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ECONOMIC STUDY OF THE PRODUCTION AND MARKETING OF FLUID MILK IN ANJAR VILLAGE IN THE BEKA'A

COWS IN ANJAR STABLE

Faculty of Agricultural Sciences
AMERICAN UNIVERSITY OF BEIRUT
Beirut, Lebanon

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GORDON H. WARD
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JOSEPH FULEIHAN

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by

Gordon H. Ward and Joseph Fuleihan[2]

SUMMARY

The study was made to ascertain whether milk production is profitable for small farmers in the Beka'a. The information was collected from 43 farmers in Anjar in February 1959.

The average area operated by these farmers was 20.3 dunums of which 15.3 were owned and 5 rented. The typical farmer interviewed used 10.8 dunums of dry land to provide bread for his family and some feed for his cows. About 40 percent of the owned land was dry with the remainder irrigated and generally planted in apples, the crop which gave the greatest income. Nearly 40 percent of the total cash receipts for 1958-1959 came from milk.

Two thirds of the 43 farmers kept 1 or 2 cows, 25 percent 3 or 4, and three farmers 5 or more. According to the data collected, the cows were classified into 31.6 percent high producers, 53.2 percent medium producers, and 15.2 percent low producers. The typical farmer had 2 cows and sold 15 kilograms of milk per day or 5,475 kilograms during 1958-59 which brought him LL 1,971 at the milk depot. His family consumed an additional 584 kilograms valued at LL 210.24.

At normal prices it was estimated that feed accounts for roughly half the cost of producing milk in Anjar, labor 25 percent, and a combination of

1 Research Project No. 43, Faculty of Agricultural Sciences.

2 Professor of Agricultural Economics and Graduate Assistant in Agricultural Economics respectively, Faculty of Agricultural Sciences, American University of Beirut, Lebanon.

depreciation, interest on invested capital, miscellaneous expenses, and returns to management the remaining 25 percent. The average cow returned LL 120.26 above the cost of feed to cover labor and the other four items mentioned above. Thus, after subtracting the value of the milk consumed, the typical farmer had net cash returns of LL 15.14 per cow. If feed prices had been normal, the estimated return above feed cost would have been LL 587.82. As it was, roughage (mostly tibn consisting of chopped straw) averaged 22 piasters per kilogram versus the normal price of 6 piasters. Only when feed prices are normal can milk production in Anjar yield net earnings above the wages of dairy-barn laborers provided, in addition, the farmer feeds economically and keeps cows giving 3,000 or more kilograms of milk per year.

Farmers bought 80 percent of the roughage and 86.5 percent of the grain-protein feed consumed by their cows. Roadsides and ditch banks were the main sources of green forage supplemented by grasses and weeds gathered from the farmers' fields. Legume hay or green alfalfa was too expensive. Two farmers found corn silage and beet pulp silage economical succulent roughages. To overcome the low feed value of the forages, a grain-protein concentrate mixture was fed at the average rate of 1 kilogram to 2.1 kilograms of milk. It consisted of cotton seed cake supplemented with home grown legume seeds and barley plus small amounts of purchased bran and corn. Two farmers fed a commercial ready-mixed dairy feed at a net cost of 10 piasters per liter of milk produced compared with 11.5 piasters for those using the home mixed ration.

Most of cows in Anjar are crosses from breeding Baladi to Friesian bulls. These crosses are being bred back to Friesian bulls. Artificial insemination was not successful because the cows usually were not bred until after their heat period. Calves are dropped in the spring when more green feed is available. This accounts for the quantity of milk produced during the winter months of December – February being only 63 percent of the June-July output. Thus, the farmers received the lowest prices of the year when their monthly sales were largest. Farmers reported the milking life of their cows to be up to 15-16 years. The average lactation period was 9½ months with a rapid decline in daily flow following a peak 2-3 months after calving. Higher producing cows had a longer lactation period.

Diseases were reported to be a minor problem, Mastitis had the highest incidence. Most farmers vaccinated against foot-and-mouth disease. Mortality from all causes was 5.5 percent during the year of the study.

Cow stables were mostly made of local stone with earth or cobble stone floors. Generally, and particularly in cold weather, the doors and few small windows were kept closed. This meant darkness and little fresh air for the cows. Floors were wet with urine a large part of the time due to inadequate drainage. The manure was piled outside the stable until hauled to the fields. Flies were numerous.

Milking was done twice daily, usually into clean sanitary pails. The milk went promptly to the depot where it was filtered into large containers immersed in tanks of ice water. The containers were trucked to Beirut every morning, packed well with ice in hot weather.

VILLAGE OF ANJAR

Consumption of milk in Lebanon greatly exceeds local production so that there is interest in expanding output. While there is some growth in the number of specialized dairy farms in the country, the expansion of milk production in the village of Anjar during the past decade has suggested that this may be a way for operators of small farms to increase their incomes. The increase in quantity of milk trucked from Anjar to Beirut up to one and a half tons per day indicates that the farmers of this village have found small scale production of milk profitable. Accordingly, the system of production followed in Anjar could show how operators of small farms in other parts of the Beka'a might develop milk production as a worthwhile part of their farming operations

The village of Anjar lies in the central Beka'a some 15 kilometers to the south-east of Chtoura and just north of the Damascus road. Its history dates back to 1939 when the Armenian refugees first moved into it. The French authorities at that time tried to help the new settlers by the development of an irrigation system and a housing project, but this work was interrupted by World War II before completion. Shortly after the end of the war part of the refugees went to Soviet Armenia and left their land allotments which were taken over by other families.

The average size of the family land-holding of the farmers interviewed was 15.3 dunums, 9.3 of which were under irrigation and 6.0 dunums were dry land. Some farmers rented and operated additional land which averaged 4.8 dunums of dry land and 0.2 dunums of irrigated land. The usual allotment of 5 dunums of dry land and 7 dunums of irrigated land was too small to support

a family except with very intensive cultivation of high value crops. In the early years the settlers planted potatoes and other vegetables on their irrigated plots. However, the net earnings per family were very meager.

In order to help the families increase their incomes, Mr. L.E. Feldmahn of the Howard Karaghusian Foundation urged Anjar farmers to increase the production of milk for sale to pasteurizing plants in Beirut. The Foundation established a milk depot in the village and supplied a truck for hauling the milk to Beirut. When the depot first opened, the truck took only a very few kilograms of milk each morning. But with a ready market at a good price close to their stables, more and more farmers took Mr. Feldmahn's advice, bought cows and started feeding them cotton seed cake to supplement the local ration of chopped straw and stimulate the flow of milk. He introduced a Friesian bull of a high milking strain to breed the farmers' cows. Many of the currently producing cows were sired by this bull and produce more milk than their dams. Before long, milk became the major source of income for Anjar families.

When it was apparent that apples could be produced profitably in the Beka'a, Mr. Feldmahn grew seedlings, budded them with the best varieties, and supplied them to interested farmers. The orchards planted by these pioneers recently started bearing. Apple revenues already exceed the income from milk.

The Youth Club, organized by Mr. H. Kendurjian, Recreation Director under the Foundation's village improvement program, is fostering poultry and heifer calf projects for individual members. At the time the milk production program in Anjar was surveyed, around 80 percent of all families in the village were keeping either dairy cattle or chickens, or both.

During the period February 5-13, 1959, information about milk production and marketing was collected from 43 farmers. The interviewing was done by Joseph Fuleihan assisted by Amin Hijazi, Extension Agent at the AUB Farm. The work was supervised by Dr. Gordon H. Ward. The cooperation of the following contributed materially to the effectiveness of the study:

Mr. & Mrs. L.E. Feldmahn, Director of the Karaghusian Foundation in the Beka'a.

Dr. Emile Rizkallah, Veterinary Advisor for the Milk Development Project.

Mr. Movses H. Makhoulian, Manager of the Milk Collection Depot.

Mr. Bedros Karakashian, Mukhtar of Anjar.

