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OUTLOOK FOR SUPPLY AND DEMAND
FOR CITRUS FRUITS IN LEBANON IN 1975

By
AMIN ABDUL MUHSEN HIJAZI

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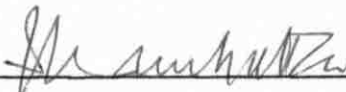
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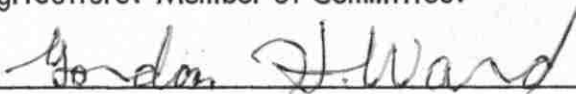
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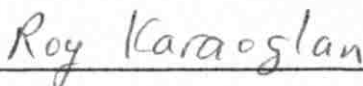
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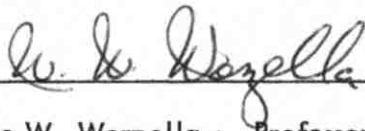
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LEBANESE CITRUS IN 1975

HIJAZI

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AN ABSTRACT OF THE THESIS OF

Amin Abdul Muhsen Hijazi for Master of Science in Agriculture
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Title : Outlook for supply and demand for citrus fruits in Lebanon in 1975.

The purpose of the study is to assess the future supply and domestic demand conditions of various citrus fruits in Lebanon and to estimate their future exportable surplus. The projections are not meant to be forecasts of what will actually take place. They represent rather, the probable future supply and demand for various citrus fruits based on the best available data and on assumptions, relating to the future, which are as realistic as possible.

Extrapolation of past production trends and production estimates derived from projected area and yield, were the two methods used to project supply. On the demand side, extrapolation of past apparent consumption trends and projecting the population and income effects on demand assuming constant relative prices were the methods used. The income elasticity of demand coefficients for various citrus fruits were derived from the cross-sectional results of a sample survey of household expenditure on food, conducted by the Central Bureau of Statistics of Lebanon, during 1965/66, for Beirut and its outskirt districts. High and low estimates were computed in each method on the basis of optimistic and pessimistic assumptions.

The high and low supply projection results in 1975 were, respectively, 261 and 224 thousand metric tons for oranges, 120 and 102 thousand metric tons for lemons, 24 and 20 thousand metric tons for mandarines and clementines and seven and six thousand metric tons for grapefruits. These constitute respective increases, over present levels, of 67 and 44%, 74 and 48%, 100 and 67% and 75 and 50%.

The high and low domestic demand results were, respectively, 133 and 116 thousand metric tons for oranges, 57 and 48 thousand metric tons for lemons, 15 and 13 thousand metric tons for mandarines and clementines and three and two thousand metric tons for grapefruits. These constitute respective increases, over present levels of 68 and 47%, 84 and 55%, 67 and 44% and 200 and 100%.

Hence, the exportable surplus, defined as the difference between supply and domestic demand, is anticipated to vary between 108 and 128 thousand metric tons for oranges, 54 to 63 thousand metric tons for lemons, seven to nine thousand metric tons for mandarines and clementines and that for grapefruits to be about 4,000 metric tons. This means that during the coming decade, the present exports of oranges must be increased by 40-66%, of lemons by 42 to 66%, of mandarines and clementines by 133 to 200% and of grapefruits by only 33%.

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I. INTRODUCTION

Importance of Citrus Industry to Lebanese Agriculture

Fruit production is the most important agricultural industry in Lebanon. In 1966, the estimated area under fruit trees was about 30% of the total area cultivated and the estimated value of fruit production was about 60% of the total value of all crops produced (Ministry of Agriculture, 1967, p 4).

Fruits are also Lebanon's principal export item. In recent years the value of fruit exports amounted to more than half of the value of agricultural exports and more than one-fifth of the value of total exports. Although Lebanon has no deficit in its overall balance of payments, it suffers from a serious deficit in its balance of merchandise trade (more than LL. 1.5 billion in 1966, while exports only amounted to LL. 400 million) - (Conseil Supérieur des Douanes, Année, 1964-1966). The existence of an exportable surplus of fruits is, therefore, particularly important as a means of earning foreign exchange and reducing Lebanon's merchandise deficit. Well developed fruit export markets are also important for keeping domestic prices remunerative to producers, especially since a large proportion of Lebanon's most important fruits (citrus, apples and bananas) is exported.

Citrus fruits are the most important among all fruits produced, from the standpoints of both production and export, and both in quantity and in value. For example, in 1966 the value of citrus fruits produced amounted to more than one-third the value of total fruits produced (Ministry of Agriculture, 1967, p 2).

In recent years exports of citrus fruits accounted for 50-60% of the total quantity of fruits exported, followed by apples 30-36%, bananas six to ten percent and all other exports of fruits five to seven percent (Conseil Supérieur des Douanes, Année, 1964-1966). During the past three years 230 to 250 thousand metric tons of citrus fruits were produced annually and of these 95-117 thousand metric tons were exported.

Purpose and Need of the Study

The purpose of this study is to assess the future supply and demand conditions of various citrus fruits in Lebanon and to estimate future exportable surpluses of citrus. The results are intended to indicate the extent to which Lebanon must depend on and develop its export markets.

Together with the study that is presently being conducted by the "Green Plan", on the future prospects of foreign markets for citrus fruits, this study should be a useful guide to policy makers in determining the extent to which the expansion of citrus fruits should be encouraged or discouraged. These two studies should also serve to guide farmers in planting the species and varieties of citrus most in demand on domestic and foreign markets. Such long-term studies on supply and demand, are specially important for crops that require large and permanent investments such as fruits. Brough (1963, pp 2-3) emphasized the need for such studies at a recent agricultural symposium at the A.U.B. He pointed out that they can serve as a basis for estimating relative future prices of specific products, and guiding farmers in their production planning.

Nature and Scope

The study deals primarily with the quantitative aspects of supply and demand projections. It makes use of the best available data on supply and demand and is based on as realistic assumptions as possible. Whenever the data permitted, separate analyses were made on the individual species of citrus fruits grown in Lebanon.

It is beyond the scope of this study to deal with the marketing and distribution factors that affect supply and demand such as the market structure, the ways of buying and selling and the problems of storage and transportation. A projection analysis by variety was not possible because of a lack of necessary data. Relevant information on the various varieties, however, was obtained and analyzed in as much detail as possible.

II. REVIEW OF LITERATURE

Very little scientific work has been done on the future projection of supply of and demand for citrus fruits in Lebanon. The Food and Agricultural Organization of the United Nations (FAO) has published the only two studies on the subject (FAO 1966a, Vol. I, pp 206-221, Vol. II, pp 9, 18, 22, 214 and Baldini 1967, pp 21-26). These studies, however, were made for several commodity groups and not for just citrus. Since rather widely differing results were forthcoming from these two studies, the need for a more thorough study, conducted specifically for citrus fruits was suggested.

The first study of FAO estimated the 1975 production of oranges and tangerines, in Lebanon, at 200 thousand metric tons, of lemons at 85 thousand metric tons and of grapefruits at 10,000 metric tons. The respective domestic demand estimates were 67 to 75 thousand metric tons, 47 to 54 thousand metric tons and three to four thousand metric tons (FAO, 1966a, Vol. I, pp 218-220). To estimate the demand, a 2.8% population growth rate, a 5.5% Gross Domestic Product at factor cost (GDP) growth rate for a high estimate, a 4.0% GDP growth rate for a low estimate and a 0.4 income elasticity of demand coefficient for each of the citrus species were assumed (FAO, 1966a, Vol. II, pp 9, 18, 22, 214). Assumptions underlying the production projections were not indicated.

In the second FAO study, Baldini (1967, pp 25-27) estimated the 1975 production of oranges and tangerines at 230 thousand metric tons and of lemons at 125 thousand metric tons. The respective estimates on total domestic disappearance were 92 and 44 thousand metric tons. To arrive at the estimate on production, Baldini

assumed a total area of citrus of 15 thousand hectares and the current yield of 25 metric tons per hectare. To obtain the separate estimates on various citrus fruits, the present proportion of oranges and tangerines was arbitrarily decreased by five percent per year and that of lemons increased by five percent per year. For the demand estimates, an arbitrary income elasticity of demand coefficient of 0.4 was assumed for each of the various citrus fruits. For the total population and per caput GDP in the base period (1964), 2.03 millions and U.S. \$ 341 were assumed, respectively. For 1975 the respective estimates were 2.7 millions and U. S. \$ 390.

This study was generally patterned after the above two. More detail, however, was injected into the analysis, particularly in relation to the individual species of citrus, and the basic underlying assumptions were made more realistic and up to date whenever possible. For example, instead of using the apparent low income elasticity of demand estimate of 0.4 for citrus, the results of a recent, but as yet unpublished, household expenditure survey in Beirut and nearby vicinity were drawn upon.

Much insight into the appropriate methodology and assumptions for this study was gained by reviewing several publications on supply and demand projections of agricultural commodities in other countries. The most important were those sponsored by the United States Department of Agriculture (USDA) in Saudi Arabia, Turkey and Ghana (Asfour, et al., 1965, pp 17-73; Palmer, 1966, pp 10-18, 153-165 and Ord, et al., 1964, pp 43-61). The study by the Organization for Economic Cooperation and Development (OECD) on the 1970 prospects for fruit and vegetable production in Turkey and Yugoslavia was also useful (OECD, 1967, pp 12-27).¹

1. Similar publications have been published recently for all member countries of the OECD.

III. METHODOLOGY

The projections made in this study are not meant to be forecasts of what will actually take place. They represent, rather, the probable future supply and demand for various citrus fruits based on the best available data and on assumptions, relating to the future, which are as realistic as possible. Some of the factors underlying the assumptions may change in the future and new knowledge may be acquired. It will be possible then to adjust the results accordingly.

In projecting supply and demand for various citrus fruits in 1975, two different methods were used : one involving direct extrapolation of past supply and demand trends and the other involving projections based on consideration of the key factors underlying supply and demand. The use of more than one method is important as a check; it also can suggest the confidence with which the results can be interpreted. In each method high and low estimates were computed on the basis of relatively optimistic and pessimistic assumptions. The final result adopted was the average of the two methods, provided there was no unreasonable difference between them. The various methods used are discussed separately under supply and demand in the following sections.

Definitions

The term supply in this study is defined as the domestic production that is available for both domestic needs and exports. The term demand, on the other hand, is meant to indicate the domestic demand alone and does not include the export demand. Finally, the exportable surplus is defined as the difference between supply

and demand. These particular concepts of supply and demand were chosen because they lend themselves to the operational aspects of this study. They, of course, are not all inclusive in their analytic content.

Supply

Method I. Extrapolation of Past Production Trends

Time-series data for 1955-1967 were extrapolated to 1975 assuming that changes will continue at approximately the same rate as in the past. To obtain the function of best fit the method of "least squares" was applied. Point and interval estimates were computed. The interval estimate was calculated on the basis of the Standard Error of the Estimate (Standard Deviation) assuming a "t" distribution and a 90% confidence level.

Method II. Production Estimates Derived from Projected Area and Yield

Total output of tree-crops is a product of area of bearing age and yield. The additional area of various citrus fruits expected to be in production in 1975 was assumed to be the sum of the present area of non-bearing age and the total area expected to be planted until 1970. The new area expected to be planted between now and 1970 was estimated after considering the recent past trends and the irrigation projects in the coastal regions. All areas of citrus near the main urban centers or 75% of them (for high and low estimates) were assumed to disappear for residential purposes to meet the needs of urbanization. As these areas have the oldest citrus trees in Lebanon and as citrus trees stay in production for a very long period of time, the

only old trees assumed to be out of production in 1975 were these areas near the urban centers.

Estimates on expected yields were determined after considering past long-term trends, the age structure of trees of bearing age and possibilities for increasing yield due to progress in technology. The yield estimates were also developed on the basis of discussions with personnel at the Abde citrus experimental station.

