Price Policy and Grain Storage for Wheat in Jordan

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INTRODUCTION

This study of price policy and grain storage for wheat was performed in the Fall of 1969 at the request of the Jordonian government and the U.S. AID Mission.

The general study objective was to provide assistance to the Government of Jordan, through the Jordan Development Board, in the area of grain pricing. Specific study objectives were to develop an effective, economically viable system whereby the cereal grain supply would meet market demand and provide reserves adequate to meet foreseeable emergencies under conditions of reasonable price stability.

Oregon State University has an AID contract in Jordan aimed at increasing wheat production and establishing a wheat grading system. Prospective yield estimates and other data were obtained from the Oregon team.

Various people in the Jordanian Government also supplied reports and helpful suggestions, as well as setting some guidelines and limits. Specific guidelines, procedures and conclusions are presented in the following pages.

SUMMARY

As part of a larger AID-sponsored study of grain storage in Jordan, it was requested that an assessment be made of the country's economic capabilities to produce and store wheat. Special emphasis was to be placed on grain price policy and grain storage facilities.

Specific steps of the study involved determining: (1) future wheat consumption needs; (2) the physical possibility of producing this quantity; (3) the price necessary to encourage production; and (4) associated grain storage needs.

While discussing these steps locally, the Jordanian officials provided additional guidelines and limitations. The most important of these were that (1) the area used for wheat would remain relatively unchanged; (2) the present population of 2.2 million people (this includes the West Bank) would increase about 3.3 percent annually and that per capita consumption would remain the same; and (3) the price of wheat should remain low enough to avoid an increase in bread prices.

These guidelines and limitations for 10 years hence or by 1980 were assumed to mean 3 million dunums or slightly less as the maximum area for wheat (750,000 acres); about 3 million people consuming 400,000 metric tons of wheat; and the price per metric ton not to exceed JD 32 (JD 1= $2.80).

Wheat Supply

Jordan produces about 55 percent (172,000 of the 308,000 metric tons) of the wheat consumed within the country. The growing population, which for this study includes the West Bank, will demand more wheat in the future, possibly as much as a third more in 10 years. This demand can be met either by imports, which may cause an unfavorable balance of payments, or by growing more wheat in Jordan. With the limited access to outside food supplies, only one main highway and a part of one ocean inlet, Jordan considers it imperative that wheat production be increased. As a trend of the past few years, Jordan has been producing an ever smaller part of its wheat needs.

Recent production demonstrations by Oregon State Agronomists working in Jordan indicate that wheat yields could be doubled in 10 years. These yields would depend on the use of improved seed, along with a greater use of fertilizer, grain drills, summer fallows, and chemical weed control.

A 100 percent increase in average yields would give an output of 140 kilograms per dunum (equal to 20.5 bushels per acre); this yield could supply Jordan's 1980 estimated demand of 400,000 metric tons. This yield increase is considered reasonable. If yield only increased by 70 percent, then only about 85 percent of Jordan's needs would be produced by 1980. With a 40 percent increase in yield, only about 70 percent of the 1980 wheat requirements would be produced. All these higher yields would permit Jordan to produce a larger share of its wheat needs than the present 55 percent.

Response to Price

Jordonian wheat farmers have show that they will strive and, in fact, do increase production with a rise in the price of wheat. It is a recorded fact that production increases following a year with a high wheat price, and production declines following a year with a low wheat price, Information is not available to determine the cost and returns of producing wheat on the different kinds of wheat farms. But by generalizing on costs and using historical price data, it is reasonable to expect an increased production response if the price of wheat is permitted to rise to as much as JD 36 per metric ton. (This is an estimated situation using historical data and the farmers in this instance did not know the future price.)

Currently, the Government has what is referred to as a price support program. But, it is ineffective. The present support program is really a means of assuring that a supply of seed wheat is available and it in no way supports the price of the larger supply of commerically produced wheat.

Forward Pricing

The Government could set a price for wheat which would bring forth a larger, and hopefully desired, supply of wheat. Announcing 8 to 12 months in advance a price for next year's wheat crop could be a technique usable in Jordan. This is known as forward pricing.

If farmers could be assured a price of JD 30 or 31 per metric ton at harvest time in place of JD 27 or 29, as in recent years, all historical comparisons indicate they would produce more wheat. As farmers adopted more of the improved techniques which could lower their costs per unit and as they became accustomed to forward pricing, it is possible the same production could be obtained at a lower support price per unit.

Two key factors in the forward pricing of wheat are: (1) be sure the forward or future price is announced early enough so that farmers can respond with larger and better prepared seedings, and (2) be sure to have resources and means available to take all the wheat farmers offer at the announced price.

The costs to the Government should be relatively small to fully implement a forward pricing policy. This assumes that all of the costs of the forward price policy incurred by the Government will be recovered and perhaps a little additional when this price-supported wheat is sold to flour mills. During the marketing year, the Government could have as much as JD 3.8 million invested in wheat for as long as 6 to 12 months.

Other Production Stimulants

Incentive payments of various kinds could be used as a means to further encourage wheat production increases. These could include loans at reduced interest rates and discounts for purchasing such inputs as fertilizers and better seed.

To further encourage farmers response, points of delivery for the farmers should be closer to the respective small producers than is the case now. Even if this delivery point were only a large truck where small farmers could deliver sacks of grain, it would be an improvement over the present system.

Role of Imports

Imports could be used as a means to supplement and compliment the objectives of Jordan's wheat program. This wheat source could be very important in building reserves as well as a part of a continuing program. Situations where imports could fit into Jordan's wheat program would include (1) the need of some foreign wheat for blending; (2) years when drought or other adverse conditions occur in the wheat producing areas; and (3) economic advantages, such as when the price of wheat is appreciably less in neighboring countries.

Wheat production is currently being increased in many countries, in part through the use of high-yielding varieties and other inputs. This increased production is leading to lower prices. Jordan should be continually alert for the opportunity to import this lower-priced wheat.

Grain Storage Situation and Needs

As of November 1969, Jordan's total storage capacity was about 116,000 metric tons. Of this, 53,000 metric tons were in private hands, 43,000 were in mill storage, and 20,000 were owned by the Government. Some of this storage is not covered. Most of the grain is stored in sacks. Present storage practices are in considerable need of improvement.

Should the Government initiate a price support and purchase program, the amount of Government storage needed would expand. The amount needed will vary according to population growth, grain consumption, and carryover desired. On the basis of an annual growth in population of 3 percent per capita consumption of 145 kilograms per year, and assuming a 30 percent carryover, the amount of Government capacity needed would be 154,000 tons in 1970 and would expand to 200,000 tons in 1979.

