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

REPORT AND RECOMMENDATIONS FOR THE IMPROVEMENT OF DAIRY FARMING IN THE LEBANON

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

Consultants
ERIC C. VESTERGAARD AND COMPANY
International Agricultural Consultants

NOVEMBER, 1970

FOREWORD

This study was carried out for the Animal Production Office of the Lebanese Ministry of Agriculture to obtain expert opinion on the improvement of the Lebanese Dairy Industry and to recommend, if possible, a suitable project upon which this improvement could be based. It was also to consider beef production allied to dairying.

The consultants were asked to carry out this survey as a result of their growing experience in this type of work in Mediterranean Countries and the Middle East.

The terms of reference were to visit the Lebanon to obtain basic local data and assess the existing situation and, as a result of this visit, together with the use of their experience of modern techniques of dairy farming and processing, to prepare this study.

Mr. Vestergaard visited the Lebanon on a number of occasions in 1969 for discussions and, together with his partner, spent two weeks in the Lebanon in May 1970.

The consultants express their sincere thanks to all those who were kind enough to give assistance in obtaining data and making visits and in particular to Dr. S. Haidar, Director General and all the staff of the Animal Production Office, to Mr. Nabhan Nabhan, Chairman, and Mr. Ibrahim K. Baltaji, Vice Chairman, and the members of the Lebanese Cattle Breeders Association.

APPENDICES

APPENDIX I

APPENDIX II

APPENDIX III

APPENDIX IV

APPENDIX V

APPENDIX XIV

MAP

PLANS

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

1. That a project be established by a suitable client in cooperation with the Lebanese Ministry of Agriculture and the Lebanese Cattle Breeder's Association. This project to house a minimum of 600 milking cows and followers and also provide, in the same ownership, either or on site or in or near Beirut, a milk processing plant with facilities for U.H.T. treatment.

2. That a project be set up, either at the new farm or in the North, for the fattening of the male calves produced from the main project.

3. That both the dairy and beef farms whether separate or together have in their ownership sufficient irrigable land upon which to grow their own fodder.

4. That the project as set up is operated by means of a U.K. management contract. This management to be the nucleus of a new government supported National Extension Service for dairy and beef farming.

5. That government support be given to the dairy and beef industry in the way suggested in this study.

6. That a study be commissioned immediately to make recommations for the establishment of a Lebanese Milk Marketing Board.

7. That special assistance be given to small farmers to co-operate with each other in production and expenditure.

8. That the Quarantine Centre in Tripoli be used to encourage the development of the beef cattle raising in the North.

9. That serious consideration be given to there establishment of properly managed A.I. centres in the Lebanon.

1. EXISTING SITUATION

A. THE FARMS

Some twenty farms were visited in order to see typical in the various areas.

On Mount Lebanon the farms were small in area and produced milk from herds, often substantial, fed on bought concentrates and largely bought fodder. What land was available was almost entirely devoted to growing vegetables and fruit, mostly irrigated.

In the North, farms varied from very small to large, where irrigated double cropping was possible, due to the mild coastal climate. There were large areas of potatoes on irrigated land and wheat and ground nuts were extensively grown on rain fed land. Very little fodder was grown.

In the Bekaa Valley, the farms usually larger, those seen varying from 30 to 220 hectares, with the exception of the farms of the Anjar settlement which were 1.4 hectares each. Some fodder was grown and it had been shown that a yield of 120 to 150 tons of green fodder per hectare could be obtained from a tetraploid ryegrass/red clover mixture. Some maize was grown for silage. Dairy herds seen carried from 70 to 160 cattle from 30 to 60 cows in milk. Most of the land seen was irrigated and the principal crops were apples, onions, wheat, sugar beet and vegetables. Double cropping was not possible due to the colder winter period.

Farms visited in South Lebanon fell into two categories . Those with substantial areas of land and those with very little land. The larger farms were usually growing substantial crops of citrus fruits, but grew little fodder

because of its lower return. The small farms had dairy herds, often quite large housed the year round. Both categories of farms, therefore, though for different reasons, relied on purchased concentrates and fodder. One exception was a farm where in 1967 a herd of some 250 cows had existed, much of the fodder being grown on rain fed land.

In general the management of the dairy herds was very poor, little attention being given to proper feeding or rationing of feed according to production. There were good Friesian cattle in each of the areas, usually imported or of Dutch origin. The local breeds of cattle were of poorer type and lower yielding.

Most milking was by hand though machine milking was practised on some of the larger farms. Very few farms had separate dairies (milk rooms) or any means of cooling the milk. Most cowsheds were low, dark inferior buildings. Standards of hygiene were very low and bacteria counts of the milk , therefore, high.

The price obtained by farmers for their milk varied from 22 pi to 42 pi per litre wholesale, or from 55 pi to 65 pi per litre direct retail.

The overall situation of dairy farming in the Lebanon is unsatisfactory with, in many cases, uneconomic production of an inferior product and an uncertain market.

B. MILK MARKETING AND DAIRY PROCESSING

Only a total of some 5,000 litres per day of pasteurised milk is sold from the three principal dairies in Lebanon, all in Beirut. This amounts to about one litre of milk for every two hunred persons in the Greater Beirut area.

From the two most modern of those dairies, liquid milk sales are only a small part of their business.

Whilst there is no reason to believe that any of the milk or milk products leaving these dairies is in any way contaminated, there is equally no positive proof of the quality in the form of officially certified test, batch by batch, as would normally be required in countries where modern dairies are operating.

These dairies purchase a total some 10.5 - 13.5 tons of raw milk per day at a price of 40 pi per litre for a minimum butterfat of 3.5% and pasteurised liquid milk retail at 75 or 80 pi per litre mostly at 3% butterfat.

There are proposals for government milk collection centres, though none yet are in operation . A few private collecting centres are in operation. One of these operated by the Howard Karagheusian Foundation receives milk from the Anjar area, cools it and delivers it to the dairies in Beirut. Collection centres greatly assist small farmers in providing a means for the them to market their milk.

Much of the milk in Lebanon is retailed by collectors who buy from farms and sell it door to door from chruns, often not even cooled. Collectors pay from 25 pi to 40 pi per li. and retail at about 60/65 pi per litre.

Some farmers retail their milk themselves for a similar price, untreated, and often not cooled.

Milk retailed by collectors and farmers has a poor keeping quality and, even if the housewife boils it, it must constitute a substantial health hazard.

Customers complain that milk sold in this way is often watered down or has much of the cream removed.

C. THE CLIMATE

The climate of Lebanon is typical "Mediterranean" dominated by the characteristics of principally west winds, influence of the sea and dry summers.

There are local variations due to the topography.

MEAN TEMPERATURE ^{o}C

	Summer		Winter	
	Max.	Min.	Max.	Min.
Beirut	33.8	22.8	20.9	6.6
Cedres	27.3	8.0	9.9	-10.4
Bekaa	37.4	10.0	5.2	- 5.3

From the table above it will be seen that the coastal areas have a mild winter whilst the mountain areas and Bekaa Valley have much colder winters.

Though the rainfall is substantial, some 890 mm on the coast and adjoining mountains, and some 620 mm in the Bekaa Valley, it falls on comparatively few days over an eight month period, leaving a four month dry summer.

D. THE SOIL

The soil varies but in the main is a red medium heavy loam of calcareous origin and, provided water is available, will grow vigorous vegetation of a very wide range. There are some areas of sand dunes on the coast, and the northern part of the Bekaa Valley is less fertile.

There are a few pockets of high salinity, especially near the coast but only rarely and in small areas is the salinity such as to affect plant growth.

E. WATER AND IRRIGATION

Water for irrigation is available from numerous rivers supplied by springs, the two principal rivers in the Bekaa are the Litani and Assi. There are also vast hydrological reserves under ground trapped by the limestone rock formation.

In 1967 only some 16-17% of cultivated land was irrigated but new schemes are being developed.

Most of the irrigation is by flooding from ditches though there is some sprinkler irrigation for small areas.

F. FODDER CROPS

At present only a very limited quantity of fodder for cattle is produced in Lebanon. Most of the fodder grown at present is in the Bekaa Valley.

In both North Lebanon and the Bekaa Valley there are substantial areas suitable for fodder crops.

Much of this land is rain fed and, therefore, limited to seasonal cropping or crops which can withstand the dry summer unless further irrigation is developed.

In the North, due to the mild winter, irrigated land is usually double cropped and fodder crops must compete with high annual returns. Maize, with its comparatively short growing season and high yields, must be considered the most suitable fodder crop on this irrigated land.

In the Bekaa Valley, since double cropping is not usually there, gross returns are less and, therefore, there is a much wider choice of competitive fodder crops for irrigated land. Trials show that one of the successful crops is a mixture of tetraploid rye-grass and red clover which has given yields of 120-150 tons per hectare of green matter, equivalent to 90 tons of silage at 60% moisture.

It is estimated that an average yield of 60 tons per hectare at 60% moisture would result in an on the farm costing of 2.1 pi per kg (£ 2.86 per ton). However, if being grown on contract for sale it must compete directly with other crops and this would result in a contract price of about 4.6 pi per kg (£ 6.22 per ton) equivalent to 11.6 pi per kg (£ 15.7 per ton) for hay as compared with tibin at about 10 pi per kg (£ 13.5 per ton).

2. FEASIBILITY

A. BASIC FACTORS FOR SUCCESS

(i) Climate

The climate is ideal for both dairy and beef production. Except for the mountain areas, cattle housing can be of a very simple type, limitting the capital costs.

(ii) The Livestock

There are some good quality imported cattle in the Lebanon giving high yields of milk and producing good calves suitable for beef production. It would also be possible to import a foundation herd of suitable cattle. The diseases found in Lebanon are controllable and present nothing more than the normal risks.

(iii) Food for the Cattle

Fodder can be successfully grown especially in the Bekaa and northern area. Good yields can be obtained and fodder production can compete with other crops.

(iv) Management

Present management of most livestock farms is poor . This can be improved to the standard required for successful dairy and beef production by the use of some ex-patriate management which in turn would provide the basic practical training for local farmers.

(v) Dairy Processing and Slaughterhouses

There are modern dairy processing plants in Beirut . However, their technical management could be improved. There is also a feeling of distrust between the farmers and the processors as a result of the use of substantial quantities of powdered milk for processing into Lebne, Leban, ice cream and other products.

A modern processing plant under the same management as a substantial dairy farm producing the minimum viable throughput for the plant, or alternatively a farmer - controlled processing plant, would have more incentive to market Lebanese milk.

(vi) The Market

The population of Lebanon was 2,853,155 in 1967 (Ministry of Plan Statistics), of which about 1,000,000 live in the Beirut area.

It is estimated that the average per capita per annum consumption of liquid milk in Lebanon is some 16 litres whereas international organisations recommend a minimum consumption of 100 litres from the nutritional point of view.

There is, therefore, a need for a substantial increase in liquid milk consumption in Lebanon.

The present production of pasteurised liquid milk in Beirut is some 5 tons per day or one litre to every 200 persons (less than 2 litres per capita per annum). It must, therefore, be assumed that, even allowing for the use of powdered milk, substantial quantities of raw milk are being retailed in Beirut.

Elsewhere almost all liquid milk available is raw milk often not even cooled. This must constitute a health hazard. Since so little 'safe' milk is available, it is only natural that the population have a distrust of milk.

It can be expected that over a period of years, if top quality liquid milk known to be safe was available, consumption would increase to some 150 litres per capita per annum (nearly ten times the present figures).

Proper treatment of milk would result in an overall price increase to the consumer as a result of the cost of treatment, but the present market price for milk of 75 or 80 pi per litre should not rise over an average of 80 pi per litre in cartons (with farmers receiving 42 pi per litre).

The market for good quality milk exists in Lebanon, but little or no effort has been made to develop it and little good quality pasteurised milk is available.

To create a market a National Advertising Compaign is necessary, combined with the availability of suitable products.

(vii) Profitability

Budget costings indicate that a substantial dairy project should show a return of approximately 25% before depreciation and 17.5% after depreciation, including the dairy processing, and the dairy farm with subsidiary beef production.

(viii) General

It is clear from the above factors that dairy production and dairy processing could be satisfactorily carried out on a profitable basis in Lebanon.