Demand

Method I. Extrapolation of Past Apparent Consumption Trends

The extrapolation was made on time-series data on the total apparent consumption of various citrus fruits (1955-1966). The total apparent consumption was estimated by subtracting net exports from production. The extrapolation had to be made on total apparent consumption and not on per capita consumption as it would have been preferred since the data available on population in Lebanon are not reliable. The function of best fit and the determination of the interval estimate for demand were determined in the same way as those for production.

Method II. Projecting Population and Income Effects on Demand

This method involves projection of the key factors underlying demand, namely population and income. It makes use of the Ohkawa equation ($d = p + gn$) which indicates that the rate of increase in total food consumption is equal to the rate of population growth plus the product of the rate of growth in per capita income

and the income elasticity of demand for food (Stevens, 1965, p 4). An assumption of constant relative prices was made in this study as in most demand projection studies. The assumption appears to be reasonably realistic in Lebanon, however, since Lebanese citrus prices have not shown long-term trends during the past decade.¹

The income elasticity of demand coefficients for the various citrus fruits in this study were derived from the cross-sectional results of a sample survey of household expenditure on food, conducted by the Central Bureau of Statistics of Lebanon during 1965/66, for Beirut and its outskirt districts. Growth rates in the population and national income were obtained from other projection studies.

1. See table 41 in the appendix on price series of citrus fruits.

IV. RESULTS AND DISCUSSION

The results and discussion are presented under three major headings. In the first part, the supply analysis for the various citrus fruits is discussed. The analysis of the domestic demand for citrus fruits is presented in the second part. Finally, the exportable surplus, which constitutes the difference between the supply and the domestic demand, is discussed.

Supply of Citrus Fruits

The Present Situation

The aim of this section is to give a clear picture of the present citrus production situation in Lebanon. A thorough knowledge of present conditions is essential to the formulation of realistic assumptions and meaningful projections into the future. After discussing the general land use pattern in the major citrus producing regions, recent production data on citrus crops are analyzed.

General Land Use Pattern in the Citrus Producing Regions : The agricultural regions in Lebanon are most appropriately described in the study of Gauthier and Baz (1960, Vol. II, pp 11-85). They divided Lebanon into regions according to major agricultural characteristics rather than administrative provinces as is the case with most other agricultural statistics in Lebanon. This study is primarily concerned with two of Gauthier's and Baz's 11 agricultural regions, namely, the coastal plain and the plain of Akkar. These two areas are characterized by immediate and prospective

citrus production potential.

The coastal plain, as defined in the above study, lies between Abde in the north and the Lebanese border in the south. This very narrow and long strip extends to the east up to an elevation of 200 meters, where it meets the lower side of Mount Lebanon. It has a total area of 47,103 hectares, of which 25,630 hectares, or 54% was cultivated in 1959. Of the total area of 7,960 hectares that were under citrus fruits in all of Lebanon, during that year, 7,241 hectares, or 90% were in the coastal plain (Gauthier and Baz, 1960, Vol. I, p 97). Table 1 illustrates the land use in this region. Citrus fruits accounted for about 30% of the total cultivated area and for more than three-fourths of the total irrigated area. The most important competitive crops with citrus were vegetables and bananas, but these accounted for only 11 and seven percent, respectively, of the total irrigated area. It must be pointed out, however, that about 2,000 hectares of the citrus area (21% of irrigated area) were interplanted with bananas. The bananas are usually pulled out when the citrus trees become of bearing age. The total dry land area accounted for more than 60% of the total area cultivated. Cereals and olives were the most important crops on this land.

The coastal plain widens in the north to form the plain of Akkar. The land use in this plain is illustrated in table 2. The 140 hectares of citrus represented only about one percent of the total cultivated area and less than four percent of the irrigated area. On the other hand, they represented less than two percent of the total area, in Lebanon, under citrus fruits. The great majority (95.5%) of the irrigated land was used for vegetables. Cereals and fallow accounted for about 64% of the

Table 1. Cultivated area in the coastal plain of Lebanon,
by land use, 1959.

Crop	Area in ha.	Percent of total cultivated area	Percent of total irrigated or dry land area
Irrigated land			
Citrus fruits	7,241	28.3	76.2
Bananas	693	2.7	7.3
Vegetables	1,053	4.1	11.1
Other crops	511	2.0	5.4
Sub total	<u>9,498</u>	<u>37.1</u>	<u>100.0</u>
Dry land			
Cereals and fallow	10,842	42.3	67.2
Olives	3,106	12.1	19.3
Figs	477	1.8	3.0
Grapes	220	0.9	1.3
Other crops	1,486	5.8	9.2
Sub total	<u>16,131</u>	<u>62.9</u>	<u>100.0</u>
Total cultivated area	25,630	100.0	-

Source : adapted from (Gauthier and Baz, 1960, Vol. II, p. 33).

total cultivated area and for over 91% of the dry land area.

Table 2. Cultivated area in the plain of Akkar of Lebanon, by land use, 1959.

	Area in ha.	Percent of total cultivated area	Percent of total irrigated or dry land area
Irrigated land			
Vegetables	3,593	28.3	95.5
Citrus fruits	140	1.1	3.7
Other crops	<u>30</u>	<u>0.2</u>	<u>0.8</u>
Sub-total	3,763	29.6	100.0
Dry land			
Cereals and fallow	8,160	64.3	91.4
Other crops	<u>769</u>	<u>6.1</u>	<u>8.6</u>
Sub-total	8,929	70.4	100.0
Total cultivated area	12,692	100.0	-

Source : adapted from (Gauthier and Baz, 1960, Vol. II, p 39)

The remaining eight percent of the citrus area (other than the 90% in the coastal plain and the two percent in the plain of Akkar) was in the olive producing region in the north (about five percent), in the hills of South Lebanon and in the western sub-region of Mount Lebanon up to an elevation of 400 meters (Gauthier

and Baz, Vol. II, p 97). These regions however, are judged sub-marginal for citrus cultivation because of their poorer soils, lack of irrigation water and less suitable climatic conditions.

More recent surveys on general patterns of land use, according to major agricultural regions, have not been conducted. Studies, since 1959 report data according to administrative provinces. Table 3 shows the areas in citrus fruit production in 1959 and 1966, by province. Of the total increase of 4,259 hectares, about 60% was in South Lebanon and about 43% in North Lebanon. The net decrease of 90 hectares (negative two percent change) in Mount Lebanon, has resulted from the use of land for residential purposes to meet the needs of urbanization.

Table 3. Total area of citrus in Lebanon, by province, 1959 and 1966.

	1959 ha. ¹	1966 ha. ²	Increase in area, ha.	Percent of total increase
South Lebanon	3,954	6,462	(+) 2,508	(+) 58.9
North Lebanon	2,039	3,880	(+) 1,841	(+) 43.2
Mount Lebanon	1,966	1,876	(-) 90	(-) 2.1
Total Lebanon	7,959	12,218	(+) 4,259	100.0

Source : 1. (Gauthier and Baz, 1960, Vol. II, pp 97-98)
2. (Ministry of Agriculture, 1967, p 2) and (Beidas, 1967)

Where, in the citrus producing regions discussed above, has this large increase of 4,259 hectares taken place ? According to the Litani project authorities, the great majority of the increase in the South has occurred in the coastal plain between Sidon and Tyre, as a result of the extension in irrigation, made possible by the Kasmiya portion of the Litani project. According to the recent survey on citrus production conducted by the Fruit Board in 1966, the area under citrus fruits in the plain of Akkar was about 1,600 hectares.¹ Since the area in 1959 was only 140 hectares, it is apparent that the vast majority of the increment in North Lebanon's citrus area has occurred in the Akkar plain. The extension in irrigation in this plain, according to authorities at the Abde citrus experimental station, was made from underground water by private initiative.

The future expansion in the citrus area in the coastal plain is limited by the availability of irrigation water. According to the Litani project authorities, a maximum of 1,000 hectares can be added to the irrigated area by 1975. The source of the irrigation water for this additional area will not be the Litani project, but the underground water to be harnessed by private initiative. In the plain of Akkar, on the other hand, and according to the same authorities, potential still exists for extending the irrigated area by 3,000 hectares, again through the use of underground water.

In the coastal plain, bananas and vegetables are still the important crops that compete with citrus. In the plain of Akkar, bananas are not successful because of the climatic conditions. Vegetables, however, according to the Abde experimental

1. Final results of this survey are not yet published.

station authorities, are still very important on the irrigated land and will continue to be strong competitors for citrus in the future.

Production Statistics on Citrus Crops : The Lebanese Fruit Board has been conducting a survey to obtain detailed statistics on areas, yields and production of citrus fruits. The field survey was finished during 1967. A provisional summary of the findings was published. The Ministry of Agriculture made some adjustments to the Fruit Board provisional data, primarily on yields and to some extent on areas. The statistics reported by the Ministry of Agriculture for oranges and lemons were adopted in this study. Those on mandarines and clementines, as a group, and on grapefruits were taken from the Fruit Board, since distinction among these crops was not maintained in the Ministry of Agriculture data. The Ministry of Agriculture data were preferred because its yield data on oranges and lemons were judged to be more accurate. There was no difference in the yield estimates for the other citrus crops.

The quantity of production of any crop is a function of area and yield. The analysis and discussion in this section, therefore, are presented primarily under three major headings, namely, the area, the yield and the production. Analysis of the available data on varieties is discussed under a fourth heading.

Areas : Table 4 shows a breakdown of the overall area under citrus fruits in Lebanon, during 1966, by bearing age, non-bearing age and species grown. Oranges are by far the most important citrus species. From a total area of citrus fruits of 12,218 hectares, 8,550 hectares, or 70% were oranges. Oranges also occupied more than 70% of the total area of non-bearing age which indicates that

they will continue to be the most important in the future.

Lemons come next in importance. During 1966, there were 2,500 hectares of lemons accounting for about 21% of the total area of citrus fruits. About 18% of the area of non-bearing age was in lemons. Mandarines and clementines accounted for about eight percent of the total area and for about 11% of the area of non-bearing age, whereas grapefruits accounted for only about one percent of the total area and for less than one percent of the area of non-bearing age.

Table 5 shows the breakdown of the total area of citrus fruits in 1966, according to bearing and non-bearing age and by province. More than 50% of the total area of citrus fruits was in South Lebanon. The vast majority (85%) of non-bearing citrus was also in this province. North Lebanon had 32% of the total area in citrus, but only 15% of the area of non-bearing age. Mount Lebanon represented 15% of the total area, but it had no new plantings. Areas suitable for citrus in this province were used for residential purposes.

As the yields for the various citrus fruits differ in different provinces, it is important to know the area of each species in each province. Such data, for oranges, lemons, mandarines and clementines and grapefruits are presented in table 6. Areas of non-bearing age are also shown. This is important for the projection analysis. Thus, in 1966, South Lebanon had more than 88% of the non-bearing area of oranges, 73% of that of lemons, about 78% of that of mandarines and clementines and 80% of that of grapefruits. The remaining non-bearing areas were in North Lebanon.

Table 4. Area of various citrus species in Lebanon, by bearing and non-bearing age, 1966.

	Bearing		Non-bearing		Total	
	ha.	percent	ha.	percent	ha.	percent
Oranges	7,140	70.0	1,410	70.2	8,550	70.0
Lemons	2,145	21.0	355	17.7	2,500	20.5
Mandarines and clementines	778	7.6	230	11.4	1,008	8.2
Grapefruit	145	1.4	15	0.7	160	1.3
Total citrus	10,208	100.0	2,010	100.0	12,218	100.0

Source : Oranges and lemons (Ministry of Agriculture, 1967, p. 2)
Others (Beidas, 1967)

Table 5. Area of total citrus fruits in Lebanon according to bearing and non-bearing age, by province, 1966.¹

	Bearing		Non-bearing		Total	
	ha.	percent	ha.	percent	ha.	percent
South Lebanon	4,762	46.6	1,700	84.6	6,462	52.9
North Lebanon	3,570	35.0	310	15.4	3,880	31.8
Mount Lebanon	1,876	18.4	-	-	1,876	15.3
Total Lebanon	10,208	100.0	2,010	100.0	12,218	100.0

1. To obtain the total area under citrus fruits by province, the data reported by the Ministry of Agriculture for oranges and lemons (Ministry of Agriculture, 1967, p. 5) and those reported by the Fruit Board for mandarines, clementines and grapefruit, were used (Beidas, 1967).