OBJECTIVES OF THE STUDY

The study was undertaken in order to:

1. Secure information regarding:
   a. The profitability of milk production by operators of small farm units in the Beka'a with a limited number of dunums of land and a few milk cows.
   b. The farm management system employed for producing crops and milk on small farms in the Beka'a.
   c. The methods of milking and of handling milk used by farmers to produce milk for drinking after pasteurization.
   d. The method of cooling milk and holding it pending daily shipment to market.
   e. The method and cost of transporting fluid milk to Beirut.
2. Verify the profitability of milk production in the Anjar community as the basis for the Pilot Extension Program in villages around the AUB Farm recommending the expansion of milk production to increase the income of farm families.

PRODUCTION OF MILK

Daily Output

With the small size holdings of the farmers in Anjar and their limited capital resources, milk production in this village is a small scale enterprise. The typical farmer kept two cows and sold an average of 15 kilograms of milk per day. This is a little over half the amount of milk the farmers interviewed said they were producing, namely, 28.6 kilograms per day.[1]

1 When the difference between daily sales and reported production was discussed with leading villagers, there was no inclination to revise the production figures downward. Persons who know the villagers well consider that the farmers tend to think of a cow's output as the maximum she gives at the peak of her lactation. They also believe that family consumption is overstated as compared with observed use of milk in the homes in the village. Social prestige is attached to liberal consumption.

The 43 farmers reported that their cows gave an average of 14.3 kilograms of milk per cow per day, as shown in Table 1. This was substantially higher than the average of 10 kilograms per cow per day reported to Mr. Feldmahn in the survey he made in the spring of 1958 and was about equal to the 15 kilograms per day average for the Friesian and cross-bred cows at the AUB Farm.

As a check, the sales of milk by two farmers from each group[1] were obtained from the Anjar Milk Depot. Table 1 shows that the sales averaged 7.5 kilograms per cow per day. By adding the estimated daily home consumption per farmer (1.6 kilograms) to sales, the estimated production per farmer was 16.6 kilograms compared with the average of 28.6 kilograms claimed. The estimated average daily production for the cross-bred cows of the typical farmer was 8.3 kilograms per cow compared with the figures given in the interviews which averaged 14.3 kilograms.

Table 1

Daily Milk Production Reported by Farmers, Home Consumption and Sales

Group	No. Cows Owned	Reported Production Kg. Milk Daily		Estimated Production	Estimated Home Consumption	Kg. Milk Sold	
		Per Cow	Per Farmer	Per Farmer	Per Farmer	Per Cow	Per Farmer
I	1-2	13.6	17.7	10.7 kgs.	0.9 kgs.	7.5	9.8
II	3-4	15.2	47.1	25.7 "	3.1 "	7.3	22.6
III	5 +	14.2	75.3	44.5 "	3.7 "	7.7	40.8
Average	2	14.3	28.6	16.6 kgs.	1.6 kgs.	7.5	15.0

NUMBER OF COWS OWNED

When the survey was made in February 1959, the 43 farmers[2] owned a total of 87 milk cows, 37 of which were then dry.

1 For analysis, the farmers were divided into three separate groups, namely I, II, and III, owning 1-2, 3-4 and 5 or more cows respectively.

2 All farmers owning 3 or more cows were interviewed. Interviewing of producers owning 1 and 2 cows was discontinued when it was found that virtually the same information was being obtained from each farmer.

Only 59 percent of the cows were giving milk during the winter months when milk prices were highest. The figures regarding the cows of the three groups of producers are given in Table 2 below.

Table 2

Number of Cows Owned by Size Groups and Percent Milking

Group	No. of Cows Owned	No. of Farmers	% of Total Farmers	% of Total Cows Owned	Number of Cows Owned					
					Total Cows	Average Cows per Farmer	Milking		Dry	
							Number	Percent	Number	Percent
I	1-2	29	67.4	42.5	37	1.3	25	67.6	12	32.4
II	3-4	11	25.6	39.1	34	3.1	13	38.2	21	61.8
III	5 +	3[1]	7.0	18.4	16	5.3	13	81.3	3	18.7
Total		43	100.0	100.0	87	2 (av.)	51	58.6	36	41.4 (av.)

PRODUCTION BY VARIOUS CLASSES OF PRODUCERS

In order to ascertain whether there was any relationship between the number of cows kept by a producer and the daily output per cow, each group of cow owners was sub-divided into three classes according to the average daily milk production they reported for their cows. Low production was taken to be up to 10 kilograms per cow per day, medium production from 11 to 15 kilograms, and high production 16 or more kilograms per day. The figures given by farmers apparently referred to the daily milk yield of the cows during the peak of their lactation.

It will be noted from the data in Table 3 that the farmers owning the larger numbers of cows had higher percentages of high producing cows than the small producers in Group I. This latter group had the highest percentage of low and medium producing cows. Group III had the highest percentage of high producing cows and the highest percentage of farmers in the high producer group.

1 Due to the small number in this group, it is probably not so typical of this size of producers as are Groups I and II. Observation of the farmers in Group III indicated they are mostly above average as milk producers.

Table 3

Classification of Farmers and Milk Cows in Anjar According to Reported Daily Milk Production.[1]

	Total				Group I				Group II				Group III			
	Low	Med.	High	Total	Low	Med.	High	Total	Low	Med.	High	Total	Low	Med.	High	Total
No. of Farmers	7	26	10	43	6	17	6	29	0.0	8	3	11	1	1	1	3
Percent of Farmers	16.3	60.5	23.2	100.0	20.7	58.6	20.7	100.0	0.0	72.7	27.3	100.0	33.3	33.3	33.3	100.0
No. of Cows	12	42	25	79[2]	7	20	8	35[2]	3	17	11	31[2]	2	5	6	13[2]
Percent of Cows	15.2	53.2	31.6	100.0	20.0	57.1	22.9	100.0	9.7	54.8	35.5	100.0	15.4	38.5	46.1	100.0

1 Low producers, up to 10 kg. per day; Medium, 11-15 kg.; High, 16 or more kg. milk per day. Cows classified on the basis of production reported by farmers. See p. 10 for explanation of Groups I, II, and III.

2 Does not include 8 dry cows for which no production records were available.

INCOME FROM MILK

In February 1959, the average milk producer obtained an annual gross cash income from the sale of milk amounting to LL. 1,971 as shown in Table 4. This constituted approximately 1/3 of his total annual cash farm income (see Table 13), the balance coming from the sale of crops, primarily apples.

Table 4

Sales Value of Milk Produced by Various Classes of Farmers

	Average Producer	Group I	Group II	Group III
Average number kg. sold during year[1]	5,475	3,490	8,233	14,988
Av. no. kg. consumed by family per year[2]	584	326	1,128	1,363
Av. no. kg. produced per farmer annually	6,059	3,816	9,361	16,351
Value of production at market prices[3]	LL 2,181.24	LL 1,373.76	LL 3,369.96	LL 5,886.36
Value of milk consumed by farm family[4]	LL 210.24	LL 117.36	LL 406.08	LL 490.68
Cash receipts for milk sold per farmer	LL 1,971.00	LL 1,256.40	LL 2,963.88	LL 5,395.68

1 Taken from delivery records of the milk depot.

2 Estimated by farmers and manager of the Anjar Milk Depot to be 0.9 kilograms daily per family for Group I farmers, 3.1 kilograms for Group II farmers, 3.7 kilograms for Group III farmers, and 1.6 kilograms for the average farm family.

3 Valued according to average price of milk of 36 piasters per kilogram.

4 Priced at 36 piasters per kilogram.

Before their apple plantings came into bearing, the typical farmer received approximately LL 1,800 yearly income from the sale of milk compared with LL 900 to LL 1,200 from the sale of crops on his dry and irrigated lands.

The typical 2-cow producer sold 5,475 kilograms of milk during the year ending February 28, 1959, as indicated by the records of the Anjar milk depot. The value of sales brought him cash amounting to LL 1,971. Such a family used an estimated additional 584 kilograms of milk during the year valued at LL 210.24. This amount should be credited to the milk enterprise, thus bringing the value of milk produced to LL 2,181,24, as shown in Table4.