B. POSSIBLE PROJECT

Considering all the factors of the study, it is recommended that development shall take the form of a substantial initial project. It is considered vital that this project should be of sufficient size to be viable in itself to carry its owndairy processing plant. These factors indicate the project should consist of some 600 top quality cattle with an annual average production of 7,000 litres per cow resulting in a daily production of at least 9,000 litres of milk, the minimum economically viable throughput of a modern UHT plant. Such a processing plant is capable without any addition of dealing with 40,000 litres of milk per day.

The supply of the minimum throughput from one source - whether owned by one entity or a co-operative - with the herd under close management, is important to ensure a high quality hygenic supply of milk to the plant, thus avoiding undue problems affecting the quality of the product during the initial period.

Once the project is fully operational and running smoothly, the management will be able to devote time and experience to the improvement of other local herds. The facilities offered by the initial herd can be fully utilised for training and demonstration purposes for local farmers to ensure the required standard for acceptance by the plant so that, as expansion of sales develops, supplies can be taken from local farms on a contract basis. When the plant is working to its initial capacity of 40,000 litres per day, three-quarters of its milk requirement will be drawn from outside its own herd. Its capacity can, of course, be further expanded as required.

Small farms a particular problem. Hand milking carries with it special problems of hygiene in that almost all hand milkers work with wet hands for comfort and the milk is necessarily milked into buckets open to dust and flies, as opposed to passing direct to pipeline and thence to churn or bulk milk tank, both of which can be protected from dust and flies. Unfortunately, it is uneconomic to milk small herds (less than 20 cows or so) by machine. Similarly the simplest way of providing , hygenic conditions for milking is to build milking parlours, or use portable milking bails, thus avoiding immediate and costly alteration to the larger buildings used to house cows which can later be improved by stages as natural rebuilding takes place. It is uneconomic to provide these facilities for very small herds.

It is, therefore, recommended that small herds should be grouped, each housing and feeding its own cows but using common milking facilities. Hygiene can then be controlled and these groups brought into the overall project . More advanced groups can then developed to co-operative farms in the fuller sense.

The overall project, in this way, can become a centre of extension work and so justify substantial government support.

The initial farm could rear all male calves for beef production or alternatively sell them for rearing and fatening at a separate beef unit. The quarantine centre at Tripoli could be used for this purpose. Beef production could be developed further by taking calves from farmers supplying milk to the plant.

C. FURTHER DEVELOPMENT

It would require 20 plants of 40,000 litres per day (40 tons) capacity to supply milk for the whole of Lebanon's present population at the minimum recommended nutritional level of 100 litres per capita per annum. It would, however, be more economic to develop about five plants with greater throughput.

Once substantial dairy industry on a sound economic footing has been developed, a milk drying plant could be considered. Milk for manufacturing must, because of international price levels, be at a lower price than that for liquid consumption. A healthy dairy industry should be able to pay a pool price to farmers allowing about one third of the production to be used for manufacturing at a reduced price.

Over a period of years both production standards and hygiene levels could be improved to a satisfactory standard. The aim should be to have over 90% of liquid milk sold in a suitably pasteurised form.

A dairy industry, could also supply some 2,500 tons of beef per annum as a by-product, thus saving some LL 7,500,000 per annum in imports. The saving in imports as a result of a health dairy industry could amount to LL 20,000,000 per annum. To achieve this some 10,000 hectares would be required for fodder production which amounts to less than 10% of the cultivated areas of the northern and Bekaa regions.

The natural result of introducing these crops into the rotation and of utilising the manure from the cattle on the land would in the long term increase the yields other crops, due to the improvement of the fertility of the soil.

3. GOVERNMENT SUPPORT

Government support to the home dairy industry of Lebanon is essential if imports are not to increase and if a home dairy industry is to be maintained, improvement and expanded.

This support could be in several forms:-

(i) Limitting the import of powdered milk. Control could be direct or by restricting the use of imported powder.

(ii) Creating a controlled price structure favourable to home produced milk. Revenue from levies imposed on imported powder (or other products) could be used to reduce the retail price of home produced pasteurised milk.

(iii) Providing a national publicity programme. Emphasis could be given to health aspects and the use of pasteurised milk.

(iv) Establishing a sampling and testing system to give the public confidence in home produced pasteurised milk.

(v) Licencing producer/retailers and milk collectors. Standards for premises and hygenic production could be imposed, reducting the contamination of retailed raw milk.

(vi) Promoting a schools milk programme giving free or subsidised milk to school children. Finance could come from levies on imported powder.

(vii) Making special loans to dairy farm co-operatives. These loans could be limited to those complying with fixed minimum standards of premises, equipment and hygiene.

(viii) Low interest loans to dairy farmers to enable them to modernise and develop. These loans could be limited to those complying with minimum standards of premises, equipment and hygiene.

(ix) Special aid to small farmers.

The establishment and control of items (i) to (v) above could be carried out through the medium of a Milk Marketing Board, responsible for the purchase of all home produced milk and possibly imported powder. This Board could have representation from the Government and the dairy manufacturers as well as the farmers.

It is recommended that a study be carried out to give guidance on the form and establishment of a Milk Marketing Board.

APPENDIX I THE EXISTING SITUATION

A. THE FARMS

(i) Mount Lebanon

These farms were visited on Mount Lebanon as being typical of the district. With each of these farms there was only a very small area of land and few farms in the district exceed 5 hectares. The crops were principally fruit and market garden vegetables and very little fodder was grown in the area. The land is mostly terraced due to the steep slopes and is, therefore, unsuitable for mechanised fodder crops.

These farms had dairy herds of 92 (32 in milk), 32 (18 in milk) and 18 (8 in milk) respectively.

Two of them had concrete bunker silos and purchased green fodder to fill them. Two of the three farms fed substantial quantities of chopped straw (tibin) in addition to concentrates.

The milk yields were excellent in one herd, quite good in another but disappointing in the third where the cows were of local origin as opposed to imported Dutch Friesians. It was general practice to milk the cows three times a day.

Accommodation for the cattle was in cowsheds, two of which were poor by British standards, and the third was still being built. Two farms had open yards as well as the cowsheds.

Facilities for cooling milk were available on only one of the farms, this consisting of a chilled water churn cooler stand in a room with direct connection to the cowsheds.

(ii) North Lebanon

Three farms to the north of Tripoli were visited as being typical of the area.

The first farm was about 3 hectares used principally for citrus and other fruit and vegetables. There were extensive buildings used for fattening cattle tied as in cowsheds. All feed for the cattle was purchased, this consisting mainly of tibin and concentrates, with small quantities of alfalfa. The cattle looked well.

The water supply was from a spring.

The other two farms were small, but the land was typical of the area. Potatoes and wheat were grown and there was some ditch irrigation. The land was flat and readily cultivable.

Irrigated land in this area often carried two crops in a year. On rain fed land there is some difficulty in maintaining perennial crops through the dry season and this limits the production and development of fodder crops such as grass/clover leys and alfalfa. Though the farms visited were small (below 5 hectares) there are a fair number of large farms(in excess of 100 hectares) in this area, mainly of rain fed land, but with a substantial possibility of irrigation from wells.

(iii) The Bekaa Valley

Nine farms were visited in the Bekaa Valley varying in size from 3 hectares to 225 hectares.

a) The Convent De Tennayel

This farm has a dairy herd of 60 cows in milk mainly of Dutch Friesian origin and was of particular interest because of the fodder trials being carried out.

A mixture of ryegrass and red clover was being paddock grazed 2.3 hectares in 23 plots of 1 donum each, provided grazing for 13 cows throughout the 8 months grazing season with some surplus, at the time of peak growth, being made into hay. Production reached 120 tons of green fodder per hectare with 10 grazings (or cuts). The crop was flood irrigated every 10-14 days. Water is obtained from springs.

The other 47 cows and all the followers were yarded and fed on silage and concentrates. There were cowsheds for 69, used for milking and winter housing.

Fresh milk, milk products and vegetables are retailed from this farm, many of the customers coming from Beirut. Wheat and barley were also successfully grown.

b) Government Experimental Farm, Tennayel

In 1968-1969 this farm of 3 hectares was used for experimental trials of ryegrass and clover for fodder production.(See working paper SR/69/B611 by Dr. Abdel-Wahab A. El-Moursi). The results of these trials indicates that a mixture of tetraploid Italian ryegrass and red clover gave a higher production than pure stands or mixtures using diploid ryegrass, and achieved a dry matter yield of 20 tons per hectare.

c) Anjar Settlement

Anjar has a population of between 4,000 and 5,000. The settlement area is about 12 square kilometres divided into some 1,600 plots, each of 7 donums (0.7 hectares), half of which were irrigated. Each farm consisted of 2 plots, one irrigated and one dry, mostly used for cash cropping. The degree to

which the individual farms have developed varies considerably. One farmer had 100 cattle (40 cows in milk) of Dutch origin. He purchases fodder which is chopped by a stationary chopper owned by the Howard Karagheusian Foundation. The Foundation also operates the local milk collection centre. The Foundation itself was growing a small plot of alfalfa as a demonstration.

d) Other farms visited in the Bekaa Valley, including the Government Experimental Farm at Turbol and the American University Farm near Baalbeck, were of considerably larger size varying from 30 to 220 hectares carrying herds of from 70 to 160 cattle with from 30 to 60 cows in milk. All these farms grow some fodder but two of them bought substantial quantities. Other crops grown included apples, onions, other vegetables, sugar beet, wheat and barley . One farm produced grapes and ground nuts, but not very successfully.

Almost all the land visited was irrigated, usually by flooding but in some cases by sprinkler. The sources of water varied between river, spring and wells of up to 300 m. pumping depth.

(iv) South Lebanon

Eight farms were visited south of Beirut. Four of these were in the village of Baasir which is estimated to have over 400 cows.

Individual farms seen in the village had from 3 to 18 cows in milk. None of them had any land for growing fodder and the cows were housed all year round. Tibin (chopped wheat straw) was extensively used for fodder and milk was sold to collectors. The cows varied from good quality imported Friesians down to the poorer type of local cattle. One farmer had just paid LL 1,500 for an in-calf heifer of local breed.

One farm visited near Sidon of 16 hectares had carried a herd of 250 cows in 1967 but the herd was sold soon after due termination of a milk contract which resulted in uncertainty of milk prices thereafter. It was stated that the farm had shown good profits during the period of a contract milk price of 40 pi per litre.

This farm had grown some fodder on rain fed land. Land on the plateau between the coastal plain and the mountains could now be irrigated and was being planted with citrus fruits.

Other dairy farms in the area grew some fodder, usually maize, but also bought fodder due to the fact that a better return could be obtained from growing citrus fruits. This is particularly true of the farms on the coastal plain. These farms had reasonably high yielding cows, mostly of Dutch origin.

(v) General Comments

Many cows were hand milked, only the larger farms having milking machines. Very few farms had facilities for cooling milk or a separate room for milk awaiting collection, most farmers tipping the milk into churns in the cowshed.

Most of the cowsheds were of poor construction, low-roofed and generally unsatisfactory for housing the herd and for milk production.

Management of the farms was not good and often non-existent. Milk yields were extremely variable, the best being very high (from imported breeds) and the majority being low as a result of poor quality cows and poor feeding.

These factors combined to result in unhygenic production of milk and uneconomic methods. One of the principal underlying factors giving rise to these circumstances must be the uncertainty of a guaranteed market at an acceptable price.

The farms fell into two broad categories, those with virtually no land and those with sufficient suitable land to produce at least a substantial part of the feed for the livestock.

Farms that purchase all feed requirements for the Livestock particularly fodder, must inevitably make less profit (or a greater loss) from dairy farming than those who provide cheaper feed by growing it themselves, since those selling feed or fodder expect to make a profit in selling it as a cash crop.

This puts dairy farming in certain areas at a disadvantage as far as large scale milk production in concerned.

Many of these farms with little or no land can only make a profit from high yielding cash crops, the sale of high quality surplus breeding stock or the sale of high price milk to a local specialist market.

B. MILK MARKETING AND DAIRY PROCESSING

(i) Dairies in Beirut

Visits were made to the three principal dairies in Beirut. Two of them were modern plants in reasonably good condition and the third was endeavouring to process milk under difficult conditions in an older building with out of date equipment.

