self-sufficiency – this is important because wheat is the main food of the people in Jordan, it must be imported, and the result would be a reduction of dependency on foreign exchange.
2. The employment situation will be improved; more economic stability will result with a reduction in riots.
3. It will not be necessary to put as much land to wheat since greater production could be achieved from less land with the new technology.

The following discussion will deal with the direct and indirect effects on Jordan from this new technique.

1. Direct effects

The following questions have to be answered in order to see and examine the direct effects from this new technique.

1. How much land in Jordan can produce wheat from Mexican varieties?
2. How high is the production of these areas?

3. How much total fertilizer is needed?

2. How much land in Jordan can produce wheat from Mexican varieties?

In Jordan the key to answering this question is to divide the present wheat area according to the rainfall. This division is important because water supply is the prerequisite for determining the applicability of Mexican wheat. This division is also important to exclude from consideration for Mexican wheat production the low productivity lands, because these lands were pushed into wheat production to meet the increase in the demand for food. This division is as follows:

A - areas receiving from 550 mm to 1000 mm

B - areas receiving from 350 mm to 500 mm

C - areas receiving less than 350 mm

a. Area A This is the highest rainfall area of the West Bank and the East Bank of Jordan. These areas are the most suitable for Mexican wheat after the irrigation land. These uplands are found in Jenin, Nablas, Tulkarm, and Ramallah in the West, and Irbid, Balga, Suwelieh, and Shubake in the East. The present area of wheat in this highest rainfall area is 55,000 hectares.

b. Area B These areas are suitable for the new varieties, but there is variation in the yield from year to year according to the level of rainfall. The present area of wheat in this rainfall area is 85,000 hectares. This area is found in Hebron, Bethlehem, Amman, Salt and Jarash. The estimated yield from Mexican wheat and fertilizer in this area in a wet year is 4.0 tons and in a dry year 2.0 tons, so the mean

for the yield in this area is 3.0 tons.

c. Area C Most of these areas are not suitable for Mexican wheat. The present area is about 80,000 hectares. These low rainfall areas are found in Tafila, Karak, Madaba, Rusuifa and Maan.

In summary, the lands which produce wheat at the present time are as follows:

1.	Irrigated land	15,000 hectares
2.	Highest rainfall	55,000 hectares
3.	Medium rainfall	85,000 hectares
4.	Low rainfall	80,000 hectares
5.	Total	235,000 hectares

The first, second and third areas are the most suitable for Mexican wheat.

3. How high is the production of these areas?

Now Jordan is a wheat importer, so much attention is placed on reaching self-sufficiency. The following analysis is to examine the relationship between the production of wheat from the suitable areas and the needs of the country for wheat in the long run.

In the irrigated area and in the highest rainfall area, the yield is 5.7 tons per hectare and the total area is 70,000 hectares. Therefore, production from these areas = yield per hectare × total area

= 5.7 × 70,000

= 399,000 tons.

In the medium rainfall, the mean yield is 3.0 tons and the total area is 80,000 hectares. Therefore, production from these areas

= mean yield per hectare × total area

= 3.0 × 85,000

= 255,000 tons.

Total production from total area

= 255,000 + 399,000

= 654,000 tons.

Table 3 summarizes the previous analysis and shows the difference between present wheat production and potential wheat production.

Table 3. Present and potential wheat production in Jordan

Present wheat production		Potential wheat production		Wheat[a] required in 1985
Area (hectares)	Production (tons)	Area (hectares)	Production (tons)	
2235,000	188,000	155,000	654,000	666,000

[a]Source: (20, p. 190).

This table shows that there are great differences between the future and present situations. These differences are due to (1) new seed, (2) heavy application of nitrogen, and (3) using only the land which is productive. The differences are:

1. differences in production, and
2. differences in wheat area.

a. Differences in production Wheat production would increase

by this new technique more than threefold. Total production from 155,000 hectares will meet the requirements until 1985.

b. Differences in areas About 80,000 hectares will be released from wheat production and they could be used for other agricultural crops. This will be discussed later.

4. How much total fertilizer is needed?

It is important to compute the total nitrogen needed since Jordan will have to import its nitrogen. In addition, the high quantities of nitrogen needed every year for wheat production will necessitate better storage facilities for the nitrogen. The total cost of importing nitrogen must be known in order to examine how much the balance of payments will improve.

Total wheat area = 155,000 hectares

Amount of nitrogen per hectare = 150 kg per hectare

Price of nitrogen per ton = 125 J D

Total amount of fertilizer needed = total wheat area X amount of nitrogen per hectare

= 155,000 X 150

= 23,250,000

= 23,250 tons

Total cost = price of nitrogen per ton X total amount of nitrogen

= 23,250 X 125

= 2,906,200 J D

In summary, the nitrogen requirements and cost per year of wheat development potential are:

Nitrogen per hectare = 150 kg per hectare

Total amount of nitrogen = 23,250 tons

Total cost = 2,906,200 J D

D. Farmer Family Annual Income and Wheat Production Improvement

Table 4 shows the difference between the present and estimated gross return per dunum, total cost per dunum and net return per dunum.

Table 4. Present and estimated wheat production in Jordan

	Present wheat production (per dunum)	Estimated wheat production (per dunum)
Gross return	5.95 J D	18.24 J D
Total cost	2.445 J D	4.54 J D
Net return	3.475 J D	13.79 J D

Present wheat production is taken from Report No. 2884 by the F.A.O. in 1970, page 45. The yield is 160 kg per dunum and is obtained by using local varieties and only 3 kg nitrogen per dunum. The estimated yield projected by using Mexican wheat and 15 kg nitrogen per dunum is 570 kg per dunum.

The difference between present and future gross returns is due to the increase in yield from 160 to 570 kg per dunum. A higher yield could be obtained by using Mexican wheat and a high quantity of nitrogen.

Estimated gross return = 570 x 0.032

= 18.24 J D

The difference between present and estimated costs is due to the

1. increased use of nitrogen,
2. increased cost of harvesting, and
3. increased cost of labor for spreading the nitrogen.

The increase in the use of nitrogen from 3 to 15 kg per dunum will increase the total cost by 1500 fils per dunum. The present total cost of nitrogen is 315 fils. This shift to using a high quantity of nitrogen is necessary because local varieties have no response to fertilizer while the Mexican variety of wheat does respond to fertilizer. The present cost and estimated cost for harvesting and labor for spreading the nitrogen are 600 and 1200 fils, respectively.

Net farmer income will increase fourfold if Mexican wheat and 15 kg nitrogen per dunum are used. Assuming that the farmer uses five dunums of his land in wheat production, the present income, future net income and the increase in net income from wheat production are 17.37, 69.0 and 51.5, respectively. Assuming the farm family consists of six persons, the per capita increase in income is 8.6 J D.

The projection which is made for 1985 for the increase in per capita agricultural income is 16.1 J D (20, p. 12). The contribution of improved wheat production, therefore, is highly significant since it will contribute about 50 percent of the increase in income per capita.