PROFITABILITY OF MILK PRODUCTION

Data obtained from the farmers and summarized in Table 5 indicated that milk production was not profitable for the average producer during the year March 1958-February 1959 in terms of cash returns above the cost of feed. The main reason was the high price of purchased roughage. Tibn cost an average of 22 piasters per kilogram as compared with 6 piasters in "normal" times as reported in Table 7. The cost of feed per cow per day averaged LL 2.65 while the milk sold brought LL 2.70. Thus, the cash returns above the cost of feed for one cow amounted to only 5 piasters per day. Such low labor earnings were very discouraging to the farmers. They were disuaded from selling their cows only by the difficulty of buying as good a producing cow for a comparable price later when feed prices should return to normal. Furthermore, the family had its milk requirements in addition to the small cash return.

Data in Table 5 show that the average farmer netted only LL 15.14 in cash per cow for the year above the cost of feed to cover his labor, miscellaneous expenses, depreciation of cows, equipment and stable, and interest on the investment in the milk production enterprise. Since none of the farmers interviewed kept records, it was not possible to obtain usable figures for these elements in the cost of producing milk. Table 5 further indicates wide variation in the cash returns above feed cost realized by the three groups of producers. The main reasons for the higher cash earnings of the farmers in Group II were their greater income obtained from higher milk production per cow and their less than average expense for feed. The loss suffered by Group II producers came from high expenditures for both roughages and concentrates.

Table 5

Returns from Milk above the Cost of Feed per Cow Kept at 1958–1959 Prices

		Average[1]		Group I[1]		Group II[1]		Group III[1]	
		Kg.	LL	Kg.	LL	Kg.	LL	Kg.	LL
Average No. Kg. Milk Produced Per Cow	Per Day	8.3	3.00	8.2	2.95	8.3	3.00	8.4	3.02
	Per Year	3030.0	1090.80	2993.0	1077.47	3030.0	1090.80	3066.0	1103.76
Cost of Feed									
Roughage:									
Farm produced[2]		620.0	122.76	827.0	181.94	271.0	59.62	724.0	103.53
Purchased		2482.5	491.54	1874.0	412.28	2612.5	574.75	3583.0	512.37
Total cost of roughages		3102.5	614.30	2701.0	594.22	2883.5	634.39	4307.0	615.90
Grain-protein feed:									
Farm produced[3]		197.0	48.07	300.0	73.20	97.0	23.28	154.0	38.81
Purchased		1263.0	308.17	1160.0	283.04	1436.0	344.64	1196.5	301.52
Total cost of concentrate		1460.0	356.24	1460.0	356.24	1533.0	367.92	1350.5	340.33
Total cost of feed		–	970.54	–	950.46	–	1002.29	–	956.23
Value of milk produced above cost of feed		–	120.26	–	127.01	–	88.51	–	147.53
Value of milk consumed by family		292.0	105.12	255.5	91.98	365.0	131.40	255.5	91.98
Cash returns above cost of feed for year 1958-1959			+ 15.14		+ 35.03		– 42.89		**+ 55.55**

1 Average producer owns 2 cows. See p. 10 for explanation of Groups I, II and III.

2 Farm produced roughages and silages averaged 20 percent of the total amount fed.

3 Farm produced grain-protein feed averaged 13.5 percent of the total amount fed.

That milk production has been profitable for farmers in Anjar is shown in Table 8 by the estimated returns above cost of feed when prices are normal. These returns amounted to LL 488.54 per cow for a year. This figure indicates a net cash income[1] of nearly LL 1.34 per cow per day from the sale of milk.

CASH EXPENDITURES FOR PURCHASED FEED

The milk producers suffered a marked reduction in cash returns above the cost of feed during the year 1958-1959 because, on the average, they had to buy 80 percent of the roughage and 86.5 percent of the grain-protein feed for their cows at much increased prices caused by the drought.

Due to the absence of natural pasture in the village and small size farms, purchases of roughage constituted about 2/3 of the cost of feed for milk cows. On account of the drought, there was an acute shortage of tibn so that the price went up more than 3 times normal. While the prices of barley and other feed grains also went up, they did not increase so much because of the abundant stocks in the world market available for import into Lebanon to supplement local production.

Group II producers were affected more adversely by the high prices of feeds than were farmers in the other groups because they grew only 9.4 per cent of the roughage they fed and 6.3 percent of the grain mixture consumed by their cows.

Group III held down their expenditures for high priced tibn by making silage from purchased green corn fodder and beet pulp obtained from the nearby sugar factory.

Farmers in Group I rented proportionally more land and grew 30.6 percent of roughages and 20.6 percent of the cereal-protein mixture consumed by their cows. Thus, they were least adversely affected by the necessity to buy feeds for their cows when the drought caused prices of cereals and straws to rise very high in relation to the price of milk.

1 Net cash income from the sale of milk is the important thing for farmers with low incomes rather than the value of the milk produced by a cow. Low income farmers need as much cash as they can get and so use relatively small amounts of milk for family consumption.

Various evidence suggests that the amount of money actually spent for feed during the year covered by the study was materially less than the cost figures in Table 5. Very little tibn was observed during the visits to the barns and stables. The thin condition of the cows also suggested that the farmers were economizing on the very high priced roughage.

INPUTS OF FEED IN RELATION TO OUTPUT OF MILK

Information regarding the amounts of feed fed cows by the three groups of low, medium, and high producers in relation to milk produced is presented in Table 6.

Table 6

Daily Amount of Feed Consumed Per Cow Kept as Reported by Farmers in Relation to Output of Milk

Feed	Average[1]	Group I	Group II	Group III
Kg. dry roughage	7.5	7.4	7.9	6.8
Kg. silage	1.0	0.0	0.0	5.4
Total roughage and silage	8.5	7.4	7.9	12.2
Kg. concentrate	4.0	4.0	4.2	3.7
Ratio of concentrate to milk	1:2.1	1:2.1	1:2.0	1:2.3
Kg. milk produced per cow per day	8.3	8.2[2]	8.3	8.4
Consumed at home[3]	0.8	0.7[2]	1.0	0.7
Sold[4]	7.5 Kg.	7.5 Kg.	7.3 Kg.	7.7 Kg.

1 Average weighted by the number of cows in each group.

2 Reported figure adjusted on the basis of reported production and home consumption in relation to number of kilograms of milk sold.

3 Reported by farmers.

4 From records of Anjar Milk Depot.

There was considerable variation in the quantities of roughage and mixed feeds fed by the various classes of producers to their cows in relation to the weight and production of the animals. Group III farmers fed the largest total amount of roughage and silage but the least amount of grain-protein mixture. This group was able to use a smaller amount of concentrate because of feeding a more nutritious roughage in the form of corn silage and using a ready-mixed nutritionally balanced dairy feed.

Standard dairy feeding practice is to feed 1 kilogram of grain-protein mixture for each 3 kilograms of milk produced by a cow receiving grass and clover hay for roughage. Anjar farmers were averaging 1 kilogram of mixed feed to each 2.1 kilograms of milk given by their cows. They were using this above normal rate of feeding concentrate in an endeavor to overcome the low nutritional value of the straw which coustituted the most part of the roughage of the cows kept by Groups I and II, and over half of the roughage fed by Group III farmers. This latter group fed concentrates at the rate of 1 to 2.3 kilograms of milk because of the more nutritious corn silage in the daily ration of roughages and the more nutritious ready-mixed feed supplied their cows.

As mentioned earlier, it appears that many of the farmars were feeding less roughage and mixed feed than they reported to the interviewers. It is likely that they gave as the quantities of roughage and grain-concentrate mixture the amounts they normally fed their cows during the peak of their production, or when the prices of tibn and other feeds were normal.