Other Considerations

Cost and return studies of the major crops are needed to determine economic advantages, and as a basis to encourage production of the most profitable crops.

Experimental work and field demonstrations which show improved technology and increased yields for wheat should be continued. Publicity should be given to these findings in order to encourage a continued adoption of improved techniques by farmers at an accelerated rate.

In anticipation of an increase in wheat production, a better grading and pricing system will be needed. The Oregon team is setting up new grade standards for wheat and training local people to use these standards. Up to this time, Jordon has had just three poorly defined wheat grades.

AGRICULTURAL BACKGROUND

Jordan has limited resources for wheat production. With some 95 million dunums (37,000 square miles) in Jordan, only about 5 percent is used for cereal, legume and industrial crops. Over the past 15 years, these crops have varied from 3.3 million to 5.2 million dunums (5). 1/

Wheat is planted on some 2.7 million dunums annually, (4 dunums = 1 acre), with this area being larger in years of favorable moisture and smaller in years of less favorable moisture. In 1956, rainfall was favorable with 400 to 600 mm. of precipitation in the major wheat areas; plantings exceeded 3.2 million dunums. In contrast, the rainfall was unfavorable in 1963 with 160 to 370 mm. of precipitation in the wheat areas; wheat was planted on only 2.1 million dunums (3). 2/

Extreme crop fluctuations may cause averages to be more difficult to understand; but, because of the limited time for this study it is necessary to use them. The 2.7 million dunums of wheat is equal to about one-fourth of the arable area and 68 percent of the area planted to winter crops. 3/

According to law, wheat is not to be grown on the steeper or more arid lands; but, this law is not enforced. In years of favorable growing conditions, some of these lands are probably planted to wheat. The extent that these lands are included in area and production statistics is unknown. One estimate shows 10 percent of the wheatland is in areas receiving less than 200 mm. of rainfall. The remaining wheatland is 48 percent in 200 to 300 mm. rainfall areas, and 42 percent with 300 mm. and over.

Dunums planted to wheat and barley have tended to decline slightly over the past few years. From 1954-58 to 1962-66, the average area of wheat and barley each decreased by 0.2 million dunums, wheat from 2.8 to 2.6 million, and barley from 1.0 to 0.8 million dunums. This is a total decrease of 400,000 dunums in cereal grains in eight years. Some people believe this 400,000 dunums will be used for wheat if winter rainfall is plentiful and favors a large wheat crop. With this recent five-year average of 2.6 million dunums of wheat, the yield averaged 67 kilograms per dunum and total production averaged 172,000 metric tons. During this same five-year period, total imports of wheat and wheat flour averaged 110,000 metric tons.

From 1962 to 1966, the local domestic (better quality wheat) price of wheat at Amman averaged JD 35.8 per metric ton. Commercial (low quality) wheat in these years averaged JD 31.5 per metric ton, equal to 88 percent of local domestic price, or a commercial price of JD 4.3 below the local domestic price. The price of PL 480 wheat averaged JD 27.1 per metric ton (equal to $75.88 per metric ton or $2.07 per bushel).

1/ The numbers in brackets refer to references at the end of this report.
2/ Source: Department of Statistics
3/ Source: Ministry of Agriculture

The Jordan Government sets a price at which it will buy wheat; but, purchases are limited to seed wheat. It will buy from farmers only, not merchants or millers. Price is determined near the time of harvest, sometime after the crop estimate of May 15. It becomes effective July 1, when the Government starts buying wheat at a stated price. The purpose of this program is largely to assure a supply of seed wheat which may be sold or given to farmers.

To a very limited extent, farmers have a choice of selling on the open market or to the Government; but, Government purchases consist of small quantities. It was reported that many farmers owe the Government money and would have to pay their debt if they sold wheat to it. Too, merchants who have extended credit to small farmers are on hand at harvest time to collect wheat as payment, so these farmers do not have wheat left for sale on July 1 when the Government starts to buy. This situation may be remedied through the new farm loan program. One small farmer said only big farmers sold to the Government. Others indicated big farmers with grain storage were better farmers and always get a price for their wheat above that offered by the Government.

SUPPLY AND DEMAND SITUATION FOR WHEAT

Some progress has been achieved in the goals of Jordan's Seven-Year Program, 1964-70. This progress includes: (1) a major reduction in the external balance of trade deficit; (2) increase in per capita income; and (3) a reduction in the level of unemployment (7).

The population estimate given as a current base for Jordan is 2.2 million which includes the West Bank. Average consumption per capita for wheat has been about 140 kilograms and, with the 2.2 million population estimate, annual wheat requirements total 308,000 metric tons.

The price of commercial wheat is about JD 29 to 30 per metric ton but at the start of the 1969 harvest the price was reported to be around JD 33 per metric ton. The 1969 crop was initially forecast as good and this, in turn, tended to drive the price downward. A standard grading system for wheat does not exist in Jordan but is being developed by Dr. D. D. Hill during the winter of 1969-70, as suggested in an earlier report (2).

An increase in wheat production can reduce wheat imports and help improve the external balance of trade. But, if it is desirable or necessary to import wheat from other countries, the supply available for imports appears adequate. All of the major wheat export countries have a surplus of wheat. In this area, Iran, Iraq, and Turkey are using more of the high-yielding varieties of Mexican wheat along with improved technology to increase production, probably to the extent of having some wheat for export. Some of the flour mills near Amman use imported wheat for blending. According to one miller, his order of preference for imported wheat by country was: Syria, Argentina, United States, and Turkey. Beyond these four countries, his preference for wheat was generally from neighboring or European countries depending on which countries had wheat available for export.

Production Response to Price

Jordan's estimated 25,000 wheat farmers have responded to the price of wheat. Chart 1 shows that wheat production increased if the previous year's price was high and production declined if the previous year's price was low. The lines on this graph tend to form boxes and indicate a definite farmer response in terms of production which was related to the previous year's price.

Chart 2. Price and Production Line (Supply) with Production Trend One Year Later, for Jordan, Based on 1955-1967 Data.

Note: A is ave. price and production for 1959, 1960, 1963, and 1966, years of high prices for wheat.
B is average production next year after A, for 1960, 1961, 1964 and 1967 using same wheat price.
C is average price and production for 1955, 1958, 1961, and 1964.
D is average production, one year after C, 1956, 1959, 1962 and 1965, using same price.
E is for years 1956, 1957, 1962 and 1965.
F is for years one year after E, 1957, 1958, 1963, 1966.

