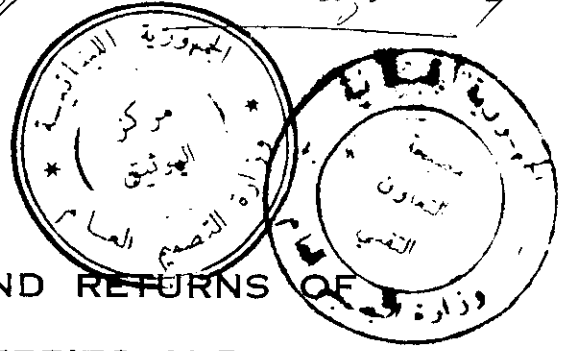


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Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)



RELATIVE COSTS AND RETURNS OF
PRODUCING APPLES, CHERRIES AND PEACHES
IN MOUNT LEBANON AREA, LEBANON

الجمهورية اللبنانية

مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

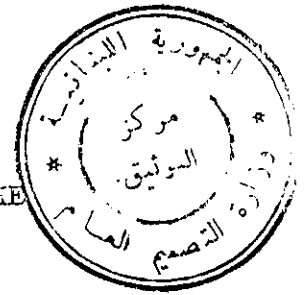
Agricultural Economics Section
Bureau of Agricultural Economics and Statistics
The Joint Technical Service
Ministry of Agriculture
Lebanon

May 1964

RELATIVE COSTS AND RETURNS OF
PRODUCING APPLES, CHERRIES AND PEACHES IN THE
MOUNT LEBANON AREA, LEBANON

by

Owen L. Brough, Jr.* and Joseph Fuleihan**



Fruit production in Lebanon has been expanding at a gradual significant rate during the past decade (see table 1). The terraced mountain area of Central Lebanon is becoming an increasingly important area for fruit production. Many new orchards of apples, cherries and peaches have been developed in recent years.

Table 1. Area Planted, Production and Value of Production*
for
Apples, Cherries and Peaches, Lebanon, 1955-1962

C r o p	Average Number of Hectars Planted		Average Annual Production in Metric Tons	
	1955-1957	1960-1962	1955-1957	1960-1962
Apples	7,130	10,860	29,870	72,670
Cherries	330	530	2,830	6,170
Peaches	1,500	1,930	4,730	7,670
Total	8,960	13,320	37,430	86,510

* Source: Bulletin of Agricultural Statistics No. 1, Bureau of Agricultural Economics and Statistics, Joint Technical Service, Ministry of Agriculture, Lebanon

The cost of developing a fruit orchard is high and once the orchard is developed it becomes costly to use the land for the production of other products. Farmers need information to help them make the long-time investment decision to develop a fruit orchard. Also, they need information to

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decide which fruit to plant. In addition, the farmer must become aware of the inputs used, the components of cost and the total cost of production so that he can determine how the costs can be reduced.

Research to help farmers make these decisions was initiated during 1963, by personnel of the Bureau of Agricultural Economics of the Ministry of Agriculture. This report is prepared to show the results of this research.

The specific objectives of this report are: (1) to record the typical inputs and costs of these inputs used by farmers in the production of apples, cherries and peaches in the terraced areas of Mount Lebanon; (2) to compare the relative investments in orchard development, the relative growing costs and components of costs for these fruits; (3) to determine the relative profitability of the fruits, when different typical yields and selling prices are considered; and (4) to make recommendations of ways of decreasing unit costs and/or improving production techniques.

Methodology

This study was designed to compare the average costs and returns of growing apples and cherries in the areas above 850 meters elevation and the cost of growing apples and peaches in the areas below 1200 meters elevation. To make these two comparisons, two representative samples of apple producers were selected. Eighty four apple producers with farms in the higher elevation were interviewed and 15 cherry producers in similar high areas were interviewed also. Cherries do not do well below 850 meters so the comparison of cherries with apples was made only for this higher elevation.

For the lower elevation (below 1200 meters) a sample of 69 apple producers were interviewed and only 10 peach producers were questioned. Peaches do not usually do well above 1200 meters so the comparison of apple producers with peach producers was made only for the lower elevations.

Only small samples of cherry and peach producers were interviewed because only a few farmers have solid plantations of these two fruits. The costs of land and terrace development used in this study is an average for all farmers producing apples and cherries or peaches for the areas under consideration.

Some judgement was used in the selection of the sample of farmers to be interviewed. Farmers who keep records or were

known to give reliable information were chosen in the sample. The interviewing was done by the professional staff of the Bureau of Agricultural Economics of the Ministry of Agriculture or by Extension Agents under the supervision of the Bureau staff.

The result of the individual interviews were averaged together to obtain the input and cost data for each item of cost. These were added to develop the total costs of production for each fruit for each area.

Comparison of Costs

The items of cost were divided into two major categories, fixed costs and growing costs.

Fixed Costs.

Fixed costs are those costs that are incurred each year regardless of the yield or changes in production practices. The components of fixed costs are: (1) interest on investment in land, buildings, irrigation facilities, machinery, fences, tools and the fully developed orchard; (2) depreciation on permanent items, such as buildings, irrigation facilities, machinery, tools and the mature orchards, and (3) repairs on buildings, fences and terraces.

Interest on Investments:

When money is invested in land, terraces, buildings or other similar inputs, a return must be calculated for the use of this money. If the money was not used for this purpose, it could be put in a bank or invested elsewhere and earn an interest rate. Likewise, money that is used to develop a new orchard, from the time the land is prepared before planting and until the returns from the orchard are greater than the production costs, must receive a return for its use. For each area it was assumed that the investments in land, buildings, machinery, fences and tools would be the same, whether the farmer planted apples or cherries in the area above 850 meters. The same procedure was followed for apples and peaches below 1200 meters (see tables 2 and 3 for the area above 850 meters and tables 4 and 5 for the area below 1200 meters). The interest costs for all fixed items, except land, were calculated on one-half their original or new value. It was assumed that on the average these items were half worn out at the time of the survey.

Table 2. Summary of Cost of Production for Apples, 1/
Produced above 850 Meters Elevation,
Mount Lebanon Area, Lebanon
1963

<u>Fixed Costs</u>	Cost Per Dunum <u>L.L.</u>	% of Total <u>Cost</u>
Interest on Investments in:		
Land and Terraces <u>2/</u> , LL. 3140.00 @6%	188.40	27.5
Irrigation Facilities, LL. 111.90 <u>3/</u> @6%	6.70	1.0
Buildings, 21.80 <u>3/</u> @8%	1.70	0.2
Machinery, LL. 13.80 <u>3/</u> @8%	1.10	0.2
Fences and Windbreaks, LL. 27.20 <u>3/</u> @8%	2.20	0.3
Hand Tools, LL. 7.00 <u>3/</u> @8%	.60	0.1
Orchard Development Costs, LL. 2698.00 @8% (1/2 the cost until 8 years old)	107.90	15.8
Depreciation on Buildings, Irrigation Facilities, Machinery, Fences and Tools		
	14.40	2.1
Depreciation on Orchard, LL. 2698.00 @3% (assuming a 33 year life after full development)		
	80.90	11.8
Repairs on Buildings, Fences and Terraces		
	<u>7.40</u>	<u>1.1</u>
Total Fixed Costs	411.30	60.1
<u>Growing Costs</u>		
Materials:		
Manure (includes transportation)	28.50	4.2
Chemical Fertilizer (includes transport)	36.00	5.3
Spray Materials (includes transport)	42.50	6.2
Water Costs (includes power for pumping)	6.50	0.9
Harvesting Materials	<u>2.50</u>	<u>0.4</u>
Total Materials Costs	116.00	17.0

1/ Average costs based on interviews with 108 farmers.