PROFITABLE FEEDING PRACTICES

Since Group III farmers realized the largest returns from the sale of milk above the cost of feed, their feeding practices in relation to milk production deserve attention as indicators of profitable production practices. They had higher producing cows and fed them at less than average expense. Their milk sales averaged 3,066 kilograms per cow per year compared with the averaged of 3,030 kilograms. These farmers fed considerably more roughage but paid only LL 615.90 for it compared with the average expenditure of LL 614.30. They fed 5.4 kilograms of corn silage per day to each cow at a total cost of 16 piasters plus 6.8 kilograms of tibn costing LL 1.50. Thus, their daily expense for roughage was LL 1.66, or the same as the average cost, for a ration of roughages that helped to produce a higher output of milk. These farmers

were the only ones to buy a commercial ready mixed nutritionally balanced concentrate for their cows.[1] Even though it cost 30 piasters per kilogram compared with 25 piasters for the home mixed concentrate fed by other producers, the amount paid per year for concentrates was less than average (LL 340.33 versus the average of LL 356.24) because less quantity was required to produce a larger than average output of milk.

The above observations are in agreement with the experiences of dairymen in the United States and Europe that economical milk production is secured by proper feeding of high producing cows. It usually costs little more to feed a high milk-yielding cow than an ordinary producer weighing about the same. The amount of roughage required to maintain the body weight of the high producing cow is virtually the same as for the low producer. Only the concentrate is fed in proportion to the milk given by the cows. Consequently, the total feed cost per kilogram of milk is substantially less in the case of high yielding cows.

CASH RETURNS FROM MILK WHEN PRICES WERE NORMAL

A drought year does not give a correct picture of the situation of milk producers during the years when weather conditions are near average and crop yields are close to normal. In order to attempt to estimate the net returns from milk sales realized by the farmers in Anjar during ordinary crop years, approximately normal prices for the various feeds fed to milk cows were assembled in Table 7 in comparison with those obtained during the 1958-1959 period covered by the study. It will be noted that the prices of feeds for this period ranged from 20 to 50 percent above normal as measured by rough averages for several years previously. Prices in Anjar for May 1961 are supplied for comparative purposes.

Comparison between the returns per cow above the cost of feed during the year of the study and years of approximately normal prices is shown in Table 8. The value of the milk output in normal years would be about 6 percent lower whereas the cost of the inputs of feed would be cut roughly 55

1 The manager of the Milk Depot reported that 18 to 20 Anjar farmers were feeding a ready-mixed ration in May 1961.

Table 7

Current and Normal Prices of Milk and Cattle Feed[1]

Item	1958-59 Prices	Normal Prices	May 1961 Prices[2]
	Pt. per kg.	Pt. per kg.	Pt. per kg.
Milk	36	34	36
Cotton seed cake	22	15	19
Barley	18	17	19
Wheat bran	20	10	16
Kersani	30	25	–
Jilbani	30	25	–
Baki	30	25	–
Beans	40	30	35
Corn	27	20	25
Ready-mixed dairy feed[3]	30	25	25
Tibn	22	6	10
Corn silage	3	2.5	5.5
Beet pulp silage	2	1.5	–

percent. The result is that the value of the milk produced per cow above the cost of feed in normal years was LL 588 compared with LL 120 for the year of the study, or nearly 5 times greater. The cash returns to producers for milk sold was LL 488 compared with LL 15. Thus in years when prices of feeds are not far above average, milk production yields a moderate return to the farmer for the time devoted to the production of milk. The normal cash returns above the cost of feed shown in Table 8 indicate that in Anjar a farmer could earn LL 1.34 per

1 Prices are averages of estimates and figures gathered from various sources: farmers, Government statistical bulletins, and R.D. Steven's survey of villages around the AUB Farm.

2 Supplied by Mr. L.E. Feldmahn.

3 Not produced prior to 1958. Normal price estimated from prices of ingredients.

day (in addition to milk for his family) on each cow giving an average of 8.3 kilograms of milk. The typical 2-cow milk producer would have LL 2.68 per day for a few hours work morning and evening. Wages of farm laborers in the area range from LL 3 to LL 5 per day. Because the farmers interviewed did not keep any records of their expenses for producing milk and had no figures on their investment in stables, cows, equipment, etc., it was not possible to determine how much of the LL 2.68 should be charged to overhead expenses or how much would be left as net compensation for the labor and management done by the farmer.

Table 8

Value of Milk Produced Per Cow Kept Compared with the Cost of Feed at 1958-1959 Prices and at Normal Prices[1]

	Amount Kg.	1958-1959 Prices LL	Normal Prices LL
Milk Produced Per Year[2]	3030.0	1090.80[3]	1030.20
Cost of Feed			
Roughages[4]:			
Farm produced (20 percent)	620.0	122.76	34.72
Purchased (80 percent)	2482.5	491.54	139.02
Total	3102.5	614.30	173.74
Grain-protein feed[5]:			
Farm produced (13.5) percent)	197.0	48.07	36.25
Purchased (86. 5 percent)	1263.0	308.17	232.39
Total	1460.0	356.24	268.64
Total cost of feed	–	970.54	442.38
Value of milk produced above cost of feed	–	120.26	587.82
Value of milk consumed by family	–	105.12	99.28
Cash returns above cost of feed	–	15.14[6]	488.54

1 For a detailed account of normal prices see Table 7.

2 Cows averaged 8.3 kilograms of milk produced daily.

3 36 piasters per kilogram of milk.

4 1958-59 roughage: average price 19.8 piasters per kilogram; normal price 5.6 piasters per kg.

5 1958-59 concentrate: average price 24.4 piasters per kilogram; normal price 18.4 piasters per kg.

6 At the prices prevailing in May 1961, cash returns above the cost of feed were LL 354.23 for those farmers who fed tibn and home-mixed concentrate; LL 386.58 for those who fed some corn silage and a ready-mixed dairy feed.

On the other hand, an analysis of the figures for the cost of keeping one milk cow in the dairy herd at the AUB Farm for a year affords a basis for making a rough approximation of the operator's net earnings at Anjar after covering miscellaneous and overhead expenses.

Expenses for 1 Cow for One Year	AUB Farm Averages[1] 1956-1958	Estimates for Anjar 1958-1959
Miscellaneous expenses	LL 79.47	LL 50.00
Depreciation of buildings and dairy equipment	72.06	40.00
Interest at 5 percent on invested capital	149.12	75.00
Total misc. & overhead expenses	LL 300.65	LL 165.00

The estimates for Anjar are based on observation of the differences in production and management practices, of the relative value of buildings, equipment, and cows compared with the A.U.B. Farm.

Applying the estimated miscellaneous and overhead expenses to the calculated value of milk produced above the cost of feed at normal prices given in Table 8, the following estimate for operator's net earnings per cow is obtained

Value of milk produced above the cost of feed (Table 8)	LL 587.82
Estimated misc. and overhead expenses	165.00
Calculated operator's earnings at Anjar	LL 422.82
Wages of dairy-barn laborer at AUB Farm per cow	LL 350.00

This comparison suggests that when prices of roughages and dairy feed are normal, milk production in Anjar has yielded the average farmer something above ordinary farm wages.

In the United States,[2] wages of labor amount to around 25 percent

1 Unpublished data from Research Project No. 37.

2 L.C. Cunningham, Costs and Returns in Producing Milk, Cornell University Agricultural Experiment Station, A.E. 1086, 1958.
W.L. Barr, Cost of Milk Production in Four Areas of Pennsylvania, School of Agriculture and Experiment Station, Pennsylvania State College, Journal No. 987, 1940.
R.H. Baker and J.I. Falconer, Costs of Producing Milk in Ohio, 1945-1946, Ohio Agricultural Experiment Station, Research Bulletin 687, 1948.
E.M. Morrison, Cost and Returns in Grade A and Manufacturing Milk Production in Selected Areas of Utah, 1956, Agricultural Experiment Station, Utah State University, Bul. 401, 1957.

of cost of producing milk while feed constitues from 40 to 50 percent, depending upon relative prices of feed, labor, and other cost elements. Making allowance for higher prices of feeds in Lebanon, it might be assumed that feed would amount to half the cost of producing milk in Anjar. On the assumption that labor accounts for 25 percent of the cost, a synthetic calculation of the costs of producing milk under "normal" prices would appear something like the following:

	Amount LL	Percent
Feed : reported quantities at normal prices from Table 8, rounded	450.00	50
Labor: rounded estimate	225.00	25
Miscellaneous: expenses, depreciation and interest, estimated	225.00	25
Estimated cost for 1 cow for 1 year	LL 900.00	

With an average cow producing 3,000 kilograms of milk, the cost per kilogram would be 30 piasters. Sale of milk at above this figure would afford the farmer an additional return for his labor and management.