From details produced during the visits, the total daily sales of pasteurised or other heat - treated milk in Beirut amounts to only 5,000 litres or approximately one litre to every two hundred persons in the Greater Beirut area.

There was no evidence of powdered milk being reconstituted and sold as liquid milk, indeed the daily intake of raw milk from farms was, in each case, in excess of that of liquid milk sales and there can, therefore, be little point in reconstituting powder for this purpose. The total raw milk daily intake of these dairies amounted to between 10.5 and 13.5 tons.

However, the flavour of much of the treated liquid milk was imperfect, probably as a result of imprecise operation of some of the equipment - a highly technical job requiring considerable experience to obtain perfect results.

Both dairies producing other milk products, such as lebne, leban and ice cream, stated they used considerable quantities of powdered milk in these.

Each of the three dairies stated that they carried out tests on incoming raw milk and on the final products but the laboratories available were limited in their facilities.

There was no evidence of official government testing of milk products or even the checking of the records of tests carried out by the dairies themselves. Whilst there is no reason to believe that any of the milk or milk products leaving these dairies is in any way contaminated, there is equally no positive proof of the

quality in the form of certified tests, batch by batch, as would normally be required in countries where modern dairies are operating.

The dairies purchase milk at 40 pi per litre at the factory and it retails at 75 or 80 pi mostly at 3% butterfat, price depending on method of processing and packaging, and the retailer.

(ii) Collection Centres

One collection centre which was in operation in the Bekaa Valley was visited. It is operated by the non-profit making Haward Karagheusion Foundation, paying 35 pi per litre and receiving 40 pi per litre delivered to Beirut. It has facilities for cooling all the milk it handles. In addition to acting as a milk collecting centre, it mixes concentrate feeds for the farms it services, and provides some advice.

There are government proposals to provide collecting centres elsewhere in Lebanon in order to improve the marketing facilities for dairy farmers. One was visited in North Lebanon, but like those in other parts of the country, it was not yet in operation.

(iii) Milk Collectors

Much of the milk in Lebanon is marketed by collectors. They purchase and collect milk from the farms and sell it in towns and villages, door to door, direct from the churns. It is clearly apparent from the low sales of pasteurised milk in Beirut, that most of the milk sold there is raw milk, usually not even cooled, and sold by collectors. Even if the housewife boils the milk, this must still constitute a substantial health hazard.

Milk sold in this manner can easily be watered down or have much of the cream removed.

Collectors pay prices varying from 25 pi per litre to 40 pi per litre and retail it for about 60/65 pi per li.

(iv) Farmer Retailers

Some farmers retail milk themselves direct and many of the small one or two cow farmers sell milk to their neighbours. The milk is seldom cooled and usually retails at 60/65 pi per litre.

APPENDIX II THE CLIMATE

The climate of Lebanon is typical "Meditarranean" dominated by the characteristics of principally West winds, influence of the sea and dry summers.

There are local variations in the climate due to the topography dividing the country into three regions, the coastal plain, the two mountain ranges roughly parallel to the coast, the valley between the mountains.

On the coast (Beirut), mean temperatures vary between summer maximum 33.8°C (93°F), minimum 22.8°C (73°F), minimum 7°C (45°F) with an absolute summer maximum of 23.2°C (110°F) and winter minimum 0°C (32°F).

At the Cedres weather station the mean summer maximum is 27.3°C (82°F) and mean winter minimum - 10.4°C (13.5°F) with an absolute maxinum of 31.5°C (89°F) and absolute minimum of - 16.2°C (3°F).

In the Bekaa Valley the mean temperatures vary between summer maximum 37.4°C (99°F) minimum 10°C (50°F) to winter maximum (January coldest month) 5.2°C (41°F) minimum- 5.3°C (22°F) with an absolute summer maximum of 41.8°C (107°F) and an absolute winter minimum- 17.6°C (0°F).

Local conditions can be affected by the hot winds of sub-tropical desert air called "Kansin", lasting about two days, principally in the spring and autumn.

Rainfall on the coastal plain and the adjoining mountains is very similar amounting to an average of 893 mm. (78.6 days) mostly from October to May inclusive, June to September being virtually dry.

The Bekaa Valley receives less rain - some 621 mm. (65.6 days) but has a similar dry period. Though the rainfall is substantial it is limited to comparatively few days over an eight month period. In London, for instance, 700 mm. falls in 170 days spread over the whole year.

The contrast in climate between the coast and the interior is more acute in the central part of the country than in the North or the South.

On the coast the humidity seldom varies much above or below 70%, except on days of the Kamsin (sub-tropical desert winds), and the day and night differences are not great.

In the Bekaa the summer humidity is generally low whilst the winter humidity is quite high, and the temperature differences between day and night are considerably greater than on the coast.

CLIMATE

Figures for the station at the American University, Beirut.

Lat: 33° 54' Long: 35° 27' Alt: 33m

Months	Temperature: Mean over 37 years 1930 - 67	Temperature: Average minimum over 47 years 1920-67	Temperature: Average maximum over 47 years 1920-67	Precipitation: Average over 90 years 1977-1967	Precipitation: Average No. of days over 53 years 1914- 67	Relative humidity	Absolute maximum temp	Absolute minimum temp
January	13.9	7.0	20.9	191.3	15.7	-	24.8	0.0
February	14.1	6.6	22.1	157.7	13.9	-	27.4	1.0
March	15.8	8.4	26.2	96.1	10.8	-	33.5	2.3
April	18.9	10.9	30.2	51.1	6.2	-	38.5	7.4
May	22.3	15.0	32.7	17.3	3.1	-	43.2	9.0
June	25.6	18.8	32.9	3.3	0.8	-	40.7	12.8
July	27.7	21.7	33.3	0.5	0.2	-	36.6	20.1
August	28.4	22.8	33.8	0.4	0.2	-	37.1	20.8
September	27.0	20.9	33.1	6.7	1.1	-	36.8	17.8
October	23.9	17.1	31.4	47.2	3.8	-	38.1	11.7
November	19.6	12.3	27.3	133.4	9.4	-	31.7	6.4
December	16.0	9.0	23.2	188.0	13.4	-	29.9	4.2
Annual Mean	21.1			893	78.6			

AIR TEMPERATURE in °C.

Monthly means from 1958 - 1967
American University-Beirut

Months	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	13.8	14.8	14.8	14.6	[illegible].0	16.0	12.6	14.0	14.9	13.3
February	15.0	10.8	15.7	13.3	14.4	16.5	13.9	14.9	15.1	12.7
March	17.4	15.1	16.5	15.6	16.3	15.4	16.5	16.9	16.0	14.2
April	19.9	19.2	19.2	19.2	18.3	18.7	18.3	18.4	19.7	17.8
May	22.4	22.6	23.8	22.6	22.1	21.0	20.0	21.1	21.9	21.4
June	25.6	25.1	25.8	25.6	25.4	26.1	24.6	25.6	25.7	25.1
July	26.7	27.1	27.8	27.4	27.6	27.6	26.7	27.1	27.9	27.5
August	28.4	27.7	27.9	28.3	28.8	28.9	27.3	27.8	28.0	28.4
September	26.7	25.9	26.3	26.0	27.3	27.7	25.7	26.4	26.4	26.5
October	22.8	22.1	24.4	24.1	24.2	23.9	23.7	21.8	23.9	23.5
November	19.7	19.0	20.5	19.2	22.8	20.0	19.4	18.9	22.1	18.7
December	16.7	16.5	18.6	16.7	17.1	15.5	16.4	16.1	16.1	15.6
Annual Mean	21.3	20.5	21.8	21.1	21.6	21.4	20.4	20.8	21.4	20.4

RELATIVE HUMIDITY PER CENT
Monthly means from 1958-1967

International Airport-Beirut

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	68	65	67	63	69	70	-	-	69	69
February	65	56	69	63	62	69	-	-	72	72
March	64	64	64	59	61	69	-	-	68	72
April	62	65	65	58	70	71	-	-	66	72
May	72	71	58	65	72	72	-	-	76	75
June	68	73	69	67	71	77	-	-	74	68
July	71	75	70	71	75	75	-	-	75	73
August	71	70	68	70	78	76	-	-	78	71
September	65	68	65	60	77	70	-	-	76	67
October	67	64	56	62	76	79	-	-	74	72
November	59	63	65	61	60	69	-	-	66	69
December	65	62	65	61	72	64	-	-	69	74
Annual Mean	66	66	65	64	70	72	-	-	72	71

NUMBER OF DAYS OF PRECIPITATION

Monthly from 1958 - 1967

American University - Beirut

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	20	13	11	18	19	16	12	24	16	17
February	5	15	7	20	13	16	20	14	11	19
March	8	13	13	11	6	14	13	8	12	16
April	2	6	8	5	6	10	4	10	3	10
May	1	3	2	2	3	4	5	3	3	4
June	2	1	1	0	0	1	0	1	0	0
July	0	1	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	1	0	0
September	2	6	3	5	0	4	2	1	3	3
October	5	9	2	4	7	7	0	12	5	7
November	3	9	9	8	2	6	10	4	4	11
December	11	11	9	12	15	12	10	13	14	18
Annual (1)	59	87	65	91	71	90	76	83	71	105
Year to (2) 31st August	72	73	77	79	82	85	83	74	75	95

PRECIPITATION IN MILLIMETRES
Monthly from 1958 - 1967

American University - Beirut

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	353.8	310.2	152.1	163.4	177.9	259.9	96.6	151.8	185.8	229.0
February	24.4	81.0	29.1	268.2	192.1	152.7	319.9	110.6	120.6	191.9
March	38.5	50.2	118.4	93.0	13.4	69.9	91.1	102.9	106.6	274.2
April	18.4	36.1	36.4	2.9	57.8	100.4	21.1	84.2	0.7	27.3
May	1.6	16.7	2.1	15.6	7.4	70.5	53.7	19.1	30.0	14.9
June	3.1	4.9	0.4	0	0	0.2	0	3.8	0	0
July	0	1.9	0	0	0	0.2	0	0	0	0
August	0	0	0	0	0	0	0	1.5	0	0
September	14.5	22.9	20.3	7.2	0	22.1	2.1	0	14.3	23.5
October	47.6	55.6	28.6	5.8	137.9	94.6	0	151.8	34.0	101.1
November	22.4	115.7	203.3	77.2	4.5	125.7	232.3	36.9	79.8	213.6
December	63.5	95.3	51.0	227.2	285.5	148.8	100.7	245.7	225.1	188.1
Annual (1)	587.8	790.5	649.8	860.5	876.5	1030.8	917.5	908.3	826.9	1263.6
Year to (2) August 31st	857.8	649.0	630.0	848.4	766.0	1081.5	959.6	809.1	878.1	1120.5

FIGURES FOR THE STATION AT CEDRES

Lat: 35° 15' N Long: 36° 05'E Alt: 1915m

Month	Temperature: Mean over 30 years 1937-67	Temperature: Average minimum over 30 years 1937-67	Temperature: Average maximum over 30 years 1937-67	Precipitation: Average over 30 years 1937-67	Average No. of days over 18 years	Relative humidity	Absolute max. temp.	Absolute mini. temp.
January	0.2	-10.3	9.9	223	14	73	15.5	-15.6
February	0.2	-10.4	10.0	207	13	70	16.6	-16.2
March	2.6	- 9.2	13.4	146	12	67	21.0	-14.0
April	6.7	- 4.6	18.8	67	8	60	22.1	-10.4
May	12.2	0.3	23.1	30	4	60	26.2	- 3.0
June	15.0	4.8	24.5	5	0.4	56	26.6	2.0
July	17.4	7.2	26.6	0.5	0.1	52	31.5	5.3
August	18.1	8.0	27.3	0.5	0.1	48	30.5	5.4
September	15.6	5.5	24.8	5	1	56	26.6	2.0
October	11.7	1.8	22.1	43	5	59	25.0	- 2.8
November	7.2	- 3.3	17.7	102	8	66	20.8	- 9.0
December	3.2	- 6.6	13.6	167	13	70	18.8	-11.2
Annual Mean	9.2			893	78.6	61		