Table 6. Area of various citrus species in Lebanon, by province, bearing and non-bearing age, 1966.

	Bearing	Non-bearing	Total			
	ha.	Percent	ha.	Percent	ha.	Percent
Oranges						
South Lebanon	3,000	42.0	1,250	88.7	4,250	49.7
North Lebanon	2,840	39.8	160	11.3	3,000	35.1
Mount Lebanon	<u>1,300</u>	<u>18.2</u>	-	-	<u>1,300</u>	<u>15.2</u>
Total	7,140	100.0	1,410	100.0	8,550	100.0
Lemons						
South Lebanon	1,290	60.1	260	73.2	1,550	62.0
North Lebanon	505	23.6	95	26.8	600	24.0
Mount Lebanon	<u>350</u>	<u>16.3</u>	-	-	<u>350</u>	<u>14.0</u>
Total	2,145	100.0	355	100.0	2,500	100.0
Mandarines and clementines						
South Lebanon	396	50.8	178	77.7	574	57.0
North Lebanon	185	23.8	51	22.3	236	23.4
Mount Lebanon	<u>198</u>	<u>25.4</u>	-	-	<u>198</u>	<u>19.6</u>
Total	779	100.0	229	100.0	1,008	100.0

Table 6 (Continued)

	Bearing		Non-bearing		Total	
	ha.	Percent	ha.	Percent	ha.	Percent
Grapefruits						
South Lebanon	76	52.4	12	80.0	88	55.0
North Lebanon	41	28.3	3	20.0	44	27.5
Mount Lebanon	<u>28</u>	<u>19.3</u>	<u>-</u>	<u>-</u>	<u>28</u>	<u>17.5</u>
Total	145	100.0	15	100.0	160	100.0

Source : Oranges and lemons (Ministry of Agriculture, 1967, p 5).
Others Beidas (1967).

Yields : Table 7 shows the average yields of the various species of citrus during the 1966/67 season. The average yield of the area of bearing age of all citrus fruits as a group was 24.5 metric tons per hectare and that for the overall area was 20.5 metric tons per hectare. The proportion of the area of non-bearing age to the total area was 16.5%. Highest yields were for lemons, followed by grapefruits and oranges. The yield of mandarines and clementines was appreciably lower than that of the rest.

Table 8 shows the yields of the various species of citrus, by province. Significant differences in yield existed between the various provinces. Yields in North Lebanon were much lower than those of South Lebanon or Mount Lebanon. Moreover, mandarines and clementines, as a group, and grapefruits do not seem to have been very successful in North Lebanon. The yield of mandarines and clementines of 8.8 metric tons per hectare was less than half that in the other two provinces. The yield of grapefruits was less than one-tenth that in South Lebanon and Mount Lebanon.

Data on yields for one year only may be inadequate as a basis for future projection, because of possible short-term fluctuations, due to natural factors. Accurate data on yields, detailed by species and provinces, however, are only available for 1966/67. A fairly accurate estimate for the total area of citrus and their overall yield, for 1965/66 was available from the Ministry of Agriculture. The overall areas and yields of citrus fruits for these two years were averaged to obtain an index by which the yields of the 1966/67 season could be adjusted to normal conditions. The calculations are shown in table 9. Thus, the overall yield of citrus

Table 7. Average yield of various citrus species in Lebanon, 1966/67.

	Ave. yield - m. tons/ha.		Percent of area of non-bearing age from total area
	Bearing area	Total area	
Oranges	23.0	19.2	16.5
Lemons	32.1	27.6	14.2
Mandarines and clementines	16.5	12.7	22.8
Grapefruits	29.4	26.6	9.4
Total citrus	24.5	20.5	16.5

Source : Oranges and lemons (Ministry of Agriculture, 1967, p 5)
Others (Beidas, 1967).

Table 8. Average yield on areas of bearing age of the various species of citrus in Lebanon according to province, 1966/67, in metric tons/ha.

	South Lebanon	North Lebanon	Mount Lebanon
Oranges	27.2	16.2	28.0
Lemons	38.9	16.6	29.4
Mandarines and clementines	19.3	8.8	18.3
Grapefruits	39.7	3.8	38.5

Source : Oranges and lemons (Ministry of Agriculture, 1967, p 5).
Others (Beidas, 1967).

fruits during 1966/67 was 4.1 percent higher than the two-year average. The data on yields in tables 7 and 8 were corrected by multiplying by the index of 95.9% and the results were assumed to be the yields under normal conditions. These results, which will be used as a basis for projection, are presented in tables 10 and 11.

Production Levels : Table 12 shows the production of the various species of citrus fruits during the 1966/67 season by province. The total production of citrus fruits was nearly 250,000 metric tons. South Lebanon produced a majority of 57% of this total output. North Lebanon and Mount Lebanon shared the remaining production about equally.

Out of a total production of oranges of 163,900 metric tons (66% of total citrus production) about 50% was in South Lebanon. North Lebanon and Mount Lebanon had 28 and 22% respectively.

South Lebanon had 73% of the total production of lemons of 68,900 metric tons (27% of total citrus production). North Lebanon and Mount Lebanon had 12 and 15%, respectively.

Out of a total production of mandarines and clementines of 12,852 metric tons (about five percent of total citrus production), 59% was in South Lebanon, 28% in Mount Lebanon and only about 13% was in North Lebanon.

Only 4,260 metric tons of grapefruits (less than two percent of total citrus production) were produced. More than 70% was in South Lebanon. Mount Lebanon produced 25% while North Lebanon produced less than four percent.

Table 9. Area, production and average yield of total citrus in Lebanon, 1965/66 and 1966/67.

	Total area ha.	Production m. tons	Average yield m.tons/ha.	Index Ave. 1965/66 and 1966/67 = 100
1965/66	12,200	231,556	19.0	96.5
1966/67	12,218	249,912	20.5	104.1
Average 1965/66 and 1966/67	-	-	19.7	100.0

Source : 1965/66 (Ministry of Agriculture, 1966)
1966/67 (Ministry of Agriculture, 1967, pp. 5-6) and
(Beidas, 1967).

Table 10. Average yield of various citrus species in Lebanon, 1966/67 adjusted for normal conditions.

	Ave. yield - m. tons/ha.		Percent of area of bearing age from total area
	of area of bearing age	of total area	
Oranges	22.1	18.4	16.5
Lemons	30.8	26.5	14.2
Mandarines and clementines	15.8	12.2	22.8
Grapefruit	28.2	25.5	9.4
All citrus	23.5	19.7	16.5

Table 11. Average yield on area of bearing age of various species of citrus in Lebanon by province, 1966/67, adjusted for normal conditions, in metric tons/ha.

	South Lebanon	North Lebanon	Mount Lebanon
Oranges	26.1	15.5	26.9
Lemons	37.3	15.9	28.2
Mandarines and clementines	18.5	8.4	17.6
Grapefruit	38.1	3.6	37.0

Table 12. Production of citrus species in Lebanon, by province, 1966/67.

	Oranges		Lemons		Mandarines and clementines		Grapefruits		Total citrus	
	M. tons	Percent	M. tons	Percent	M. tons	Percent	M. tons	Percent	M. tons	Percent
South Lebanon	81,600	49.8	50,200	72.9	7,611	59.2	3,028	71.1	142,439	57.0
North Lebanon	45,900	28.0	8,400	12.1	1,623	12.6	153	3.6	56,076	22.4
Mount Lebanon	36,400	22.2	10,300	15.0	3,618	28.2	1,079	25.3	51,397	20.6
Total Lebanon	163,900	100.0	68,900	100.0	12,852	100.0	4,260	100.0	249,912	100.0

Source : Oranges and lemons (Ministry of Agriculture, 1967, p 6)
Others (Beidas, 1967)

Varieties : Statistics on areas, yield and production of the various varieties of citrus fruits are available only for 1963/64, from a survey conducted by the Fruit Board during September 1963.

Table 13 shows the area of bearing age, the yield and the production of the various varieties of oranges grown during 1963/64. The most important variety was the Shammuti (Jaffa orange) which accounted for about 42% of both the total bearing area and the total output. Next in importance were the Baladi (local) varieties which accounted for about 28% of the area and 31% of the output. Valencia accounted for 12% of the area but only nine percent of the output. Other varieties were the Moughrabi (sweet orange), the Blood orange (Mawardi) and the Washington Navel.

Table 13. Area of bearing age, yield and production of varieties of oranges grown in Lebanon, 1963/64.

	area of bearing age		yield m.tons/ha.	production	
	ha.	percent		m.tons	percent
Shammuti (Jaffa orange)	2,445	42.4	15.9	38,949	42.1
Baladi varieties (Khetmali, Bizri)	1,627	28.2	17.6	28,687	31.0
Valencia	695	12.1	12.2	8,450	9.1
Moughrabi (sweet orange)	553	9.6	15.7	8,685	9.3
Blood orange	265	4.6	22.9	6,079	6.6
Washington Navel	180	3.1	9.6	1,731	1.9
Total	5,765	100.0	16.1	92,581	100.0

Source : (Beidas, 1964).

The latter accounted for only three percent of the area and for less than two percent of the output. Data on the non-bearing area of these various varieties were not available.

Table 13 also shows significant yield differences among the various varieties of oranges. The highest yielding variety was the Blood orange with an average yield per hectare of bearing age of 22.9 metric tons, compared with the overall average yield of all varieties of 16.1 metric tons per hectare. The Baladi varieties come next followed by the Shammuti, the Valencia and finally the Washington Navel. The latter's average yield was only 9.6 metric tons per hectare.

Table 14 reflects the area of bearing age and the yield in 1963/64 of the various varieties of oranges according to the location of production. The most important points highlighted in the table are : (1) The Shammuti variety was almost equally distributed among the three provinces. (2) The majority of the Baladi varieties (63%) was in North Lebanon. This substantiates the reports of exporters who also reported that the majority of the exports of these varieties go to Syria from North Lebanon. (3) The great majority of the Valencia, Blood orange, and Washington Navel oranges was in South Lebanon. (4) About 80% of the Moughrabi variety were in North Lebanon. (5) The yield of the Baladi varieties in Mount Lebanon was higher than that in the other two provinces. (6) The Valencia and the Washington Navel yielded very poorly in North Lebanon and in Mount Lebanon. (7) The yield of the Blood orange variety in North Lebanon was less than 50% of that in South Lebanon or Mount Lebanon.

Table 14. Area of bearing age and yield of the varieties of oranges grown in Lebanon by province, 1963/64

		Shammuti	Baladi	Valencia	Moughrabi	Blood orange	Washington Navel
South Leb.	area - ha.	901	577	587	101	250	162
	Percent of total	36.9	35.5	84.5	18.3	97.7	90.0
	yield - m. tons/ha.	16.6	22.0	14.2	22.1	23.0	10.4
North Leb.	area - ha.	730	1,027	93	436	3	14
	Percent of total	29.8	63.1	13.4	78.8	1.1	7.8
	yield - m. tons/ha.	14.4	14.9	0.8	14.1	10.7	3.0
Mount Leb.	area - ha.	814	23	15	16	12	4
	Percent of total	33.3	1.4	2.1	2.9	4.5	2.2
	yield - m. tons/ha.	16.6	27.7	2.3	19.4	24.3	0.3

Source : (Beidas, 1964).

According to the citrus experimental station at Abde, the tendency during the 1960's has been towards planting more of Valencia and Washington Navel and less of the other varieties. No statistics are available to substantiate this observation. While the author agrees that more of these varieties has been planted during the past few years, he does not agree that the relative importance of the Shammuti has decreased. The export demand is still strongest for this latter variety. According to market outlet studies¹ conducted by the author of this thesis, the important importing countries of Lebanese citrus fruits (Arab countries) do prefer the Navel and the Valencia oranges compared to others, except the Shammuti. The Shammuti is still the most preferred variety in these importing countries. It is probably the inferior Baladi varieties that have had a smaller share of the new area planted to oranges. Syria, which usually imports the great majority of the Baladi varieties, is now demanding more of the other better varieties. In the future, the majority of the Baladi varieties will probably be utilized for processing.