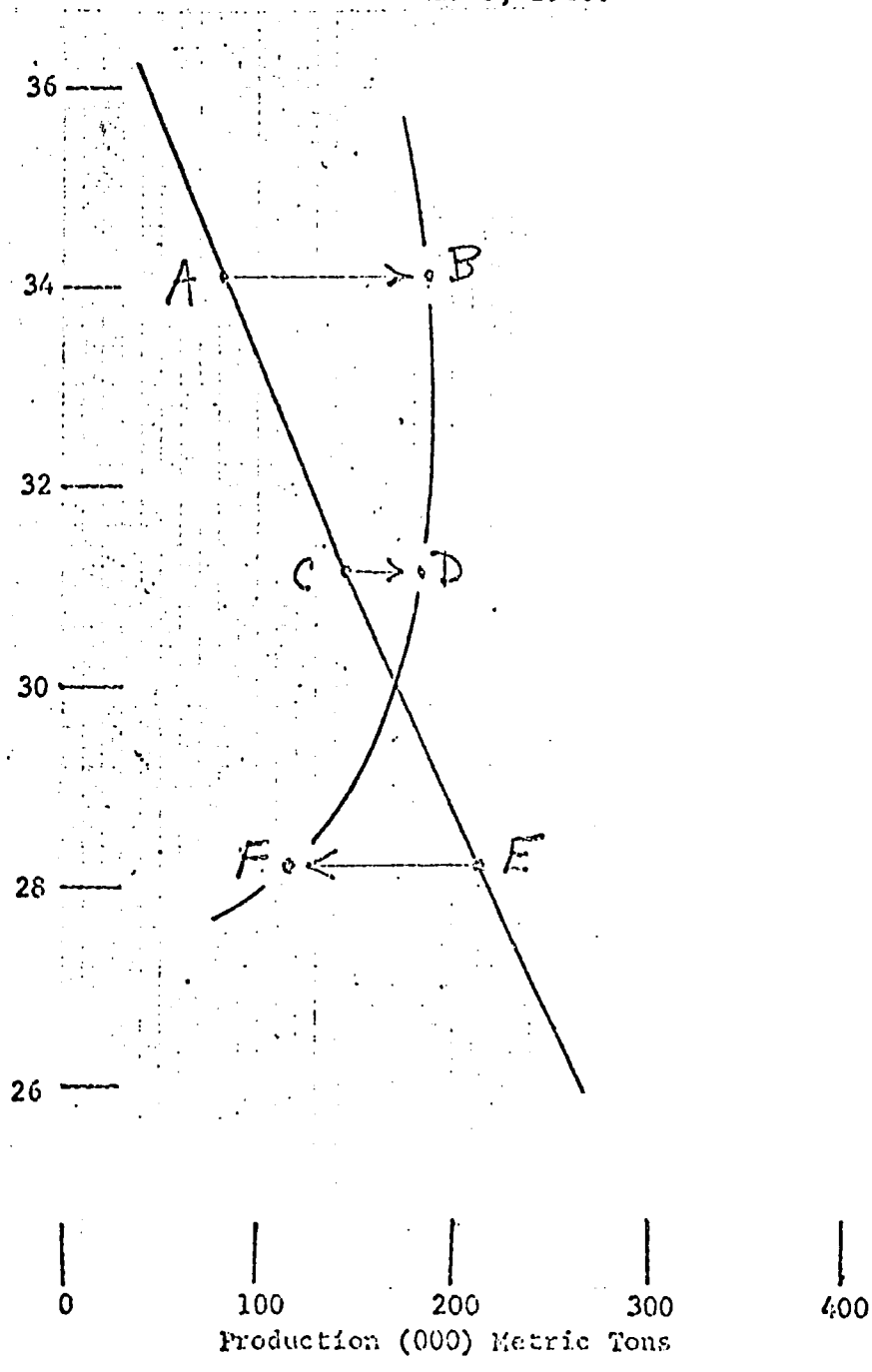

Chart 1 Production and Commercial Price of Wheat in Jordan 1955-68 (Cobweb Theory)