In summary, the results of introducing this new technique in Jordan are:

1. increase in the supply of wheat,
2. increase in the yield of wheat, and
3. decrease in the present wheat area.

There are both negative and positive effects. The negative effects are using less land in the wheat production, using fewer men, and using more fertilizer. The positive effects are no more need to import wheat, reduction in the price of wheat to consumers, and increase in return to the farmer.

1. Indirect effects

Improvement in wheat production has the following side effects:

1. release of land from wheat production,
2. double cropping,
3. help for the balance of payments, and
4. improvement of the employment situation.

a. Release of land from wheat production In economic theories, fertilizer is considered as a substitute input for land. The released land could be used in the agricultural sector or any other sector. In Jordan, as in most underdeveloped countries, this released land will still remain in the agricultural sector because this sector still does not provide quantities of the most important foods needed for all the people.

By introducing this new technique, approximately 80,000 hectares of land will be released from wheat production. About 40,000 hectares could be planted in vegetables, fruits and other grains. The remaining 40,000 hectares are suitable for grass. Thus, the released land would

make it possible to increase output of other crops which Jordan is now importing. Planting the low productivity land in grasses would make it possible to improve the livestock production.

If these areas produced legumes such as lentils (and the value of lentils is 0.820 J D per dunum), then the value of production on these 80,000 hectares = 0.820 x 80,000

= 606,000 J D

and the value of lentils which is 0.820 J D per dunum is computed as follows:

$$38 \times 21.6 = 0.820 \text{ J D}$$

where 38 and 21.6 are the average prices and the average yields from 1961 to 1966 from the Statistical Yearbook 1966.

b. Double cropping Double cropping is possible with the new technique because these varieties have a shorter growing period than the traditional varieties. The new practice of double cropping will increase the return per unit and improve the employment situation. The return per unit will increase because of the increase in the percentage of crops per hectare per year. The employment situation also will improve because of the increase in the rate of employment and the decrease in the rate of underemployment.

The possibility for double cropping is only on the 15,000 hectares which is represented as the present wheat irrigation area. Of course, not all of the farmers will practice double cropping. The local variety is harvested in Jordan Valley in May and June, while the Mexican wheat

could be harvested in March. The time left from March to April is suitable for summer crops, such as watermelon.

Under the assumption that the owner gives his land to a cash tenant only for the second crop, rents the hectare by 10 J D, and that about 10,000 hectares practice double cropping, then the gain for the farmers from this new practice will equal 10 x 10,000 or 100,000 J D.

c. Help for the balance of payments Agricultural development as represented by the development theory is going to help the balance of payments by increasing the exports and/or reducing the imports.

Wheat required in 1985	= 654,000 tons
Present supply of wheat	= 188,000 tons
Difference between wheat required and supply	= 466,000 tons

In the long run, the improvement of wheat production will cut the amount imported to meet the demand for wheat by the consumers. This amount is equal to 466,000 tons and the value is equal to 14,912,000 J D. On the other hand, this new technique will require that the necessary nitrogen be imported, and the value of this amount is equal to 2,906,200 J D. The balance of payments will improve by the difference between the value of imported wheat if there are no improvements and the value of nitrogen if there are improvements.

Improvement in balance of payments = 14,912,000 - 2,906,200

= 2,005,800 J D.

Projections for 1985 to the GNP agricultural and nonagricultural

sectors, GNP only agricultural, and the imported commodities are 560,000,000 J D, 47,250,000 J D and 126,000,000 J D, respectively. Therefore, the contribution of improvement in wheat production will be

1. an increase in the GNP agricultural and nonagricultural sectors of 2.5%,
2. an increase in GNP agricultural only of 25%, and
3. a reduction of the imported commodities of 10%.

d. Improvement in the employment situation By introducing this new technique, employment opportunities can be increased with the possibility of double cropping. In addition, more labor is needed to increase the fertilizer application and to harvest the higher quantities of grain.

In the rainfall area where only one crop a year is common, the harvesting can be done in the traditional way. The time for harvesting will increase because of the high yield obtained. The result is a decrease in the percentage of underemployment.

In the irrigated areas where the land is assured of growing more than one crop, the harvesting should be done by machines because any delay in soil preparation is lost time for growing the second crop. The present and future rotation per year is wheat followed by vegetables. The new rotation will require more labor than the old one. Therefore, the percentage of employment will increase.

2. Requirements for the contribution

Capital and demonstration are needed to utilize this new technology effectively.

a. Capital Agricultural development needs capital resources with the land and labor available. Capital is needed to develop more land and use better materials and new methods of cultivation. One of the problems which confronts economic development in Jordan, and in most developing countries, is the shortage of capital. This shortage of capital is due to low income in the agricultural sector which makes the farmers unable to save enough to change it to investment and capital formation.

Development of wheat production in Jordan will require increased use of fertilizer. Fertilizer costs will be very high when compared with other inputs. This cost will increase since the cost of fertilizer will increase. The use of high quantities of fertilizer (150 kilograms of nitrogen per hectare with price 124.85 fils per kilogram of nitrogen) requires more capital. Capital formation has to come from the Agricultural Bank through supplementary credit to the farmer.

b. Demonstration Demonstration is needed to remove the skepticism of government officials and farmers. These demonstrations and experiments should be made on private farms as well as on government projects. Since the farmers in most of the less developed countries are doubtful of results of demonstrations carried out in the research stations, they will feel more confident when the demonstrations are made on their own farms.

A seed multiplication demonstration program may be carried out by the Research Departments.

E. Summary

This study was concerned with the improvement in wheat production in Jordan through the use of Mexican varieties, and how it is feasible for Jordan to exploit this technology. Positive and negative effects are summarized in the following tables (Tables 5 and 6).

Table 5. Positive effects

Items	Units	Present wheat production	Estimated wheat production
Yield per dunum	Kilograms	100	470
Farmer net return per dunúm	Dinars	3.475	13.79
Total wheat production	Tons	188,000	654,000
Wheat total value	Dinars	6,016,000	20,928,000

Table 6. Negative effects[a]

Items	Units	Present wheat production	Estimated wheat production
Wheat area	Hectare	235,000	155,000
Optimum unit of nitrogen per dunum	Kilogram	Very small[a]	15
Total amount of nitrogen	Tons	Very small[a]	23,000
Total cost of nitrogen	Dinars	Very small[a]	2,906,200

[a]Total consumption of nitrogen per year for all crops is 2,000 tons.
Source: (9, p. 162).

The side effects resulting from introduction of this new technique are summarized by the following:

1. Double cropping is possible in the irrigated land.
2. Underemployment is decreased in the rainfed area.
3. Employment is increased in the irrigation area.
4. Importation of wheat is eliminated in the short and long run.
5. Balance of payments will be helped by 10 percent through reduction of wheat imports.
6. Production of other crops will be increased by releasing some land from wheat production.