The most important varieties of lemons are the Saksali, the Eureka and the Malti (Khalidi, 1963). No statistics are available on the breakdown of the total area of lemons according to variety. According to the Abde experimental station and according to some exporters, however, the Saksali variety predominates.

The "Yousif Afandi", which is the Mediterranean mandarine is the most important variety among the mandarines and clementines (Khalidi, 1963). According

1. Studies undertaken by the "Green Plan".

to the Abde experimental station authorities, more than 80% of the area of mandarines and clementines are of this variety. They believe, however, that the tendency at the present is towards the clementine which is earlier and has very few seeds. The same authorities report that Marsh Seedless is the most important variety of grapefruits grown.

Projection for 1975

In trying to estimate the future production of citrus fruits, it is important to keep in mind the nature of the citrus production process. Citrus trees begin to bear fruit three to four years after planting. They develop in size and bearing capacity for many years, however, and they reach their maximum yield after a period of 30 to 40 years (Wolf, 1965, Vol. 14, 9, p 4). The growing of citrus, therefore, is a very long-range enterprise. Its production and export supplies are, consequently, inelastic in the short run to changes in price or market conditions.

In this section, the analysis on the two methods used for projection, namely, the extrapolation of past trends and the method derived from projected areas and yields, is first presented. After comparing the results of these methods, the final projection of citrus supply in 1975 is determined.

Method I. Extrapolation of Past Production Trends : Citrus growing in Lebanon is very old. However, it reached significant commercial importance only after the Second World War (Ma'louf, 1966, p 2). As shown in tables 15 and 16, the production of total citrus fruits in Lebanon, increased by 117% during the past decade. This substantial increase in production after the Second World War, concurs

with what happened in the world at large. Stimulated by a growing demand, the world-wide planting of citrus fruit, notably of oranges, increased substantially throughout the postwar period (FAO, 1967, Vol. 16, 10, p 14).

Time-series data on areas and yields are only available for total citrus fruits as a group. Even these, however, are not at all reliable. Much more reliable data are available on the production. Extrapolation analysis, therefore, was made only for the production.

Shortcomings in the data required that oranges, mandarines, clementines and grapefruits be aggregated into one group for analysis by Method I. This is because the statistics reported for different years for these species involved grouped data, and the groupings have not been the same in all years. In most years, mandarines and clementines were grouped with oranges. In other years, they were grouped with grapefruits. Citrus fruits, in this method, therefore, were grouped as follows : (1) oranges and other citrus except lemons and (2) lemons. This affects the evaluation of the orange situation only slightly, however. As seen in table 12 above, from the total production of oranges and other citrus except lemons, 91% were oranges, seven percent were mandarines and clementines and only two percent were grapefruits. Moreover, as shown in table 4, more than 70% of the total area of citrus of non-bearing age were in oranges during 1966. Mandarines and clementines accounted for about 11% while grapefruits accounted for less than one percent. Another shortcoming of the time-series data available on production is the fact that no breakdown by region or province is given.

Table 15. Production of citrus fruits in Lebanon,
1955/56 - 1966/67, in metric tons

	Oranges and other cit. except lemons	Lemons	Total
1955/56	79,500	22,000	101,500
1956/57	87,500	21,000	108,500
1957/58	91,000	25,000	116,000
1958/59	101,000	30,000	131,000
1959/60	125,000	35,000	160,000
1960/61	115,000	40,000	155,000
1961/62	143,000	57,000	200,000
1962/63	145,000	55,000	200,000
1963/64	165,000	60,000	225,000
1964/65	160,000	65,000	225,000
1965/66	162,556	69,000	231,556
1966/67	180,912	69,000	249,912

Source : 1955/56 - 1962/63 (Ministry of Agriculture, 1963, p 9)
 1964/65 (Ministry of Agriculture, 1965)
 1965/66 (Ministry of Agriculture, 1966)
 1966/67 (Ministry of Agriculture, 1967, p 5) and (Beidas, 1967).

Table 16. Production of citrus fruits during 1955/56 - 1957/58 and 1964/65 - 1966/67, in thousand metric tons

	3-yrs. ave. 1955/56 - 1957/58	3-yrs. ave. 1964/65 - 1966/67	Index ave. 1955/56 - 1957/58 = 100
Oranges and other citrus except lemons	86.0	167.8	195
Lemons	22.7	67.7	298
Total citrus	108.7	235.5	217

Source : Table 15.

The following facts about the present situation suggest that this substantial upward trend in production will most likely continue through 1975 :

- (1) There exist sizeable proportions of areas of non-bearing age - 16.5% for oranges (from total area of oranges), 14.2% for lemons, 22.8% for mandarines and clementines, and 9.4% for grapefruits (refer to table 7).
- (2) Possibilities for area expansion still exist. As discussed above, about 1,000 hectares in the coastal plain and 3,000 hectares in the plain of Akkar could be added to the irrigated area by 1975. There has not been, and most likely will not be, any large change in the land use pattern in these two regions to which citrus are well adapted. The great majority of the additional area that could be irrigated in the coastal plain will therefore most probably be planted with citrus (refer to table 1). Although the great majority of the additional area that could be irrigated in the Akkar plain will most likely be planted with

vegetables (refer to table 2), the remaining area is enough to permit the upward trend in citrus to continue. As noted in connection with table 5, the total area of non-bearing age in North Lebanon during 1966 (practically all in the plain of Akkar) was only 310 hectares. This means that the citrus trees here are, generally speaking, one to five years of age and on the average only about 60 hectares were planted per year.¹

It must be borne in mind when discussing area expansion, that trees of bearing age in 1975 must have been planted before 1971. This renders the effect of any future area expansion on the results of this study of minor importance. In other words, the already planted area whether currently of bearing age or of non-bearing age is far more important than future plantings for determining the production in 1975. Moreover, thus far serious market outlet problems for citrus fruits have not arisen, as for example in the case of apples. Farmers, therefore, still have an economic incentive to plant citrus.

- (3) Possibilities for increasing yields still exist. Yield increases can be attributed to two major factors, age structure and technology.
- (a) Increase in yields due to age structure - About 30% of the area of bearing age at the present (let alone the area of non-bearing age) have trees of only six to ten years of age (Ma'louf, 1966, p 29). As discussed earlier, citrus trees develop in size and bearing capacity for many years and reach their maximum yield after a period of 30-40 years.

1. The age of five years was considered by the Fruit Board and the Ministry of Agriculture as the maximum age of trees of non-bearing age. In other words, the age of six years was adopted as the age when citrus fruit start to bear. The same is adopted for this study.

- (b) Increase in yields due to better technology - According to the Abde experimental station authorities and to a study by the Fruit Board (Ma'louf, 1966, pp 15-20), large variations in yield exist for citrus orchards of about the same age and having approximately the same varieties. Such yields vary between ten and 60 metric tons per hectare.

This suggests that there is a considerable opportunity for increased yields if improved cultural practices are adopted on a more widespread basis.

Rough estimates on the average yield of the overall citrus area suggest an approximate 40% increase during the past decade. The average yield during the three years 1955-1957 was 14.7 metric tons per hectare, while it reached 20.6 metric tons per hectare during 1964-1966.¹ It was therefore judged that yields would increase by 20-40% during the coming decade.

A straight line arithmetic function ($y = a + bx$) was chosen to describe the trend. The basic assumption was that production in the future would increase at the same absolute rate as it had in the past. Due to the nature of the citrus production process and the relative limits on area expansion and yield at this stage of citrus production in Lebanon, it was judged that using a logarithmic straight line function to describe the trend, would give unrealistically high estimates. This is further substantiated when one examines the present areas of bearing and non-bearing age and the expected future yields from them.

1. Data from Ministry of Agriculture.

As discussed under methodology, the method of "least squares" was used to determine the line of best fit. The results are presented in figure 1. The production of oranges and other citrus except lemons, as a group and as estimated by this method, is anticipated to rest between 250 and 280 thousand metric tons by 1975. That of lemons is anticipated to rest between 120 to 135 thousand metric tons.

Method II. Production Estimates Derived from Projected Areas and Yields :

The results of the above mentioned survey on areas and yields of the various citrus fruits, conducted by the Fruit Board during 1966, make possible the use of this method. Our base, therefore, is 1966.

Projected Areas of Citrus of Bearing Age in 1975 : The area of the various citrus fruits, expected to have trees of bearing age in 1975, is the sum of the following : (1) area of bearing age in 1966, (2) area of non-bearing age in 1966, (3) new areas expected to be planted between 1966 and 1970, (4) minus the areas expected to be cut down for residential purposes between 1966 and 1975. The unknowns at the present are only (3) and (4).¹

In estimating the new areas that are expected to be planted between 1966 and 1970, some arbitrary assumptions had to be made. The degree of arbitrariness, however, was kept to a minimum by interviewing various people well informed on the citrus situation, and by closely analyzing actual past trends.

1. Orchards that will become too old for production were all assumed to fall under number (4). Refer to chapter on methodology.

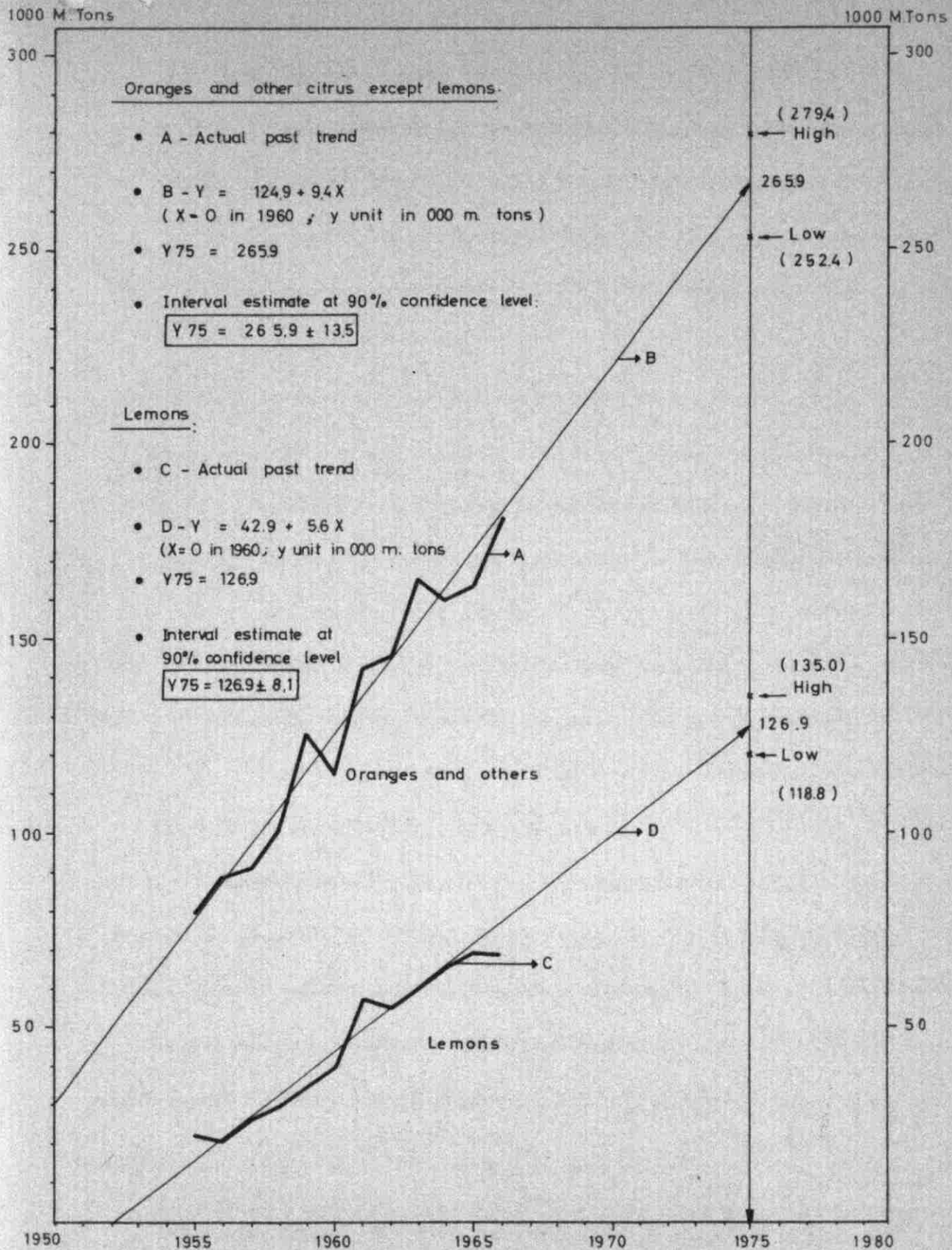


Figure 1. Future projection of the production of various citrus fruit in Lebanon by extrapolation of past trends.