AIR TEMPERATURE IN °C

Monthly means from 1958-1967

Station at Cedres

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	0.5	1.2	1.2	0.3	1.8	3.6	-4.6	-0.7	1.5	-1.4
February	0.4	-5.2	2.4	-0.9	-0.1	1.9	-0.4	0.1	1.5	-2.4
March	4.0	0.8	2.8	0.7	7.0	1.1	4.3	3.9	2.9	-0.6
April	9.0	8.4	6.8	7.4	6.2	6.9	4.9	5.5	8.0	3.7
May	10.9	11.3	14.0	13.4	12.5	9.4	9.6	11.1	10.5	9.0
June	14.2	15.0	14.7	15.9	17.1	15.7	14.8	16.4	15.5	12.7
July	16.8	15.3	17.6	17.8	18.6	16.7	17.4	17.8	16.8	15.8
August	18.3	15.9	17.5	18.7	20.6	18.2	16.5	20.0	18.5	15.7
September	14.4	-	15.6	13.2	17.8	16.4	15.0	17.0	14.7	13.6
October	11.0	-	13.2	11.7	12.3	12.1	12.9	8.5	11.0	10.8
November	7.0	-	7.5	8.0	10.0	7.2	7.0	6.0	9.9	4.4
December	3.8	4.2	4.5	2.7	3.3	2.0	2.2	2.8	2.1	1.5
Annual Mean	9.2	-	10.0	9.1	10.6	9.3	8.3	9.0	9.4	6.9

RELATIVE HUMIDITY PER CENT

Monthly means from 1958-1967

Station at Cedres

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	78	76	78	-	-	-	73	75	75	68
February	62	74	80	-	-	-	83	67	72	77
March	62	72	81	-	-	-	71	59	62	72
April	54	52	78	-	-	-	66	67	57	67
May	61	63	73	-	-	-	59	59	62	64
June	63	58	72	-	-	-	59	56	52	55
July	55	61	70	-	-	-	51	49	54	54
August	44	54	63	-	-	-	53	44	54	59
September	62	-	68	-	-	-	56	51	65	63
October	63	-	69	-	-	66	44	73	64	74
November	77	-	-	-	-	66	63	67	60	77
December	68	81	79	-	-	71	66	73	71	74
Annual Mean	62	-	-	-	-	-	62	62	62	67

NUMBER OF DAYS OF PRECIPITATION

Monthly from 1958 - 1967

Station at Cedres

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	18	12	12	15	14	14	13	21	13	16
February	6	15	7	21	14	12	20	13	12	21
March	10	12	13	9	4	16	18	12	15	18
April	1	3	5	9	12	9	7	14	2	10
May	5	3	2	1	3	5	5	1	1	10
June	1	0	0	1	0	1	0	2	0	0
July	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	1	0	0	0	0	0
September	2	5	1	0	0	2	0	0	6	1
October	4	3	3	3	9	9	0	17	8	9
November	5	7	8	9	5	7	10	5	6	14
December	10	9	8	15	14	11	10	14	15	20
Annual (1)	62	69	59	83	75	86	81	99	78	119
Year to(2) 31st August	71	66	63	76	74	85	92	83	79	110

PRECIPITATION IN MILLIMETRES

Monthly from 1958 - 1967

Station at Cedres

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	147	161	111	176	73	205	106	217	154	287
February	60	285	50	155	186	119	200	184	112	175
March	56	120	185	113	13	90	156	95	114	266
April	13	70	27	44	46	130	39	111	7	74
May	42	32	2	25	6	39	29	6	4	72
June	6	0	0	2	0	2	0	12	0	0
July	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	1	0	0	0	0	0
September	3	25	1	0	0	2	0	0	33	5
October	16	20	13	19	32	86	0	138	54	95
November	19	100	109	259	12	77	127	64	25	234
December	106	23	70	248	207	170	53	152	273	157
Annual (1)	836	836	568	1040	577	919	1021	979	776	1365
Year to(2) 31st August	642	812	543	707	851	836	865	803	745	1259

FIGURES FOR THE STATION AT RAYAK

Lat: 33° 52' N Long: 36°00'E Alt: 923m.

Months	Temperature: Mean over 37 years 1931-67	Average minimum over 44 years 1923-67	Average maximum over 37 years 1930-67	Precipitation: Average over 37 years 1930-67	Average No. of days over 37 years 1930-67	Relative humidity over 22 years 1946-67	Absolute maximum temp.	Absolute minimum temp.
January	5.2	-5.3	16.7	155	13	79	22.5	-17.6
February	6.2	-4.3	18.6	129	12	77	25.4	-11.9
March	8.8	-2.9	23.7	82	9	70	30.0	- 7.2
April	12.9	-0.3	28.0	34	6	61	37.0	- 3.0
May	17.3	2.9	32.5	16	3	57	38.5	- 0.6
June	21.4	6.4	36.1	0.9	0.5	49	39.0	2.6
July	23.9	9.7	36.8	0.2	0.1	45	41.8	6.8
August	24.2	10.0	37.4	0.2	0.1	47	41.3	6.8
September	21.4	7.8	35.0	0.9	0.9	53	38.0	4.5
October	17.4	4.1	31.5	21	3	55	35.3	0.0
November	12.0	-0.4	25.6	64	7	66	29.9	- 6.8
December	6.9	-3.3	19.8	118	11	78	24.2	-12.7
Annual Mean	14.8			621.2	65.6	61		

AIR TEMPERATURE IN °C

Monthly means from 1958 - 1967

Station at Rayak

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	5.3	6.0	6.8	5.8	6.5	7.9	2.0	5.5	7.0	4.3
February	7.3	1.5	8.1	5.3	5.7	8.7	5.6	7.1	7.5	4.1
March	10.5	7.7	9.7	7.5	11.7	8.3	10.8	10.5	9.2	6.5
April	14.7	14.2	13.0	13.2	12.3	13.2	11.8	12.1	13.4	11.4
May	17.7	17.8	20.4	18.6	18.3	15.5	15.7	16.8	16.7	15.9
June	21.6	21.7	21.8	22.5	23.0	22.1	21.2	23.3	21.6	18.5
July	24.0	22.5	24.3	24.8	24.1	24.2	23.7	24.4	23.4	21.5
August	25.1	22.8	24.4	24.8	25.7	25.0	23.4	25.2	24.1	21.2
September	20.9	19.6	21.8	19.2	23.1	22.8	20.6	22.2	20.7	19.0
October	16.6	16.0	19.2	16.9	18.3	18.5	17.6	14.9	16.6	16.4
November	11.8	11.4	12.8	11.0	14.6	12.7	12.0	11.0	14.0	10.0
December	8.4	8.0	9.6	5.7	7.7	6.0	6.6	7.9	7.6	7.4
Annual Mean	15.3	14.1	16.0	14.6	15.9	15.4	14.2	15.1	15.1	13.0

RELATIVE HUMIDITY PER CENT

Monthly means from 1958 - 1967

Station at Rayak

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	89	84	83	89	85	81	75	83	73	75
February	79	85	77	86	83	80	79	75	67	77
March	73	86	76	66	68	75	70	65	59	70
April	62	64	73	65	73	71	61	67	48	59
May	63	66	64	54	57	75	79	55	41	60
June	58	48	69	55	44	58	54	53	35	42
July	52	55	58	40	53	49	58	47	38	37
August	48	70	51	46	55	46	53	58	39	44
September	61	70	63	61	56	53	58	55	50	50
October	66	68	49	59	70	55	40	71	55	63
November	66	74	79	74	53	66	62	73	54	73
December	83	77	85	83	81	74	76	77	78	77
Annual Mean	67	71	69	65	65	65	62	65	53	61

NUMBER OF DAYS OF PRECIPITATION

Monthly from 1958 - 1967

Station at Rayak

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	22	10	10	17	15	12	14	16	5	10
February	7	6	4	22	14	8	18	12	11	17
March	4	8	9	13	4	12	12	10	17	15
April	1	5	5	7	8	10	5	12	3	9
May	2	5	1	1	3	4	3	1	2	6
June	0	0	0	0	0	1	0	1	0	0
July	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0
September	0	0	1	1	0	0	0	1	0	0
October	2	4	1	5	6	8	0	8	7	9
November	2	4	7	8	0	3	10	5	6	9
December	6	9	7	17	15	12	7	8	13	18
Annual (1)	46	51	45	91	65	70	69	74	64	93
Year to(2) 31st August	61	44	46	76	75	68	75	69	60	83

PRECIPITATION IN MILLIMETRES

Monthly from 1958 - 1967

Station at Rayak

Month	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
January	164.0	187.9	8[illegible]9	146.8	1[illegible]8	166.3	85.5	136.4	95.2	168.1
February	18.6	88.0	32.7	83.3	14[illegible]3	139.1	206.4	150.6	81.6	122.8
March	33.5	45.1	72.1	72.5	20.2	86.7	88.3	58.8	124.1	212.7
April	10.5	16.3	31.6	9.2	24.7	74.0	31.1	70.6	3.8	30.0
May	6.0	30.3	0.7	1.7	5.7	5.2	23.3	5.1	5.6	45.5
June	0	0	0	0	0	7.6	0	1.0	0	0
July	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0
September	0	0	0.3	5.8	0	0	0	1.5	0	0
October	11.1	6.7	6.8	20.3	24.3	54.8	0	87.8	24.3	87.5
November	1.7	27.5	55.8	52.1	0	45.0	162.2	31.5	10.3	65.9
December	75.2	43.4	31.3	147.0	198.3	76.0	35.2	201.0	190.7	116.7
Annual (1)	320.6	445.2	316.2	539.6	529.3	654.9	632.0	744.3	535.6	849.2
Year to(2) 31 August	425.7	455.6	299.6	407.7	531.9	701.5	610.6	619.9	632.1	804.4

APPENDIX III THE SOIL

The geology of the Lebanon is fairly simple being of volcanic origin.

The rock structure is mainly limestone and the soil is mainly sedimentary.

The limestone rock formation, which covers about two-thirds of the country, results in the surface soils tending to be dry (arid) with vast hydrological reserves below.

The Bekaa Valley is the northernmost part of the Great Rift Valley which runs south through the Red Sea to the center of Africa.

The soil in the Lebanon is in the main very fertile with the exception of an area to the norths of Baalbeck and certain packets on the coastal plain.

It varies but in the main is a red medium heavy loam of calcareous origin and, provided water is available, will grow vigorous vegetation of a very wide range; near the coast tropical plants flourish.

There are a few pockets of high salinity, especially near the coast, but only rarely and in small areas is the salinity such as to affect plant growth.

APPENDIX IV WATER AND IRRIGATION

Ten principal rivers run from the coastal mountains to the sea and provide substantial quantities of water for irrigation on the narrow coastal plain. There is a large new irrigation scheme for the land near the coast in the south, from the control of the Litani river.

There are numerous springs on the mountains and a large number in the Bekaa Valley and there is substantial irrigation in the Bekaa Valley from the Litani and Assi rivers.

The Assi river runs north along the Bekaa Valley for 46 km through Lebanon before entering Syria. Its source is the most regular in the country producing between 7 and 16 cubic metres persecond. The mean annual production is 458 million cubic metres.

The Litani is the longest river in the Lebanon, 160 km, rising in the Bekaa at about 1000 metres altitude and flowing south in the middle of the plain which it leaves at Qaraoun, flowing on through gorges eventually turning west to enter the sea north of Tyre under the name of Qasmia. Its mean annual flow at Qaraoun is estimated at 410 million cubic metres.

In parts of the Bekaa Valley wells are used for irrigation and these are up to 600 m. deep though the pumping level is usually substantially above this (300m).

In 1967 only some 16-17% of the cultivated land was irrigated, though much of the remainder could be irrigated from wells or other sources.

Most of the irrigation practised is dry flooding from ditches, though there is some sprinkler irrigation for small areas.

APPENDIX V FODDER CROPS

At present only a very limited quantity of fodder for cattle is produced in the Lebanon. Negligible quantities are produced in the mountain areas due to the terrain and it would be impossible to carry out extensive mechanised fodder cropping in such areas. Consequently, any fodder for livestock in these areas must come from other areas or be imported.

In South Lebanon irrigated land is utilised mainly for citrus fruit production and vegetables. This occupies most of the coastal plain and is now extending back to the foothills. There is, therefore, little suitable land available for fodder crops. Fodder grown in this area must be on an intensive irrigated system to be sufficiently profitable to compete with other crops.