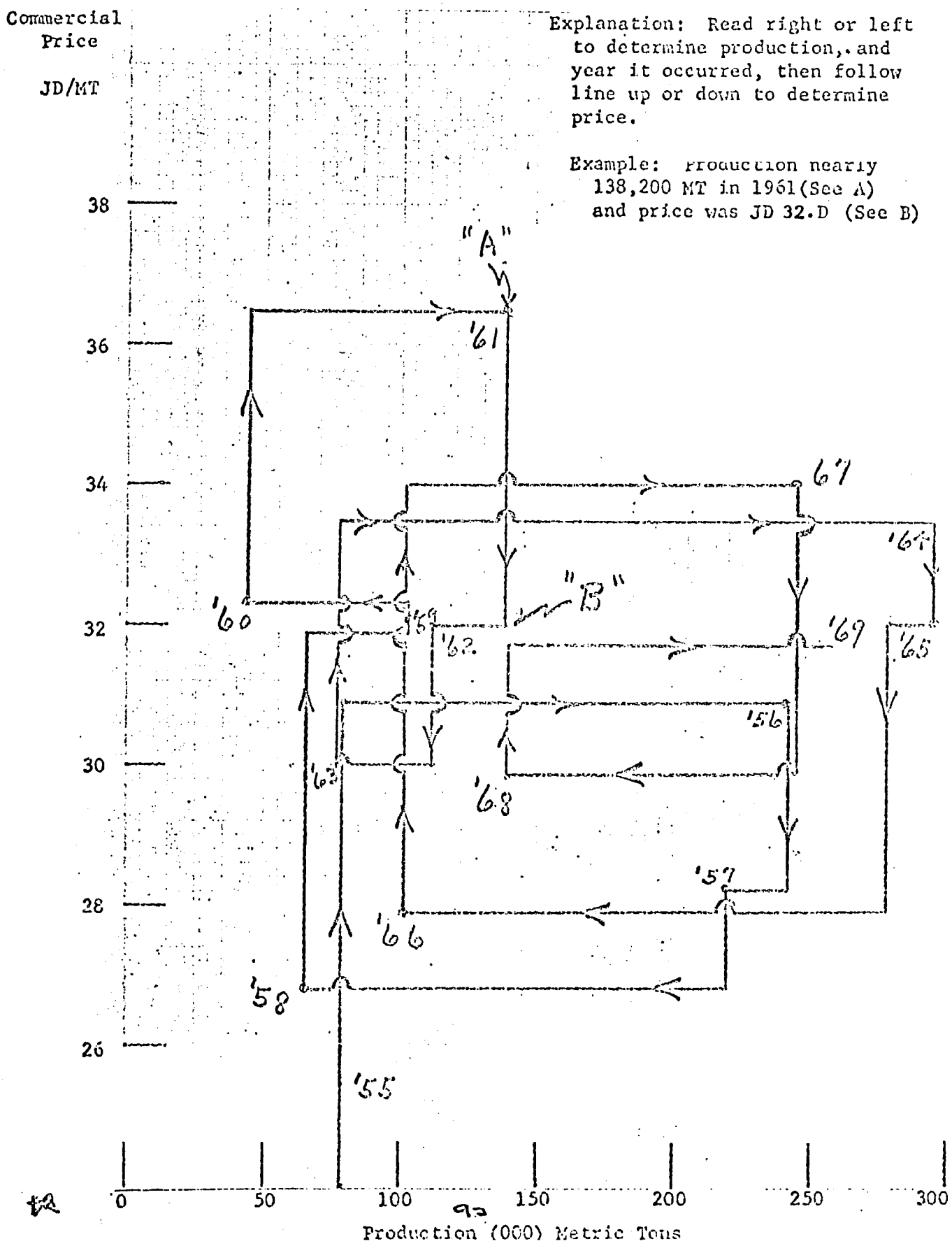

Chart 2 shows the relationship of price to production and to production for the next year. The situation illustrated here is that last year's price influences the farmer's response to wheat production. Line A,C,E shows the production-price relationship for the period 1955-66. The years with high prices (point A) have relatively low production and were followed the next year by increased production (point B). A comparison of the years at point B with the years for point A, shows increases of 123 percent in wheat production, 12 percent in dunums of wheat, and 67 percent in annual rainfall. At the middle point C, production the next year increased to point D, the increases were 27 percent in wheat production, 5 percent in dunums of wheat, and 17 percent in annual rainfall. With a low price and a correspondingly large wheat crop (point E) the following year's crop decreased by 54 percent (point F) while dunums decreased 19 percent and annual rainfall decreased 25 percent. In all instances, the price tended to return toward the average of JD 31.5 per metric ton for commercial wheat. This further illustrates Jordanian farmers are responsive to price.

Definition of Price Policy

A price policy is a frame of reference in which those in authority can work to accomplish goals by use of prices. Basically, in the case of wheat, the producer or farmer is of primary consideration. He should obtain a price for his wheat which will assure him of a return for all his expenses plus some profit. Also the consumer of the product, in this instance bread, would be assured that the price remains within reasonable relationships to other products. Thus, the prices paid to farmers for wheat must be sufficient to bring forth the desired supply, but not high enough to bring forth excessive supplies or to cut production of other crops.

Jordan Government wheat purchases are limited to seed wheat and are too small to be effective for price support. Excessive production in one or two consecutive years will over-tax all storage facilities. On the other hand, an effective fixed price for support purposes could impose severe demands on storage because the price support agency should be expected and prepared to take all the supported grain that is offered, even if supply exceeds requirements (4).

A seminar in Istanbul (November 1968) emphasized many problems with respect to price policy. For example, will higher prices lead to greater output or, in fact, reduce output? What will happen to the rest of the economy if food prices increase? Is it better to let food prices increase or is it more effective to subsidize production? Several seminar participants agreed that a price support program might serve as an incentive for greater output even if it were set below the market equilibrium price because the support reduced price risk.

Background information is lacking to determine Jordanian farmers' response to forward pricing; that is, announcing a price in October or November for next year's crop. The analysis for this study is based on aggregate supply and prices which may be accurate only in broad terms. A similar method proved useful recently in a study of land use adjustments to increase production in Greece (9). There are limiations on the degree of refinement that can be applied from this type of analysis. Mellor wrote that we are greatly in need of careful studies of aggregate supply response which would give us a more accurate idea of how prices change aggregate agricultural production (8). In some instances, he suggests credit or some other factors may affect production more than prices. He concluded with the conflicts that could arise from price adjustments and says, "In summary, then, the problem of meeting scarcity is a complex one, in which questions not only of economics but of administration and politics necessarily enter."

Assumptions for Projections

The following guidelines were used to make assumptions about the next 10 years:

The rate of population growth is estimated at about 3 to 3½ percent annually. At this rate, the population in 10 years is estimated to be 2.9 million.

Annual wheat and flour consumption has been accepted as 140 kilograms per capita. This consumption rate is expected to continue into the long term; therefore, it is assumed the current or short-term consumption is 308,000 metric tons of wheat. Ten years hence, the long term consumption will be 400,000 metric tons annually.

Under present circumstances, wheat area will remain fairly constant in both the short and long term. Thus the existing 2.6 million dunums is about what can be expected in the long term, probably as a minimum. Some people think the 400,000 dunums decrease in cereals over the past eight years will be used for wheat again, especially if the price is high enough to attract this area into wheat. So, the long term wheat area is assumed to range somewhere around 2.6 to 3 million dunums.

Research is underway to increase wheat yields. Greater use of fertilizers, grain drills, summer fallow, chemical weed control, and high-yielding varieties of Mexican wheat all add to the very favorable possibility of increasing production. Yields of 80, 100, 120, and 140 kilograms per dunum are possible by the end of 10 years with improved technology (see Chart 3). The differences in yields reflect differences in the rates of adopting technology. This rate of adoption can be influenced by the wheat price. For any year shown along the bottom axis, imports with any selected yield is equal to the distance from that point up to the consumption line.

The price of wheat in this study is supposed to be at a level which will not cause a rise in bread prices. This means any increases in wages need to be absorbed by the wheat producer or by some kind of incentive payment. Here it is assumed that past relationships of wheat supply to wheat price will continue into the long term, although some people think the current commercial wheat prices of JD 29 per metric ton could increase by 10 percent without any increase in the price of bread. In other words, all production and prices not specifically mentioned here as changing will remain as they were in recent times. The one exception is that neighboring countries will be expected to have more wheat for export or at least they will demand less wheat from other exporting countries. Thus the exporting countries will have more wheat available for Jordan, if it is needed.

Chart 3. Estimated Wheat Consumption* and Trends of Wheat Production** with Estimated Imports, 10 Years Hence, Jordan

Explanations: *Jordan's wheat consumption is estimated to be 308,000 MT in year 1 and 400,000 MT in year 10.
**Average production for 1962-66 is used for year 1, with selected yields per dunum reflecting total production at the end of 10 years.