III. THE CONTRIBUTION OF LAND REFORM IN JORDAN TO AGRICULTURAL DEVELOPMENT

Land reform was carried out in the irrigated land of Jordan in 1960 during the work in the East Ghor Irrigation Project. Consolidation and redistribution of land was done by instituting minimum and maximum holdings of land.

In the dry farming land, a development project will be carried out all over the country. The development project has received assistance from the F.A.O. of the United Nations. The aims of this project (23, p. 37) are summarized by the following:

1. soil conservation construction;
2. correct land use and new crop rotation;
3. introduction of improved seed varieties, use of fertilizers, pest control and weed control;
4. introduction of new crops; and
5. introduction of machinery which has proved successful under similar conditions in other countries.

The project directors (23, p. 37) found that successful agricultural development is closely tied to the social and economic problems of the farmers in the dry land farming areas. And if the program was to be carried out, the Government of Jordan would solve the problems of fragmentation and uneconomic holdings.

This study will deal with the following:

1. the present land tenure structure – the causes of both land fragmentation and uneconomic holdings and their effects,

2. Innovations without land reform — the effect of land tenure structure on the following proposed innovations:
   a. soil conservation construction,
   b. pasture improvement, and
   c. mechanization; and
3. land reform in the irrigated area.

A. The Present Land Tenure Structure

Although there is security of tenure in Jordan, because the titles of the farms are given to the farmers, the farmer's land is often not contiguous; that is, he may have several pieces of land. This fragmentation of land is very expensive to operate and is a big obstacle to the introduction of new ideas and changes, reducing the efficiency of labor and capital use, and wasting time and effort.

According to custom and the Moslem religion, a man's land is divided equally among his inheritors. The result of this division is noncontiguous holdings, or there are many people involved in a small piece of land which is very difficult to buy or sell to improve the size or the shape of the unit. Two or more long, narrow strips of land were given to each farmer in 1937 during the registration of titles in order to break up the system of Musha tenure which is the village system. But, as long as fragmentation exists with equal inheritance by women and men, the degree of fragmentation tends to increase.

Undersized holdings exist because of the inheritance system and the lack of minimum size of a holding. In addition to that, the ratio of population to cultivated land increases the size of a small holding,

since Jordan became overpopulated.

The total area of agricultural holdings is put at 6,101,200 dunums in the Government's report, and the total number of holdings is 93,544. The mean size of a holding is approximately 62 dunums.

Table 7 shows the relationship between the size and the number of holdings. From this table, it is shown that 56 percent of the farmers have less than 30 dunums. Also, there are large farms which are owned by a few people.

Table 8 represents the number of units in group size on the East Bank. About 62 percent of the total units are smaller than 30 dunums, which is the minimum economic size defined for an irrigated area; only about 9.6 of the units are considered large.

Regional differences in the average size of a holding vary from 34 dunums in the North to 230 dunums in the South. This variation is explained by the fact that the North has good rainfall, good land and many people, while in the South most of the land is desert, little rain falls, and fewer people live there.

Land ownership is reaching an unsatisfactory situation from two points of view. On the one hand, there are many farmers with small holdings (about 65 percent have less than 3 hectares). Those farmers are unable to save enough to change their holdings to an investment, and even those small units could not provide a subsistence for a peasant. Therefore, the owners are forced to move to the cities looking for another alternative employment, giving their land to share tenants. The owners give the tenants their land under unimproved agricultural

Table 7. Number of agricultural holdings by size[a]

Size of group in dunums	Number of holdings[b]	Percent
Less than 10	34,039	36.4
10 - 19	10,193	10.0
20 - 29	8,363	10.0
30 - 39	7,621	8.1
40 - 49	5,393	5.8
50 - 99	14,221	15.2
100 - 199	8,003	8.6
200 - 499	3,747	4.0
500 - 999	688	0.7
1,000 - 1,999	198	0.2
2,000 - 4,999	60	0.1
5,000 - 9,999	16	
10,000 and over	2	
Total	93,544	100.0

[a]Source: (1, p. 225).

[b]A holding is all land fragments owned by one owner.

Table 8. Number of units and the size group in dry land and on the East Bank[a]

Size of group in dunums	Number of units[b] in every group
1 - 9	41,
10 - 19	30,298
20 - 29	18,234
30 - 39	11,935
40 - 49	7,968
50 - 99	18,070
100 - 199	9,053
200 - 499	3,954
500 - 999	795
1,000 - 1,999	217
2,000 - 4,999	59
5,000 - 9,999	10
More than 10,000	1
Total	142,361

[a]Source: (9, p. 22)

[b]A unit is one continuous tract of land owned by one owner.

tenancy; where both of them are not interested in improvement, but they are trying to get the most output with minimum expenditure.

On the other hand, there are a few farmers with large-sized holdings and they could save money. Those farmers who saved are in a minority, and they are not interested in changing their savings to an investment, because most of it goes into luxury items.

B. Innovations without Land Reform

In the dry land area an agricultural development program will take place by new innovations after the Government of Jordan has solved the problems of fragmentation and land ownership. The following study will deal with how some of these innovations can increase the agricultural production and how small size fragmentation of land holdings impel the use of the following innovations:

1. soil conservation and land tenure structure,
2. pasture improvement and land tenure structure, and
3. mechanization and land tenure structure.

1. Soil conservation and land tenure structure

Soil conservation construction, as one of the main goals of the land farming project, has two purposes. The first one is to maximize the use of the rainfall instead of allowing it to run off, while the other is to minimize the soil erosion.

Run-off and erosion are a function of steepness of slope and length of slope; this relationship is positive and directly proportional. Terrace building has the effect of decreasing the length of slope and

therefore decreasing the run-off and erosion of soil.

The efficiency of construction will decrease and the technical difficulties will increase under the present tenure structure which is characterized by small size fragmentation of land holdings. Construction treatment can be taken on a farm-by-farm basis or a group-of-farms basis.

Soil conservation works on a field of small size fragmentation; if given farm-by-farm treatments, the wastage of lands and efforts will be very high. Many small terraces in this case must be built to control the soil erosion. And the following are the differences between many small terraces and a big one.

a. Cost differences Cost economies prevail in building the big or large terrace, while cost diseconomies prevail in building many small terraces. Cost economies refers to the phenomena which cause a unit's costs to decrease, and a large scale causes unit cost to decrease. On the other hand, cost diseconomies refers to a small scale which causes unit cost to increase.

b. Less land needed Less land is needed for a big terrace than for many small terraces. Therefore, extra land and wastage of land is involved for building many small terraces.

c. Stability and instability of construction Stability of construction comes from a big terrace and has a long life. Instability comes from many small terraces and the life of these terraces is very short.

On the other hand, if the treatment bases are villages or sections

of a village, there will be a large number of people in one unit treatment and this requires cooperation among many individual farmers. In this case, it is difficult to obtain the agreement of a large number of persons on the technique proposed and on the correct methods of construction.