LAND OWNED AND OPERATED

The main reason that most farmers in Anjar produce milk is that their land holdings averaging 15.3 dunums are too small to support a family from crop receipts alone until the apple orchards on irrigated land come into full production. Their farms are about 1/4 the size of the typical farm of 60 dunums in the villages around the AUB Farm.[1] Attempts to rent additional land have been successful to a very limited extent, the area of rented land averaging only 5 dunums per farm.

The average area of land operated per farmer was 20.3 dunums, 15.3 dunums of which were owned, as shown in Table 9. Most of the rented land was dry and not irrigated, while around 3/5 of the owned land was irrigated. Most of the irrigated land was planted with apple trees in order to obtain maximum income per dunum.

1 R.D. Stevens, Size and Type of Farming In Eleven Villages, Beka'a Valley, Lebanon, AUB Faculty of Agricultural Sciences, 1957.

Table 9

Average Size of Land Owned, Rented, and Operated per Farmer

	Irrigated	Dryland	Total
Dunums owned	9.3	6.0	15.3
Dunums rented	0.2	4.8	5.0
Total operated	9.5	10.8	20.3

Dryland was a more important source of feed for cows because few farmers grew any green feed or dry roughage between their apple trees. The dryland crops mostly provided both grain and straw or stems suitable for feeding. However, there was no definite relationship between the number of cows kept and the number of dunums operated.

Table 10

Average Number of Dunums of Land Owned, Rented, and Operated by Farmers in Different Groups According to Milk Production

	Irrigated			Dryland			Total		
	Gr. I	Gr. II	Gr. III	Gr. I	Gr. II	Gr. III	Gr. I	Gr. II	Gr. III
Dunums owned	9.3	7.8	14.0	6.5	4.9	6.3	15.8	12.7	20.3
Dunums rented	–	0.6	–	4.1	3.4	16.7	4.1	4.0	16.7
Total operated	9.3	8.4	14.0	10.6	8.3	23.0	19.9	16.7	37.0

Comparison of the number of dunums operated with the number of cows kept showed that the farmers with the largest number of cows operated the largest areas of both irrigated and dry land. It appeared that the farmers in Group III with 5 or more cows were individuals with more capital resources and managerial ability who owned and operated more land and produced more crops than the farmers in Group II in relation to the number of cows owned. They had an average of 11.7 dunums of apples compared with 7.9 dunums for Groups I and II.

Group I farmers operated the largest number of dunums of dryland (8.3) in relation to the number of cows owned and Group II farmers the smallest

number (2.7). With more dryland per cow, Group I farmers bought a smaller percentage of their feed requirements. Three of the 29 farmers in Group I grew a total of 19 dunums of green forage interplanted in their apple orchards. These three farmers had green forage for their cows from the equivalent of 1/2 dunum per cow, on the basis that forage crops occupied 1/2 of the area of the orchard land. Consequently they had to buy less dry forage than other farmers.

CROPS GROWN

The farmers interviewed generally grew wheat and barley, lentils and vetches on their dry land; apples, corn and vegetables on irrigated land. Most of the barely and vetches and all of the straw from the cereal and legume crops were fed to the cattle as was most of the corn grown on irrigated land.

Study of the data in Table 11 regarding crops grown in relation to the numbers of cows to be fed showed that Group I farmers, with the smallest number of cows, grew an average of 6.1 dunums of wheat and barley per cow compared with 1.3 dunums of these crops per cow for Group II and 3.4 dunums per cow for Group III. These figures suggest that farmers who expanded milk production on purchased feed found it more profitable to produce their own grain and roughage to the extent that land could be rented for this purpose.

The figures further indicate that some crops were grown for feed and others to sell in the market for cash. Most of the crops sent to market came from irrigated land. The irrigated corn, alfalfa, baki and barley were suitable for feeding animals, as were the cereals and legumes grown on the dryland. The only dryland crop raised primarily for sale was grapes which had yielded more income per dunum than other crops grown without irrigation water. Wheat provided flour for the family and only the excess was sold.

The number of dunums of various crops produced by the three groups of farmers included in the survey are shown in Table 11, together with the income received. The average gross income from crops sold by the farmers interviewed was LL 3,226.45 for the year ending February 28, 1959. The values of crops fed to cows were omitted from crop income because they became part of the income received from the milk produced by the cows.

The average gross returns per farmer from crops were highest for Group III, owning the largest number of cows, because these farmers averaged 6.7

Table 11

Cash Income of Farmers Keeping Milk Cows in Anjar

Crop Grown	Average Gross Value per Dunum[1]	Average		Group I		Group II		Group III	
		Dunums Grown	Income LL	Dunums Grown	Income LL	Dunums Grown	Income LL	Dunums Grown	Income LL
Irrigated									
Apples	627.90	4.7[2]	2,951.13	4.5[2]	2,825.55	4.6[2]	2,888.34	6.7[2]	4,206.93
Potatoes (interplanted)	104.00[3]	0.5	52.00	0.5	52.00	–	–	2.3	239.20
Beets	120.00	0.3	36.00	0.5	60.00	–	–	–	–
Corn sold	67.50	0.1	6.75	0.2	13.50	–	–	–	–
fed		0.4	–	0.5	–				
Cabbage	150.00	0.1	15.00	0.2	30.00	–	–	–	–
Squash (interplanted)	90.00[3]	0.3	27.00	0.5	45.00	–	–	–	–
Alfalfa	–	0.1	[4]	–	–	0.5	[4]	–	–
Baki (interplanted)	8.13[3]	0.2	1.64	0.3	2.44	–	–	–	–
Barley (interplanted)	7.38[3]	0.2	1.48	0.3	2.21	–	–	–	–
Poplar	–	0.2	[4]	–	–	–	–	2.3	[4]
Total Irrigated[5]		7.1	3,091.00	7.5	3,030.70	5.1	2,888.34	11.3	4,446.13
Dry land									
Wheat	20.75	4.3	89.24	3.3	68.48	3.1	64.33	18.0	373.50
Barley sold	14.76	1.1	16.24	1.6	23.62	–	–	–	–
fed		2.1	–	2.9	–	0.8	–		
Lentils	15.40	0.1	1.54	–	–	0.5	7.70	–	–
Baki sold	16.25	0.02	0.33	–	–	0.1	1.63	–	–
fed		0.9	–	1.1	–	0.5	–		
Kersani sold	14.40	0.4	5.76	–	–	1.5	21.60	–	–
fed		0.7	–	0.7	–	0.8	–	–	–
Jilbani fed	14.40	0.5	–	0.3	–	0.6	–	1.7	–
Grapes	27.93	0.8	22.34	0.7	19.55	0.5	13.97	3.3	92.17
Total Dryland		10.9	135.45	10.6	111.65	8.4	109.23	23.0	465.67
Total Dunums		18.0		18.1		13.5		34.3	
Total gross crop income per farmer			3,226.45		3,142.35		2,997.57		4,911.80

1 Figures taken from Table 12

2 Of bearing age - 5 years and above

3 Estimated at half the usual yield per dunum

4 Not harvested yet

5 Totals of irrigated dunums do not add up to the same totals in Table 4 because only orchards of bearing are included here.

dunums of bearing apple trees (which gave the highest returns among all crops grown) as compared to 4.5-4.6 dunums for the other two groups. Average gross crop returns were lowest for Group II farmers because they grew no vegetables.