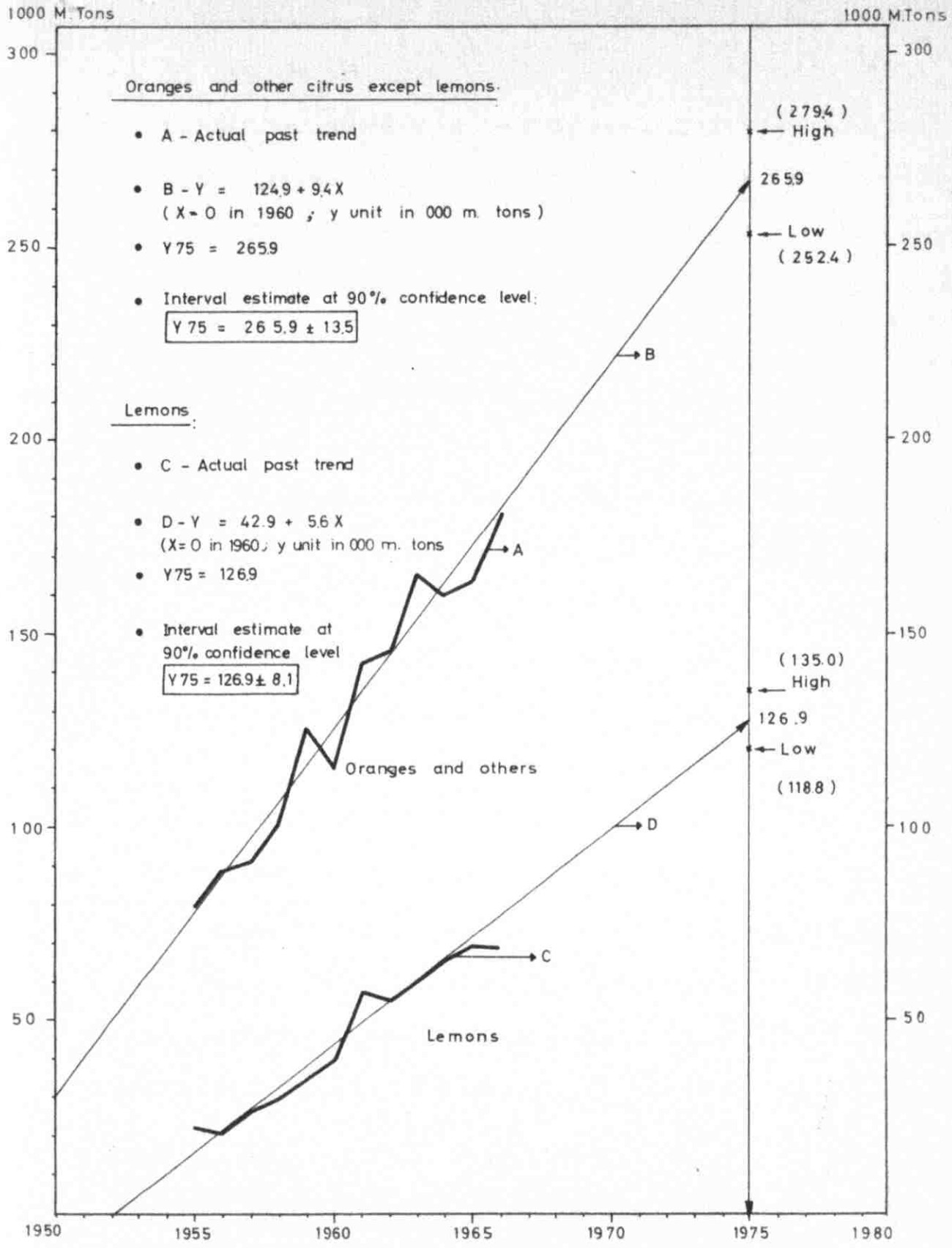


Figure 1. Future projection of the production of various citrus fruit in Lebanon by extrapolation of past trends.

These assumptions are :

- (1) For South Lebanon, the potential for an expanded irrigated area is 1,000 hectares. As discussed above, the great majority of this area is expected to be planted to citrus. The high and low estimates were, therefore, assumed to be 1,000 and 750 hectares added between 1966 and 1970.¹
- (2) For North Lebanon, it was assumed that the planting of new areas will expand at the same rate as it has in the recent past for the high estimate and at 75% of this rate for the low estimate. The area of non-bearing age in 1966 was divided by five to obtain the rate of planting new areas in recent years.
- (3) In Mount Lebanon, as there were no areas of non-bearing age in 1966, it was assumed that no new areas of citrus would be added.

The results of the analysis of new areas expected to be planted between 1966 and 1970 are presented in table 17.

In estimating the areas expected to be cut down for residential purposes to meet the needs of urbanization, the data on areas of citrus fruits near the main urban centers of Lebanon were obtained from unpublished reports by the Fruit Board on a survey conducted to obtain data on areas and productions of the various citrus fruits in 1963. These areas are presented in table 18 with a breakdown by species

1. The estimated additional area of 1,000 hectares, expected to be irrigated by 1975 in the coastal plain (see under land use), is, according to the Litani project authorities, all in South Lebanon.

and provinces. The high and low assumptions on how much of this area will have been cut for residential purposes by 1975 were 100% and 75% respectively. This covers a period of 12 years. By 1966, our base year, it must be remembered that 3/12 of the areas is assumed to have been already cut. The results are presented in table 19, with a breakdown by species and provinces. Thus, a very sizeable area of total citrus fruits in Lebanon, between 1,329 hectares and 997 hectares, presently of bearing age, is expected to disappear by 1975 for residential purposes.

Table 17. Estimates of additional areas of citrus species in Lebanon expected to be of bearing age in 1975, by province, in hectares!¹

	Oranges		Lemons		Mandarines and clementines		Grapefruit	
	High	Low	High	Low	High	Low	High	Low
South Lebanon	555	370	106	70	81	55	8	5
North Lebanon	128	96	76	57	41	31	3	2
Mount Lebanon	-	-	-	-	-	-	-	-
Total Lebanon	683	466	182	127	122	86	11	7

1. Areas expected to be planted between 1966 and 1970.

Table 18. Area of citrus species near the main urban centers of Lebanon by province, 1963, in hectares!¹

	Oranges	Lemons	Mandarines and clementines	Grapefruits
2 South Lebanon	263	151	16	2
3 North Lebanon	507	237	63	-
4 Mount Lebanon	340	150	27	-
Total Lebanon	1,110	538	106	2

1. From data reported by the Fruit Board in unpublished reports.
2. Area in the outskirts of Sidon.
3. Area in the outskirts of Tripoli.
4. Area in the outskirts of Beirut.

Table 19. Estimates of areas of citrus species in Lebanon expected to be cut down for residential purposes until 1975, by province, in hectares.

	Oranges		Lemons		Mandarines and clementines		Grapefruits	
	High	Low	High	Low	High	Low	High	Low
South Lebanon	197	148	114	86	12	9	2	1
North Lebanon	380	285	178	133	57	43	-	-
Mount Lebanon	255	191	114	86	20	15	-	-
Total Lebanon	832	624	406	305	89	67	2	1

Projected Yields : As discussed under the first method, the yield per unit area is expected to increase between 20-40% during the coming decade. The upper and lower limits of this range are adopted for the low and the high estimate respectively, for each kind or species of citrus fruits, on the expected areas of bearing age in 1975. The yields of areas of bearing age, adjusted for normal conditions (presented in table 11) are multiplied by this expected rate of increase to obtain the expected yields in 1975.

Projection Results : The final results on the areas of bearing age, the yields and production are presented in tables 20, 21, 22 and 23 for oranges, lemons, mandarines and clementines, and grapefruits. Thus, according to this method, the production of oranges in 1975 is anticipated to vary between 225 and 275 thousand metric tons, of lemons between 85 and 105 thousand metric tons, of mandarines and clementines between 20 and 25 thousand metric tons and of grapefruits between six and seven thousand metric tons.

Table 20. Estimates of area of bearing age, yield and production of oranges in Lebanon in 1975, by province.

	Area, ha.		yield, m. tons/ha		production 000 m. tons	
	High	Low	High	Low	High	Low
South Lebanon	4,657	4,423	36.5	31.3	170	138
North Lebanon	2,843	2,716	21.7	18.6	62	51
Mount Lebanon	1,109	1,045	37.7	32.3	42	34
Total Lebanon	8,609	8,184	31.8	27.2	274	223

Table 21. Estimates of area of bearing age, yield and production of Lemons in Lebanon in 1975, by province.

	Area, ha.		yield, m. tons/ha		production 000 m. tons	
	High	Low	High	Low	High	Low
South Lebanon	1,570	1,506	52.2	44.8	81	68
North Lebanon	543	479	22.3	19.1	12	9
Mount Lebanon	264	236	39.5	33.8	10	8
Total Lebanon	2,377	2,221	44.0	38.1	105	85

Table 22. Estimates of area of bearing age, yield and production of mandarines and clementines in Lebanon in 1975, by province.

	area, ha.		yield, m. tons/ha		Production 000 m. tons	
	High	Low	High	Low	High	Low
South Lebanon	646	617	25.9	22.2	16.7	13.7
North Lebanon	234	210	11.8	10.1	2.8	2.1
Mount Lebanon	183	178	24.6	21.1	4.5	3.8
Total Lebanon	1,063	1,005	22.6	19.5	24.0	19.6

Table 23. Estimates of area of bearing age, yield and production of grapefruits in Lebanon in 1975, by province.

	area, ha.		yield, m. tons/ha		Production 000 m. tons	
	High	Low	High	Low	High	Low
South Lebanon	95	91	53.3	45.7	5.1	4.2
North Lebanon	47	46	5.0	4.3	0.2	0.2
Mount Lebanon	28	28	51.8	44.4	1.5	1.2
Total Lebanon	170	165	39.7	33.9	6.8	5.6

Final Supply Estimates in 1975 : Table 24 compares the results of the two methods. For oranges and other citrus except lemons, included in one group, the differences between the two methods were only 8.9 and 1.8% for the high and low estimates respectively. The differences for lemons were much higher : 22.6% on the high estimate and 28.8% on the low estimate. For overall citrus fruits, the differences in the high and low estimates were only 1.4 and 10.4% respectively.

The average of the estimates of the two methods was adopted for use in projecting the exportable surplus. Estimates on mandarines and grapefruits separately, however, were only given by the second method; these, therefore, were adopted for projection purposes. The final estimate on oranges separately was obtained by subtracting the mandarines and the grapefruits estimates from the grouped estimate of oranges and other citrus except lemons. The final results on oranges and other citrus except lemons as a group, and lemons are shown in table 25. The final results on each kind separately are shown in table 26.

The supply of oranges in 1975 is anticipated to vary between 225 and 260 thousand metric tons. For lemons the estimates were 100 to 120 thousand metric tons.

Table 27 compares the 1975 estimates with the present situation. During the coming decade the supply of total citrus fruits in Lebanon is expected to increase by 110 and 170 thousand metric tons, or by 45 to 70%. Supply of oranges is expected to increase by 44 to 67%, of lemons 48 to 74%, of mandarines and clementines 67 to 100% and of grapefruits 50 to 75%.