Treatment in this case will cause disassociation of costs and benefits. This undesirable phenomena means that some farmers will benefit without cost, while the others benefit with cost. Cost in soil conservation works will not be paid by the farmers but by the United Nations. And the farmer's cost in this example is the land which will be taken from individual farmers for building these constructions. The farmer's benefit is the increase in the production as a result of controlling the run-off water. Some individual farmers may not find erosion control to be profitable because they must pay all of the cost which is the land taken, but they realize only part of the return. The others find it profitable because they do not pay the cost and enjoy a full return.

Maintenance in the future for all soil conservation works is required in order to prevent them from falling apart. With a large number of farmers, it is difficult to maintain these constructions because the responsibility for maintenance will be scattered.

2. Pasture improvement and land tenure structure

Pasture improvement production will be carried out by the project through increasing the pasture area and grazing control. This improvement will lead to an increase in the livestock production and a decrease

in the rate of running off water and, in turn, will lead to less soil erosion.

It is recommended by the project to grow pasture in the area of lowest rainfall instead of growing wheat in this area. In addition to that, it is recommended to use the land which has more than a 15 percent slope for pasture. At present this land is bare of vegetation except for three weeks in spring, and it is considered as wasted land.

Controlled grazing is unknown and according to tradition every farmer can graze his animals on lands where no crops are growing. Controlled grazing will be done through:

1. Seeding and establishing a field of pasture in both the steepest soil and in the lowest rainfall area. These two areas will be seeded with perennial species grass which has the capacity to survive in a dry year if these lands are protected from grazing for only one year.
2. Through limiting the number of animals per dunum of pasture and keeping them out of the field by fencing the pasture field.

The first policy needs to be instituted by the government, while the second one needs education of the farmers by the project experts.

Under the present land tenure structure which is characterized by small size fragmentation in holdings, it is difficult and impossible to maintain pasture and to keep off grazing animals because of one of the following:

1. The extra cost involved for protection of the pasture area —

Having more than one unit, living on one and growing pasture on the others makes it difficult and impossible to watch and to control the other farmer's animals. And, if the farmer uses labor for this purpose, this will increase the cost per dunum of producing this crop.

2. Access to many of the fields by men and animals is possible only through the lands of other farmers.
3. Cost of fencing — Fencing the pasture area has the effect of controlled grazing. The cost of fencing the long, narrow strips is greater than for the fields of rectangular shape. The total length for a side of the long, narrow strip field is greater than for the rectangular shaped field. And the first shape requires more material, such as wire, than the second one.
4. Commonly, the landowner gives his land to a share tenant for one year. The latter is looking for the highest output for a given year and the result is that the pasture area will be overgrazed and it is difficult to reseed. The payout period is short in this case. The cost of pasture establishment is estimated to be equal to 1.500 J D per dunum and the life of a pasture will be at least four years. And, if the farmers move away from their traditional ways, the cost per year per dunum will decrease and be equal to 1.5 divided by 4, or 0.375 J D, while the cost per year per dunum under the traditional way is equal to 1,500 J D.

3. Mechanization and land tenure structure

The Department of Statistics estimates that from 1958 to 1968, about 1,843 tractors have been imported into Jordan. Prior to this, all cultivation was done by men, horses, and oxen. Several studies show that the need of the country is about 13,700 tractors of 30 h.p. This estimate is calculated from the minimum requirement for high level yield of from 0.5 to 0.8 h.p. per cultivated hectare.

One of the main aims of the project is to introduce machinery such as tractors, boom sprayers, and seed drills. The experts of the project are testing this machinery under local conditions and are showing the farmers how they work.

At this stage of development, the goal of using the machine is to increase the yield per hectare. On the other hand, the use of mechanization at a high degree of development as in the U.S. is considered a substitute for labor.

The use of machines in the agricultural sector has the effect of increasing the nonagricultural and the agricultural output. Nonagricultural output could be increased through releasing labor from agriculture and using them in the other sectors. Agricultural output could be increased by the machinery as described by Schertz:

> Mechanization can permit the completion of tasks with more precision, accomplish more quickly, develop resources not presently utilized, and accomplish tasks not possible with traditional techniques" (16, p. 3).

In Jordan, timeliness of preparation is very important and the delay in planting time till after the first time means a later start and loss of first rain, and the result is a low yield. This delay is

especially harmful in the grain rainfall area, where land preparation is impossible by men or horses before the first rains, while it is possible by tractors. The preparation of a good seed bed needs enough power for plowing the soil and it comes from tractors, not from animals. Drill seeders accomplish tasks not possible with the traditional practice of throwing seeds on the ground and then plowing them under. For instance, good distribution of plants and good germination of seed, and the result is less seed could be obtained by the drill seed.

The following represent the disadvantages of small fragmentation holdings which characterize the use of land in Jordan and how they impel the use of machines:

1. Extra cost is involved in moving the machine from one field to another.
2. The farm size is not large enough to enable farmers to produce beyond subsistence levels. It was mentioned before that more than 56 percent of the farmers hold less than 3 hectares. Producers on such farms cannot produce on a commercial level and their access to the use of mechanization is minimized.
3. The long, narrow strips and the small size limit the correct movement of the machines and, therefore, decrease the efficiency of the machine.
4. The uneconomic use of the machine is caused by the small size holding. Increasing returns to scale cause declining per unit cost, while decreasing returns to scale have the

opposite effect.

Fragmentation of land holdings and inadequate total size of holdings can be both solved by land reform that includes consolidation of fragments and redistribution of the land.

A land reform or land redistribution program was put into operation in the irrigation land in 1960, when the East Ghor Irrigation Project was developed. And the following will describe and analyze the results of that land reform.

C. Land Reform in the East Ghor Irrigation Project

The East Ghor Irrigation Project is located on the East Bank of the Jordan River in the Hashimite Kingdom of Jordan. The irrigation system has been designed to provide water for irrigation of 120,000 dunums. To provide water to irrigate farms to increase the agricultural output of the lands by the proper utilization of resources, the Government of Jordan and the USAID provided funds for the construction and the redistribution of the lands under the project. The USAID and the World Bank provided funds in the form of credit to assist in making loans to farmers.

Consolidation of the land and redistribution of the farm units was one of the short-run project targets. Prior to the law of land reform in 1961, the land was fragmented and in various sizes. The causes and the effect of land fragmentation and undersizing were discussed before.

The land reform in the Jordan Valley in 1961 was done by consolidating and organizing the lands into units. The minimum size of a holding was defined as 30 dunums and the maximum size was determined to be 200 dunums.

Redistribution of the consolidated lands was ordered in this manner:

1. holders who themselves exploit their lands in the project area,
2. professional farmers residing in the project area,
3. professional farmers from district inhabitants,
4. professional farmers from inhabitants of other districts, and
5. holders who utilize their land by share cropping within the project area.

In 1961 prior to the land reform, there were about 3,668 farm units in the area. After the distribution program, about 3,700 farm units were provided. The important difference is that prior to distribution about one-fourth of the holdings were less than 20 dunums and one-fourth were between 20 and 39 dunums. After distribution, the smallest unit was 30 dunums. This was done through reducing the holdings of big landowners and using the surplus for increasing the size of uneconomic holdings.