In North Lebanon there are substantial areas suitable for fodder crops. Much of this land is at present rainfed and land which is irrigated often carries two crops in a year due to the temperate winter. Since cultivable land is in short supply in Lebanon it is considered that, with the development of further irrigation in this area, intensive fodder production can compete with other crops on the irrigated land and, even where they are no more profitable or slightly less profitable, the introduction of them to a rotation will result in improved production of other crops, and in this way prove beneficial in increasing overall production and profitability. This will result in increased humus in the soil which, as well as improving the soil structure, increases its water retention capability.

In the Bekaa Valley there is some fodder crop production. It is evident that this can be profitable if it is intensive. Because of the colder winter only one crop per season is usual (as opposed to double cropping in the North) and, therefore, fodder crops can be more competitive. It has been shown that a production of 120-150 tons per hectare of green fodder can be obtained from suitable mixtures of rye-grass and clover. In this area hay could be produced on contract for other areas of Lebanon and used to replace the imported straw(tibin), having a much higher feeding value at only a slightly higher price. This would result also in a saving of imported concentrates. Here again the introduction of substantial fodder cropping into a rotation would in the longer term result in improved yields of other crops.

Little use is made of silage though a few silos of recent construction were seen. The introduction of a silage permits a wider choice of fodder crops and can assist in the reduction of costs of milk production. However, to transport green fodder long distance (e.g. Bekaa to Mount Lebanon) is expensive and must increase production costs.

Conservation of fodder in the form of hay wafers should be investigated since this would reduce transport costs below that of hay.

Tetraploid ryegrass and red clover

This mixture grows well under irrigated conditions giving up to 10 cuts per year. Production of green fodder has been shown to be up to 120-150 tons per hectare in the Bekaa Valley when irrigated (approximately 90 tons @ 60% moisture content). Production of 60 tons per hectare @ 60% moisture content should result in an on the

farm costing of 2.1 pi per kg (£ 2.86 per ton). If this is fed on the farm the combined profit from producing and feeding it will compare favourably with other crops.

However, if being grown on contract for sale, it must compete directly with other crops and this would result in a contract price of about 4.6 pi per kg (£ 6.22 per ton)@ 60% moisture. This is equivalent to 11.6 pi per kg (£ 15.7 per ton) for hay as compared with tibin at about 10 pi per kg (£ 13.5 per ton).

Alfalfa

Alfalfa yields are considered to be less than of a tetraploid ryegrass/clover mixture whilst the feeding value is approximately the same. Nevertheless, alfalfa grows well under irrigation and it may well be that under equal management the right varieties would produce equal yields.

Maize

Maize grows well in all areas of Lebanon where irrigation is available. In the Bekaa a yeild of some 60 tons per hectare at 60% moisture can be expected. Its feeding value is rather less than alfalfa or tetraploid ryegrass/clover, being lower in protein, and there is a lesser opportunity for even greater yields. However, it must be considered a valuable fodder crop, particularly for irrigated land in the North where its short growing season permits double cropping in suitable climatic conditions.

Vetch and Barley

Yields of some 50 tons per hectare have been obtained. This could be a particularly useful fodder crop for dry land (rain fed) areas in the Bekaa and the North, and yields of 30 tons per hectare could be expected.

Sorghum

Sorghum is particularly suited to dry climates with a mild winter. Good yields have been reported in Lebanon but no positive data was available. Its feeding value is less than alfalfa being lower in protein, but yields may well be higher, thus justifying its use. Sudan grass is related to it and can be crossbred with it. Sudan grass produces particularly high yields in South Africa (125 - 150 tons per hectare).

Drumhead Cabbage

Drumhead cabbage can provide good fodder for cattle, especially relative to milk production. If irrigated, yields can be as high as 100 tons per hectare, but it has a higher moisture content (89%) and mechanised harvesting is not possible. It could, however, prove a useful crop for the small dairy farmer.

YIELDS IN TONS PER HECTARE 1958 - 1967

Crop	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
CEREALS										
Wheat	0.7	0.9	0.6	1.0	0.9	1.1	0.9	0.7	1.0	1.0
Sorghum	1.0	1.1	1.2	1.1	1.1	1.2	1.2	1.6	0.9	0.9
Maize	1.8	1.1	1.5	2.1	2.1	2.0	2.0	1.9	1.8	1.8
Barley	1.0	1.4	0.6	0.9	1.0	1.0	1.0	0.9	0.9	1.2
LEGUMES										
Alfalfa	21.0	19.2	15.0	18.3	24.0	30.0	30.0	60.0	60.0	59.3
Vetches	0.9	0.8	0.7	0.6	0.7	1.0	1.0	0.9	0.6	0.9
TUBER and ROOT CROPS										
Potatoes	8.1	8.8	6.2	8.0	10.0	10.7	10.0	12.0	12.7	11.8
Onions	9.0	13.8	11.0	20.8	18.6	13.2	24.0	11.5	12.4	14.6
INDUSTRIAL CROPS										
Sugar Cane	33.3	20.0	33.8	40.0	40.0	40.0	40.0	33.6	33.5	25.3
Sugar Beet	14.7	13.9	21.2	27.4	30.0	35.0	42.8	49.2	50.0	52.4
Tobacco	0.8	0.9	0.8	1.0	1.0	0.9	0.9	0.9	0.9	0.9
Peanuts	1.4	1.4	1.3	1.3	1.4	1.7	1.7	2.2	1.6	1.3
Sesame	1.0	1.0	1.0	1.0	1.1	0.9	0.9	1.0	1.0	0.8
Aniseed	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9
Others	-	-	-	-	-	-	-	-	-	-

YIELDS IN TONS PER HECTARE 1958 - 1967 (Inclusive)

Crop	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
FRUIT										
Citrus	16.5	20.0	18.9	23.6	23.5	23.3	21.0	19.0	20.3	23.17
Apples	4.6	6.8	5.3	7.5	7.1	6.5	10.9	10.5	9.5	15.8
Bananas	12.8	9.1	11.1	10.0	9.6	9.3	6.6	7.7	11.7	11.0
Grapes	3.6	3.7	2.9	3.7	3.5	3.6	4.2	3.5	5.1	5.9
Olives	2.0	0.8	1.1	2.4	1.7	2.2	1.1	1.7	1.1	3.0

CULTIVATED AREAS IN HECTARES FOR EACH TYPE OF CROP 1958 - 1967

Crop	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
CEREALS										
Wheat	68,000	72,200	65,000	68,800	68,600	55,000	70,000	76,400	68,079	66,5
Sorghum	3,500	3,000	2,000	1,500	1,200	800	1,200	1,400	1,456	1,2
Maize	8,000	11,000	6,500	6,000	7,000	6,000	5,500	4,900	4,753	2,9
Barley	19,000	18,000	18,000	12,800	13,500	10,000	15,000	13,500	14,136	13,3
Total	98,500	104,200	91,500	89,100	90,300	71,800	91,700	96,200	88,424	84,1
LEGUMES										
Alfalfa	100	120	120	120	125	200	200	260	252	2
Vetches	6,100	5,600	4,700	4,000	3,000	2,500	4,235	5,150	5,022	5,4
Total	15,600	15,730	13,735	11,880	8,995	8,670	12,680	14,315	17,652	13,7
TUBER and ROOT CROPS										
Potatoes	4,700	4,800	4,500	6,300	6,000	6,500	8,000	4,460	6,207	6,8
Onions	2,500	2,400	2,100	1,200	2,200	2,500	1,000	2,250	2,610	3,
Garlic	50	65	60	80	120	300	250	310	316	5
Total	7,250	7,265	6,660	7,580	8,320	9,300	9,250	7,020	9,133	10,4
INDUSTRIAL CROPS										
Sugar Cane	240	100	80	70	75	50	50	25	25	
Sugar Beet	550	900	850	800	1,000	870	1,800	1,500	2,000	2,1
Tobacco	3,990	4,000	4,010	4,010	4,200	4,658	6,750	6,550	6,603	6,7
Peanuts	1,440	1,250	650	1,500	2,500	3,000	3,000	2,400	2,520	2,5
Sesame	800	850	500	400	450	400	150	150	150	1
Aniseed	50	40	40	40	50	50	50	50	50	
Others										
Total	7,130	7,140	6,130	6,820	8,275	9,028	11,800	10,675	11,348	13,2

CULTIVATED AREAS IN HECTARES FOR EACH TYPE OF CROP 1958 - 1967 (Inclusive)

Crop	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
ROOT VEGETABLES	770	770	765	810	840	1,150	1,300	1,300	1,605	968
EDIBLE LEGUMES	2,700	2,650	2,200	2,100	2,300	2,100	2,325	2,348	2,382	2,704
VEGETABLES	8,260	8,320	7,745	8,005	9,725	12,325	13,615	14,325	14,137	12,574
FRUIT CROPS										
Citrus	7,950	8,000	8,200	8,480	8,500	9,000	10,016	12,200	12,300	11,028
Apples	9,115	9,500	10,000	11,275	11,300	11,500	11,438	10,960	10,960	10,850
Raisins	22,500	23,000	24,000	24,200	24,500	25,000	23,847	23,847	14,664	15,223
Olives	22,500	22,600	27,000	27,000	27,000	27,500	28,618	26,618	26,965	26,837
Others	14,685	15,015	15,500	16,055	17,510	16,250	12,260	11,397	10,332	10,390
Total	76,750	78,115	84,700	87,010	88,810	89,250	86,179	85,022	75,221	74,328

PRODUCTION IN TONS 1958 - 1967

Crop	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
CEREALS										
Wheat	48,000	67,200	40,000	68,500	75,200	60,000	59,500	55,000	69,992	67,690
Sorghum	3,500	3,200	2,300	1,600	1,300	960	1,450	2,240	1,412	1,180
Maize	14,000	12,000	13,000	12,500	15,000	12,000	11,000	9,065	8,841	5,185
Barley	18,500	25,000	11,000	12,000	13,100	10,000	15,000	12,600	12,723	15,746
LEGUMES										
Alfalfa	2,100	2,300	1,800	2,200	3,000	6,000	6,000	15,600	15,120	14,560
Vetches	4,800	4,250	3,300	2,800	2,200	2,400	4,050	4,350	3,040	5,132
TUBER AND ROOT CROPS										
Potatoes	38,000	42,000	28,000	50,000	60,000	70,000	80,000	53,640	79,080	80,945
Onions	36,000	33,000	23,000	25,000	41,000	33,000	24,000	25,875	32,364	43,978
INDUSTRIAL CROPS										
Sugar Cane	8,000	2,000	2,700	2,800	3,000	2,000	2,000	841	838	195
Sugar Beet	8,100	12,500	18,000	21,900	30,000	31,000	77,000	73,770	100,000	110,000
Tobacco	3,000	3,730	3,290	4,000	4,200	4,198	6,000	5,764	6,250	6,378
Peanuts	1,900	1,750	850	2,000	3,500	5,200	5,000	5,201	4,108	3,239
Sesame	800	850	500	400	500	360	140	150	150	109
Aniseed	50	40	40	40	50	50	50	50	50	27
Others										530

PRODUCTION IN TONS 1958 - 1967 (Inclusive)

Crop	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
ROOT VEGETABLES										
Carrots	5,500	5,800	7,000	7,000	9,000	6,000	5,500	5,700	12,000	12,488
Radishes	3,800	3,500	3,000	3,000	3,000	3,500	3,900	3,900	3,680	3,603
EDIBLE LEGUMES	15,600	16,300	14,000	15,000	16,500	9,500	10,600	15,300	13,142	16,708
VEGETABLES										
Water Melons	26,000	27,000	22,000	25,000	35,000	21,000	27,300	32,500	15,205	18,737
Courgettes					18,000	14,000	15,700	13,500	7,445	8,025
Cucumbers	18,000	21,000	23,000	20,000	25,000	20,000	18,900	16,500	20,556	21,904
Aubergines	14,000	13,500	12,000	13,000	14,000	27,000	29,000	25,000	25,108	19,848
Tomatoes	28,000	31,000	25,000	30,000	32,000	34,000	41,770	45,300	53,789	59,176
FRUIT CROPS										
Oranges	93,000	115,000	100,000	127,000	133,000	150,000	145,000	148,556	163,900	153,848
Lemons	30,000	35,000	40,000	57,000	55,000	60,000	65,000	69,000	68,900	56,910
Other Citrus	8,000	10,000	15,000	16,000	12,000	15,000	15,000	14,000	17,140	17,376
Apples	42,000	65,000	53,000	85,000	80,000	75,000	125,000	115,080	104,010	157,021
Pomegranates	14,000	14,000	12,000	13,000	10,000	8,000	1,500	1,400	1,214	4,562
Bananas	27,300	21,000	26,000	26,000	25,000	28,000	22,000	25,340	29,750	27,157
Grapes	80,000	85,000	70,000	90,000	85,000	90,000	100,000	83,800	75,988	80,321
Olives	44,000	18,000	30,000	65,000	16,000	60,000	30,000	49,000	29,376	67,773