Table 24. Comparison of the results of two methods used to estimate the production of citrus fruits in Lebanon in 1975, thousand metric tons.

	Results				Difference method I as the base		Percentage difference method I as the base					
	Method I		Method II		High	Low	High	Low				
	High	Low	High	Low								
Oranges and other cit. except lemons	279.4	252.4	304.3	247.9	(-)24.9	(+)	4.5	(-)	8.9	(+)	1.8	
Lemons	135.0	118.8	104.5	84.6	(+)	30.5	(+)	34.2	(+)	22.6	(+)	28.8
Total citrus	414.4	371.2	408.8	332.5	(+)	5.6	(+)	38.7	(+)	1.4	(+)	10.4

Table 25. Average of the results of two methods used to estimate the production of citrus fruits in Lebanon in 1975

	Average of Methods I and II, 000 m. tons	
	High	Low
Oranges and other citrus except lemons	291.9	250.2
Lemons	119.8	101.7
Total citrus	411.7	351.9

Table 26. Final supply estimates (production) of various citrus species in Lebanon in 1975, in thousand metric tons.

	Supply in 1975	
	High	Low
Oranges	261	224
Lemons	120	102
Mandarines and clementines	24	20
Grapefruit	7	6
Total citrus	412	352

Table 27. Comparison of supply estimates (production) of various citrus species in Lebanon in 1975 with the present situation, in thousand metric tons.

	Ave. 1965/66 - 1966/67	1975		Difference		Index ave. 1965/66 - 1966/67 = 100	
		High	Low	High	Low	High	Low
		Oranges	156	261	224	105	68
Lemons	69	120	102	51	33	174	148
Mandarines and clementines	12	24	20	12	8	200	167
Grapefruit	4	7	6	3	2	175	150
Total citrus	241	412	352	171	111	171	146

Demand for Citrus Fruits

Due to the limited domestic demand, the citrus industry in Lebanon is, to a large extent, oriented towards the export market. In recent years, out of a total production of citrus of 225 to 250 thousand metric tons, 96 to 116 thousand metric tons, or some 43 to 46%, were exported. The remaining, which is the apparent domestic consumption, or the domestic disappearance, is mostly consumed as fresh fruits. At the present, there are two processing plants utilizing only about 5,000 metric tons of citrus fruits, the great majority of which is oranges. More than two-thirds of the processed fruits (juice and juice concentrates) are exported.¹

Method I - Extrapolation of Past Apparent Consumption Trends

The domestic apparent consumption is determined by subtracting net exports from production.² The time-series data on production and exports in Lebanon, however, are not exactly comparable because they do not refer to the same period of time. The production is reported on a crop year basis (for example, what is reported as the production of 1966, is the production of the split year 1966/67), whereas the export data are reported on a calendar year basis. To even out this overlapping in time, a two-year moving average of the difference of the production of an $n/n+1$ crop year and the net exports of the $n+1$ year, was obtained. The harvesting season of citrus fruits in Lebanon starts in October and ends in June. The majority of the

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1. According to interviews held with the directors of the processing plants.
 2. Negligible quantities of lemons and grapefruits were imported during 1964 and 1965.

harvest is therefore available for exports during the year following the one during which the harvest starts. Thus, the exports of an $n+1$ year were subtracted from the production of a crop year of $n/n+1$. The results of this procedure are presented in table 28 for oranges and other citrus except lemons, as a group, and in table 29 for lemons. The apparent consumption of oranges and other citrus except lemons has doubled during the past decade. That of lemons has increased by 135%.

By inspecting the time-series data, as obtained in tables 28 and 29, on a simple arithmetic chart and on a semi-logarithmic chart, it was found that a linear arithmetic function ($y = a + bx$) was most appropriate to describe the secular trends. It was, therefore, used to compute the 1975 estimates.¹

The results are presented in figure 2. The apparent consumption of oranges and other citrus except lemons, as a group, as estimated by this method, is anticipated to reach between 133 and 148 thousand metric tons by 1975. That of lemons is anticipated to reach between 54 and 66 thousand metric tons.

Method II - Projecting Population and Income Effects on Demand

The most important variables that affect demand for food products, assuming no change in the relative prices, are the population, the level of income and the income elasticity of demand (Heady, 1962, p 645; Johnston and Mellor, 1961, p 572). The mathematical relation between these variables and food consumption is given by Ohkawa as $d = p + gn$; where d is the rate of increase in total

1. The same procedure used for estimating the future production by extrapolation was used here.

Table 28. Production, net exports and estimates of domestic apparent consumption of oranges and other citrus fruits except lemons, in Lebanon, 1955 - 1966, in thousand metric tons.

	1 Production (1)	2 Net exports (2)	Diff. bet. (1) and (2) - (Prod. $n/n+1$, net exports $n+1$) (3)	Two-yrs. moving ave. of (3) (4)
1955	79.5	-	-	-
1956	87.5	41.2	38.3	40.4
1957	91.0	44.0	43.5	43.1
1958	101.0	48.3	42.7	43.2
1959	125.0	57.3	43.7	52.5
1960	115.0	63.7	61.3	63.0
1961	143.0	50.2	64.8	69.2
1962	145.0	69.5	73.5	71.2
1963	165.0	76.2	68.8	80.8
1964	160.0	72.2	92.8	85.5
1965	162.6	81.7	78.3	81.3
1966	180.9	78.3	84.3	-

1. See table 15.

2. These are essentially the exports since negligible quantities were imported only during 1964. See appendix, table 39.

Table 29. Production, net exports, and estimates of domestic apparent consumption of lemons in Lebanon, 1955-1966, in thousand metric tons.

	1 Production (1)	2 Net exports (2)	Diff. bet. (1) and (2) - (Prod. n/n+1, net exports n+1) (3)	Two-yrs. moving ave. of (3) (4)
1955	22.0	-	-	-
1956	21.0	7.2	14.8	13.2
1957	25.0	9.4	11.6	14.5
1958	30.0	7.6	17.4	18.3
1959	35.0	10.8	19.2	18.3
1960	40.0	17.7	17.3	19.5
1961	57.0	18.3	21.7	30.2
1962	55.0	18.4	38.6	32.8
1963	60.0	28.1	26.9	31.7
1964	65.0	23.5	36.5	33.4
1965	69.0	34.8	30.2	31.1
1966	69.0	37.1	31.9	-

1. See table 15.

2. These are essentially the exports since negligible quantities were imported only during 1964 and 1965. See appendix, table 39.

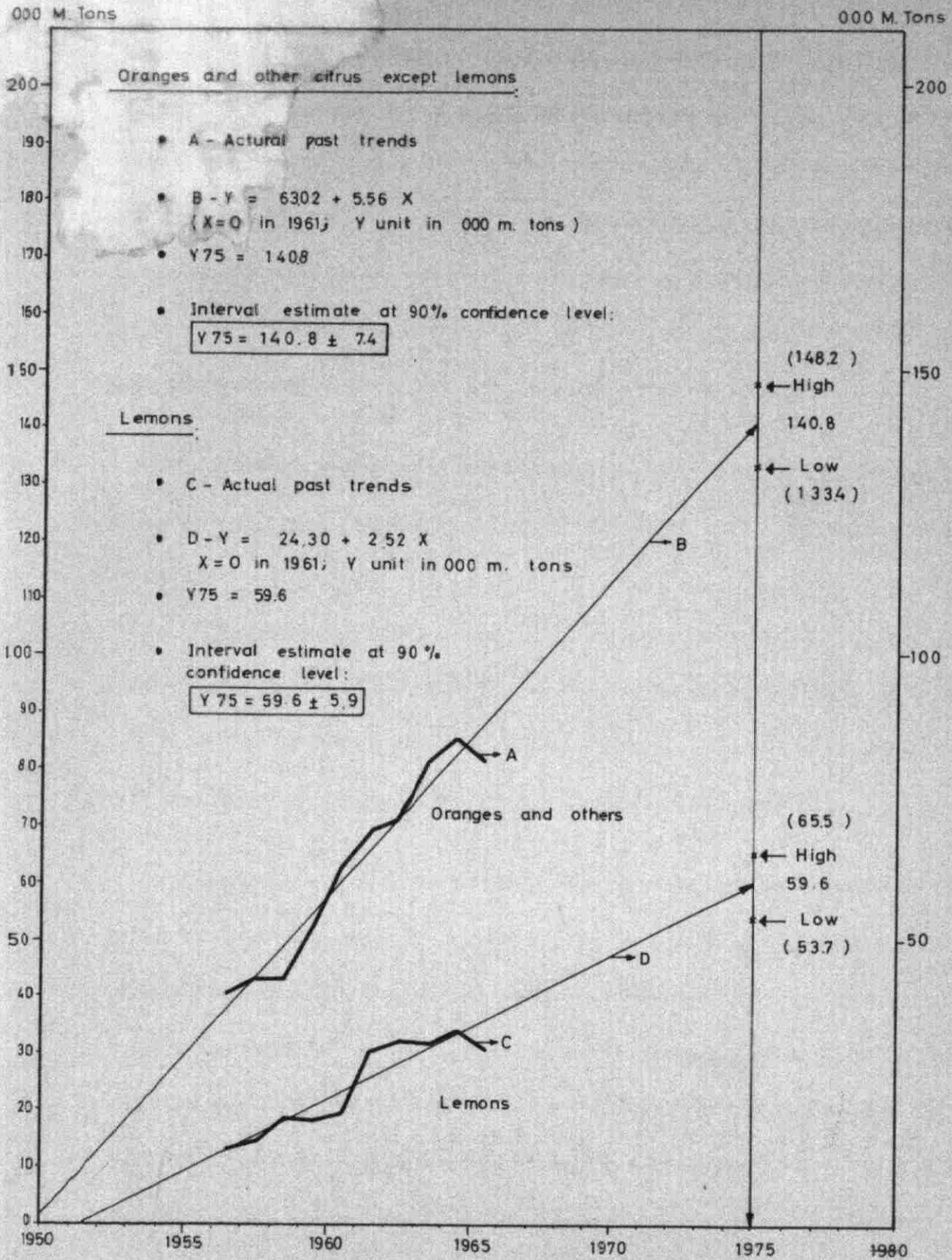


Figure 2. Future projection of the domestic apparent consumption of various citrus fruits in Lebanon by extrapolation of past trends