2/ Investments in land and terraces usually vary from LL. 1000 to LL. 5000 per Dunum. The value that is used will greatly affect the total cost of production.

3/ This value is 1/2 the original investment.

Table 2 (Cont.) Summary of Cost of Production for Apples,
Produced above 850 Meters Elevation,
Mount Lebanon Area, Lebanon
1963

	<u>Cost</u> <u>Per Dunum</u> <u>L.L.</u>	<u>% of</u> <u>Total</u> <u>Cost</u>
<u>Growing Cost (Continued)</u>		
Labor:		
Repairs on Machinery, Tools and Irrigation Facilities	4.00	0.6
Pruning and Removing Branches	14.00	2.0
Fertilizing (includes fertilizer mixing)	8.40	1.2
Plowing and Cultivation	40.00	5.8
Irrigating	12.00	1.7
Spraying (includes spray mixing)	21.50	3.1
Propping Trees	2.70	0.4
Harvesting (includes transportation to nearest road)	21.00	3.1
Guarding	10.00	1.5
Supervision	10.00	1.5
Miscellaneous labor costs	<u>7.20</u>	<u>1.1</u>
Total Labor Costs	150.80	32.0
Interest on Operating Capital (@8% annually for average period of 4 months)	6.50	0.9
Total Growing Costs	<u>273.30</u> =====	<u>39.9</u> =====
Total All Costs <u>1/</u> (except management)	684.60	100.0

If Yield is <u>2/</u>	1500 Kg/Du	2000 Kg/Du	2500 Kg/Du
Total Fixed Costs Are:	27.4 Ps/Kg	20.6 Ps/Kg	16.5 Ps/Kg
Growing Costs Are:	17.7 Ps/Kg <u>3/</u>	13.5 Ps/Kg	11.0 Ps/Kg <u>3/</u>
Total All Costs Are:	45.1 Ps/Kg <u>3/</u>	34.1 Ps/Kg	27.5 Ps/Kg <u>3/</u>

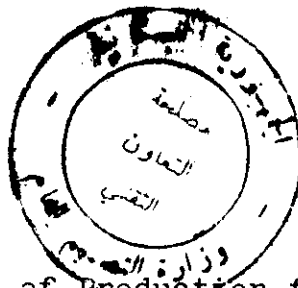
1/ Cost of apples delivered to nearest road in the buyers' boxes.

2/ Cost calculated on 50.7 as average number of trees per dunum

3/ Costs adjusted for yield.

Table 3. Summary of Cost of Production for Cherries 1/
Produced Above 850 Meters Elevation,
Mount Lebanon Area, Lebanon,
1963

<u>Fixed Costs:</u>	<u>Cost</u> <u>Per Dunum</u> <u>L.L.</u>	<u>% of</u> <u>Total</u> <u>Cost</u>
Interest on Average Investment in:		
Land and Terraces, LL. 2140.00 @6%	188.40	20.1
Irrigation Facilities, LL. 112.00 <u>2/</u> @6%	6.70	0.7
Buildings, LL. 21.50 <u>2/</u> @8%	1.70	0.2
Machinery, LL. 14.00 <u>2/</u> @8%	2.20	0.2
Hand Tools, LL. 7.00 <u>2/</u> @8%	.60	0.1
Orchard Development Costs 2568.00 @8% (Interest calculated on $\frac{1}{2}$ the original development cost through the 7th year)	102.70	11.0
Depreciation on Buildings, Irrigation Facili- ties, Machinery, Fences and Tools	14.30	1.5
Depreciation on Orchard, LL. 2568.00 @10% (assuming a 10 year life after full deve- lopment)	256.80	27.4
Repairs on Buildings, Fences and Terraces	<u>7.40</u>	<u>0.8</u>
Total Fixed Costs	580.80	62.0
<u>Growing Costs: 3/</u>		
Materials:		
Manure <u>4/</u> , $\frac{1}{2}$ bag manure/tree annually @ LL. 2.50/bag	68.70	7.3
Chemical Fertilizer <u>4/</u> , 1 Kg nitrate/tree @ 16 Ps/Kg; $\frac{1}{2}$ Kg superphosphate/ tree @ 11 Ps/Kg	11.80	1.3
Spray Material <u>4/</u> , 1 winter spray ans 3 summer sprays, Total of 19 Ps/tree/year	10.40	1.1
Water Costs	6.40	0.7
Harvesting Materials	<u>2.40</u>	<u>0.3</u>
Total Material Costs	99.70	10.7



Tables 3. (cont.) Summary of Cost of Production for Cherries
Produced Above 850 Meters Elevation,
Mount Lebanon Area, Lebanon,
1963

	Cost Per Dunum L.L.	% of Total Cost
<u>Growing Costs (cont.)</u>		
Labor:		
Repairs on Tools, Machinery and Irrigation Facilities	4.00	0.4
Pruning and Removing Branches, 1 man-day/dunum @ LL. 10.00/man-day	10.00	1.1
Fertilizing; manure 25 Ps/bag; chemical fertilizer, 1 application, 1/3 man-day/dunum @ LL. 7.00/man-day	9.20	1.0
Cultivation and Weeding, 2-3 times, 6 man-days /dunum/year @ LL. 7.00/man-day	42.00	4.5
Irrigating, 4 irrigations, 2½ dunum/man-day/irrigation, @ LL. 7.00 man-day	11.20	1.2
Spraying, 47 tins/dunum/year @ 20 Ps/tin	9.40	1.0
Picking, 5 Ps/Kg	67.50	7.2
Sorting and Packing, 5 Ps/Kg	67.50	7.2
Guarding and Supervision	20.00	2.1
Miscellaneous Labor Costs	9.00	1.0
Total Labor Costs	249.80	26.7
Interest on Operating Capital, @ 8% annually for an average period of 4 months	5.70	0.6
Total Growing Costs 5/	355.20	38.0
	=====	=====
Total All Costs 5/ (excluding Management)	936.00	100.0

If Yield is	1000 Kg/Du	1350 Kg/Du	1700 Kg/Du
Fixed Costs Are	58.6 Ps/Kg	43.0 Ps/Kg	34.1 Ps/Kg
Growing Costs Are 5/ 6/	32.4 Ps/Kg	26.6 Ps/Kg	23.2 Ps/Kg
Total All Costs Are 5/6/	91.0 Ps/Kg	69.6 Ps/Kg	57.3 Ps/Kg

- 1/ Growing costs based on interviews with 15 farmers. Fixed costs based on the cherry producers and a large sample of apple producers.
- 2/ This value is ½ the original investment. This assumes that, on the average, these items are half-depreciated.
- 3/ Cost calculated on 55 trees as the average number of trees per Du.
- 4/ Includes the cost of transportation to the farm.
- 5/ Cost of cherries delivered to the nearest road in the buyers' boxes.
- 6/ Harvesting costs are adjusted for yield.