COMPOSITION OF CROPS IN LEBANON

1964 - 1966

Crop	Calories	Protein gm.	Fat
Cereals	1,269	36.0	4.5
Potatoes	38	0.9	0.1
Sugar	350	-	-
Pulse crops and nuts	110	6,1	3.7
Vegetables	158	6.0	0.8
Fruit	196	3.6	2.2
Meat	143	11.8	10.2
Eggs	22	1.7	1.6
Fish	10	1.1	0.6
Milk	146	11.7	6.7
Fats and Oils	243	-	27.5
Total	2,685	78.9	57.9

* 1/3 animal protein, 2/3 vegetable protein

CONSUMPTION OF AGRICULTURAL PRODUCTS IN LEBANON

per head 1960 - 1966

	Consumption in kg. per person per annum						
Crop	1960	1961	1962	1963	1964	1965	1966
Cereals	87.6	111.7	132.5	120.4	120.7	130.6	133.2
Potatoes	13.1	21.3	19.6	22.5	24.2	12.7	23.3
Sugar(1)	23.3	22.6	30.6	21.6	27.7	33.0	40.7
Grasses	6.5	2.4	12.1	5.2	11.3	10.5	1.6
Nuts	2.8	4.0	2.9	5.3	2.6	2.2	3.1
Vegetables	92.8	94.9	105.1	96.7	108.6	105.0	113.9
Fruit	124.7	183.0	169.0	177.5	191.9	166.3	138.3
Meat	20.4	25.5	30.2	33.3	39.1	30.1	30.2
Eggs	2.4	3.1	3.2	2.6	3.7	5.2	5.6
Fish	2.9	3.2	3.6	3.2	3.0	2.9	2.6
Milk(2)	42.4	50.2	52.1	57.8	68.2	66.4	68.1
Cheese(3)	1.7	2.2	1.9	2.4	2.8	2.8	2.8
Fats and Oils	7.2	14.0	9.6	13.8	9.4	11.7	9.0

1) Equivalent in unrefined sugar
2) Fresh milk equivalent
3) Production of cheese locally is included in the milk figure

Note: The consumption figures show the actual quantities sold for consumption without taking account of the stocks in hand from one year to another.

APPENDIX VI THE MARKET

In 1967 the population of Lebanon is shown as 2,367.141 plus 486,014 foreign residents totalling 2,853,155(Ministry of Plan Statistics).

The minimum milk consumption, recommended by international organisations such as F.A.O., required from the nutritional point of view is 100 litres per capita per annum. This would amount to a total of 285,315 tons or some 780 tons per day. For Beirut and Mr. Lebanon with a population of about 1,000,000, it would amcunt to some 274 tons per day.

The statistics for 1967 show a population of 31,140 dairy cattle over 15 months old, which could be expected to produce less than 100,000 tons per annum (274 tons per day) under present conditions.

In the same year there were imports of powdered, condensed and evaporated milk, equivalent to some 45,000 tons of liquid milk. This gives an approximate consumption of some 16 litres per capita per annum. It is, therefore, in the national interest as regards nutrition to increase the present consumption of liquid milk by six times.

The present consumption of pasteurised liquid milk in the Beirut area is some 5 tons per day or one litre to every 200 persons (less than 2 litres per capita per annum). It must, therefore, be assumed that, even allowing for the use of powdered milk, substantial quantities of raw milk area being retailed in Beirut daily and this must constitute a substantial health bazard.

Present consumption is achieved in spite of the fact that the Beirut area is the only area where pasteurised milk is available, and even there the flavour is often not good.

It can be expected that, in a period of 10 years, if top quality liquid milk known to be safe was available, consumption would increase to some 150 litres per capita per annum (nearly ten times the present import figure). Many European countries have a consumption of over 200 litres per capita per annum.

In addition to the present population, a further increase in consumption can be expected as a result of population increase. From 1957 to 1967 the number of registered births increased by some 33%, whilst deaths remained more or less static, giving a population increase of some 68,000 p.a., increasing on these figures by some 3% per annum. Thus it is clear that there will be an increasing demand for liquid milk in the Lebanon.

Substantial quantities of milk powder is being imported. This powder is purchased at a very low price. Its use in these quantities has created a situation where it is difficult for the former to market his milk. The resulting lack of confidence by farmers in the home milk industry has virtually halted the modernisation and development of dairy farms, milk being produced in unhygenic conditions in an inefficient manner. If this situation continues, it will result in the virtual collapse of the dairy industry in the Lebanon and in the total reliance on imports which will increase annually from the present high figure of some LL 36 million.

This would also have a disastrous effect on beef production, since in any country where land is in short supply and intensive farming practised, most of the beef production comes from male calves from dairy herds. In U.K. some 86% of the home produ - ced beef is a by-product of the dairy industry . Without this production, beef prices would inevitably rise steeply, or reliance would be increased on imports which in the Lebanon in 1967 were some LL 62 million.

The retail price of pasteurised milk in Beirut is at present 75 and 80 pi per litre. Raw milk varies in price from 60 to 65 pi per litre.

It is inevitable that, if more milk is to be pasteurised, it will result in an overall increase in price, since it must bear the cost of pasteurisa - tion and packaging.

It is considered that U.H.T. milk could also be retailed at an average of 80 pi per litre in cartons, paying the farmers 42 pi per litre. This milk will keep without refrigeration for up to 6 months and is transported by ordinary vehicles and so could readily be distributed throughout Lebanon. It is further considered that a top quality product in this form would find a ready market at this price, provided that it was given adequate publicity. The initial market would be in the larger towns where incomes are highest.

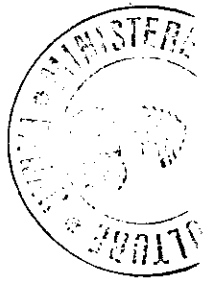
POPULATION

Number of twons and villages and registered population by Mohafazats and Cazas

Mhafazats and Cazas	No.of twons & villages at 31. 12.1961	Registered population at 31.12.1961	No.of towns & villages at 31.12.1964	Registered population at 31.12.1964
Beirut	1	298,129	1	330,995
Mount Lebanon				
Baabda	69	112,419	68	127,416
Metn	131	151,715	128	161,853
Chouf	122	131,769	120	143,168
Aley	86	89,166	86	97,084
Kesrouane	92	76,536	92	82,770
Jbail	114	60,679	114	66,396
Total	614	622,284	608	678,687
NORTH LEBANON				
Tripoli	52	162,496	53	181,809
Koura	43	53,128	43	55,635
Zgharta	49	61,823	50	65,473
Batroun	68	55,399	69	58,650
Akkar	170	125,751	169	139,033
Bcharre	22	47,482	22	50,809
Total	404	506,079	406	551,409
SOUTH LEBANON				
Saida	97	80,000	97	90,131
Nabatie	59	59,771	61	68,991
Sour	66	72,811	67	83,374
Bent Jbeil	42	60,621	40	69,950
Merjayoun	30	53,921	31	61,851
Hasbaiya	18	29,294	18	32,262
Jezzine	98	48,007	98	52,399
Total	410	404,425	412	458,958
BEQAA				
Zahle	45	106,498	45	116,641
Beqaa-West	38	52,255	39	57,313
Baalbek	78	111,040	80	117,308
Hermel	29	21,246	29	23,185
Rachaiya	28	29,928	28	32,645
Total	218	320,967	221	347,092
GRAND TOTAL	1,647	2,151,884	1,648	2,367,141

SUMMARY OF ANIMAL NUMBERS BY MOHAFAZATS 1964 - 1965

Type	Mount Lebanon	North Lebanon	South Lebanon	Beqaa	Total Lebanon	Mount Lebanon	North Lebanon	South Lebanon	Beqaa	Total Lebanon
MILKING COWS										
Under 15 months	4,878	6,298	1,752	3,665	16,593	4,819	7,410	2,458	4,354	19,041
15 months & over	9,518	13,963	8,168	6,119	37,768	9,039	14,373	8,517	7,069	38,998
Total	14,396	20,261	9,920	9,784	54,361	13,858	21,783	10,975	11,423	58,039
OTHER BEASTS										
Under 15 months	4,098	5,619	4,689	3,063	17,469	4,726	6,016	6,514	3,260	20,516
15 months & over	3,297	7,666	5,788	3,423	20,174	3,687	7,725	9,383	4,429	25,224
Total	7,395	13,285	10,477	6,486	37,643	8,413	13,741	15,897	7,897	45,740
Total Beasts	21,791	33,546	20,397	16,270	92,004	22,271	35,524	26,872	19,112	103,779
SHEEP										
Female	13,336	30,226	20,547	120,456	184,565	13,317	26,362	22,889	115,180	117,748
Male	3,117	5,805	4,285	24,316	37,523	5,787	6,041	5,544	24,419	41,791
Total	16,453	36,031	24,832	144,772	222,088	19,104	32,403	28,433	139,599	219,539



Summary of Animal Numbers by Mohafazats 1964 - 1965

Type	Mount Lebanon	North Lebanon	South Lebanon	Beqaa	Total Lebanon	Mount Lebanon	North Lebanon	South Lebanon	Beqaa	Total Lebanon
GOATS										
Females	64,285	38,238	83,610	196,852	382,985	59,822	44,143	89,830	160,361	354,156
Males	16,700	13,184	20,535	37,482	87,901	15,463	15,897	25,862	30,786	88,008
Total	80,985	51,422	104,145	234,334	470,886	74,285	60,040	115,692	191,147	441,164
HENS and CHICKENS										
Layers	253,653	202,010	157,935	499,402	1,113,000	317,362	313,458	254,657	628,970	1,514,447
Broilers	4,262,521	1,633,595	300,162	4,962,156	11,158,434	4,437,678	2,045,711	322,069	5,924,542	12,730,000
Total	4,516,174	1,835,605	458,097	5,461,558	12,271,434	4,755,040	2,359,169	576,726	6,553,512	14,244,447
OTHER ANIMALS										
Pigs	6,707	139		598	7,915	6,916	1,145	357	616	9,033
Horses	421	776		1,269	2,851	421	1,099	267	1,540	3,327
Mules	789	786		2,381	4,334	956	943	299	2,609	4,807
Donkeys	6,507	9,261		10,802	34,468	6,500	11,851	7,468	10,607	36,426
Camels	32	207		250	844	27	211	233	230	80
Rabbits	11,861	7,361		7,751	29,862	11,063	4,850	2,773	6,614	25,306
Bees(Hives)	10,278	8,053		5,055	31,186	11,798	14,616	7,088	4,387	37,884

SUMMARY OF ANIMAL NUMBERS BY MOHAFAZATS 1966 - 1967

Type	Mount Lebanon	North Lebanon	South Lebanon	Beqaa	Total Lebanon	Mount Lebanon	North Lebanon	South Lebanon	Beqaa	Total Lebanon
MILKING COWS										
Under 15 months	4,853	7,462	2,476	4,385	18,176	2,365	6,558	3,245	2,523	14,691
15 months & over	8,641	13,735	8,139	6,754	37,269	6,470	13,840	6,343	4,487	31,140
Total	13,494	21,197	10,615	11,139	56,445	8,835	20,398	9,588	7,010	45,831
DRAUGHT COWS										
Total	-	-	-	-	-	4,745	7,017	11,142	5,167	28,071
OTHER BEASTS										
(1966 total includes draught cows										
Under 15 months	4,791	6,099	6,068	3,305	20,263	2,436	5,485	3,091	3,540	14,552
15 months & over	4,024	8,434	10,824	4,835	28,117	1,887	1,587	2,587	2,395	8,442
Total	8,815	14,533	16,892	8,140	48,380	4,323	7,072	5,664	5,935	22,994
Total Beasts	22,309	35,730	27,507	19,279	104,825	17,903	34,487	26,394	18,112	96,896
SHEEP										
Female	12,927	25,486	22,361	111,833	172,607	12,675	57,482	16,660	81,212	168,029
Male	5,619	5,978	5,245	23,723	40,565	4,062	6,629	3,364	15,765	29,820
Total	18,546	31,464	27,606	135,556	213,172	16,737	64,111	20,024	96,977	197,849