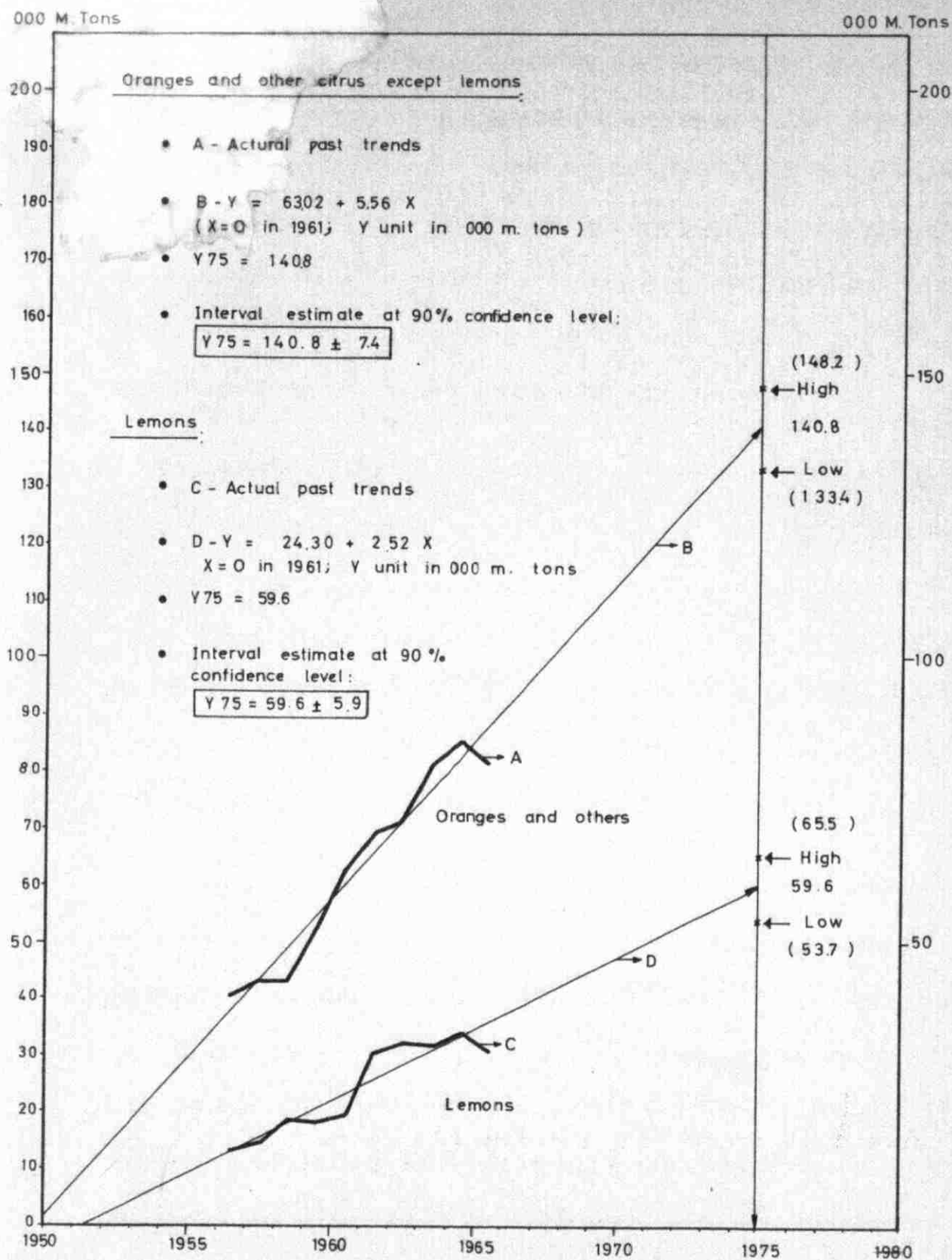


Figure 2. Future projection of the domestic apparent consumption of various citrus fruits in Lebanon by extrapolation of past trends.

consumption, p the rate of population growth, g the rate of growth in per capita income and n the income elasticity of demand (Stevens, 1965, p 4). This method was selected primarily because it does not require estimates of absolute magnitudes, but rather only growth rates, of population and income. In Lebanon, estimates on the former are less reliable than those on the latter. The determination of estimates for the above three independent variables and the level of domestic consumption of various citrus fruits at the present are discussed in the following sections.

Population : The last population census in Lebanon was taken in 1932. Since then only approximate estimates of the population and its rate of growth have been made.

The rate of population growth of 2.3%, estimated by the IRFED Mission, for the period between 1960 and 1975, was adopted in this study (IRFED, 1960-61, Vol. I, p 47). The growth rate of 2.3% seems to be the most frequently adopted for Lebanon (Oxford University, 1960, p 106 and Remba, 1965, p A-3).

Income : As in the case of population, only approximate estimates on the national income of Lebanon are available. The FAO, in its study on agricultural commodities projections for 1975 and 1985, used 4.0% and 5.5%, for Lebanon, as low and high estimates respectively, of the growth rate in the Gross Domestic Product (GDP) at constant factor cost, for the period 1965 to 1975 (FAO, 1966a, Vol. II, p 18). These estimates were adopted for this study. With a 2.3% growth rate in population, the low and high estimates of per capita GDP were 1.7 and 3.2% respectively.

High and low estimates of income growth were assumed because the pace of Lebanon's future economic development is very difficult to estimate. The rate of population growth is more stable and therefore, it can be projected with more certainty. Thus no ranges of estimates for the population growth were assumed.

Income Elasticity of Demand : The income elasticity of demand coefficients were derived from the cross-sectional results of the sample survey of household expenditure on food, conducted in Beirut and its outskirts, by the Central Bureau of Statistics (CBS) during 1965/66. For the low projection estimates in this study, the CBS elasticity coefficients estimates for the various citrus fruits were used.¹ For grapefruits, however, the estimate of the CBS (3.01) was judged too high. By inspecting the data on per capita total expenditure and the corresponding per capita consumption of grapefruits on a double-logarithmic chart, it was judged that a straight line with an elasticity of 1.5 fits the data more appropriately.

For a high estimate of elasticity coefficients to represent the whole of the Lebanese population, the lowest 80% of the expenditure groups as classified by CBS was analyzed. This procedure is derived from the assumptions that the lower the level of income, the higher should be the elasticity and that the average income for all Lebanon is less than that for people living in Beirut. It also assumes no rigidities in the demand for citrus fruits due to the pattern of food consumption in

1. A double logarithmic function ($\log y = a + b \log x$), assuming constant elasticity was used by the CBS to compute the elasticity coefficients. Twenty per capita total expenditure groups and the corresponding per capita consumption were analyzed. The results are not published yet. See the appendix for the raw data.

the rural areas. The data were inspected on a double-logarithmic chart and straight lines were fitted by the graphical method to obtain the constant elasticity coefficients.

The results on the high and low estimates of elasticity coefficients for the various citrus fruits are shown in table 30. Thus, the demand, with respect to income, is least elastic for lemons and most elastic for grapefruits. It is important to point out that these results are appreciably higher than the arbitrary 0.4 elasticity coefficient adopted by the FAO for each of the various species of citrus fruits.

Table 30. Estimates of income elasticity of demand coefficients for the various citrus fruits in Lebanon, 1965/66.¹

	High	Low
Oranges	0.80	0.60
Lemons	0.65	0.50
Mandarines and clementines	1.00	0.80
Grapefruits	2.00	1.50

1. Adapted from data in an unpublished report by the Central Bureau of Statistics in Lebanon in 1968.

Level of Consumption in the Base Period : The level of actual consumption in the base period was determined by subtracting net exports from production and correcting the results for waste and processing. The average of the two years 1965/66 and 1966/67 was taken as the base period.

As the export data of the customs group some kinds of citrus fruits together as one item (oranges and mandarines), the export data of the Fruit Board, which give the exports of every kind separately, were used. These data, however, report the gross weight. By comparing the net data of the customs and the gross data of the Fruit Board for two years (1965 and 1966), a 20% difference was found. The export data for oranges and mandarines of the Fruit Board were adopted, therefore, after being multiplied by 80%. To obtain the apparent domestic consumption the net exports of an $n+1$ year were subtracted from the production of $n/n+1$ year, as estimated in the first method of projecting demand.

The waste in citrus fruits in Lebanon was determined by comparison with other similar countries. The waste estimates in some Mediterranean and Middle Eastern countries (Spain, Greece, Italy, Jordan and the UAR) in total citrus fruits ranged between three and ten percent of production (FAO, 1966b). For Lebanon a five percent waste factor was judged appropriate. The raw citrus quantities used by the processing industry were obtained by interviewing the authorities of the two processing plants.

The estimates of total actual consumption of the various citrus fruits in the base period are presented in table 31. They are based on the above assumptions.

Table 31. Estimates of total actual consumption of various citrus fruits in Lebanon, 1966 and 1967, in thousand metric tons.

	Production		Net exports		Apparent		Ave. waste	Ave. process quant.	Ave. actual consump.	
	1965/1966	1966/1967	1966	1967	1966	1967				
Oranges	148.0	163.9	73.0	80.8	75.0	83.1	79.0	7.8	4.8	66.4
Lemons	69.0	68.9	37.1	38.2	31.9	30.7	31.3	3.5	0.3	27.5
Mandarines and clementines	11.4	12.9	3.1	2.8	8.3	10.1	9.2	0.6	-	8.6
Grapefruits	3.2	4.3	2.2	3.0	1.0	1.3	1.2	0.2	0.1	0.9

Projection Results : The rate of increase in total actual consumption was computed by applying Ohkawa's equation. The level of actual total consumption in the base period was then compounded by this rate to get the estimates for 1975. To get the full range between the low and high estimates, the low estimate of income growth was used with the low elasticity coefficients and the high estimate of income growth with the high elasticity coefficients.

The waste factor was determined by multiplying the production estimates for 1975 by five percent. The quantities of raw citrus anticipated to be processed in 1975 were those estimated by the authorities of the two processing plants. The waste and processing quantities were added to the actual total consumption as obtained above to get the total apparent consumption or disappearance.

The results obtained on the actual consumption, waste, processing and apparent consumption are presented in table 32 for the various citrus fruits. The overall domestic apparent consumption or disappearance of citrus fruits in 1975 according to this method is expected to vary between 170 to 200 thousand metric tons including 16 to 23 thousand metric tons to be utilized for processing.

Final Demand Estimates in 1975

The data in table 33 compare the results of the two methods used to project the demand or the apparent consumption. For oranges, and other citrus except lemons as a group, the results appear to be remarkably close with a difference of less than one percent. In fact, however, these results are not as close as it appears because of the factor of processing. The results of the method of extrapolation can be considered not to include quantities expected to be utilized

Table 32. Estimates of actual total consumption, waste, processed quantities and apparent consumption of citrus fruits in Lebanon in 1975 in thousand metric tons.

	Total actual consumption		Processed quantities		Waste		Apparent consumption or disappearance	
	High	Low	High	Low	High	Low	High	Low
Oranges	103.0	88.0	20.0	15.0	13.1	11.3	136.1	114.3
Lemons	39.8	35.9	2.0	1.0	6.0	5.0	47.8	41.9
Mandarines and clementines	13.6	11.8	-	-	1.2	1.0	14.8	12.8
Grapefruits	1.8	1.3	0.5	0.3	0.3	0.3	2.6	1.9
Total citrus	158.2	137.0	22.5	16.3	20.6	17.6	201.3	170.9

for processing since prior to 1965 (when the second processing plant, which is now utilizing the majority of the processed citrus fruits, started operation) processed quantities were negligible. The results of the second method included 15-20 thousand metric tons of oranges for processing. Differences in the estimates of lemons were 22% to 27%.

In general, the average of the estimates of the two methods was adopted for use in projecting the exportable surplus. Estimates on mandarines and grapefruits separately, however, were only given by the second method; these, therefore, were adopted for projection purposes. The final estimate on oranges separately was obtained by subtracting the mandarines and the grapefruits estimates from the grouped estimate of oranges and other citrus except lemons. The final results on

oranges and other citrus except lemons as a group, and lemons are shown in table 34. The final results on each kind separately are shown in table 35.

The domestic demand for oranges in 1975 is anticipated to vary between 116 to 133 thousand metric tons. For lemons the estimates were 48 to 57 thousand metric tons, for mandarines and clementines, 13 to 15 thousand metric tons and for grapefruits two to three thousand metric tons.

Table 36 compares the 1975 estimates with the present situation. During the coming decade, the domestic demand for total citrus fruits in Lebanon is expected to increase by 60 to 90 thousand metric tons, or by 49 to 73%. Demand for oranges is expected to increase by 47 to 68%, for lemons 55 to 84%, for mandarines and clementines, 44 to 67%, and for grapefruits 100 to 200%.

Exportable Surplus

The 1975 exportable surplus was determined by subtracting the 1975 demand estimates from the 1975 supply estimates. The results are presented in table 37. A surplus of 108 to 128 thousand metric tons is anticipated for oranges, 54 to 63 thousand metric tons for lemons, seven to nine thousand metric tons for mandarines and clementines and four thousand metric tons for grapefruits.

Table 38 summarizes the results of the analyses on supply, demand and exportable surplus and shows their comparison with the present. During the coming decade the exportable surplus of total citrus fruits in Lebanon is anticipated to increase by 43 to 70%. The surplus of oranges is expected to increase by 40 to 66%, of lemons by 42 to 66%, of mandarines and clementines by 133 to 200% and of grapefruits by only 33%. As also shown in the table, the demand and supply of

oranges are expected to increase in the same proportions. The demand for lemons and grapefruits is expected to increase at a sizeably higher rate than the supply. The opposite is true for mandarines and clementines. This means a lower proportion of exportable surplus from production for lemons and grapefruits and a higher proportion for mandarines and clementines.