The economic size is the size which will permit the best use of all agricultural resources. In Jordan it is assumed that 30 dunums will provide a hard working family with sufficient cash to enable the purchase of necessities not produced on the farm.

The abundance of human resources in the agricultural sector without alternative jobs in other sectors and the scarcity of land play a role in choosing between efficiency or welfare. Efficiency in the production requires a large scale while the welfare requires a small scale.

Jordan's stage of development needs rapid increase in the agricultural output, equity and participation in the development process. Creation of large farms to produce rapid development is a goal in conflict

with the equity and participation in the development process. Therefore, the land reform in the Jordan Valley serves the double purpose of efficiency and welfare in this area.

A study shows that the net income per dunum in the project area rose from 2.2 J D in 1959-60 to 10.8 J D and 13.6 J D in 1964-65 and 1965-66, respectively. Also this study indicates that the total agricultural income for the entire 120,000 dunums rose from 2,795,715 J D in 1960 to 3,372,876 J D in 1965-66.

The above increase in the agricultural production is mainly due to two projects that were put into operation. The first project is the East Ghor Irrigation Project and the second one is the East Ghor Rural Development Project. In this area land holding patterns were changed, a large number of subsidiary projects were completed, including dams on the side Wadis, farm-to-market roads, marketing centers, public health facilities, agricultural credit research and extension services were established.

Land reform in this area was characterized by the following features:

1. Efforts to increase the production applied after land reform took place.
2. The economic capability of many of the new smaller units was probably as high as or higher than the large units from which they were created.
3. The process of land reform was as follows:
   a. Consolidation of the land into units.
   b. Redistribution of the new land to a new owner and the priority of redistribution were defined.

c. Minimum and maximum size were defined.

4. Repayment of landowner debts to the East Ghor Canal Authorities in twenty years.

5. The repayment to landowners by the Authority in twenty years if a farm unit was allotted to the original landowner.

In summary, the project in this area accomplished the following objectives:

1. social justice,

2. equality of opportunity, and

3. economic development.

Results of land ownership before and after the land reform are shown on the following page.

D. Summary and Conclusion

I examined the effect of small size fragmentation holdings under the existing methods of production and under the changes proposed in the methods of production. Physical cost benefit analysis was involved.

Theresult is that the disadvantage of the present tenure structure is greater when there are changes in the production methods by the proposed innovations than the existing methods of production. And for better utilization of land which is one of the natural resources and for the purpose of economic development. Certain policies need to be instituted for the use of the land. Consolidation of small holdings and redistribution of land is one of the institutions and this policy will increase the efficiency of agricultural production on cultivated land.

Table 9. Land ownership before land reform[a]

Size of ownership (hectares)	Landowners		Area owned	
	Area	Percent	Area	Percent
0.1 - 0.9	1,304	35.7	550	3.5
1.0 - 1.9	708	14.3	993	6.3
2.0 - 2.9	378	10.3	907	5.7
3.0 - 7.0	866	23.6	3,609	24.7
7.6 - 10.0	113	3.1	987	6.2
10.1 - 50.0	252	6.9	4,781	30.2
50.1 - 100.0	32	0.9	2,178	13.8
Over 100	10	0.3	1,524	9.6
Total	3,668	100.0	15,850	100.0

[a]Source: (1, p. 225).

Table 10. Land ownership after land reform[a,b]

Size of ownership (hectares)	Landowners		Area owned	
	Area	Percent	Area	Percent
3.0 - 5.0	1,046	74.9	3,486	54.8
5.1 - 6.2	128	9.1	748	11.8
6.3 - 13.0	195	14.0	1,623	25.5
13.1 - 20.0	19	1.4	307	4.8
Over 20	18	0.6	197	3.1
Total	1,396	100.0	6,360	100.0

[a]Source: (1, p. 225).

[b]This land ownership covers only 52 percent of the total project area of 12,000 hectares. The remaining area is almost completely allocated to new farmers, but their ownership classifications were not available.

IV. THE CONTRIBUTION OF EXPANDED PRODUCTION OF OFF-SEASON VEGETABLES IN JORDAN TO AGRICULTURAL DEVELOPMENT

Vegetable production represents a major sector of the Jordanian economy. Vegetables and fruits accounted for about 45 to 50 percent of the total agricultural output. And the agricultural sector of the Kingdom's economy contributed $80 million, or about one-fifth of the gross domestic product in 1970 (30, p. 1).

Tomatoes are the most important crop in the dry farming land and in the Jordan Valley. Cucumbers, beans, sweet peppers, squash, cauliflower and eggplant are widely grown vegetables. The expansion of tomato production has resulted in surpluses and exports to other countries in the Middle East as represented by the following table.

Table 11. Tomato production and exports and total vegetable exports, averages 1957-59 and 1961-65 annual 1967-70 (30, pp. 6-8)

Item	Year			
	1957-59	1961-65	1967	1968
Tomato production[a]	98,000	202,000	216,000	180,000
Tomato export[b]	No data	4,316,000	4,924,000	6,232,000
Total vegetable exports[b]	No data	6,231,000	8,532,000	10,007,000

[a]Units in tons.

[b]Units in dollars.

Vegetable production for one crop is continuous during the year, because of different weather in different regions both existing at the same time. In the high dry land vegetables such as tomatoes, cucumbers, beans, sweet peppers, squash and lettuce are produced from April to September, while in the Ghor irrigation area these vegetables are produced from October to May.

In the Jordan Valley, the Ghor area is suitable for the production of off-season vegetables for export to the Arab countries and to Europe. These vegetables are tomatoes, sweet peppers, cucumbers, beans, watermelons, squash and lettuce.

The Jordan Valley is located between the Western uplands and the Eastern uplands. The River Jordan is 220 meters below sea level where it enters Jordan and falls to 392 meters below sea level at the Dead Sea. Irrigation is supplied from the East Ghor Canal, and the area of land suitable for cultivation by irrigation is reported about 519,000 dunums. This area has an average temperature from 13^{o} to 31^{o}C and an average winter rainfall of 250 mm from November to March. See Table 13.

The Jordan Valley has the seasonal advantage of a warm winter climate. The length of the seasonal advantage is about six weeks and sixteen weeks relative to the Middle East countries and Europe, respectively. The seasonal advantage of Jordan in winter vegetables provides exports to Syria and Lebanon, while these countries at the present time are slightly more than self-sufficient in vegetables. And, after the end of the seasonal demand in Lebanon and Syria, Jordan exports vegetables to the neighboring countries.

Table 12. Vegetable demand and supply projections[a]

Items	Tons			Rates of growth (percent per year)	
	Base period 1960-62	1975	1985	Base-1975	1975-85
Gross domestic consumption	267,000	480,000	730,000	4.3	4.3
Production	520,000	712,000	1,081,000	2.4	4.2
Export possibilities			351,000		

[a]Source: (20, pp. 63, 120).