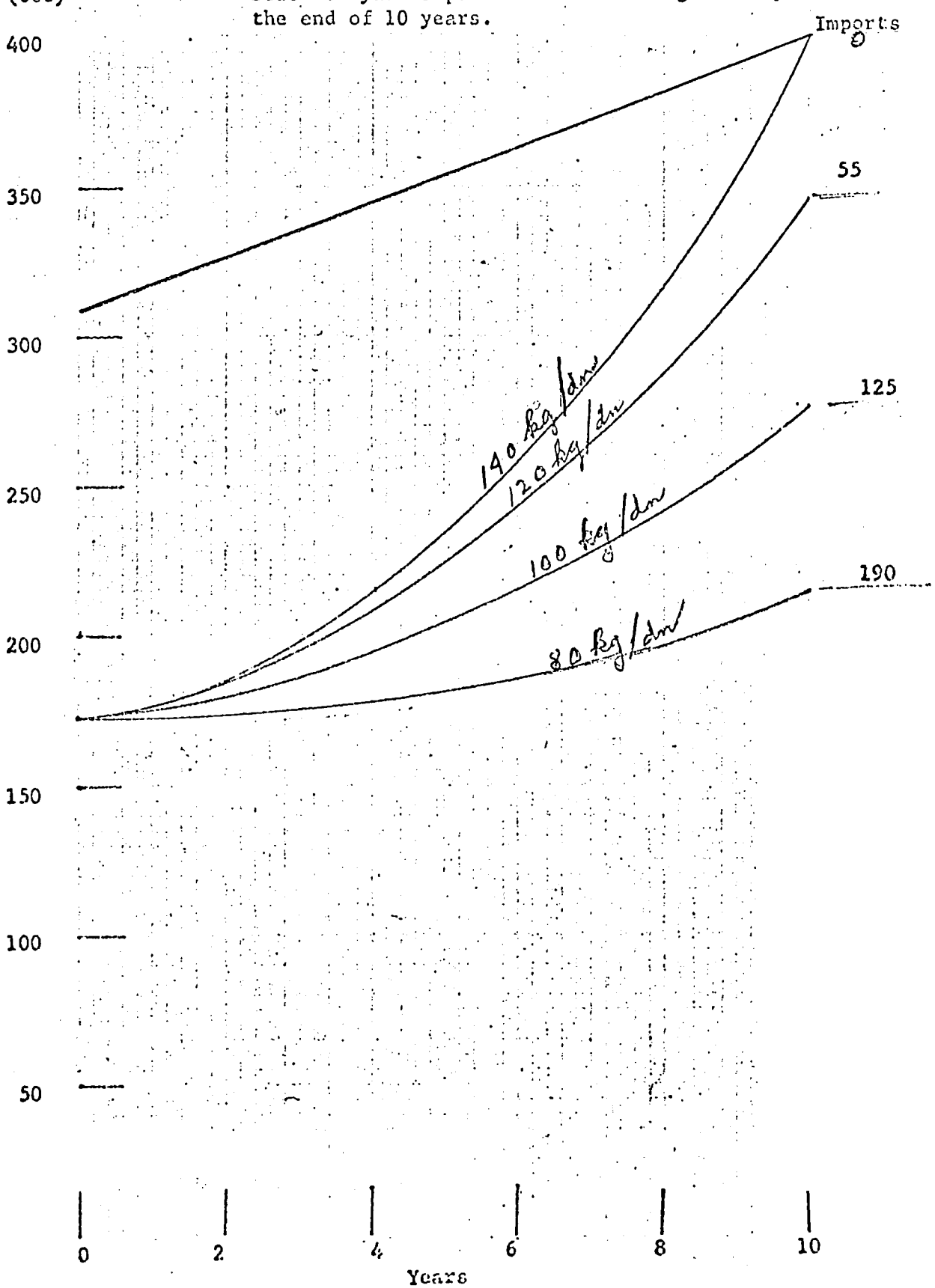

Chart 4. Estimates of Gross Sales and Costs Per Dunum, for Selected Yields and Sale Prices of Wheat, Jordan