SUMMARY OF ANIMAL NUMBER BY MOHAFAZATS cont:

Type	1966 Mount Lebanon	North Lebanon	South Lebanon	Beqaa	Total Lebanon	1967 Mount Lebanon	North Lebanon	South Lebanon	Beqaa	Total Lebanon
GOATS										
Females	59,994	44,258	90,053	159,924	354,229	62,747	55,784	92,004	139,795	350,330
Males	15,508	15,941	25,921	30,712	88,082	12,938	12,646	26,143	29,234	80,961
Total	75,502	60,199	115,974	190,636	442,311	75,685	68,430	118,147	169,029	431,291
HENS and CHICKENS										
Layers	1,011,017	313,380	46,515	1,537,282	2,908,194	955,500	273,000	54,600	1,446,900	2,730,000
Broilers	4,846,120	2,946,143	795,219	5,730,228	14,317,710	4,165,000	2,450,000	735,000	4,900,000	12,250,000
Total	5,857,137	3,259,523	841,734	7,267,510	17,225,904	5,120,500	2,723,000	789,600	6,346,900	14,980,000
OTHER ANIMALS										
Pigs	4,700	1,179	328	720	9,609	7,230	1,542	-	30	8,802
Horses	406	1,058	257	1,483	3,204	132	1,177	154	1,397	2,860
Mules	929	917	291	2,535	4,672	649	753	314	1,771	3,487
Donkeys	6,609	12,051	7,598	10,787	37,045	4,228	8,614	8,653	8,774	30,269
Camels	26	224	392	198	840	30	213	191	86	520
Rabbits	10,683	4,684	2,678	6,387	24,432	9,743	2,769	3,197	5,752	21,461
Bees (Hives)	11,621	13,301	7,938	4,255	37,115	11,019	10,957	10,492	3,866	36,334

APPENDIX VII LABOUR AND MANAGEMENT

A. THE FARMS

Labour employed on the farms visited was unskilled or semiskilled. Whilst employees were anxious to look after the livestock in their care, they lacked adequate knowledge of cattle feeding, cattle health, milking and basic hygiene.

Often a few cattle were left tied in a cowshed and permitted to eat concentrates set out ready for neighbouring cows which were out in open yards for exercise.

When hand milking was in progress the milkers' hands were kept wet with milk (for comfort) and milking machines, where seen , were not properly sterilised. Special overalls or coats not used during milking.

Management was inadequate and often non-existent. Little attention was given to the suitability of feed, rarely was feed rationed in accordance with milk yield, individual milk yields were seldom recorded, cows hooves were often not trimmed as necessary, and attention of hygiene was inadequate.

In contrast to this, some farmers had shown considerable skill in the selection and breeding of their cattle.

Milk yields were very variable but some herds of imported cattle had high yields.

The buildings and equipment were often totally inadequate but, of course, this is more likely to be as a result of no confidence in the future of the industry and a lack of capital than a lack of knowledge.

If this situation is to be improved it is essential that considerable training will be provided with regard to management, the practical use of equipment and hygiene.

In connection with the project recommended by this report, it is considered essential that expatriate management be utilised for the first few years.

Apart from ensuring the success of the project, this will provide an opportunity for the practical training of nationals at all levels and in this way the project will inevitably become an extension centre, assisting improvement and development of local farms, particularly with reference to the establishment of a co-ordinated National dairy and beef industry.

B. DAIRIES

Labour working in the dairies visited showed reasonable skills for the jobs they were doing. They usually wore overalls or other suitable clothing. However, labour was extravagantly used. There seemed to be reasonable skill in management at the various levels.

Where modern equipment was in use, specially trained operatives were employed. However, some of these operatives were handicapped in that they had only received a simple basic training for the machines, and, therefore, lacked the special experience required to obtain the best possible products as regards flavour.

Laboratory equipment was available but this was a bare minimum for simple tests. Better equipped and better used laboratories would enable more thorough and better quality control of the products.

APPENDIX VIII SPECIAL ASSISTANCE TO SMALL FARMS

Small farms in Lebanon fall into two categories, small areas of land cropped in the ordinary way and small areas of land used as intensive 'factories' for poultry, cattle and other stock.

The first category often have one or two cows providing milk for the family and possible one or two neighbours. These cattle are usually grazed on waste land at the edge of fields or beside roads and no special food is grown for them. They also utilize over-ripe or surplus vegetables which would otherwise be wasted. Attempts to improve dairy production of these units individually is doomed to failure because of the impossible task of bringing the essential knowledge of general cow management services and equipment to such widely dispersed fragmented units. Modern hygenic milk production has certain basic requirements.

a) Good clean water supply (for cleaning equipment)
b) Facilities for cooling milk
c) Machine milking

It must be realised that it would be grossly uneconomic to provide these essentials for one or two cows. It would equally be grossly uneconomic to provide a milk collection service for small units so that any milk sold from these units would be retailed locally as raw milk, thus continuing an undesirable health hazard.

Experience in other countries with a similar problem has shown that the giving of good quality imported cattle to small farms of this type does not greatly increase production because the farmers do not have the knowledge to look after these cattle in a proper manner.

Therefore, if assistance is to be given to this type of small farm to increase dairy production, it must be done through co-operative units where the cows, though individually owned, if desirable, can be housed and managed in larger units. It is suggested that in order to be economically viable, units of cows should be upwards of fifty. They could be housed in part covered yards, milked by machine in modern bails, the milk passing direct to bulk milk tanks for cooling. Each former could devote a portion of his land to fodder and, if the farms are properly laid out and co-ordinated, harvesting and feeding could be mechanised, thus making a better use of labour. Individual farmers could raise their own calves and grow other cash crops. Proper hygenic production and collection of milk would be possible and the 'centre' could act as a local extension post through which advice could be given.

Creation of these co-operatives would not be simple in the first instance due to the natural conservatism of farmers. Initial projects would be more readily accepted if sited on land not previously occupied by those farmers, the farmers being invited to come onto the land, provided they agree to the system. Schemes of this type could be combined with rehousing and resetlement . Once the results of this sort of scheme could be seen, many small farmers would wish to follow the example.

Small farms of the 'factory' type can be assisted more easily because of the larger herd size. Many of them already have herds of sufficient size to become modern viable units and only need loan facilities and an assured market. Others could be helped on a progressive system enabling them to increase their herd size to the minimum. Some could be encouraged to co-operation in the same manner as the first category.

Any assistance given to either category should be directed towards creating economically viable farms which can maintain themselves and progress, encouraging further development. Assistance to small farms should, therefore, include a guaranteed market through collection centres or major projects as envisaged elsewhere in this report.

APPENDIX IX

QUARANTINE CENTER AND SLAUGHTERHOUSE AT TRIPOLI

The Quarantine Centre and Slaughterhouse at Tripoly was visited.

This was completed some two years ago to handle sheep and cattle imported live for slaughter. As a result of the closure of the Suez Canal it cannot fulfil its intended purpose.

The project comprises a new slaughterhouse and covered lairage for 750 cattle and 1,000 sheep.

Some minor alterations to the lairage would make it suitable as a fattening centre for beef and sheep. These are principally in connection with manure handling. The present lairage was intended only for short period housing and did not cater for bedling for the stock. Manure removal was to be by washing down with water which would carry the manure to disposal. This is impracticable for yards housing livestock for longer periods . Some alteration to the pen divisions would permit manure and bedding to be removed by scraping with a tractor and blade.

This project could then be used for fattening calves from dairy herds which are at present slaughtered as calves. Feeding and costing trials could be carried out, the results being published to encourage other farmers to rear beef animals.

The slaughtering facilities could be used for cattle fattened on the site and for cattle fattened by other farmers. As beef production increases, through a stable developing dairy industry, the project could revert to its original purpose, but for home produced cattle instead of imported cattle.

APPENDIX X **FUNCTIONS OF THE BRITISH MILK MARKETING BOARDS**

The Milk Marketing Board of England was set up in 1933 as a result of government commission, at a time when thousands of dairy farmers were on the verge of ruin. Milk prices were low and milk supplies, though less than half today's quantity, exceeded demand and the milk retailed was of variable quality, large quantities being retailed as raw milk.

There are 18 members of the Board, 12 being regional members(dairy farmers) elected by dairy farmers in each region, three national members (dairy farmers) elected by dairy farmers from all regions and three being appointed by the Minister of Agriculture. In each region there is a committee elected by the dairy farmers to advise the Board.

The aims of the Board were:-

a) The strengthening of the position of producers, by enabling them to negotiate as a solid body with one voice and with adequate information, and by ensuring that negotiated agreements are universally observed.

b) The prevention of undercutting of the liquid market, and the provision of satisfactory arrangements for the sale of milk for manufacture.

c) The improvement of the quality of the milk supply.

d) The stimulation of the demand for liquid consumption.

e) The recognition of the service rendered by producers who cater primarily for the liquid milk market.

f) The development of the manufacture of milk products.

g) The co-ordination of the efforts of all concerned-producers , distributors and manufacturers - to secure prosperity for the whole milk industry of the country, but with adequate safeguards for the interests of the consuming public.

The functions of the Board are:-

a) Buying all milk produced on farms and selling it to distributors and manufacturers.

b) Collecting payment from the buyers and pooling the receipts among producers each month.

c) Arranging the collection of milk from farms and its delivery to depots or town dairies.

d) Allocating milk supplies to distributors and manufacturers.

e) Assisting dairy farmers with their breeding and herd management policies providing artificial insemination and milk recording services.

f) Advising farmers on all aspects of farm management through the Low Cost Production and Consulting Officer Services.

g) Operating milk quality control schemes with the cooperation of the buyers.

h) Running creameries which distribute milk and manufacture dairy products under the Board's own brand name "Dairy Crest"

i) Operating a fleet of milk transport vehicles on a commercial basis.

j) Developing markets for milk and dairy products through sales campaigns and publicity.

APPENDIX XI ARTIFICIAL INSEMINATION AND SEMEN IMPORTS

The use of artificial insemination provides vast opportunities for the improvement and development of dairy cattle.

Through A.I. one bull can sire many more progeny than by natural service. This enables the semen of proven bulls to be used widely to improve progeny. It also enables the small farmer to breed far better bulls than he could afford to own, in addition to the fact that, for small herds, it is cheaper than maintaining a bull.

However, if A.I. is to be successful, collection and insemination must be carried out by skilled operators. Bulls must be very carefully selected since not only can a good bull be put to wider use in this way, but use of a poor bull can result in widespread deterioration in progeny.

It is, therefore, recommended that A.I. be used only as a result of the setting up of proper centers with skilled staff. Centers could be developed as a part of projects, as envisaged elsewhere in this report.

As a result of modern development, semen can now be imported and in this way the use of the world's best bulls obtained very cheaply . The use of imported semen on selected imported cows will produce bulls which can be selected, proved, and used at the centers as they are developed.

APPENDIX XII THE INITIAL PROJECT

A. BASIC CONSIDERATIONS

(i) Type of Milk Treatment

It is recommended that the milk shall be treated by the Ultra High temperature method, and packaged aseptically into cartons.

Ordinary pasteurised milk in Lebanon, even when produced under ideal conditions, stored in cold stores, and kept in home refrigerators is unlikely to keep fresh for 24 hours in summer, due to the fact that pasteurisation kills only bacteria known to be harmful to man and does not kill all souring bacteria. Because it is inevitably exposed to changes in temperature during handling and distribution (dairy to shop/ shop to customers home)much of it sours before use.

U.H.T. aseptically packed milk will keep fresh for up to six months without any form of refrigeration during storage or transportation.

The U.H.T. treatment process not only kills bacteria harmful to man, but kills all bacteria including those which cause souring. Combined with the aseptic packaging this results in the packaged milk being completely free from bacteria so that as long as the carton is intact, the milk remains fresh.