Table 13. Temperature and rainfall reading in Deir Alla by week and months during 1969 (temperature in °C, humidity and rainfall in mm)[a]

Week and reading	Month											
	December	November	October	September	August	July	June	May	April	March	February	January
First week												
Temperature[b]	19.0	21.5	29.5	33.4	30.7	29.9	32.9	23.3	18.2	21.1	15.2	15.6
Humidity	59.1	58.3	68.0	62.5	56.0	53.0	39.0	55.0	61.0	64.4	69.9	62.9
Rainfall	0	19.7	0	2.6	0	0	0	0	0	0.1	10.0	18.9
Second week												
Temperature[b]	18.3	21.8	30.0	30.4	30.3	30.5	29.5	26.1	19.0	16.9	14.2	14.2
Humidity	54.5	57.0	52.3	57.2	10.0	53.0	52.0	52.0	62.0	75.6	77.3	75.0
Rainfall	0.2	0	1.1	2.6	0	0	0	0.2	0.3	1.4	2.5	8.1
Third week												
Temperature[b]	16.4	23.7	25.2	30.2	31.2	29.8	30.6	30.6	20.4	18.3	15.9	16.0
Humidity	59.5	33.0	68.5	59.5	61.0	54.0	51.0	39.0	57.0	72.0	72.1	65.1
Rainfall	0	0	8.0	2.6	0	0	0	0	4.1	56.0	0	14.9
Fourth week												
Temperature[b]	16.5	22.1	24.5	30.1	32.4	29.9	29.8	29.0	23.4	24.6	18.4	12.2
Humidity	13.5	51.2	56.7	58.3	61.0	55.0	53.0	52.0	51.0	77.1	69.9	76.5
Rainfall	9.2	4.5	0.1	2.6	0	0	0	0	0	33.5	0	42.5

[a]Source: (9, p. 88).

[b]Average temperature.

Table 14 shows the area and the production of principal vegetables in the Jordan Valley. And Table 15 shows the vegetable yield in the Ghor area compared to the national vegetable yield. The yield in the Ghor area is greater than the national yield because of

1. more experienced growers, and
2. more suitable physical conditions of climate.

Transport problems were solved because roads have been constructed. At the end of December 31, 1965, about 324 kilometers of the roads had been completed in the Ghor area. That construction facilitated the movement of farm produce from farms to market. In addition to that, the roads lead to a main north-south highway. A vegetable production plan is aimed at supplying the domestic demand and Arab countries. Now it is recommended that the plan should be aimed at supplying the internal demand and developing exports to Europe and neighboring countries (23, p. 1). The first statement is true, while the second one needs study of the domestic demand and supply because the increasing domestic demand for food may not leave an adequate surplus for exports.

Demand and supply projections were made by the F.A.O. in 1966 for 1975 and 1985. The aim of the plan as reported is to select for agricultural development the path which could maximize the contribution of agriculture to overall economic growth.

Demand projections for vegetables were derived by multiplying the total base period data by the indices of population growth and of per-head consumption growth. Vegetable consumption will increase from an estimated 267,000 tons in the base year to 730,000 tons in the final year

Table 14. Area and production of principal vegetables and fruit trees in the Northern, Middle and Eastern Ghor areas, 1970[a]

Crops	Northern Ghors		Middle Ghors		Southern Ghors		Total	
	Area[b]	Production[c]	Area	Production	Area	Production	Area	Production
Tomatoes	24,381	73,143	15,700	23,050	24,120	26,920	64,201	123,113
Eggplants	12,007	2,845	9,600	19,200	456	872	22,063	22,917
Cabbages and cauliflower	3,825	8,301	1,790	1,940	0	0	5,615	10,241
Onions	1,533	2,258	1,375	687	92	154	3,000	3,099
Potatoes	106	1,212	370	740	10	10	986	1,962
Squash	5,100	6,667	2,360	3,845	82	82	7,542	10,594
Cucumbers	363	544	890	1,000	1,143	873	2,396	2,417
Peppers	3,065	4,597	2,205	1,102	96	76	5,366	5,775
Beans	700	486	476	377	185	92	1,361	955
Green peas	2,600	195	3,750	3,610	109	109	6,459	3,914
Okra	325	175	650	325	0	0	975	500
Watermelon and melons	2,248	6,744	1,430	4,425	433	408	4,111	11,577
Bananas	8,500	6,375	1,170	1,540	0	0	9,670	7,915
Citrus fruits	12,897	45,000	1,880	3,705	533	154	15,310	48,869
Others	2,354	5,243	2,117	829	342	307	4,813	6,379

[a]Source: (9, p. 130).

[b]Area unit is in dunums.

[c]Production unit is in tons.

Table 15. Vegetable yield, 1963-64 (kilograms per dunum)[a]

Crop	National average	Southern Ghor	Northern Ghor
Tomatoes	1,000	1,500	4,000
Eggplant	1,230	1,650	4,000
Cauliflower	1,330	1,650	3,500
Cucumbers	No data	750	1,250
Onions	600	1,500	2,500
Lettuce	No data	1,000	1,600
Potatoes	740	600	2,000

[a]Source: (1, p. 258).

of the plan. See Table 12.

Vegetable supply projections were leased on a survey of the existing resources and on the evaluation of possible expansion in yield and area. Vegetable production will increase from an estimated 520,000 tons in the base year to 1,081,000 tons in the final year of the plan. See Table 12.

Table 12 shows that surplus for export in the long run will be 351,000 tons.

A. Economic Opportunities

Expansion in the past and the expected expansion in the future in vegetable production, as shown before in the Ghor area, needs to deal with the following economic opportunities:

1. return per dunum of vegetables compared to other alternatives,
2. labor situation,
3. markets in the Middle East, and
4. markets in Europe.

1. Return per unit

One way the potentials for agricultural development are obtained is through increases in value. Value increases are achievable by substitution of high valued crops for low valued crops.

In the Jordan Valley, the net return per dunum is estimated as 2.3, 1,4, 16.9, and 30.4 J D for wheat, barley, vegetables and fruits, respectively. Therefore, it is suggested that grains be replaced by vegetables or fruit or cotton selected for higher values per dunum in the Jordan Valley.

Cash crops are recommended in the Ghor area because of the following two reasons:

1. to recover the capital cost of the irrigation project in this area in a short period, and
2. to increase net income for farmers in the project area.

Fruits or vegetables are considred as cash crops and growing fruit is slightly more profitable to the farmers than growing vegetables. In spite of that, farmers in the Ghor area after 1961 became vegetable growers and the decision to grow vegetables enabled the farmers to get benefit from high value crops.

The question which is raised is why the farmers do not choose to be fruit growers as long as this crop is more profitable to them. The selection of land for a particular crop is determined by many factors, such as availability of capital, skills, shortage or abundance of labor, transport and marketing. I believe that the factor that limits the expansion of fruit production is the farmers' shortage of capital and skills.

Capital is needed in fruit production for preparing the land, planting, and the years of waiting until production. Also, skills are one of the factors which affect regional production patterns.