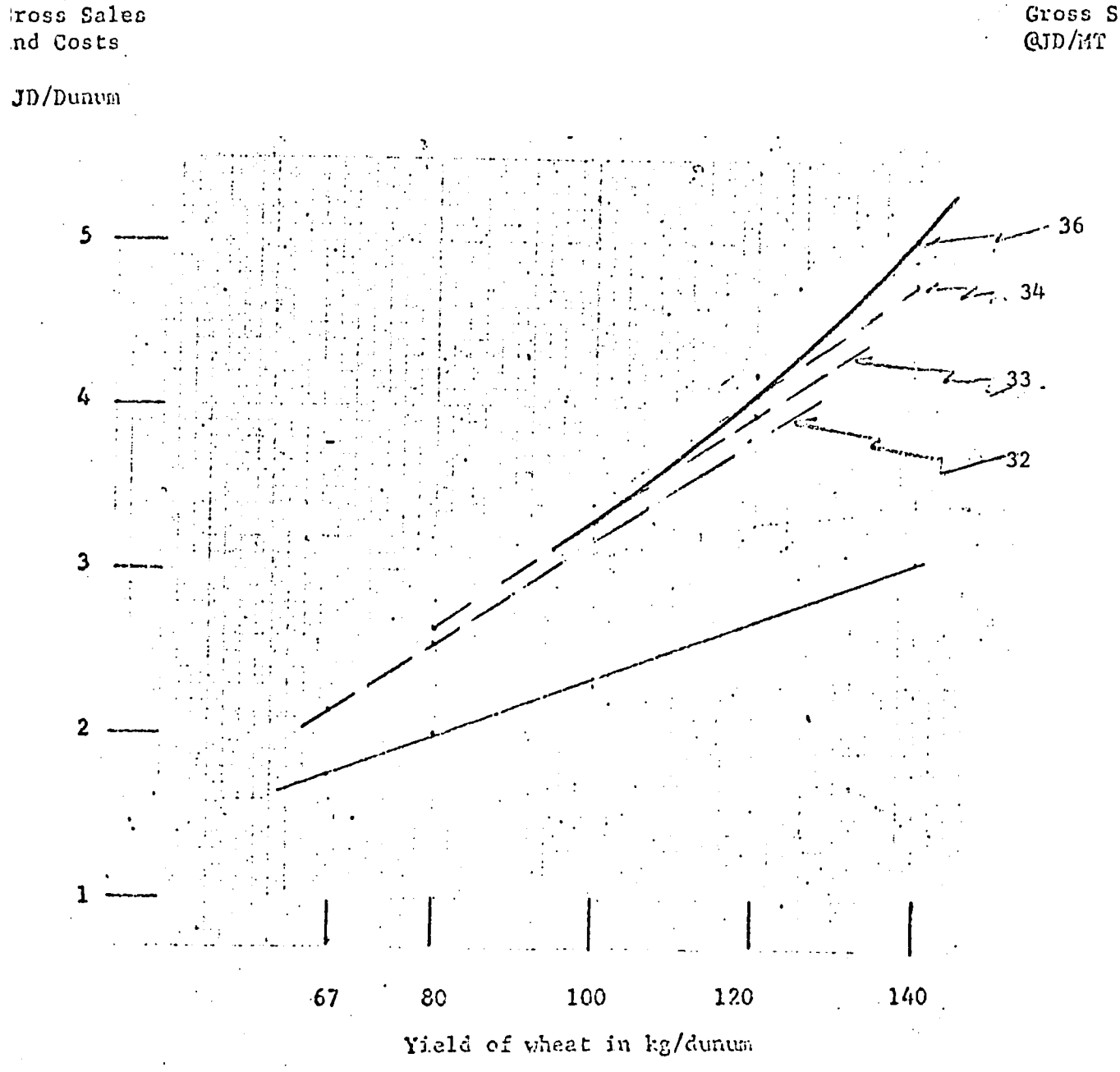

Chart 5. Estimates of wheat price and supply response for Jordan, 1980

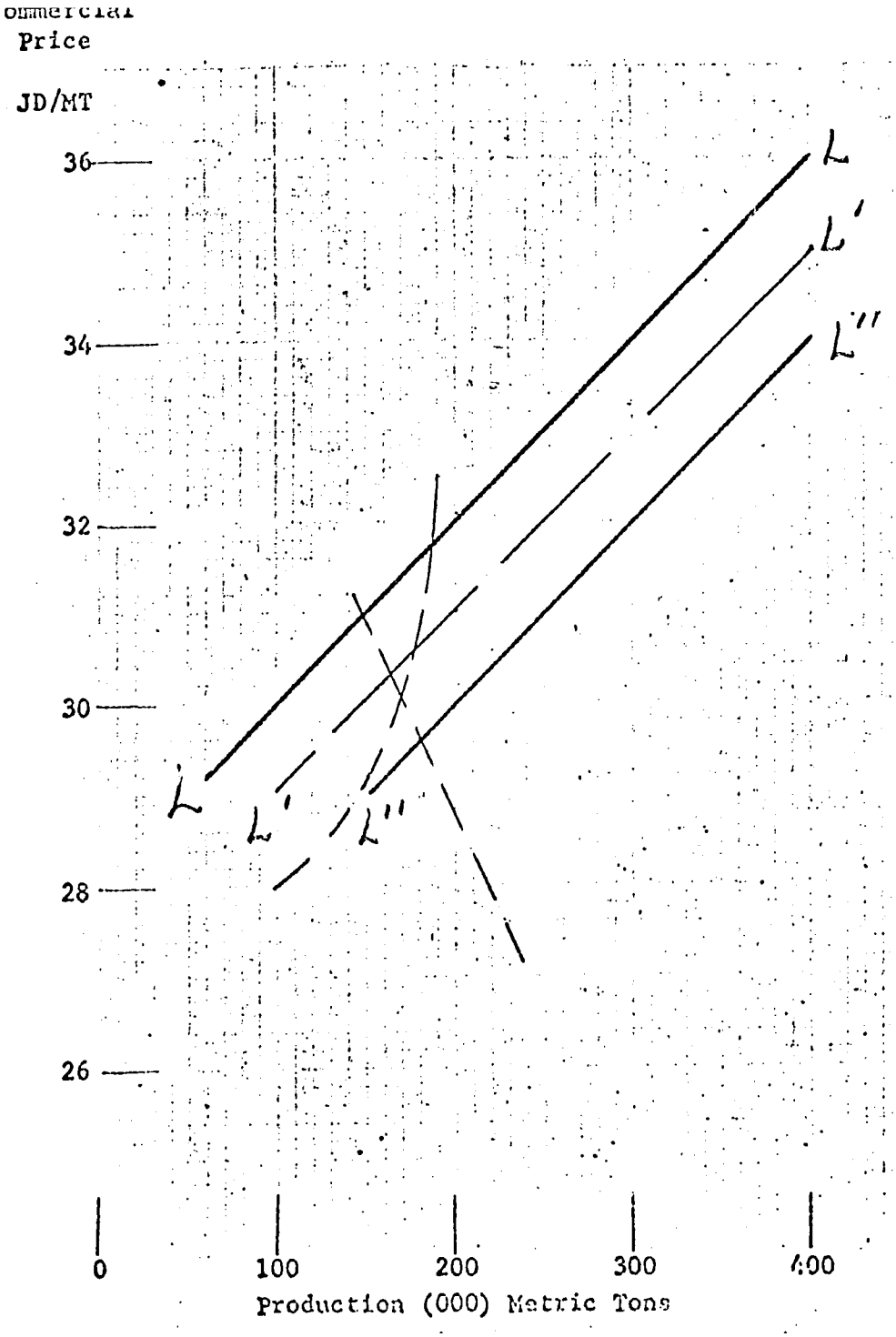

Table 1 - Price, production, dunums, cost and return estimates for short term. Jordan.

	Short term 67 kg. yield
Price per metric ton (JD)	31.5
Production (000 metric tons)	172
Area (000 dunums)	2,567
Gross sales (000 JD)	5,418
Producers' cost (000 JD)	4,492
Net return (000 JD)	926
Price per metric ton (JD)	32
Production (000 metric tons)	210
Area (000 dunums)	3,134
Gross sales (000 JD)	6,720
Producers' cost (000 JD)	5,484
Net return (000 JD)	1,236

Table 2 - Price, production, dunums, costs and return estimates for long term with selected yields. Jordan.

		Long Term		
		100 kg. Yield	120 kg. Yield	140 kg. Yield
A.	Price per metric ton (JD)	33	33	33
	Production (000 metric tons)	250	250	250
	Area (000 dunums)	2,500	2,083	* *
	Gross sales (000 JD)	8,250	8,250	-
	Producers' cost (000 JD)	5,785	5,543	-
	Net return (000 JD)	2,465	2,707	-
B.	Price per metric ton (JD)	34	34	34
	Production (000 metric tons)	300	300	300
	Area (000 dunums)	3,000	2,500	2,143
	Gross sales (000 JD)	10,200	10,200	10,200
	Producers' cost (000 JD)	6,942	6,652	6,558
	Net return (000 JD)	3,258	3,548	3,642
C.	Price per metric ton (JD)	35	35	35
	Production (000 metric tons)	350	350	350
	Area (000 dunums)	*	2,917	2,500
	Gross sales (000 JD)	-	12,250	12,250
	Producers' cost (000 JD)	-	7.762	7,650
	Net return (000 JD)	-	4,488	4,600
D.	Price per metric ton (JD)	36	36	36
	Production (000 metric tons)	400	400	400
	Area (000 dunums)	*	*	2,857
	Gross sales (000 JD)	-	-	14,400
	Producers' cost (000 JD)	-	-	8,742
	Net return (000 JD)	-	-	5,658

* Requires a number of dunums beyond the limits of this study.
** Requires too few dunums to be realistic.

To get the 300,000 metric tons would require a price of JD 34 per metric ton. This maximum level of production would give gross sales of JD 10,200,000 and cost JD 6,942,000 to produce. The net return to the producers would be JD 3,258,000.