Table 4. Summary of Cost of Production for Apples 1/
Produced Below 1200 Meters Elevation,
Mount Lebanon Area, Lebanon,
1963

	Cost Per Dunum <u>L.L.</u>	% of Total <u>Cost</u>
<u>Fixed Costs</u>		
Interest on Investments in:		
Land and Terraces <u>2/</u> LL. 3122.00 @6%	187.30	28.1
Irrigation Facilities, LL. 101.30 <u>3/</u> @6%	6.10	0.9
Buildings, LL. 26.00 <u>3/</u> @8%	2.10	0.3
Machinery, LL. 15.30 <u>3/</u> @8%	1.50	0.2
Fences and Windbreaks, LL. 33.50 <u>3/</u> @8%	2.70	0.4
Hand Tools, LL. 7.80 <u>3/</u> @8%	.60	0.1
Orchard Development Costs, LL. 2298.00 @8% ($\frac{1}{2}$ the cost until 7 years old)	91.90	13.8
Depreciation on Buildings, Irrigation Facili- ties, Machinery, Fences and Tools	14.80	2.2
Depreciation on Orchard, LL. 2298.00 @ 3% (assuming a 33 year life after full development)	68.90	10.3
Repairs on Buildings, Fences and Terraces	<u>8.00</u>	<u>1.2</u>
Total Fixed Costs	383.90	57.6
<u>Growing Costs</u>		
Materials:		
Manure (includes transportation)	26.00	3.9
Chemical Fertilizer (includes transportation)	41.00	6.1
Spray Materials (includes transportation)	44.00	6.6
Water Costs (includes power for pumping)	6.70	1.0
Harvesting Materials	<u>2.50</u>	<u>0.4</u>
Total Materials Costs	120.20	18.0

1/ Average costs based on interviews with 93 farmers.

2/ Investments in land and terraces usually vary from LL 1000 to LL. 5000 per Dunum. The value that is used here will greatly affect total cost of production.

3/ This value is $\frac{1}{2}$ the original investment.

Table 4. (Cont.) Summary of Cost of Production for Apples
Produced Below 1200 Meters Elevation,
Mount Lebanon Area, Lebanon,
1963

	Cost Per Dunum L.L.	% of Total Cost
<u>Growing Costs (Cont.)</u>		
Labor:		
Repairs on Machinery, Tools and Irrigation facilities	4.00	0.6
Pruning and Removing Branches	14.00	2.1
Fertilizing (includes fertilizer mixing)	8.50	1.3
Plowing and Cultivation	40.00	6.0
Irrigating	13.50	2.0
Spraying (includes spray mixing)	22.50	3.4
Propping Trees	3.00	0.4
Harvesting (includes transportation to nearest road)	23.00	3.4
Guarding	10.00	1.5
Supervising	10.00	1.5
Miscellaneous labor costs	7.40	1.1
Total Labor Costs	155.90	23.4
Interest on Operating Capital @8% annually for average period of 4 months.	6.70	1.0
Total Growing Costs	282.80	42.4
	=====	=====
Total All Costs <u>1/</u> (excluding management)	666.70	100.0
<hr/>		
If Yield is <u>2/</u>	1500 Kg/Du	2000 Kg/Du
Total Fixed Costs Are:	25.6 Ps/Kg	19.2 Ps/Kg
Growing Costs Are:	18.5 Ps/Kg ^{3/}	14.2 Ps/Kg
Total All Costs Are:	44.1 Ps/Kg ^{3/}	33.4 Ps/Kg
		2500 Kg/Du
		15.4 Ps/Kg
		11.6 Ps/Kg
		27.0 Ps/Kg ^{3/}

1/ Cost delivered to nearest road in the buyers' boxes.

2/ Costs calculated on 51.2 as the average number of trees per dunum.

3/ Costs adjusted for yield.

Table 5. Summary of Cost of Production for Peaches, 1/
Produced Below 1200 Meters Elevation,
Mount Lebanon, Lebanon, 1963

	<u>Cost</u> <u>Per Dunum</u> <u>L.L.</u>	<u>% of</u> <u>Total</u> <u>Cost</u>
<u>Fixed Costs:</u>		
Interest on Average Investment in:		
Land and Terraces, LL. 3122.00 @6%	187.30	29.1
Irrigation Facilities, LL. 101.30 <u>2/</u> @6%	6.10	0.9
Buildings, LL. 26.00 <u>2/</u> @8%	2.10	0.3
Machinery, LL. 15.30 <u>2/</u> @ 8%	1.20	0.2
Fences and Windbreaks, LL. 34.50 <u>2/</u> @8%	2.80	0.4
Hand Tools, LL. 7.40 <u>2/</u> @8%	.60	0.1
Orchard Development Costs, LL. 1357.00 @8% (interest calculated on $\frac{1}{2}$ this original development cost through 4th year)	54.30	8.4
Depreciation on Buildings, Irrigation Facili- ties, Machinery, Fences and Tools	14.80	2.3
Depreciation on Orchard, LL. 1357.00 @ 5% (assuming a 20 year life after full deve- lopment)	67.80	10.6
Repairs on Buildings, Fences and Terraces	<u>8.00</u>	<u>1.2</u>
Total Fixed Costs	345.00	53.7
<u>Growing Costs: 3/</u>		
Materials:		
Manure <u>4/</u> , 1/4 bag cow manure per tree annually, @ LL. 2.20 per bag	30.20	4.8
Chemical Fertilizer <u>4/</u> , 3 Kgs/tree ammonium sulfate @17 Ps/Kg 2 Kg/tree superphosphate @ 11 Ps/Kg 1 Kg/tree potassium chloride @18Ps/Kg	50.00	7.8
Spray Materials <u>4/</u> , 1 winter spray and 3 summer sprays @40 Ps per tree per year	22.00	3.4
Water Cost	6.80	1.1
Supports, 3 Ps. per tree per year	1.60	0.2
Harvesting Materials	<u>1.60</u>	<u>0.2</u>
Total Materials Costs	112.20	17.5

Table 5. (Cont.) Summary of Cost of Production for Peaches Produced Below 1200 Meters Elevation, Mount Lebanon, Lebanon, 1963

	<u>Cost Per Dunum L.L.</u>	<u>% of Total Cost</u>
<u>Growing Costs (Cont.)</u>		
Labor:		
Repairs on Tools, Machinery and Irrigation Facilities	4.00	0.6
Pruning and Removing Branches, 30 Ps per tree, per year	16.50	2.6
Fertilizing, 25 Ps/bag manure; 2 applications chemical fertilizer, $\frac{1}{2}$ man/Du/ application @LL. 7.00 per man	10.50	1.7
Cultivating and Hoeing, 6 man days per dunum per year @ LL. 7.00 man-day	42.00	6.5
Irrigating, 4 Irrigations, 1man for 2.5 dunums/irrigation @ LL.7.00/man	11.20	1.7
Spraying, 60 tins of spray/dunum/year @20 Ps/tin	12.00	1.9
Thinning, 1 man-day/du @LL 7.00/man-day	7.00	1.1
Propping	1.50	0.2
Picking 1.5 Ps/Kg	24.80	3.9
Sorting and Packing, 1.3 Ps/Kg	21.40	3.3
Guarding and Supervising	20.00	3.1
Miscellaneous Labor Costs	8.00	1.2
Total Labor Costs	178.90	27.8
Interest on Operating Capital, 8% annually for an average period of 4 months	6.50	1.0
Total Growing Costs <u>5/</u>	297.60	46.3
	=====	=====
Total All Costs <u>5/</u> (excluding management)	642.60	100.0

If Yield is	1200 Kg/Du	1650 Kg/Du	2100 Kg/Du
Fixed Costs Are	28.8 Ps/Kg	20.9 Ps/Kg	16.4 Ps/kg
Growing Costs Are <u>5/6/</u>	23.8 Ps/Kg	18.1 Ps/Kg	14.8 Ps/kg
Total All Costs Are <u>5/6/</u>	52.6 Ps/Kg	39.0 Ps/kg	31.2 Ps/kg

- 1/ Growing costs based on interviews with 10 farmers. Fixed costs based on a large sample of apple and peach producers.
- 2/ This value is $\frac{1}{2}$ the original investment. This assumes that, on these items are half-depreciated.
- 3/ Costs calculated on 55 as average number of trees per dunum.
- 4/ Includes cost of transportation to the farm.
- 5/ Cost of peaches delivered to nearest road in the buyers' boxes.
- 6/ Harvesting and hauling costs adjusted for yields.