In the Jordan Valley, it is reported that the area in 1966 was as follows:

1. Over half was in vegetables.
2. One-third was in field crops.
3. The rest was in fruit.

Farmers in the Ghor area, however, are gradually becoming vegetable

growers and vegetables, as well as fruit, are high value crops.

2. Labor requirements and productivity

Evaluation of both the quality and the quantity of available farm labor is a necessary element in the evaluation of an agricultural development program, because the quality and the quantity determine the degree of success or failure of any development attempt.

Unfortunately, Jordan's agricultural sector outside the Ghor area lacks an adequate supply of efficient human resources. Farmers in Jordan, as well as in other developing countries, have low levels of education.

In the Jordan Valley in the Ghor area, a Rural Development Project was carried out in June, 1963. One of the Project's objectives was to provide farmers with agricultural education regarding production and marketing practices. Since 1963 the farmers have been gaining experience in vegetable production with the help of the extension services in this area.

Quantity of labor is also important, as well as quality, as mentioned before. Between December and March in the off-seasons are the months of peak demand for cultivating and gathering. A report from the F.A.O. mentions that the population in this rural area had increased as expected because of the greater seasonal demand.

Therefore, there is no shortage in the human resources requirement regarding the expansion in vegetable production. Expansion in vegetable production has the effect of increasing the labor productivity, since it is considered a labor intensive crop.

3. Market for Jordanian vegetables in the Middle East

Marketing structures in most of the Middle Eastern countries, as well as in many of the underdeveloped countries, are considered as obstacles towards economic progress because they are characterized by the following:

1. Lack of efficient transportation and communication. The inadequate transportation causes delay and damage to perishable products. Shortage of market information creates uncertainty with regard to the profit obtained by selling products in different markets.
2. Marketing is also confronted by lack of grades and limited storage, processing and refrigeration.

In Jordan in 1964, an Agricultural Marketing Center was established with the help of the United Nations Development Program in order to overcome the above elements.

The opportunities for exporting vegetables which are produced in the winter to neighboring countries in the Ghor area are:

1. a monopoly position in Syrian and Lebanese markets,
2. export to oil producing countries,
3. Jordan as a member of the Arab Common Market, and
4. cheap truck transport.

a. A monopoly position in Syrian and Lebanese markets Jordan has a seasonal advantage that is the warm winter climate of the Jordan Valley. And the seasonal advantage and low delivery cost cause Jordan to occupy a monopoly position as the sole supplier in the winter months

in Syrian and Lebanese markets. The length of the seasonal advantage is about six weeks. Export from African countries to the Middle East during the winter is possible and competition could be expected. But the high transport cost in comparison with that of Jordan's stands as an obstacle to such export expectation.

b. Export to oil producing countries Jordan has an opportunity for exporting its vegetable surplus to the oil countries, such as Kuwait and Saudi Arabia. These countries are importing most of their food which they need from other countries in the Middle East and from outside the region.

c. Jordan as a member of the Arab Common Market One of the opportunities for Jordan for exporting vegetables to the Middle Eastern countries is that the kingdom is a member of the Arab Common Market. Import duties have been abolished for agricultural products since the existence of the Arab Common Market in order to facilitate trade between Arab countries. The trade is very strong with regard to fruit and vegetable marketing between Syria, Jordan, Iraq, Lebanon and the oil countries.

d. Cheap truck transport Truck transport is cheaper than refrigerated transport or other means used for long distance. From Jordan to Kuwait, Syria and Lebanon, transport without refrigeration is feasible in the wintertime.

Projections of vegetable supply possibilities and the projections of demand were made by the F.A.O. Indicative World Plan. This study gives a picture of future markets for total vegetables in 1975 and

1985.

The demand for vegetables is projected to increase because of the increase in population and a rise in per capita income. Total consumption for Jordan, Syria, Iraq, Lebanon, Kuwait and Saudi Arabia are estimated at 3,789,000 tons, and 5,579,000 tons in 1975 and 1985, respectively.

Supply for vegetables is projected to increase as a result of the increase in yield per unit and the expanded area. Total production for the six is estimated at 3,816,000 tons and 5,976,000 tons in 1975 and 1985, respectively.

The six countries will show a 127,000 ton net surplus of vegetables and 407,000 tons in 1975 and 1985, respectively.

There are several interpretations of the future with regard to Jordan, and they are:

1. There is expansion of vegetable production in Iraq, Lebanon and Syria. Syria and Lebanon show a surplus, while Iraq will be in balance during the period of the plan. In addition to that, Jordan has a geographically disadvantageous position for competing against Syria and Lebanon. But, during the winter, Jordan will continue to provide the Syrian and Lebanese markets.
2. There is no production in Kuwait, while Saudi Arabia has a deficit until 1973 and, in 1985, will be in balance.
3. In spite of the fact that Jordan has a monopoly position in winter, it is reported that a regular tomato supply to the

Aleppo market in Syria from the Ghor area exceeded the demand. Furthermore, it is reported that, because of excess supplies, shipment of tomatoes to the Aleppo market suffered a heavy financial loss of about 10 percent. The situation will be worse in the future because most of the increase in vegetable production as projected will come from the Ghor area.

4. The Arab Common Market is affected by political considerations, since it contains socialist and nonsocialist countries.

It is concluded that the traditional export to the neighboring countries does not fully exploit the climatic advantage. Some short-run and long-run vegetable balances are shown in the following table.

Table 16. Short-run and long-run vegetable balances in six countries of the Middle East (000 tons)[a]

Countries	Year	Production	Consumption	Export (+) or import (-) or balance (.)
Jordan	1975	712	480	232+
	1985	1,081	730	351+
Lebanon	1975	485	450	35+
	1985	675	630	45+
Syria	1975	1,179	1,089	90+
	1985	1,628	1,528	110+
Iraq	1975	1,080	1,080	.
	1985	1,692	1,692	.
Kuwait	1975	0	73	73-
	1985	0	99	99-
Saudi Arabia	1975	560	617	57-
	1985	900	900	.

[a]Source: (20, p. 196).

4. Markets in Europe

One of the recommendations which is given to the Government of Jordan is to start exporting vegetables, especially tomatoes, which are grown in the winter in the Ghor area, to the European Market.

Consumers whose income has reached a good level appreciate quality and they are willing to pay higher prices for better grades. In Europe the income per capita is high, while in the Middle Eastern countries few people have high income. The result is that demand for high quality is very low in the Middle East and the opposite is true in Europe. High quality for export to the European Market to get high prices requires improvement of the grading and packing system. In addition to that, the export to Europe is a solution for disposing of surpluses.

If the trade of agricultural products is only between developing countries, it is difficult to answer the following question: Which comes first, higher income of consumers or better quality agricultural products? On the other hand, the export policy to Europe requires immediate improvements in marketing such as grading.

Export of winter vegetables has not yet developed to Europe because of the following reasons:

1. lack of knowledge about foreign markets,
2. lack of know-how about transportation of perishables and long distances, and
3. lack of knowledge about the consumers' preferences in the foreign market.