Also in Table 2 is a price of JD 33 per metric ton with 250,000 metric tons of production. This quantity is below the desired needs but it requires only 2,500,000 dunums with gross sales of JD 8,250,000 and a net return of JD 2,465,000. This specific situation is not good because imports of 150,000 metric tons would be too large.

3. Yield of 120 kilograms per dunum:

With this alternative, 300,000 metric tons could be produced on 2.5 million dunum (Table 2). This production means imports of only 100,000 metric tons would be needed to provide the consumptive requirements in the long term. This would be an improvement over the short term. To bring forth this production, an estimated price of JD 34 should be received by the producers. Gross sales of JD 10,200,000 and costs of JD 6,652,000 leaves a net return of JD 3,548,000. This net return should attract the farmers' interest and bring forth the production of 300,000 metric tons of wheat.

A further increase in price to JD 35 could bring forth an estimated 350,000 metric tons of wheat and thereby reduce imports to 50,000 metric tons. This quantity of wheat would require 2,917,000 dunums, which is within the desired framework for this study. Producers' net income would be further increased, rising to JD 4,488,000 with gross sales of JD 12,250,000 and costs of JD 7,762,000. This alternative with 350,000 metric tons of production and imports of only 50,000 metric tons could be a most desirable situation. Smaller imports of wheat, like 50,000 metric tons in the long term, will certainly help toward a more favorable balance of exports and imports.

4. Yield of 140 kilograms per dunum:

With this yield, the area for wheat production would need to be 2,143,000 dunums to produce 300,000 metric tons (Table 2). It is assumed this output would come about with an announced price of JD 34 per metric ton for wheat. This output would generate wheat sales of JD 10,200,000 and a net return of JD 3,642,000 after paying costs of JD 6,558,000. The imports would be an estimated 100,000 metric tons. This quantity of imports is favorable when compared to the short term and under some situations might be considered as a desirable long term alternative.

A JD 1 increase in price to JD 35 per metric ton would be expected to raise wheat output to 350,000 metric tons using 2,500,000 dunums. This 350,000 metric tons of output for wheat would require imports of only 50,000 metric tons. As with other situations, the net return increases with higher prices. Here gross sales equal JD 12,250;000; costs equal JD 7,650,000; and net return is JD 4,600,000.

A JD 36 per metric ton and this yield are expected to encourage a wheat drop equal to all of Jordan's estimated wheat requirements in the long term.

This long term alternative requires a higher price of JD 36 per metric ton to encourage production increases which will equal total consumptive requirements of 400,000 metric tons, using 2,857,000 dunums. This large production means imports are not necessary. Here, as shown in Table 2, gross sales total JD 14,400,000 while costs amount to JD 8,742,000 and net returns equal JD 5,658,000.

Review of Alternatives

The feasible alternatives for the long term (by 1980) are those which will reduce imports below 136,000 metric tons, the quantity of imports estimated in the short term. Thus, to be included as a feasible alternative, the yield must be at least 100 kilograms per dunum and the minimum price at least JD 34 per metric ton based on recent historical data for market or commercial wheat (See Chart 2 and Table 2). Of the alternatives shown in Table 2, only the botton three situations qualify as feasible long term alternatives. The price is for commercial wheat without respect to new grade standards which are currently being developed.

turns out to be much below 350,000, it may be the farmer response is along line L'-L' and if response is much above 350,000 metric tons, then perhaps a price-supply line below L"-L" should be drawn.

But back to the JD 33 with 350,000 metric tons. It would seem the Government could be required to purchase as much as one-third the crop at harvest time to make the announced support price effective. Jordan is a wheat deficit country and imports could be limited until the Government holdings are used. Thus it would seem the one-thrid of a crop purchased by the Government would be sold to millers within 6 to 12 months. Assuming an announced forward price of JD 33 and production of 350,000 metric tons, the Government would need JD 3,851,000 for 6 months; this would then decrease to zero by the end of the crop year. As more storage space becomes available on private farms and a price-supply line is developed which represents farmer response to forward pricing, the Government costs of providing a price support program should decrease.

Other means could be used to support the price and add to farm income. For example, if it is desirable, small farmers could get a higher price or payments could be higher as compared to relatively large farmers. Too, some means of picking up grain at the place of farmer storage, especially for small farmers, might be a way of getting better response from all farmers but more especially the small farmer. To avoid too much Government expenditure at any one time, it might be desirable to issue certificates to farmers as payment, and date the certificates to be redeemable at different times throughout the year.

To develop guidelines for a price policy which can become effective by 1980, one must rely on past performance in Jordan and the experiences of other countries. Forecasting crop conditions throughout the year together with forward pricing of wheat must be started now and widely publicized in order to gain knowledge of farmers' responses to these in terms of increased wheat production. The framework and guidelines outlined here will need to be continually adjusted in line with new and current economic conditions. This means the support prices, incentives, wheat production, and the availability of imports as well as the import price will bear on the effectiveness of a long term grain price policy for Jordan aimed at increasing wheat production, and maintaining present positions with respect to dunums used for wheat and the price of bread.

Table 3

GRAIN STORAGE FACILITIES
EAST AND WEST BANK OF JORDAN

District	Department of Supply			Mills			Private			All Storage
	Covered	Open	Total	Covered	Open	Total	Commercial	Farm	Total	
					Metric Tons					
Amman	12,000	-	12,000	21,000	17,000	38,000	33,253	4,000	37,253	87,253
Irbid	3,000	-	3,000	2,500	2,500	5,000	6,000	2,180	8,180	16,180
Balqa	-	-	-	-	-	-	2,000	500	2,500	2,500
Karak	1,000	-	1,000	-	-	-	3,500	1,500	5,000	6,000
Na'an	-	-	-	-	-	-	-	-	-	-
Nablus	4,000	-	4,000	-	-	-	-	-	-	4,000
Total	20,000	-	20,000	23,500	19,500	43,000	44,753	8,180	52,933	115,933

Data supplied by USAID/Jordan and the Supply, Import-Export Department, Government of Jordan. November 1969.

PRESENT STORAGE SITUATION

Farm Storage

Most grain is stored in sacks. It is understood that various other containers, such as barrels, or bins made of mud and straw, are used by farmers to store wheat for home consumption and to keep seed for planting.

There appears to be a special need for improved farm storage. In visits to several farms, it was noted that one farmer used an abandoned building in a village as storage, another used a room attached to his home and a third used a building normally used for machinery storage.

Apparently no pest control measures are used for grain in farm storage. However, in the case of the few farm storage structures visited, no insect damage was apparent. Much damage was done by mice and rats. Spillage of grain due to rodents was noted in all of the storage structures.