For the apples and cherries grown in the area above 850 meters, farmers estimates of the value of land and terraces (including water rights) without an orchard was from L.L. 1500 to L.L. 5000 per dunum. The average value of land and terraces was L.L. 3140 per dunum. The average investments in irrigation facilities per dunum was L.L. 112, in buildings, L.L. 21,80, in machinery, L.L. 13.80, in fences, in windbreaks, L.L. 27.20 and in hand tools L.L. 7.00 per dunum. For each of these investment items there was a large variation among farmers in the amount invested in each item.

For apples and peaches produced, in the area below 1200 meters elevation, the average value of land and terraces (including water rights) was L.L. 3122 per dunum. As with the higher elevation farmers estimates of the value of the land and terraces varied greatly from L.L. 1200 to L.L. 5300 per dunum. The average per dunum value of investments in other permanent structures and machines were similar to those found in the higher altitude (see tables 4 and 5).

Orchard development costs were calculated by adding all costs of planting the trees and the yearly growing costs until the trees were mature (the year when annual returns are greater than annual costs). In Table 6 is given the yearly costs incurred during the development of the board. Peach trees mature at an earlier age than cherry or apple trees. Thus, the period for which the growing costs were charged as development costs for peaches was only 4 years, whereas for apples and cherries it was 7 years.

The value of production during these orchard development years was deducted from the growing costs to obtain a net development cost for each year. Interest was charged on all previous years' net costs until the orchard reached the assumed mature age. (4 years for peaches and 7 years for apples and cherries).

Interest on orchard development costs was calculated by multiplying the interest rate (8%) by one half the net cost of developing the orchard. After the orchard is fully developed it has a life expectancy of several years. The life expectancy of these orchards was assumed to be 33 years, 20 years and 10 years for apples, peaches and cherries respectively. During this period the productivity of the orchard decreases gradually. The new orchard is like a new machine that gradually becomes less valuable with time and similarly the orchard must be depreciated in value over the period of its life. It was found that some orchards were new and some were old. It was assumed that on the average all orchards

Table 6. Average Net Orchard Development Costs For Apples, Cherries, and Peaches in Mount Lebanon, Lebanon, 1963

<u>Item:</u>	Apples Below 1200 Meters L.L.	Peaches Below 1200 Meters L.L.	Apples Above 850 Meters L.L.	Cherries Above 850 Meters L.L.
<u>1st Year:</u>				
Fixed Costs	200	200	201	201
Materials	137	190	137	148
Labor and Machine Operating Costs	74	86	74	107
Interest on This Year's Opera- ting Capital	6	7	6	7
Interest on All Previous Orchard Development Costs	0	0	0	0
Total Cost for Year	<u>417</u>	<u>483</u>	<u>418</u>	<u>463</u>
Returns from Sale of Product	0	0	0	0
Net cost for Year	<u>417</u>	<u>483</u>	<u>418</u>	<u>463</u>
<u>2nd Year:</u>				
Fixed Costs	200	200	201	201
Materials	41	44	41	37
Labor and Machin Operating Cost	69	77	69	97
Interest on This Year's Opera- ting Capital	3	3	3	4
Interest on All Previous Orchard Development Costs	33	39	33	37
Total Cost for Year	<u>346</u>	<u>363</u>	<u>347</u>	<u>376</u>
Returns from Sale of Product	0	0	0	0
Net Cost for Year	<u>346</u>	<u>363</u>	<u>347</u>	<u>376</u>
<u>3rd Year:</u>				
Fixed Costs	200	200	201	201
Materials	49	62	45	37
Labor and Machine Operating Costs	80	100	76	98
Interest on Year's Operating Capital	3	4	3	4
Interest on All Previous Orchard Development Costs	61	68	61	67
Total Cost For Year	<u>393</u>	<u>434</u>	<u>386</u>	<u>407</u>
Returns from Sale of Product	0	124	0	0
Net Cost for Year	<u>393</u>	<u>310</u>	<u>386</u>	<u>407</u>

Table 6 (Cont) Average Net Orchard Development Costs For Apples, Cherries, and Peaches in Mount Lebanon Lebanon, 1963

Item:	Apples	Peaches	Apples	Cherries
	Below 1200 Meters L.L.	Below 1200 Meters L.L.	Above 850 Meters L.L.	Above 850 Meters L.L.
<u>4th Year:</u>				
Fixed Costs	200	200	201	201
Materials	61	78	50	52
Labor and Machine Operating Costs	88	123	80	103
Interest on This Year's Operating Capital	4	5	3	5
Interest on All Previous Orchard Development Costs	92	92	92	99
Total Cost for Year	445	498	426	460
Returns from Sale of Product	36	297	16	0
Net Cost for Year	409	201	410	460
<u>5th Year:</u>				
Fixed Costs	200		201	201
Materials	75		60	77
Labor and Machine Operating Costs	102		86	136
Interest on This Year's Opera- ting Capital	5		4	6
Interest on All Previous Development Costs	125		125	136
Total Cost For Year	507		476	556
Returns from Sale of Product	132		44	165
Net Cost for Year	375		432	391
<u>6th Year:</u>				
Fixed Costs	200		201	201
Materials	88		72	87
Labor and Machine Operating Capital	118		98	150
Interest on All Previous Orchard Development Costs	155		159	167
Interest on This Year's Opera- ting Capital	5		4	7
Total Cost for Year	566		534	612
Returns from Sale of Product	300		136	275
Net Cost for Year	266		398	337

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام



Table 6. (Cont) Average Net Orchard Development Cost for Apples, Cherries and Peaches in Mount Lebanon, Lebanon, 1963

<u>Item</u>	Apples	Peaches	Apples	Cherries
	Below 1200 Meters L.L.	Below 1200 Meters L.L.	Above 850 Meters L.L.	Above 850 Meters L.L.
<u>7th Year:</u>				
Fixed Costs	200		201	201
Materials	101		88	97
Labor and Machine Operating Costs	138		117	184
Interest on This Year's Operating Capital	6		5	8
Interest on All Previous Orchard Development Costs	<u>176</u>		<u>191</u>	<u>194</u>
Total Cost for Year	<u>621</u>		<u>602</u>	<u>684</u>
Returns from Sale of Product	<u>529</u>		<u>295</u>	<u>550</u>
Net Cost for Year	92		307	134
	=====	=====	=====	=====
Total Net Orchard Development Costs	2298	1357	2698	2568

were half depreciated out. Therefore, the interest on the investments in the cost of developing the orchard was calculated at one half of the net cost of developing the orchard to the mature condition.

The average orchard development costs were L.L. 2298 per dunum for apples and only L.L. 1357 per dunum for peaches, when these fruits are grown below 1200 meters. The orchard development cost was much lower for peaches because in the 5th year, the value of production exceeded the cost of production, while for apples below 1200 meters it was the 8th year before annual returns exceeded the annual costs.

For the areas above 800 meters the average orchard development costs were L.L. 2698 per dunum for apples and L.L. 2568 per dunum for cherries.

The interest rate used was 6% annually for investments in land, land improvements, and irrigation facilities. It was assumed that money used for these purposes could be borrowed at a lower rate than money for investments in such items as machinery or fences. A higher interest rate of 8% was used for the fixed investments other than developed land and irrigation facilities.