The figures for apple orchards in Table 11 cover only the apple trees of bearing age, five years and above. In addition to these, Group I farmers each averaged 3.4 dunums, Group II 3.3 dunums, and Group III 5 dunums of non-bearing apple trees. These will soon come into production and substantially increase the returns from crops. It should also be noted that most orchards were less than 10 years of age and will, therefore, give increasing returns as they grow older. The yields, prices, and gross values per dunum of the various crops grown by the farmers are shown in Table 12.

Table 12

Yields, Prices, and Gross Values per Dunum of the various Crops in Anjar, 1958 Crop Year.

Crop	Yield Kg. per dunum	Price[1] Pt. per kg.	Gross Value LL per dunum
Irrigated			
Apples[2]	1,697	37	627.90
Potatoes	1,300	16	208.00
interplanted	650	16	104.00
Beets	1,500	8	120.00
Corn	250	27	67.50
Cabbage	2,500	6	150.00
Squash	600	30	180.00
interplanted	300	30	90.00
Baki (interplanted)	cut green	?	8.13[3]
Barley (interplanted)	cut green	?	7.38[3]
Dryland			
Wheat	83	25	20.75
Barley	82	18	14.76
Lentils	55	28	15.40
Baki	65	25	16.25
Kersani	60	24	14.40
Jilbani	60	24	14.40
Grapes	133	21	27.93

1 Prices reported by farmers interviewed.
2 Average figures for 18 orchards for which records were available.
3 Estimated at half the value of grain yield per dunum.

RELATIVE INCOME FROM CROPS AND MILK

The purpose of the Karaghusian Foundation in fostering milk production in Anjar has been to increase the incomes of the families living on the small land allotments allowed them in the village. The extent to which this objective has been achieved is indicated by the figures in Table 13 which show the estimated cash returns from milk and from crops by the group of 43 farmers.

Table 13

Comparison of the Cash Income per Farmer from Crops and Milk

	Average		Group I		Group II		Group III	
	Income LL	% of Total	Income LL	% of Total	Income LL	% of Total	Income LL	% of Total
Cash receipts from crops	3,226.45	62.1	3,142.35	71.4	2,997.57	50.3	4,911.80	47.7
Cash receipts from milk	1,971.00	37.9	1,256.40	28.6	2,963.88	49.7	5,395.68	52.3
Total cash receipts	5,197.45	100.0	4,398.75	100.0	5,961.45	100.0	10,307.48	100.0

The above figures show that those farmers who produce milk derive more than one third (37.9 percent) of their annual cash income from cows and that those with 3 or more cows obtain roughly half their income by milking cows. However, this analysis tends to under-estimate the importance of milk in the economy of the village because roughly 85 to 90 percent of the crop sales are apples which have a very high value per dunum, as indicated in Table 12. The gross value of apples produced per dunum is about three times that of potatoes and four times that of many other vegetables. If the farmers in this village still grew vegetables instead of apples on their irrigated land, their income from crops would be less than half what it now is. On this basis of comparison, it appears that milk constituted 60-65 percent of the farm income of the village previous to the time the apple plantings came into bearing.

SEASONAL VARIATION IN MILK PRODUCTION

Study of the quantities of milk sold from Anjar, month to month during the year covered by the survey showed wide seasonal variation. The extent of this variation appears in Table 14 and in graphic form in Figure 1. From the low point of production during January when the index was 76.5, production climbed steadily to a peak of 126.2 in July (average for 12 months= 100). Production is definitely above average during the period May through

Table 14

Monthly Fluctuations of Milk Production in Anjar and Price Per Kilogram[1] March, 1958–February, 1959

	Volume of Milk Sold Kg.	Index of Variation[2]	Price of Milk Piasters per Kg.
March, 1958	25,132	88.4	36
April	28,134	98.9	36
May	33,909	119.2	36
June	35,721	125.6	34
July	35,875	126.2	34
August	33,852	119.0	34
September	30,080	105.8	36
October	26,288	92.4	36
November	24,919	87.6	36
December	22,862	80.4	38
January, 1959	21,744	76.5	38
February	22,729	79.9	38
Total and Av.	341,245	100.0	36

1 Actual figures taken from Mr. Feldmahn's records and records of the Milk Handling Depot in Anjar for 90 milk producers.

2 Expressed as percentages of the base which is the average for the 12 months.

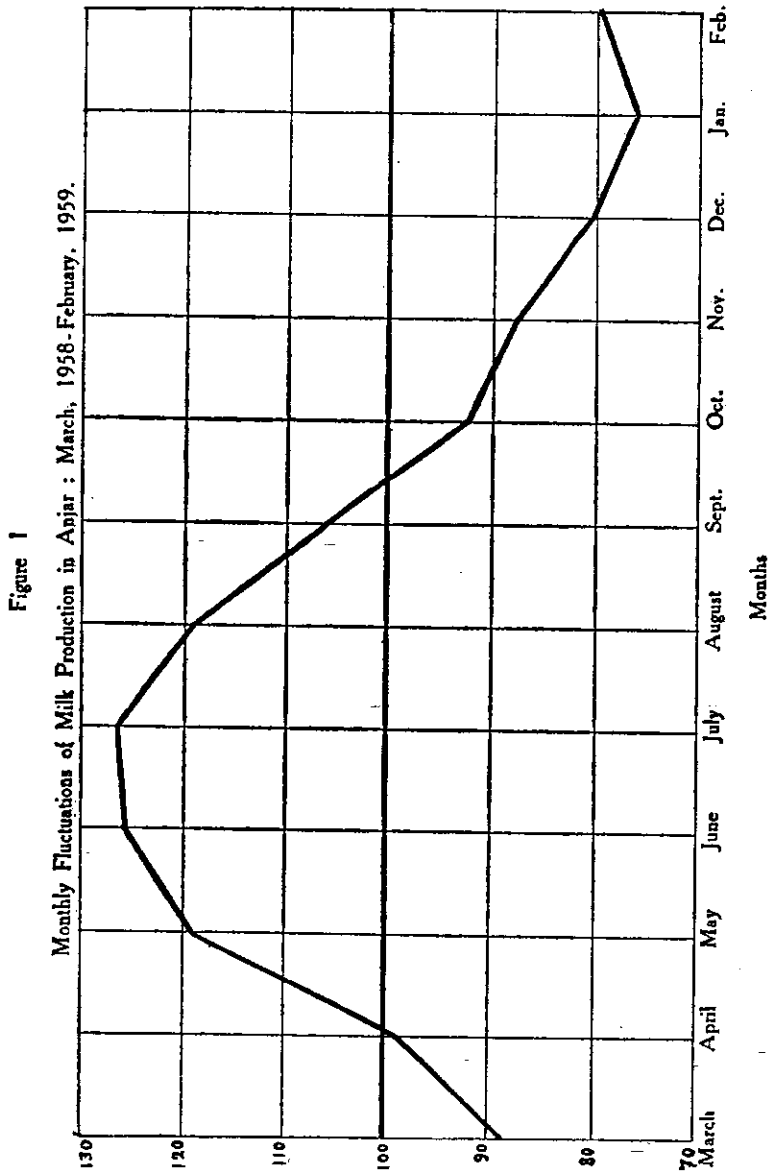

Figure 1

September and below average from October through April. Comparison of the average of the three lowest months, December – February (78.7), with that of the four highest months, May–August (122.5), shows that the winter production is only 64 percent of the spring and summer average.

With this wide fluctuation in volume of milk shipped to Beirut from Anjar, there is often a shortage of high quality milk for pasteurizing in the city during the winter months and a substantial surplus during the summer months. Thus, the price to producers is reduced 2 piasters per kilogram below average for the surplus months and increased 2 piasters per kilogram above average during the winter months. Those farmers who produce more than the usual quantity of milk during the winter months when prices are higher thereby obtain a larger income for the year.