Commercial Storage

Two of the largest flour mills in Amman were visited, and both milling facilities and storage areas examined. Both mills store grain in sacks only. One mill had all wheat on hand in covered storage. The other mill, however, had at least two large stacks of wheat still stored in the open, even though there was adequate covered storage available at the time of our visit. This plant was moving wheat from the storage site directly to the mill in order to reduce labor cost of having to move the grain twice.

Storage practices at both mills are very poor. Sacks of grain were placed directly on the warehouse floor. Many sacks had water or high-moisture damage. Wood pallets would have helped to reduce much of this.

No passageways are provided; therefore, proper ventilation and control of insects and rodents cannot be accomplished. Insect and rodent damage was evident. There appeared to be no effort to clean up spillage caused by rodents or damaged sacks.

The present estimated mill storage capacity is shown on Table 3. The covered storage is made of concrete and considered to be good. However, if proper storage practices were followed, the capacity would be considerably reduced. The open storage is used merely to hold wheat until it can be moved into covered storage or directly into the mill.

At one mill some extra covered storage was being constructed. The manager gave no indication as to the additional capacity, but it appeared to be a small amount in comparison to needs. The manager of the other mill visited

indicated that plans were being made to provide for 2,500 metric tons of additional storage. This storage would be built for bulk handling of wheat in an effort to reduce losses and labor costs.

Government of Jordan Storage

The Government's Supply Import/Export Department (SIED) has storage sites at Ruseifa, Irbid, and Karak. There is also a site located on the West Bank at Nablus. We visited the site at Ruseifa.

Government storage at Ruseifa consists of both bulk and sack storage. The storage structures are of three types: (1) flat covered storage for sacks, (2) concrete bins with a capacity of 500 metric tons each, and (3) metal silos with a capacity of 100 metric tons each.

Only a part of the flat warehouse storage space was being used at the present time. These structures could provide adequate protection for grain stored in them, with proper insect control protection. It is our understanding that the SIED does use insect control measures at the Government sites.

The metal silos have no grain stored in them at the present time. They have not been used recently because of grain being lost a few years ago which was due to deterioration. The SIED does not consider the metal bins suitable for grain storage.

The concrete bins are considered to be of good construction. All of the bins contained some wheat; but, none were filled to capacity. Cleaning and elevating equipment are provided for these bins. Grain can be received either in bulk or sacks; however, only sacked grain has ever been received at the site, since grain in all areas are sacked.

The SIED plans to build additional bulk storage at the site at Ruseifa; but, there is apparently no time schedule set for this project.

The total SIED storage capacity, including the West Bank, is also shown in Table 3.

ESTIMATED STORAGE NEEDS

An attempt was made to estimage Government storage needs from 1970 to 1979. The process involved taking into consideration population growth, grain consumption, average use of storage space, and carryover. The results are presented in Table 4.

1. Population (column 1) was estimated to increase at the rate of 3 percent per year. This implies an increase from 2,200,000 in 1970 to 2,900,000 in 1979.

2. Consumption (column 2) was estimated to average 140 kilograms per person per year. This figure, when multiplied by population, indicated an increase in consumption from 308,000 metric tons in 1970 to 400,000 metric tons in 1979.

3. Storage space needed, in one sense, is equal to consumption. When the grain is harvested there is an immediate peak load need for storage. This capacity is drawn down during the year to zero. On the average, grain storage space is utilized about 20 percent of the year. This figure is indicated in column 3.

4. Carryover in the past has been about zero. This figure is undesirable in that it makes no provision for national emergency, possible loss of flour presently furnished by U.N.R.W.A., or possible interruption of foreign imports. If a price support and purchase program is to be instituted in Jordan, what level of carryover or reserve stocks is desirable? In the United States, the figure is much higher than Jordan could afford. We have postulated three possible levels: 20 percent, 30 percent, and 50 percent. These percentages, multiplied by estimated annual consumption, produce the figures reported in columns 4, 6, and 9.

The average storage unitization figure in column 3, plus the carryover figures reported in columns 4, 6, and 8 produce the total Government storage figure presented in columns 5, 7, and 9. On the basis of the various carryover levels, the capacity needed by the Government would expand as follows:

Carryover level Percent	Government Storage Needed 1970	1979
20	124,000	160,000
30	154,000	200,000
50	216,000	280,000

The Government expressed an interest in a carryover level of 30 percent.

These figures are, of course, rough and will vary as assumptions change. The selection of a 20 percent figure for average storage utilization and its use as a basis for calculating total storage needs is arbitrary. In terms of peak load needs at harvest time it is obviously inadequate. But if it is recalled that many kinds of private storage are available and that imports may be received at other times during the year, it is less out of line.

There are several factors which will influence the need for additional storage especially in the Government sector. If the Government adopts a price support purchase program it may be necessary to provide additional storage, not only at present sites, but possibly at other points throughout the wheat producing area. Also, if indicated increases in yield per dunum are realized and the Government adopts a sound policy to stockpile feed grains which will provide a sizable carryover as indicated in Table 3, additional storage facilities will no doubt be needed in all sectors of the wheat industry.

Table 4

ESTIMATED GRAIN STORAGE NEEDS IN JORDAN, 1970-1979

Year	Population*	Consumption** MT	Average use of storage space (20%)*** MT	Government Storage Needs Under Varying Carryover Levels					
				20% Carry Over		30% Carry Over		50% Carry Over	
				Carry Over MT	Storage Needed MT	Carry Over MT	Storage Needed MT	Carry Over MT	Needed MT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1970	3,200,000	308,000	63,000	63,000	124,000	92,000	154,000	154,000	216,000
1971	2,266,000	317,000	63,000	63,000	126,000	95,000	158,000	158,000	221,000
1972	2,334,000	327,000	65,000	65,000	120,000	98,000	163,000	163,000	228,000
1973	2,403,000	336,000	67,000	67,000	134,000	101,000	168,000	168,000	235,000
1974	2,475,000	345,000	69,000	69,000	138,000	103,000	172,000	172,000	241,000
1975	2,549,000	356,000	71,000	71,000	142,000	107,000	178,000	178,000	249,000
1976	2,626,000	367,000	73,000	73,000	146,000	110,000	183,000	183,000	356,000
1977	3,704,000	378,000	76,000	76,000	152,000	113,000	189,000	189,000	265,000
1978	3,785,00	390,000	78,000	78,000	156,000	117,000	195,000	195,000	273,000
1979	2,869,000	400,000	80,000	80,000	160,000	120,000	200,000	200,000	280,000

* Estimated increase at 3.0 percent per year
** Estimated at 140 K.G. per capita
*** Estimated use of present storage space over complete season

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