Tomatoes, as shown before, are the most important crop produced in

the winter for domestic supply and for supplying Arab countries. Other vegetables are considered as marginal. In addition to that, fresh tomatoes are recommended as a first crop to export to the European Market.

In North Europe, tomatoes are not produced at all in the winter since they do not find favorable conditions. In South Europe, tomatoes are produced all year because there is an excellent climate. Because of the existence of tomato importing and exporting countries in Europe and outside the region, the next section will examine the fresh tomato demand and supply in 1970 in Europe from the international trade point of view.

B. International Trade Aspect

This section will deal with the following:

1. local competition,
2. competition from Africa and other countries, and
3. tariffs and restrictions.

1. Local competition

There are tendencies of trade between the European countries since the existence of the Common Market and the preferences according to members and associates of the Common Market. So the purpose of this study is to find out if the fresh tomatoes market in Europe is in need of other suppliers from outside the region.

Tomatoes in Europe are produced in two types: open field and glass house. The open field type is found in Italy and Spain. These two countries produce fresh tomatoes for their domestic requirements

and for export to North and Central Europe. The production of fresh tomatoes in Spain and Italy comprises two types: ribbed tomatoes for domestic market and smooth, round tomatoes for export.

In Spain the harvesting is continuous during the year. Fresh exports are almost made during the winter season and it went to the United Kingdom. In Italy the harvesting of tomatoes starts at the beginning of April and it continues until January. Fresh exports are almost made during summer and autumn and it went to Germany, Switzerland and France.

The glass-house type is found in most of North and Central Europe. All the North and the Central are importing substantial part of their fresh tomatoes except of the Netherlands which are exporting some of fresh tomatoes. The production of glass-house type comes through changing in cultivation techniques: that is the change over from cold to heated glass. However, this production still unable to produce fresh market crops economically before April because of lacking luminosity. Production in producier countries of glass-house type are smooth round varieties tomatoes.

Total import requirements of the European OECD countries for all types of the fresh tomatoes are estimated about 700,000 tons for 1970. Import requirements for open-field types and glass-house types are estimated to be 180,000 tons and 520,000 tons, respectively.

Total export availabilities of the European OECD countries for all types of fresh tomatoes are estimated about 670,000 tons for 1970. Export availabilities for open-field types and glass-house are estimated

Table 17. Trade in fresh tomatoes of the European OECD countries as estimated for 1970, units in tons (14, p. 103)

Types of fresh tomatoes	Export availability	Import requirement	Net trade - deficit + surplus
Open field	80,000	180,000	- 100,000
Glass house	590,000	520,000	+ 70,000
Total	670,000	700,000	- 30,000

to be 80,000 and 590,000 tons, respectively,

The region as a whole estimated to have a net deficit of about 20,000 tons in 1970 for all types of tomatoes. For open-field tomatoes the net deficit are estimated at about 100,000 tons. And for glass-house type an export surplus are estimated at about 70,000 tons in 1970.

In fact the market situation as regards open-field tomatoes depend on non-OECD European supplying countries.

2. Competition from Africa and other countries

Climate condition in North Africa and Eastern European countries permit the open-field production of tomatoes during the winter period.

North African countries such as Morocco, Algeria and Tunisia are the only supplier to the European countries of fresh tomatoes. The competition between these countries and Jordan can put in terms of transport cost and varieties.

Jordan has a higher transport cost than North African countries,

because of longer distance. Therefore, the North African countries have the advantage in terms of transport cost.

The varieties presently cultivated in both North African countries and Jordan does not meet customer tastes of European Market. And if Jordan to be in a strong competitor, the selection of more suitable varieties are needed.

Bulgaria, Rumania and Hungary are making great efforts to expand their out-off-season tomatoes production for fresh tomatoes, but the export is directed towards Eastern Europe.

3. Tariffs and other restrictions

Tariffs, the preferences accorded to members and the standardization are the factors which affect the trade between the EEC and the nonmember countries.

Tariffs which is the import duties are meant to restrict the vegetables and fruits imports from nonmembers. However, negotiation is needed between Jordan and the EEC for the double purposes that is reduction on tariffs and agreement for exports.

With regard to the preferences according to members and associates, it's found that the European market for fresh tomatoes depends upon non-OECD supplier countries.

Producing for export to European markets where sales are by grade must be standardized. Standardization are applied by the member countries of the EEC for vegetables and fruits. The importance for standardization comes from that for one year about 150,000 tons of fruit and vegetables were turned back at the German frontier for

failure to meet standards.

E. Summary

The expansion and improvement in the off-season vegetables production has the following effects: increase in the gross national product, increase in the net farm income because it is considered as valued cropped, improve the balance of payment through increasing in the export, and increase the productivity of labor since the vegetables need more labor than most of the other crops.

The plan for improvement out-of-season vegetables production recommended to supply internal demand and developing export to Europe and neighboring countries. The obstacle with regard to the export to Europe is the varieties, since the present varieties which cultivated in Jordan did not meet the tastes of customer of the European market.

V. SUMMARY

Agriculture is a major sector of the economy; it contributed about one-fifth of gross domestic product in 1970.

Jordanian's natural resources occupied in the agricultural are not fully utilized since the cultivated land characterized by low productivity. Also, the supply of natural resources and the capital are limited.

This study discussed the development of agricultural sector in Jordan through the application of Mexican wheat, land reform in the dry land, and expansion of our-of-season vegetables production for export.

The farmer's income will increase if they used improved seed and fertilizer for wheat production became their net return will be increased by using this technique rather than the traditional one. In addition to that the balance of payment will be improved through reduction or elimination the wheat import. Also the employment situation will improved because of using high quantity of fertilizer, possibility of double cropping, and the increase in the output.

With regard to the production of out-of-season vegetables for export, the farmer's income will increase since the return from vegetables is higher than the traditional grain crops. In addition, the balance of payment will be improved through increasing the value of exports by increasing the quantities and moving the export from the traditional market to the European Market. The employment situation will be improved because vegetables production in general need high

quantity of labor.

If land reform in the dry land is going to be done by the same way in the irrigated land, it will have the following effects: economic development, social justic, and equality of opportunity.

The question which raises is whether to concentrate the effort on one development opportunity, e.g. Mexican wheat, or to improve the agricultural sector by doing all three. However, with limited capital resources and experts, Jordan couldn't take every new program at the same time. Therefore, concentration of the effort will be more productive if it is taken by the leading crops. In Jordan and in the Middle East, wheat is the leading crops. And if Jordan concentrated in wheat production, the result will be the quickest and it become a force in it self that will affect others. However, concentration should not completely at the expense of all other means of agricultural development. In many cases the effect of several improvements is cumulative if the works can take place at the same time in the same area. With regard to the expansion of vegetables production, the government had done many things such as irrigation project, credit facilities and extension services. Now, it is the task of the private enterprise to play an important role in marketing the outputs.

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