Depreciation:

Buildings, irrigation facilities, machinery, fences and tools, all decrease in value over time. Therefore, a yearly depreciation cost for these items must be added to the other fixed costs. The total average depreciation for these items was L.L. 14.80 and L.L. 14.30 per dunum for apples or peaches at lower altitudes and apples or cherries at higher altitudes respectively.

As has been explained above, the new orchard was depreciated over time. For each fruit the depreciation rate was based on the "straight-line" method of calculation. The annual amount of the cost of depreciation depends on the number of productive years of the orchard. For example, it was assumed that an average apple orchard would have a productive life of about 33 years after full development. Therefore, the yearly rate of depreciation would be 3% of the total orchard development cost, the annual depreciation rate of peaches was assumed to be 5% and for cherries 10% (see Tables 2, 3, 4 and 5).

Repairs:

Permanent production items that require repairs regardless of the quantity of production are buildings, fences and windbreaks. A nominal cost for annual repairs of these items was calculated (see Tables 2, 3, 4, and 5). Repairs on machinery, tools and irrigation facilities are related to how much these items are used each year. Therefore, they are considered as growing costs and will be discussed later.

Total Fixed Costs:

Using the methods of calculations outlined above, the average total fixed costs for apples, cherries and peaches were determined. The average total fixed costs for apples at the two elevations and for cherries and peaches differed mainly because of the differences in the orchard development costs and the amount of depreciation charged for the orchard.

For the area above 850 meters, the average total fixed costs for cherries was L.L. 581 per dunum and for apples, it was L.L. 411 per dunum. For the area below 1200 meters, the average fixed cost for apples was L.L. 384 per dunum and for peaches, it was L.L. 345 per dunum (see tables 2, 3, 4 and 5).

Growing Costs.

Growing costs are those costs which occur each year and which vary with the quantity of production. Examples are the cost of fertilizer, water, spray materials, labor and supervision. The yearly growing costs presented here are for a mature orchard and represent the average yearly costs expected over the life of the orchard, after the development period.

Growing costs have been divided into three categories: materials, labor and interest on operating capital. Materials are those items which the farmer usually buys, such as manure, chemical fertilizers, spray materials, water and supplies used in harvesting.

Fertilizers:

The quantity of manure or chemical fertilizer used varies greatly among farmers. Some farmers use mostly manure with small quantities of chemical fertilizers, while other farmers use only chemical fertilizers. The fertilizer costs shown in Tables 2, 3, 4 and 5 are an average for all the farmers interviewed.

In the lower elevations where apples and peaches are grown, farmers applying manure, usually used cow or horse manure with applications of $1/4$ sack per year per tree or if they applied manure every other year, they usually used $1/3$ to $1/2$ sack per tree every two years.

There was no great difference between apples and peaches in the quantity of manure applied. It was more common for apple producers to apply manure every other year and for peach producers to apply it every year. The average cost of manure for apples was L.L. 26 per dunum and for peaches L.L. 30 per dunum.

In the higher elevations (above 850 meters), producers of cherries usually applied about $1/2$ a sack of cow or horse manure per tree per year while apple producers applied only $1/4$ sack per tree each year or $1/3$ sack per tree every other year. The average total cost of manure was almost L.L. 70 per dunum for cherries and only about L.L. 29 per dunum for apples, or less than half as much.

The mountain farmers do not use as much chemical fertilizer as do the fruit farmers in the Bekaa Valley. Apple producers in both the lower and higher elevation spent, on the average, between L.L. 36 and L.L. 40 per dunum for chemical fertilizer each year. However, the peach producers used more chemical fertilizer or about L.L. 50.00 per dunum per year. It is interesting to note that, on the average, the cherry producers spent a small amount for chemical fertilizers (about L.L. 12 per dunum per year). However, as has been pointed out, they used more manure and the total cost of both types of fertilizers (manure and chemical) was only slightly higher (L.L. 80) than the total cost of all types of fertilizer for apples (about L.L. 69 per dunum per year).

Spray Materials:

The number of times the fruits are sprayed and the kinds of spray materials used vary among farmers. It appears that spraying techniques have not been standardized for anyone of the fruits. This point would seem to indicate that horticulturists need to establish desirable spraying recommendations and that the Agricultural Extension Service must make these recommendations know to the farmers.

The most common practices were to spray cherries 4 times per year, peaches 4 times per year and apples 7 - 12 times

per year. The cost of spray materials are related to the number of times the orchard is sprayed.

The cost of spray materials are twice as costly for apples as for peaches and about 4 times more than for cherries. (see tables 2, 3, 4 and 5).

Water Costs:

Many farmers interviewed have free access to gravity fed irrigation water. The right to use this water is included as part of the value of the land. Only a few of the farmers interviewed had high costs of pumping water from streams or wells. The cost of water shown in Tables 2, 3, 4 and 5 represents an average of a few who pump water and a larger number who have free gravity fed water. For this reason, the average cost of water per dunum is relatively low.

Labor Costs:

The labor, listed under this heading, includes all labor used in the production of the crop, regardless of its source. It includes both hired and family labor. The value assigned for family labor was established by using the daily rate of pay for comparable labor.

Repairs on machinery, tools and irrigation facilities are considered as a growing cost in this study because if there was no production, there would be no need for these repairs.

Pruning:

Most of the farmers prune their trees every year. Pruning costs were variable because of the differences in the cost of labor used for pruning. Some farmers paid L.L. 7.00 per day per man while other farmers paid as high as L.L. 12.00 per day. More labor was required to prune peaches than apples, and apples were pruned more heavily than cherries (see tables 2, 3, 4 and 5).

Plowing, Cultivating and Hoeing:

Nearly all farmers cultivated or plowed their orchards by hand and all hoeing and weeding was done by hand. Most farmers cultivated 2 to 4 times during the season. The average cost of plowing, cultivating, hoeing and weeding was just over L.L. 40 per dunum and it was about the same for all fruits and the two elevations. It is interesting to note

that the cost of cultivating and plowing was two and a half times higher in the mountain areas than for the fruit of the Bekaa Valley. The farmer in the Bekaa uses tractors for cultivation. This suggests that some reduction in the cost of doing these jobs may be possible if some methods of mechanized cultivation were adopted by the mountain farmers. The use of small two-wheeled hard tractor should be investigated and the economic effects of these machines need to be studied. Because of this need, the Bureau of Agricultural Economics is starting research on this problem during the current year.

Irrigation:

Peach and cherry producers irrigated their orchards about 4 times a year, while apple producers irrigated their orchards about 8 or 9 times during the year.

Harvesting:

The cost of harvesting is much higher for cherries than for either apples or peaches. The cost of harvesting apples, as shown in Table 3, does not include sorting or packing because most farmers sell their apples to the cold storage operator or have them stored at the storage plant where the sorting and packing is done. Peaches and cherries are usually sold on the fresh market and the sorting and packing is done at the farm. Therefore, the sorting and packing costs for peaches and cherries were included as a harvesting cost.

Guarding and Supervision:

The cost per dunum of guarding and supervision depends on the size of the orchard. Usually, one man is hired to do this job for a particular orchard. The salary for this man is usually a set amount per month. Thus, the larger the orchard, the smaller the cost per dunum for these services. The average cost for guarding and supervising was L.L. 20 per dunum. This amount was used for this item of cost for all three fruits. (See tables 2, 3, 4 and 5).