The main reason for the wide seasonal variation in volume of milk produced between winter and summer is the common practice of breeding cows to drop their calves during the spring. This season is preferred because there is more grass and green feed for the cow during the period of her highest milk production. Producers believe that they save on feed bills by this practice.

MILK PRODUCTION AND MANAGEMENT PRACTICES

Feeding

Milk is produced and sold by farmers in order to make profitable use of one or more of their productive resources. Quite frequently it is the most profitable way for a farmer to market the pasture, hay and roughages grown on his farm. On the other hand, when farmers have more labor than they can employ profitably on their limited amount of land, milk production utilizes their work productively and usually also profitably. This has been the case in Anjar except when drought very greatly increases the price of roughages. The farmers studied were operating small scale milk factories in their stables with cows transforming feed (80 to 86.5 percent purchased) into milk to supply consumers in Beirut. Consequently, their feeding practices were quite different from those of dairy farmers who have plenty of pasture and grass-legume hay as the main feed for their cows.

With their small size operations, Anjar farmers have virtually no pasture for their cows. The principal green feed reported was scavenger grazing

along the sides of roads and irrigation ditches, mostly during spring. The families with one or two cows devoted more time to this type of feeding than did those with larger numbers of cows. When there was green feed available, many farmers cut grasses and weeds from their own fields as well as from the sides of roads and ditch banks. Only a few farmers (16.3 percent) interplanted their orchards with baki or barley as a winter forage crop and cut it green for their cows. Two farmers in Group II had planted small plots of alfalfa to supply more green feed but they had not harvested any when the survey was made. Alfalfa requires so much scarce water that it is more profitable to use the limited water available to irrigate apple trees which give a higher return for the quantity of water applied.

The biggest problem in feeding in Anjar was the lack of good quality roughage. Most farmers thought that tibn in a cow's ration was as essential as bread is in the human diet. Because of the summer dry season and shortage of land, there is no grass and legume hay produced and alfalfa grown on irrigated land is too expensive to feed ordinary cows. Consequently, Anjar farmers bought most or all of their roughage as tibn which is low in nutritive value. This is ordinarily available at about 1/6 the price of milk. However, when the survey was made, 1 kilogram of tibn was worth nearly 2/3 the price of one kilogram of milk because of the 1958 drought.

Alfalfa hay, when it can be purchased, costs 25 to30 piasters per kilogram. According to the data in Table 6, a cow consumed 7.5 kilograms per day of dry roughages and 4 kilograms of concentrate to produce 8.3 kilograms of milk valued (36 piasters per kilogram) at roughly LL. 3.00. If he is going to make ends meet, a milk producer cannot afford to pay over half the sales value of his milk for feed. But the alfalfa hay for a day's feed would cost about LL. 2.00 ond the concentrate grain mixture about LL. 1.00 per day for the average cow. Thus the cost of the feed for one day would equal 100 percent of the sales price of the milk produced from it. Consequently, ordinary farmers producing milk in the Beka'a can not afford to feed alfalfa to their cows even though it is a very nutritious roughage.

Two farmers had successfully tried improvised silos and fed corn silage. Many more were interested in making corn silage but the village lacked a silage chopper.[1] Silage is a relatively low cost nutritious feed which supple-

1 The manager of the Milk Depot reported that 10 to 12 Anjar milk producers rented a chopper in the fall of 1960 and made corn silage.

ments dry roughages and reduces the amount of expensive grain concentrate which has to be fed for heavy milk production. A few farmers had tried beet pulp from the nearby sugar factory and one was still using it as silage. Most farmers claimed that their cows had no appetite for beet pulp, particularly if it was three or more days old and fermented.

New born calves were allowed to suck one or two of the cow's teats for an average of 2 1/3 months during which time the calves were gradually fed increasing amounts of roughage and the grain-protein mixture. The number of months that a calf was fed milk did not vary significantly between groups or classes of farmers.

As shown in Table 6, farmers were feeding more grain-protein mixture than is normal, 1 kilogram for each 2.1 kilograms of milk as compared to the usual 1 to 3 ratio. They had been told that cows eating tibn will produce more milk when fed liberally with high protein feeds such as cotton seed cake (which makes up nearly half the concentrate mixture eaten daily) and home grown kersani, jilbani, baki, and beans. Different farmers fed varying amounts amounts of barley, corn, wheat, and wheat bran. Generally, the protein concentrate mixture had an abnormally high percentage of protein and was deficient in carbohydrates. Thus, the cows were not receiving sufficient carbohydrates to have the raw materials for making the quantity of milk which they had the inherited ability to produce.

Breeds and Breeding

Milk cows were predominantly crossbreeds of the pure Dutch Freisian bulls and the local Baladi cows. There were very few Shami milk cows. The crossbreeds had a higher milk production performance than either the Baladi or Shami. Crossbreeding serves to combine the high milk production qualities of the Freisian cows with the heat and disease tolerance of the local cows.

All the cows in the community were bred naturally by two Freisian bulls, one of which was provided by the Karaghusian Foundation, and the other one was privately owned. The service fee per cow was LL 5. Some farmers were aware of the necessity of changing the bulls every few years to overcome the hazards of inbreeding. A few leaders were looking for suitable new bulls, but had not purchased promising calves because the prices

quoted were considered too high.[1]

Milk producers were not making use of the Government's artificial insemination service center at Zahle due to the difficulty of getting the cows inseminated in time. When the technician arrived after receiving word, the heat period of the cow usually had ended.

The Length of Lactation and Dry Period

The average length of the lactation period was 9 1/2 months and the dry period of the cows was 2 1/2 months. Variations between groups ranged from 2 1/2 dry months for Group 1 to 2 3/5 months for Groups II and 1 4/5 months for Group III. It could thus be noticed that on the whole the cows of farmers having the largest numbers of cows had a longer lactation period than the rest.

The general lactation pattern appeared to be high daily production following birth of a calf with a gradual increase in the amount produced daily during the first two or three months. The next three months production fell rather rapidly to a daily ouptut of a few kilograms tapering off gradually to the time of drying up at between 9 and 10 months after dropping a calf.

Control of Diseases

Diseases were a minor problem as only 13 farmers reported having had one case of disease during the previous year. Mastitis showed the highest rate of incidence, 3.5 percent. Some cows were parasitized by liver flukes. A few cases of abortion were reported, some of which were caused by mechanical injuries.

Disease incidence on the whole, was higher for Groups with the smaller number of cows. Of the farmers in Groups I and II, 36 to 38 percent reported one case of cattle disease. No diseases were reported for cows belonging to Group III. Veterinarians state that properly fed cows generally have better health, and Group III cows were fed some of the nutritious ready-mixed dairy feed produced by the new feed mill in Beirut.

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1 Two new Freisian bulls purchased from a commercial dairy farm were in service in Anjar in May 1961.

Most cow stables in Anjar are dark and poorly ventilated. Floors without bedding are wet with urine and manure.

Washing cans and milk pails with detergent soap was the first step in producing milk that keeps sweet longer.

The majority of farmers, 79 percent, vaccinated their cows regularly against foot-and-mouth disease and the rest vaccinated occasionally or not at all. While all of the Group III farmers vaccinated yearly, only 91 percent of Group II farmers and 72.4 percent of farmers of Group I did the same. Vaccination against black leg and anthrax took place only when there was an outbreak in the area. The vaccine was supplied free of charge by the government, but the previous year cows had not been vaccinated because no vaccine was available.

Five cows out of 92 died between March 1, 1958 and February 29, 1959, a mortality of 5.5 percent.

Manure

An overwhelming majority of farmers used on their farms all the manure produced by their cows. Most of it went on apple orchards to reduce to a minimum the amount of commercial fertilizer purchased. Manure was dumped in piles not far from the stable and the milking quarters, and left uncovered until it was applied on the fields. Generally no bedding was used in the stables so that the manure usually was 100 percent excreta from the animals. In warm weather flies were quite numerous in and around the stables.