Table 33. Comparison of the results of two methods used to estimate the apparent consumption of citrus fruits in Lebanon in 1975, in thousand metric tons.

	Results				Difference method I as the base		Percentage diff. method I as the base	
	Method I		Method II		High	Low	High	Low
	High	Low	High	Low				
Oranges and other cit. except lemons	148.2	133.4	153.5	129.0	(-) 5.3	(+) 4.4	(-) 0.4	(+) 0.3
Lemons	65.5	53.7	47.8	41.9	(+)17.7	(+)11.8	(+)27.0	(+)22.0
Total citrus	213.7	187.1	201.3	170.9	(+)12.4	(+)16.2	(+) 5.8	(+) 8.7

Table 34. Average of the results of two methods used to estimate the apparent consumption of citrus fruits in Lebanon in 1975, in thousand metric tons.

	Ave. of two methods	
	High	Low
Oranges and other citrus except lemons	150.8	131.2
Lemons	56.7	47.8
Total citrus	207.5	179.0

Table 35. Final demand estimates (apparent consumption) of various citrus fruits in Lebanon in 1975, in thousand metric tons.

	Demand in 1975	
	High	Low
Oranges	133	116
Lemons	57	48
Mandarines and clementines	15	13
Grapefruits	3	2
Total citrus	208	179

Table 36. Comparison of demand estimates (apparent consumption) of various citrus fruits in Lebanon in 1975 with the present situation, in thousand metric tons.

	Ave. 1966, 1967	1975		Difference		Index ave. 1966, 67 = 100	
		High	Low	High	Low	High	Low
Oranges	79	133	116	54	37	168	147
Lemons	31	57	48	26	17	184	155
Mandarines and clementines	9	15	13	6	4	167	144
Grapefruits	1	3	2	2	1	300	200
Total citrus	120	208	179	88	59	173	149

1. From table 31.

Table 37. Estimates of exportable surplus of various citrus fruits in Lebanon in 1975, in thousand metric tons.

	1		2		Exportable surplus	
	Supply		Demand		High	Low
	High	Low	High	Low	High	Low
Oranges	261	224	133	116	128	108
Lemons	120	102	57	48	63	54
Mandarines and clementines	24	20	15	13	9	7
Grapefruit	7	6	3	2	4	4
Total citrus	412	352	208	179	204	173

1. See table 26.
2. See table 35

Table 38. Comparison of estimates of supply, demand and exportable surplus of various citrus fruits in Lebanon in 1975 with the present situation, in thousand metric tons.

	1	Ave. 1965/66-1966/67	1975		Index Ave. 1965/66-1966/67=100	
			High	Low	High	Low
Oranges	S	156	261	224	167	144
	D	79	133	116	168	147
	X	77	128	108	166	140
Lemons	S	69	120	102	174	148
	D	31	57	48	184	155
	X	38	63	54	166	142
Mandarines and clementines	S	12	24	20	200	167
	D	9	15	13	167	144
	X	3	9	7	300	233
Grapefruits	S	4	7	6	175	150
	D	1	3	2	300	200
	X	3	4	4	133	133
Total citrus	S	241	412	352	171	146
	D	120	208	179	172	149
	X	121	204	173	169	143

1. S - Supply
 D - Demand
 X - Exportable surplus or actual exports

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of the study is to assess the future supply and domestic demand conditions of various citrus fruits in Lebanon and to estimate their future exportable surplus. The projections are not meant to be forecasts of what will actually take place. They represent rather, the probable future supply and demand for various citrus fruits based on the best available data and on assumptions, relating to the future, which are as realistic as possible.

Extrapolation of past production trends and production estimates derived from projected area and yield were the two methods used to project supply. In the second method, the additional area of various citrus fruits expected to be in production in 1975 was assumed to be the sum of the present area of non-bearing age and the total area expected to be planted until 1970. The new area expected to be planted between now and 1970 was estimated after considering the recent past trends and the irrigation projects in the coastal regions. Estimates on expected yields were determined after considering past long-term trends, age structure of trees and possibilities for increasing yield due to progress in technology.

For the domestic demand projections, an extrapolation of past apparent consumption trends and a projection of population and income effects on demand, assuming constant relative prices, were used. In the second method of demand projection, the population growth was considered to have a direct proportional effect on demand. The effect of the rise in per capita income was measured by the income elasticity of

demand. The income elasticity of demand coefficients for various citrus fruits were derived from the cross-sectional results of a sample survey of household expenditure on food, conducted by the Central Bureau of Statistics of Lebanon, during 1965/66, for Beirut and its outskirts.

Table 38 sums up the results on supply, demand and exportable surplus. It also shows their comparison with the present.

The high and low supply projection results in 1975 were, respectively, 261 and 224 thousand metric tons for oranges, 120 and 102 thousand metric tons for lemons, 24 and 20 thousand metric tons for mandarines and clementines and seven and six thousand metric tons for grapefruits. These constitute respective increases over present levels, of 67 and 44%, 74 and 48%, 100 and 67% and 75 and 50%.

The high and low domestic demand projections were, respectively, 133 and 116 thousand metric tons for oranges, 57 and 48 thousand metric tons for lemons, 15 and 13 thousand metric tons for mandarines and clementines and three and two thousand metric tons for grapefruits. These constitute respective increases over present levels of 68 and 47%, 84 and 55%, 67 and 44% and 200 and 100%.

Hence, the exportable surplus, defined as the difference between supply and domestic demand, is anticipated to vary between 108 and 128 thousand metric tons for oranges, 54 to 63 thousand metric tons for lemons, seven to nine thousand metric tons for mandarines and clementines and four thousand metric tons for grapefruits. This suggests that during the coming decade, export market outlets for oranges must be increased by 40 to 66%, for lemons by 42 to 66%, for mandarines and clementines by 133 to 200% and for grapefruits by 33%.

Conclusions

The demand for oranges in Lebanon, in 1975, is anticipated to increase in practically the same proportion as the supply. The demand for lemons and grapefruits is projected to increase at a sizeably higher rate than the supply. The opposite is true for mandarines and clementines. This means a lower proportion of exportable surplus, from production, for lemons and grapefruits and a higher proportion for mandarines and clementines.

During the past decade, Lebanon was able to approximately double its exports of oranges and other citrus except lemons, as a group (see table 28) and to increase those of lemons by more than four times (see table 29). In absolute terms the exports of the former increased by approximately 45 thousand metric tons and those of the latter by 27 thousand metric tons. During the coming decade the exportable surplus is projected to increase by 40 to 66% (30 to 50 thousand metric tons) for oranges, 42 to 66% (15 to 25 thousand metric tons), for lemons, 133 to 200% (four to six thousand metric tons), for mandarines and clementines, and only 33% (0.3 thousand metric tons) for grapefruits. This presents a continuing challenge to the marketing of Lebanese citrus. Studies conducted by colleagues of the author and by the author himself at the "Green Plan", however, are revealing that the prospects of import demand in the foreign markets are good for all the species of citrus except oranges. Jordan, now a net importer of oranges, and an important market for Lebanon, is anticipated to be a net exporter in ten years time.

Accordingly, Lebanon is not expected to have difficulties exporting its various citrus fruits, except oranges, even in the case of mandarines and clementines where the proportional increase in exportable surplus is projected to be the highest. Some difficulties might be expected in the exports of oranges. This is further substantiated by the commodity projection studies conducted by FAO, which revealed that the supply of oranges in the world at large in 1975, is expected to exceed the demand and, that the pressure to export will rise (FAO, 1966a.Vol. I, p 212-215).

The future market development is anticipated to be more towards the domestic market for lemons and grapefruits and more towards the export market for oranges, and mandarines and clementines as a group. Real prices of lemons and grapefruits are expected to be on an upward long-term trend. Those of oranges and mandarines are expected to be on a declining long-term trend if Lebanon cannot promote its exports to the required extent.

Recommendations

In the light of the results of this study, the following recommendations are given :

On Further Research

Further research on the domestic demand should be made for the various varieties of each species of citrus, with special emphasis on consumers tastes and preferences. This, together with available studies on import demand in the foreign markets, will make it possible to draw a stronger land use policy as to what varieties should be encouraged or discouraged.

On Production Planning

The Government should encourage the planting of lemons and grapefruits. This can perhaps best be done through the Government Extension Service and the Government land reclamation and development project, the "Green Plan", through its system of distributing fruit seedings at minimal cost.

On Exports and Processing

The Government must make long-term plans for the promotion of oranges, mandarines and clementines exports. New export outlets for oranges must be found. The Government should also encourage the processing of oranges to relieve the pressure on the exportable surplus. This seems particularly advisable in view of the growing world-wide consumer demand for citrus juices (FAO, 1966a. Vol. I, p 209).

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APPENDIX

Table 39. Exports and Imports of citrus fruits in Lebanon, 1955-1966, in thousand metric tons.

	Oranges and mandarines		Lemons		Other citrus	
	Exports	Imports	Exports	Imports	Exports	Imports
1955	33.4	-	9.9	-	0.3	-
1956	41.2	-	7.2	-	0.2	-
1957	44.0	-	9.4	-	0.4	-
1958	48.3	-	7.6	-	0.1	-
1959	57.2	-	10.8	-	0.1	-
1960	63.4	-	17.7	-	0.3	-
1961	49.9	-	18.3	-	0.3	-
1962	68.8	-	18.4	-	0.7	-
1963	75.3	-	28.1	-	0.9	-
1964	70.8	-	23.5	0.1	1.4	0.1
1965	80.3	-	34.8	0.3	1.3	-
1966	76.1	-	37.1	-	2.2	-

Source : (Conseil Supérieur des Douanes, Année, 1955-1966).

Table 40. Per caput consumption of various citrus fruits in Greater Beirut according to per caput total expenditure, 1965/66

Per caput expenditure			per caput consumption, in grams			
L. L.			Oranges	Lemons	Mandarines and clementines	Grapefruits
class interval		Average				
(1)	0- 494	383	10,281	3,948	1,490	-
(2)	494- 621	565	8,580	6,686	3,696	520
(3)	621- 760	692	16,040	8,557	2,574	224
(4)	760- 903	840	22,825	9,089	6,351	448
(5)	903- 1023	971	17,358	12,746	7,033	-
(6)	1023- 1139	1,074	15,337	14,262	6,199	113
(7)	1139- 1284	1,212	24,396	14,286	5,372	746
(8)	1284- 1421	1,350	25,437	15,457	6,078	300
(9)	1421- 1593	1,499	24,014	14,454	6,781	150
(10)	1593- 1750	1,673	32,321	17,384	9,557	602
(11)	1750- 1990	1,869	28,806	18,050	9,353	972
(12)	1990- 2221	2,100	38,153	14,975	10,949	790
(13)	2221- 2485	2,354	44,069	16,105	16,011	711
(14)	2485- 2802	2,640	45,172	19,224	11,180	1838
(15)	2802- 3195	3,007	39,733	16,494	13,338	601
(16)	3195- 3774	3,486	48,671	20,089	12,944	1122
(17)	3774- 4368	4,059	36,904	23,422	12,514	3586
(18)	4368- 5342	4,769	42,165	18,614	16,542	1206
(19)	5342- 7293	6,187	46,176	23,182	23,106	2874
(20)	7293-35036	11,296	72,812	28,015	24,905	5848

Source : (Central Bureau of Statistics, 1968, unpublished report)

Table 41. Wholesale price series of citrus fruits in Beirut, 1955-1965, in L.P. per kilogram.¹

	Oranges	Lemons
1955	29	35
1956	30	40
1957	27	42
1958	27	40
1959	23	27
1960	27	27
1961	29	28
1962	22	22
1963	27	24
1964	28	26
1965	27	23

Source : (Ministry of Agriculture, 1966 pp 7, 71)

1. The prices represent the "seasonal average" which was defined as the arithmetic average of prices during the months when the crop is available in abundant quantities.