Miscellaneous Labor Costs:

Past experience has shown that when the cost of production is developed by adding the individual costs for each cultural operation a small quantity of what might be called "overhead labor" is not accounted for. This overhead labor consists of the time required for workers to travel to the field, to prepare their tools for use, or to change from one job to another. An arbitrary cost of 5% of total non-custom labor costs was added as miscellaneous labor costs to account for this overhead labor.

Interests on Operating Capital:

All during the year the farmer pays money for materials and labor. If he had not used this money for these purposes, he could have earned interest by investing it in some other use. If he borrowed the money to pay yearly operating costs, he must pay interest for use of this money. In either case, the cost of using this money to pay operating costs must be charged as an expense against that year's crop. In this study, a charge of 8% of the total growing costs was used to determine the cost of using this money. However, farmers use this operating money for an average period of only 4 months; therefore, only one third of the annual interest cost (growing costs multiplied by 8%) was used as a cost of production (see tables 2, 3, 4 and 5).

Cost Per Kilogram

Cost per dunum is only one way of looking at cost of production. Cost per kilogram of product is more important as a measure of cost. Yearly growing costs per dunum do not vary much from year to year but yields may differ greatly from year to year. Therefore, to demonstrate the effect of yield changes on the cost per kilogram, three levels of yield were chosen for each fruit (see tables 2, 3, 4 and 5). It can be seen that the level of yield has an important effect on the cost of production per kilogram and thus the cost at which the farmer can sell his product and still cover his costs. For example, if the yield of a dunum of apples at the higher elevation is only 1500 kilograms, the total cost of production is about 45 piasters per kilogram, while if the yield per dunum is 2500 kilograms, the total cost of production is only about 27 piasters per kilogram.

The main reason the cost per kilogram becomes smaller as yield increases is because fixed costs are a set amount for each dunum per year, and as yield increases, this cost is spread over more kilograms.

Comparison of average costs of production between apples and cherries grown above 850 meters elevation:

The average total cost per dunum of producing cherries was much higher (L.L. 936) than for apples (L.L. 685). The main difference in cost per dunum between these two fruits was the fixed cost and the cost of harvesting, sorting and packing (see table 7).

The fixed costs differ because the value of a mature orchard of cherries was depreciated over a fewer number of

Table 7: Comparison of Average Costs of Production for Apples and Cherries Produced Above 850 Meters Elevation, Mount Lebanon Area, Lebanon, 1963

<u>Cost Item</u>	<u>Apples LL/Du</u>	<u>Cherries LL/Du</u>
<u>Fixed Costs:</u>		
Interest on Investments in Land Terraces, Irrigation Facilities, Buildings, Machinery, Tools, Fences and Developed Orchards.	308.60	302.30
Depreciation on Buildings, Irrigation Facilities, Machinery, Fences, Tools and Developed Orchards	95.30	271.10
Repairs on Buildings, Fences and Terraces	7.40	7.40
Total Fixed Costs	<u>411.30</u>	<u>580.80</u>
<u>Materials:</u>		
Manure	28.50	68.70
Chemical Fertilizers	36.00	11.80
Spray Materials	42.50	10.40
Water and Other Materials	9.00	8.80
Total Materials	<u>116.00</u>	<u>99.70</u>
<u>Labor Costs:</u>		
Pruning and Removing Branches	14.00	10.00
Fertilizer Application	8.40	9.20
Cultivation, Hoeing and Weeding	40.00	42.00
Irrigating	12.00	11.20
Spray Application	21.50	9.40
Propping Trees and Thinning	2.70	0.00
Harvesting and Packing	21.00	1/ 135.00
Miscellaneous Labor and Repairs on Machinery and Tools	11.20	13.00
Supervising and guarding	20.00	20.00
Total Labor Costs	<u>150.80</u>	<u>249.80</u>
<u>Interest on Operating Capital:</u>	<u>6.50</u>	<u>5.70</u>
Total Growing Costs:	273.30	355.20
Total All Costs:	<u>684.60</u>	<u>936.00</u>

1/ Does not include labor for Sorting and Packing.

years than an apple orchard (cherries 10 years and apples 33 years). The average total annual growing cost per dunum for cherries was highest mainly because of the high cost of harvesting. Material costs per dunum were higher for apples because apples are sprayed more than cherries. Total cost of fertilizer for cherries was slightly higher because the plant nutrients were applied mainly in the form of manure (see table 7).

Labor costs are interesting to examine. If we exclude labor for harvesting, sorting and packing operations, and the labor for guarding and supervision, apples require 16 man-days per dunum and cherries only 14 man-days per dunum. (See table 9). This difference is mainly due to the fewer times cherries are sprayed and the slightly fewer times cherries are irrigated. Harvesting operations require 10 man-days per dunum for apples. Total labor requirements for cherries are almost double that needed for apples (see table 9).

Comparison of Average Costs of Production Between Apples and Peaches Grown Below 1200 Meters Elevation:

The average total cost per dunum of producing peaches (L.L. 642) was only slightly lower than for apples (L.L. 667). Annual growing costs for peaches were slightly higher mainly because of higher harvesting costs (see table 8). Apples had slightly higher costs for spray material. Farmers fertilized peaches more.

Average fixed costs were somewhat lower for peaches than for apples. This is mainly because the cost of developing a mature peach orchard is less than for apples. It requires only about 5 years to develop a peach orchard and about 8 years to develop an apple orchard. (The year when annual returns exceed annual costs, see table 6).

Total labor costs were higher for peaches. If we exclude labor for harvesting, sorting and packing operations and the labor for guarding and supervision, apples and peaches both require about 16 man-days of labor per year (see table 10). However when we include labor for the harvesting operations, peaches require 23 man-days per year as compared to apples which require only 19 man-days per year.

Ways of Reducing Cost of Production

The cost of production can be measured in two ways, the cost per dunum and the cost per kilogram. When considering ways of reducing the cost, the latter is a more important

Table 8. Comparison of Average Costs of Production for Apples
And Peaches Produced below 1200 Meters Elevation
Mount Lebanon Area, Lebanon,
1963

<u>Cost Item</u>	<u>Apples LL/Du</u>	<u>Peaches LL/Du</u>
<u>Fixed Costs:</u>		
Interest on Investments in Land Terraces Irrigation Facilities, Buildings, Machinery, Tools, Fences and Developed Orchards	292.20	254.40
Depreciation on Buildings, Irrigation Facilities, Machinery, Fences, Tools and Developed Orchards.	83.70	82.60
Repairs on Buildings, Fences and Terraces	8.00	8.00
Total Fixed Costs	<u>383.90</u>	<u>345.00</u>
<u>Materials:</u>		
Manure	26.00	30.20
Chemical Fertilizers	41.00	50.00
Spray Materials	44.00	22.00
Water and Other Materials	9.20	10.00
Total Materials	<u>120.20</u>	<u>112.20</u>
<u>Labor Costs:</u>		
Pruning and Removing Branches	14.00	16.50
Fertilizer Application	8.50	10.50
Cultivation, Hoeing and Weeding	40.00	42.00
Irrigating	13.50	11.20
Spray Application	22.50	12.00
Propping Trees and Thinning	3.00	8.50
Harvesting and Packing	23.00	46.20
Miscellaneous Labor and Repairs on Machinery and Tools	11.40	12.00
Supervision and Guarding	20.00	20.00
Total Labor Costs	<u>155.90</u>	<u>178.90</u>
<u>Interest on Operating Capital:</u>	<u>6.70</u>	<u>6.50</u>
Total Growing Costs	282.80	297.60
Total All Costs	<u>666.70</u>	<u>642.60</u>

1/ Does not include labor for Sorting and Packing

Table 9. Comparison of Average Labor Requirements 1/ for Apples and Cherries Produced Above 850 Meters Elevation, Mount Lebanon Area, Lebanon, 1963

Kind of Labor	Apples Man-Days Labor Per Dunum	Cherries Man-Days Labor Per Dunum
Labor Used for Growing Operation	16	14
Labor Used for Harvesting Operations	<u>3</u>	<u>19</u>
Total All Labor Used	19	33

1/ Excludes labor for guarding and supervision.