Housing and Equipment

Most of the stables visited were constructed of local stones that were held together with a mixture of clay and straw. Roofs were mainly made of long wooden posts 20-40 centimeters apart and the space in between filled with brush and weeds. On top was a mixture of clay and straw to shed the rain. A few stables were made of concrete.

Ventilation, lighting, drainage and crowding of animals, seemed to be problems in the stable of almost every farmer interviewed. Over one third of the farmers had donkeys, horses or poultry housed with their milk cows. Few stables had any windows. Those which did, usually were shut specially during winter. In cold weather even the doors were closed so that very little air circulated. As a result, the cows were not getting adequate air and sunlight.

Most stables had either a cobble stone or earth floor with inadequate drainage. Floors generally were wet with urine, even those made of concrete because of the lack of bedding to cover the manure and absorb the urine. Cows lying down to rest usually arose with manure caked on their sides and legs.

Soon after milking, farmers bring milk to the depot to be weighed. A receipt is issued for each delivery, night and morning.

After weighing, milk is strained through clean cloth into large metal cans for cooling.

More than 90 percent of the stables had no water troughs for drinking and the common practice was to supply the drinking water in pails. Many stables, on the other hand, had some kind of a feeding trough. When not outside grazing, most cows were tied in place. Few barns had wooden stanchions.

Milking Practices

Farmers milked their cows twice daily, around 5:00a.m. and 4:00p.m. One third washed the cow's udder regularly before milking but the majority cleaned the udder only occasionally, every third or fourth day. Most of the farmers milked into sanitary aluminium pails supplied by the Karaghusian Foundation. Directly after milking they took their milk to the receiving depot operated by the Foundation

Marketing Procedures

At the milk depot, the specific gravity of each producer's milk was tested as a safeguard against the addition of adulterants. The milk was not tested for either bacteria, sediment, or butterfat. After weighing, the milk was filtered into large metal shipping containers which were kept cool by placing ice around them in storage tanks containing cold water.

Upon delivering their milk, farmers were given receipts for the quantity delivered. They were paid weekly according to the seasonal price of the milk which varied from 36 piasters per kilogram in the spring to 34 piasters in the summer, to 36 piasters in the fall, and to 38 piasters in winter The milk was transported daily by the Foundation's truck to Beirut, a distance of 60 kilometers. Ice again was placed around the containers for the trip to Beirut where the price at milk plants was 4 piasters higher than in Anjar. The difference represents the costs of operating the receiving and holding depot in Anjar and of trucking the milk to Beirut.

Milk is cooled and kept cold in metal cans immersed in iced water in the Anjar depot.

Milk is trucked from Anjar to Beirut early each day. Cakes of ice on the metal cans keep it cold in hot weather.

APPENDIX

PRODUCTION AND MANAGEMENT PRACTICES FOR PROFITABLE MILK PRODUCTION[1]

Feeding

1. Regular feeding of green forage or legume hay is essential for proper nutrition. When accompanied by a balanced concentrate ration and proper management practices, it helps cows to produce up to their inherited ability. Proper nutrition contributes to profitable milk production.

2. When nutritious pasture, irrigated legume forage or hay is not obtainable at an economical cost for milk production, oat, oat-vetch, or oat-Austrian winter pea hay produced on dry land affords more nutritious roughage for milk cows than barley harvested for grain and straw[2].

3. Since straws are generally deficient in digestible carbohydrates as well as protein and are low in vitamines and minerals while at the same time high in fiber, a grain - protein feed containing the proper amounts of these elements to provide a nutritionally balanced ration for milk production contributes to low cost of production.

4. Feeding a nutritionally balanced dairy feed instead of mainly cotton seed cake gives lower cost milk. Since protein concentrates generally are more expensive than cereals, a dairy feed containing cereals in proper balance with protein concentrates generally costs little more than cotton seed cake. Nutritionally balanced feed generally contributes to lower cost of production by giving a better yield of milk in relation to the quantity of feed consumed.

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1 This section was prepared in consultation with Professor Ramzi Khoury, dairy specialist in the AUB Faculty of Agricultural Sciences, whose assistance is gratefully acknowledged.

2 Research at AUB Farm by a graduate student, Chain R. Manghirmalani, during the 1959-60 and 1960-61 crop-years with sub-normal rainfall showed that oats, oats and vetch, or oats and Austrian winter peas harvested for hay at the boot stage of growth of the oats yielded roughly 200-325 kilograms per dunum of air dried hay containing 14-17 percent protein. With normal rainfall, the yield of hay would be substantially larger and generally would exceed the combined weight of barley grain and straw harvested from the land under the same conditions.

5. Feeding corn silage and beet pulp silage contribute to improved nutrition and lower cost milk. Generally, they supply elements stimulating milk flow as well as digestible nutrients at low cost.

6. Milk production is fostered by "free choice" feeding of mineralized salt and ground limestone to correct mineral deficiencies and stimulate appetite for consumption of the amount of feed for maximum flow.

Breeding

1. For maximum profit, every effort should be made to have cows freshen every 12 months. To do this cows have to conceive when bred during the scheduled month. This necessitates proper natural breeding or artificial insemination at the correct time for conception to take place.

2. Cows that freshen in the fall are more profitable. They give the largest quantities of milk when prices are seasonally highest. They usually give greater total yearly production because spring time grasses stimulate larger milk flow when the daily production of the cow is normally declining.

3. Heifers can be bred to freshen in the early fall. This sets the pattern for the cows to give the most milk output during the winter when milk prices are highest.

4. Cows bred with semen from "proven sires" will produce heifers which will give more milk than their dams. High producing cows have proved to be more profitable than low producers because they give more milk from the amount of feed fed them. High production is inherited and certain bulls possess the power to transmit the high production ability of their ancestors to their offspring. Raising calves from high producing cows and sired by semen from a bull of a high producing family is an economical way to build up a herd of profitable milking cows.

Sanitary Housing

1. Cows are more healthy and produce milk more economically when housed in a clean, light, airy, well ventilated place with a dry floor so the cows can lie down in comfort. It is a fact that contented cows produce milk at lower cost per kilogram.

2. Sheds with one side open to the east to give abundant sunlight with little wind, and sufficient flour space for all cattle to move around freely encourage milk production at low cost.

3. Dry floors with drains to carry away liquid manure keep down diseases and foster sanitary production of milk for market as does the use of dry soil and/or wood shavings to keep the cows out of wet manure.

4. The production of quality milk is aided by milking the cows in a clean place that is easily kept sanitary.

5. Manure needs to be removed from the cow shed, yard and milking place frequently to foster the production of clean milk. The manure should be taken to the fields daily or kept in a tightly covered place away from the cows to reduce the number of flies. Flies bother cows and thereby curtail the flow of milk.

Management Practices

1. Early weaning of calves helps to increase the amount of milk for sale. It is profitable because nutritious feed for growing strong calves can be purchased for less than the price of the milk calves normally suck from their mothers. It trains cows to let down their milk without the calf sucking or being present.

2. Washing the hands of milkers and the udders of cows before milking fosters the production of clean milk with low bacterial content for sale as a quality product for which a higher price generally is obtainable.

3. Good management practices, especially comfortable, well ventilated housing, fly control, and good milking methods stimulate cows to give more milk.

4. Use of sanitary milking pails cleaned regularly with detergent or soap and water helps keep the milk clean and the number of bacteria low.

5. Prompt cooling and holding milk at a low temperature is essential to hold down the growth of bacteria so the milk will be of good quality when it reaches the pasteurizing plant.

6. Regular examination of cows by a veterinarian and periodic vaccination

against prevalent diseases help to keep cows healthy and producing at maximum capacity during a longer lactation.

7. Unprofitable cows should be replaced with high producers which yield a profit on the feed fed them and the labor devoted to their care and milking. Generally a cow does not produce a profit unless she gives milk valued at twice or more the cost of the feed she consumes during a year. Feed usually constitutes roughly half the total cost of producing milk. The other half goes to pay for the needed labor, medicines and miscellaneous expenses, depreciation, interest on the capital utilized, and returns to the farmer for his own labor and management.