Table 10. Comparison of Average of Labor Reuquirements 1/ for Apples and Peaches Produced Below 1200 Meters Elevation, Mount Lebanon Area, Lebanon, 1963

Kind of Labor	Apples Man-Days Labor Per Dunum	Peaches Man-Days Labor Per Dunum
Labor Used for Growing Operations	16	16
Labor Used for Harvesting Operations	<u>3</u>	<u>7</u>
Total All Labor Used	19	23

1/ Excludes labor for guarding and supervision.

concept to consider. The fruit is usually sold at a price per kilogram and thus cost per kilogram is most valuable as a measure of the farmers' ability to make profit. However, in this report, reductions in both cost per dunum and cost per kilogram will be considered.

Cost per Dunum:

A large proportion, or more than half of the total cost of production per dunum is made up of fixed costs. For apples and cherries grown above 850 meters elevation, fixed cost represent about 60% of total costs. For apples and peaches grown below 1200 meters elevation fixed costs represent about 58% of total cost for apples and about 54% for peaches (see tables 2, 3, 4 and 5). The two major components that make up fixed costs are the cost of land and terraces and the cost of developing a mature orchard. It is unlikely that any reduction in the price of land can be achieved and most likely, land prices will increase during the next few years. Therefore, any reduction in fixed cost, due to lower land costs, is unlikely.

For farmers planning new orchard reductions in the cost of constructing terraces may be possible through the use of heavy machinery. Preliminary evidence indicate that terraces and be built at a lower cost, by the partial use of heavy machinery, than when all construction is done by hand labor. However, farmers who have already constructed terraces and planted orchards have sunk costs. This part of the fixed cost cannot be changed because he has already spent the money for this purpose.

Interest on money invested in orchard development and depreciation of the value of a developed orchard are the two ways in which orchard development costs can affect fixed costs. These two items represent about half of the fixed costs per dunum. For an orchard that is already developed, orchard development costs cannot be changed. For an orchard that is to be developed in the future, it is likely that material and labor used in the development of the orchard will become higher priced. Therefore, it seems that there is no real practical possibility of reducing orchard development costs.

The reduction of growing costs per dunum appear to be the only possibility of reducing total cost per dunum. Observation of the cost information presented in Tables 2, 3, 4 and 5, indicate that the cost of materials make up from 30% to 40% of the growing costs depending on the fruit. Fertilizer costs are the most important components of the cost of materials. Present recommendations suggest the use of even higher rates

of fertilizer applications, thus increasing further the fertilizer costs. However, preliminary recommendations also suggest that the application of less manure and more chemical fertilizer, especially the nitrates, will result in a higher level of plant nutrition and thus a lower total cost for fertilizer. Further research and testing is needed to determine the most profitable kinds and quantities of fertilizer to apply on fruits grown in the mountain areas.

Horticultural specialists have suggested that some farmers may be spraying too many times per year (this is especially true for apples), or they are using spray materials that are too expensive. However, at present, there does not seem to be sufficient evidence to substantiate this claim. Research is needed to develop recommendations for farmers concerning the most profitable spraying practices for each of these fruits.

The examination of labor requirements to perform the growing operations and the labor costs, do suggest one way of reducing total labor costs. Farmers should consider the use of small hand guided two wheel tractor to perform the cultivation operation. Preliminary evidence obtained from a study of small tractor operating costs indicate that plowing and cultivation can be done by small tractors for about one half the present cost by using only hand labor. Farmers also should consider reducing the number of times they plow or cultivate. A logical procedure would be to deep plow, with hand tractor, once early in the spring. After this, only control of weeds is necessary either by hand or by use of rotavators or other shallow cultivating machines. Deep plowing several times during the season does not appear to have merit as a tillage practice. If farmers would follow a plan of fewer cultivations per person and mechanization of cultivation by using small land guided tractors where feasible, total cultivation costs per dunum could be reduced by at least 50%.

Where sufficient water is available, permanent legume or grass plantings may be considered to replace the practice of clean cultivation in the orchards. This practice, where feasible, would eliminate entirely the annual cost of cultivating and plowing.

It seems unlikely that other labor costs can be reduced. In fact, daily wages for labor have been increasing and thus future labor costs per dunum may be higher than at present.

Cost Per Kilogram:

The cost of production per kilogram may be reduced in two ways: first, by a reduction in the cost of production per dunum for a given yield, or by an increase in yield. As has been pointed out above, there is little hope of reducing the cost per dunum and still maintain yield. However, it is very possible to increase yield and, therefore, reduce cost per kilogram even though costs per dunum are increased.

Yield may be increased by using more fertilizer, more water and/or better spraying methods. It is likely that to increase yield by any of these means will result in higher cost per dunum, but lower cost per kilogram. The important point to consider is that the added returns gained from adding fertilizer, water or spray material must be equal to or greater than the cost of these added materials. In other words, the cost per kilogram can be reduced if for each additional Lebanese Pound invested in more fertilizer, water or spray materials, more than one additional Lebanese Pound in product can be obtained. The question of what are the most profitable quantities and kinds of fertilizer, spray material, and quantities of water to apply must be answered by horticulturists and other agronomic specialists. Research and extension programs must be aimed at giving answers to these questions.

Use of Cost Information by Individual
Farmers

The cost information and the explanation of costs presented above are the average for groups of farmers interviewed during the year 1963. Individual farmers or Agricultural Extension Agents may want to calculate the exact cost of production for a particular orchard. The cost summaries presented in this report can serve as a guide to this job. The farmer can use his own costs for each item of cost and compare these with the group average. Foreexample, a farmer may have higher land values or higher water costs than the average for the group of farmers interviewed. He can substitute his value for those listed in tables 2, 3, 4 and 5. Also he may use different quantities of fertilizer, or have a different cost for spray materials than those listed for the average of the group of farmers interviewed. For these cost items, he can substitute his own costs for those shown in tables 2, 3, 4 and 5. For items of cost, for which he does not have accurate record, such as orchard development costs, he can use the average for the group as shown in tables 2, 3, 4 and 5.

After making the appropriate substitutions of his costs for the costs listed in tables 2, 3, 4 and 5, the farmer will be able to make a good estimate of the costs per dunum for his particular orchard. Once his cost per dunum is calculated, he can easily calculate his own cost per kilogram by dividing his total cost per dunum by his yield per dunum.

These cost summaries have other important uses for the farmer of Agricultural Extension Agents. After the farmer has calculated his own costs of production, he can then compare each item of cost with those for the average of the group, If for example, his costs are higher for any particular item of cost, he should ask himself why they are higher, and try to determine if there are ways of reducing the cost for this particular item. If the farmer does this for each item of cost listed in tables 2, 3, 4 and 5, he may discover ways of reducing his total costs of production.

Farmers who consider planting new orchards will find this information useful. The orchard development costs will give him a good estimate of how much money he must invest to plant and develop a new orchard and take care of it until the orchard is in full production or until he can expect returns from the orchard.

Factors Affecting Decisions to Develop New Orchards

Farmers with established mature orchards already have made large investments per dunum, and unless the fruit crop is very unprofitable, it is uneconomic for them to remove the orchard the orchard and plant a different fruit of another crop. However, farmers who are considering planting and developing new orchards must consider several factors in order to decide which fruit to grow.

Most important of these factors is the relative profitability of each fruit as compared to other fruits. He must consider expected yields, prices and costs of production. Farmers interested in developing new orchards can develop good estimates of expected average yield of the new orchard by observing the yields of their neighbors who have mature orchards, and he can use estimates of cost presented in this report. However, the farmer does not know the future prices for each kind of fruit. As a guide to these new producers, the relative profitability of apples or cherries, and apples or peaches can be examined under different price and yield assumptions.

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

Prices of Equal Profit:

By assuming a level of yield and a price for one fruit and by using the average production costs and expected yield for a second fruit crop, it is possible to determine the price that the farmer must receive for the second fruit crop in order to make the same profit (returns minus costs), this is called the "price of equal profit". The prices recorded in tables 11 and 12 are the prices of equal profit for peaches and cherries relative to apples.

As an example of how to use these tables, assume a farmer expects a yield for apples of 2000 Kg. per dunum, and he estimates the average future price for which he can sell his apples to be 35 piasters per kilogram, the price of equal profit for peaches (table 11) can be found by first looking across the top of the table to find the apple yield of 2000 Kg; second, under this heading, find the column with 35 piasters at the top (this is the expected price of apples); third, look down that column to the price that corresponds to the expected yield of peaches (let us assume the expected yield of peaches is 1600 Kg. per dunum); the price of equal profit for peaches is 42.1 piasters per kilogram. To say this another way, if a farmer expects an average apple yield of 2000 kilograms per dunum, a selling price for apples of 35 piasters per kilogram and an expected average yield for peaches of about 1600 Kgs per dunum, then peaches will be more profitable if he can get 43 piasters per kilogram or more for his peaches.

The information in tables 11 and 12 can be very helpful to farmers when they are trying to decide which is the most profitable fruit to plant in the Mount Lebanon area. He can determine a series of reasonable possibilities for different yields and prices and if they all favor one fruit, then he can be quite sure that this crop will be the most profitable.

Risk and Uncertainty:

Net profit is not the only factor to consider when deciding which fruit to plant. The farmer must also be concerned with the relative year to year instability of prices and yields among the different fruits.

Apples tend to have more price stability because they are storable and have a greater potential export market, while peaches and cherries are highly perishable and the market is mostly a local market. A large crop of cherries or peaches may mean very much lower prices for that year. Apples also appear to have less year to year variability in yield than either cherries or peaches. These points, all seem to suggest that the

Table 11. Prices of Equal Profit of Peaches for Selected Price and Yield Levels
for Apples Produced Below 1200 Meters Elevation, Mount Lebanon,
Lebanon, 1963

Yield of Apples	1500 Kg/Du				2000 Kg/Du				2500 Kg/Du			
	25	35	45	25	35	45	25	35	45	25	35	45
1200	28.6	41.1	53.6	38.6	55.3	71.9	48.6	69.4	90.3			
1600	22.1	31.5	40.9	29.6	42.1	54.6	37.1	59.0	68.4			
2000	18.2	25.8	33.2	24.2	34.2	44.2	30.2	47.8	55.2			
2400	15.7	21.9	28.2	20.7	29.0	37.3	25.7	40.3	46.5			

(Prices of Equal Profit)

$$Pp = \frac{YaXPa - Ca + Cp}{Yp}$$

Where:

Pp = Price of Equal Profit of Peaches P=/kg
 Ya = Yield of apples Kg/Du
 Pa = Price of Apples, Ps/Kg
 Ca = Cost of Producing Apples, LL/Du
 Cp = Cost of Producing Peaches, LL/Du
 Yp = Yield of Peaches, Kg/Du

Table 12. Prices Of Equal Profit of Cherries for Selected Price and Yield Levels for Apples Produced Above 850 Meters Elevation, Mount Lebanon, Lebanon, 1963

Yield of Apples	1500 Kg/Du					2000 Kg/Du					2500 Kg/Du				
	30	40	50	30	40	50	30	40	50	30	40	50			
<u>Price of Apples</u>															
<u>Yield of Cherries</u>															
1000	68.9	83.9	98.9	83.4	103.4	123.4	97.9	122.9	147.9						
1400	52.1	62.8	73.5	62.4	76.7	91.0	72.8	90.6	108.5						
1800	42.7	51.0	59.4	50.8	61.9	73.0	58.8	72.7	86.6						
2200	36.8	43.6	50.4	43.4	52.4	51.5	50.0	61.3	72.7						

Where:

- $P_c = \frac{(Y_a \times P_a) - C_a + C_c}{Y_c}$
 P_c = Price of Equal Profit of Cherries Ps/Kg
 Y_a = Yield of Apples, Kg/Du
 P_a = Price of Apples, Is/Itg
 C_a = Cost of Producing Apples, Ll/Du
 C_c = Cost of Producing Cherries, Ll/Du
 Y_c = Yield of Cherries, Kg/Du

year to year income and net profit may be more stable for apples than for either cherries or peaches. Therefore, if a farmer does not have adequate financial resources to survive a low profit year, he will be interested in the fruits that have a more stable year to year income, even though on the average, the fruit is slightly less profitable.

Labor Requirements:

The small farmer who considers planting one of these fruits, should be concerned about the returns from the use of his family labor. If he plans to have his family perform all of the labor required in the production of the fruit, he should consider which fruit will give him the highest returns for his family labor. Data in table 13 shows the total value of production per dunum (assuming average yields and prices), the labor returns above costs (except labor costs) and the returns to labor. Cherries have the highest labor return. However, small changes in yield or prices cause rather large changes in labor income therefore this relationship among the fruits would be quite different if other price and yield assumptions were made.

Other Factors:

The quantity of water required is another factor that should be considered when deciding which fruit to plant. Apples use more water than either peaches or cherries. Therefore, if scarcity of water is a problem, apple yields would be affected more and either cherries or peaches would be a better fruit to plant.

Another factor to consider is the amount of investment required to develop an orchard. On the average, it requires about L.L. 2600 to develop a dunum of either apple or cherry trees in areas about 850 meters elevation and only about L.L. 400 to develop a dunum of peach trees, and about L.L. 2300 to develop a dunum of apples below 1200 meters elevation. Also, returns from peaches start coming to the farmer in a much shorter time after planting than is the case for apples or cherries. Farmers with small capital resources should take this fact into consideration.

Another factor to consider is the future export potential of each fruit. If future export potentials are good for a fruit, it is likely that prices will be steady and at a higher level. Not much is known at this time about export possibilities. Research is needed to determine estimates of these potentials.

Trends in local consumption, both in Lebanon and in neighboring Arab countries, could also have an effect on future prices and thus the relative profitability of each crop.

Table 13. Relative Returns to Labor for Apples, Cherries and Peaches, Mount Lebanon Area, 1963

Item	Apples Below 1200 Meters	Peaches Below 1200 Meters	Apples Above 850 Meters	Cherries Above 850 Meters
Expected Yield Kg/Du	2000	1650	2000	1350
Expected Price Ps/Kg	33	40	35	75
Value of Production LL/DU	660	660	700	1012
Cost of Production LL/Du (excluding labor costs)	511	464	534	686
Returns to Labor LL/Du	149	196	166	326
Number of Man-Days Equivalent Required Per Dunum	19	23	19	33
Returns per Man-Day of Labor LL.	7.80	8.50	8.70	9.90

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