The protein content of the milk is not impaired so it is fresh in the best sense of the word.

The packaged milk can conveniently be carried by any flat bed lorry or van and so no special transport vehicles are required.

The market will not be restricted to Beirut alone, since the milk can readily be transported, it can be sent to other towns and villages through out the Lebanon.

It is also unnecessary to make daily deliveries. It can be delivered in convenient loads at weekly or even longer intervals. This substantially reduces the transport costs as opposed to those of delivering ordinary pasteurised milk. These facts are important when considering supplies to hospitals , schools and army depots.

(ii) Capacity of Plant

In order to operate satisfactorily and economically the plant requires an average minimum throughput of 9,000 litres per day.

The same plant without extension has a capacity of some 40,000 litres per day.

Capacity can be readily expanded beyond this level by the addition of further equipment and can be brought to a capacity of some 250,000 litres per day.

(iii) Dairy Herd Producing the Milk

In order to produce the minimum operating requirement of 9,000 litres per day a herd of 600 cows averaging some 5,100 litres (1120 gallons) per annum is required.

It is considered that under the prevailing conditions in Lebanon it is absolutely essential that this basic herd be kept in one set of premises for the following reasons:-

a) it is essential that milk delivered for processing be of high quality, and free from contamination. Inspection has shown that it will be necessary to have expatriate management in addition to very substantial local labour-training in order to achieve this. It would not be possible for one manager to give the necessary suprvision to numerous herds at every milking time to ensure such standards since he can only be in one place at a time.

The economics will not permit the employment of more than one expartriate manager for this purpose.

b) The supply of milk from the basic herd must be as even as possible otherwise a larger herd will be required in order to supply the minimum daily throughput. This necessitates expert control of the breeding programme.

c) The general management of a herd of this size must be first class in order to operate satisfactorily. Such management must have strict control of food supplies including crop production, actual feeding and tending of cattle, and control of labour, as well as the many small items which include the keeping of records. It is impracticable for one manager to supervise such matters on a number of farms.

d) The control of disease and breeding programme require careful attention and such control will be simplified if the cattle are on one site.

e) By keeping the basic herd on one farm the difficulties of management and control will be reduced to a minimum during the initial period of development.

B. THE SITE

(i) Dairy Plant

The site for the plant will need to be some two hectares in size in order to permit future development either as part of the farm site or if required as a separate unit.

It will require a water supply of 30 cubic metres per hour (110 gallons per minute).

It will require on electricity supply of approximately 200 KVA.

It should have direct access to a good tarmac road.

It should be conveniently placed near to the source of the milk or near to the subsequent center for distribution in order to reduce transport costs.

It should be in a prominent position in order to take advantage of the publicity value of passer-by and be convenient for visitors.

It is felt that a site in Beirut would have substantial advantages as respects availability of suitable skilled and semi-skilled staff, availability of services, product distribution, and publicity.

However if the farm is to be sited in the Bekaa Valley (see (ii) below) the dairy plant could be sited near the farm . It would still be within a reasonable distance of Beirut but would have some disadvantage from the point of view of distribution, though this would be offset by the ease of transport of raw milk from farm of dairy in winter.

(ii) <u>The Farm</u>

It is recommended that the basic farm should be sited in the Bekaa Valley at a place where water is available for irrigation.

This area has a number of advantages over the other possible areas:-

a) A site can be selected where irrigation can be carried out.

b) Because of the climate in the Bekaa, suitable land would not have to compete with 'double cropping' and therefore the return from fodder crops can compete with other crops.

c) It is near the principal Market - Beirut.

d) Land suitable for mechanised harvesting of fodder crops can be selected. (i.e. not mountainous).

e) Farms of suitable size are available.

f) The Bekaa is not suitable for citrus and other high profit crops.

C. THE CATTLE

It is recommended that the cattle be Friesians. They are known to thrive in the local climate and with good management will not suffer de-generation or loss of production due to the climate.

British Friesian cattle have an inherent high milk yield and have good udders which retain their shape well in subsequent lactations, resulting in a long working life. The bull calves produce good quality lean beef, have a high rate of weight gain and are very efficient in food conversion.

It is recommended that half the initial herd (300 head) be obtained as maiden heifers, together with six bulls. The other half of the initial herd should be obtained as in calf heifers. This will enable production to start early whilst keeping the initial cost lower than it would be if all 600 head were in calf heifers.

It is suggested that the imported heifers shall be pure bred Friesians out of recorded cows sired by proven bulls. This will ensure the milk potential and butterfat content, but at the same time will be substantially cheaper than equivalent pedigree animals. They will be selected from cows having four generations of pedigree sires behind them and will therefore be at least 93.5% pure Friesian.

If pedigree cattle are required they can, of course, be obtained but will command a higher price without necessarily providing more milk.

In view of the importance of the breeding programme in relation to milk production it is considered essential that bulls, as opposed to artificial insemination, be used for the first few years. Therefore it is proposed that six pedigree bulls be imported. After the initial development the bulls can be used to start an artificial insemination centre.

Imported semen from highly prolific proven sires could be used on selected animals after the first lactation in order to imporve the herd.

Once in full operation the farm will have:-

600	Cows
6	Stock bulls
285	Calves from birth to six months old
135	Bulls from 6 to 12 months old
539	Heifers from 6 to 30 months old
1565	Total at any one time.

D. THE FOOD FOR THE CATTLE

(i) Fodder

It is proposed that 180 hectares of tetraploid ryegrass/red clover be grown annually on the farm. This, with irrigation and judicial use of fertilisers, will produce some 5250 tons of hay at 18% moisture or the equivalent quantity of silage.

In budgeting the cash flow of the project allowance has been made for the rental of 400 hectares of land. Cropping will be arranged so that in the initial year there is a surplus of hay allowing a carry forwards from year to year to allow for seasonal fluctuations and give flexibility in feeding.The area of land under fodder crops each year can then be adjusted as necessary. The surplus land will give ample allowance for rotation of crops. No profit has been budgeted for the break crops and all rental has been charged to the fodder crops.

The feeding programme will allow for fodder to be fed green over approximately half the year and for the remainder to be bed as hay and silage (made in bunkers). It is expected that the proportion of hay and silage will vary from year to year but storage facilities have been allowed for approximately equal equivalent tonnages.

The Cows will receive a basic ration of up to 11kg. (24.2 lbs) of hay per day or equivalent green fodder or silage. This will allow for maintenance of the animal plus the first two gallons of milk, some barley being fed as necessary. The remainder of the production ration will be purchased concentrates.

(ii) Concentrates

With a minimum use of fodder, that is feeding the cows with concentrates for every litre of milk produced and rearing all calves, bulls to one year old, and heifers to calving date , the annual consumption of concentrates will be a little under 2,500 tons (metric).

With the planned use of fodder it is expected that the annual consumption of concentrates could be as low as 1050 tons.

It must be emphasised that the feeding plan will be flexible and will vary from year to year but the cost of feeding will remain substantially as budgeted.

Consumption of concentrates by the cows will vary up or down from year to year in accordance with the actual milk production.

E. MILK PRODUCTION

(i) Milk yield from the basic herd

The heifers selected will be out of high yielding dams, as evidenced by official records, and sired by bulls which have been selected on the basis of the milk output of their progeny.

This will ensure the milking potential of the cattle.

The start of milk production will depend on the time of purchase of livestock and the proportions bought as in-calf or maiden heifers. This in turn will depend on the starting date for the contract and must be related to the growth of fodder.

It is not until the cows reach their fourth lactation that maximum yields can be expected. During their first lactation they can be expected to give about 875 gallons(3,977 litres) on the average and in second third and fourth lactations 1,000 gallons (4,545 litres), 1,125 gallons (5,114 litres) and 1250 gallons (5682 litres) respectively.

The actual quantity of milk produced will depend to a large extent on the feeding standard adopted. It will also depend on the general health and management of cattle, and milking techniques.

Quite apart from the variation of yield between cows and successive lactations there is also fluctuation in yield within the lactations and variation in period of lactation. It is usual to aim at a calving record of one calf per cow per year. This gives a lactation period of some 10 months, leaving the cow dry for two months before the next calf.The table below shows the average monthly percentage of production during this lactation period, these figures being produced by the National Institute for Research in Dairying , Shinfield, United Kingdom in conjunction with the United Kingdom Milk Marketing Board.

MILK PRODUCTION PER LACTATION

Month	Lactation Cycles % per Month	1st 3,977 litres (875 gals.)	2nd 4,545 litres (1,000 gals.)	3rd 5,114 litres (1,125 gals)	4th 5,682litres (1,250 gals)
1	15	597 litres	682 litres	767 litres	852 litres
2	15	597 litres	682 litres	767 litres	852 litres
3	14	557 litres	636 litres	716 litres	796 litres
4	12.5	497 litres	568 litres	639 litres	710 litres
5	11	437 litres	500 litres	563 litres	625 litres
6	9.7	386 litres	442 litres	496 litres	551 litres
7	8.4	334 litres	382 litres	430 litres	477 litres
8	6.9	274 litres	313 litres	353 litres	393 litres
9	4.7	187 litres	213 litres	240 litres	267 litres
10	2.8	111 litres	127 litres	143 litres	159 litres
	100 %	3,977 litres	4,545 litres	5,114 litres	5,682 litres

ASSESSMENT OF MILK PRODUCTION FOR THE PROJECT

In order to estimate milk production it is, therefore, necessary to make certain assumptions.

The assumption taken in preparing the table below are:-

(1) That milk yields will be based on the quantities shown above and restated thus:-

3,977 litres (875 gals) average 1st lactation.

4,545 litres (1,000 gals) average 2nd lactation.

5,114 litres (1,125 gals) average 2nd lactation.

5,682 litres (1,250 gals) average other lactations.

(2) That 300 animals will be purchased as in calf heifers, and 300 as maiden heifers.

(3) That the 300 in-calf heifers will calve evenly over a month period starting on the first day of Year One.

(4) That the 300 maiden heifers will calve over a two month period starting six months later.

(5) That the herd replacement will be at the rate of 20% per year.

(6) That replacements will be reared, and so it will be 2½ years from the first day of Year One that replacement will be available to enter the herd.

(7) That, since all cattle purchased will either be in-calf or maiden heifers, losses for the first three years will be below average.

YEAR 1

MONTHS	TOTAL MONTH'S PRODUCTION IN LITRES	AVERAGE DAILY PRODUCTION IN TONS (Metric)
1	41,679	1.39
2	125,062	4.17
3	163,971	5.47
4	154,243	5.15
5	139,044	4.63
6	122,904	4.10
7	149,648	4.99
8	217,950	7.27
9	239,729	7.96
10	206,939	6.90
11	167,127	5.57
12	130,404	4.35
	1,857,700	5.16
	Total year's production.	Daily Average. (360 days)

YEAR 2

MONTHS	TOTAL MONTH'S PRODUCTION IN LITRES	AVERAGE DAILY PRODUCTION IN TONS (Metric)
1	157,809	5.26
2	230,091	7.67
3	252,156	8.41
4	218,874	7.30
5	176,685	5.89
6	137,996	4.60
7	158,373	5.28
8	230,850	7.70
9	252,874	8.43
10	219,313	7.31
11	176,919	5.90
12	138,060	4.60
	2,350,000 Total year's production	6.53 Daily average.

YEAR 3

1	157,346	5.24
2	227,763	7.59
3	258,591	8.62
4	225,099	7.50
5	182,696	6.09
6	143,748	4.79
7	205,631	6.85
8	281,357	9.38
9	302,360	10.08
10	263,213	8.77
11	214,836	7.16
12	170,760	5.69
	2,633,400 Total year's production	7.31 Daily average.

YEAR 4

MONTHS	TOTAL MONTH'S PRODUCTION IN LITRES	AVERAGE DAILY PRODUCTION IN TONS (Metric)
1	216,730	7.22
2	292,049	9.73
3	305,283	10.18
4	259,463	8.65
5	203,439	6.78
6	159,150	5.31
7	245,116	8.17
8	318,115	10.60
9	333,157	11.11
10	287,932	9.60
11	250,348	8.34
12	187,218	6.24
	3,058,000	8.49
	Total year's production	Daily Average

In subsequent years production will level out at about 3,120,000 litres per annum. These figures take account of the fact that there will always be a proportion of heifers in the herd as replacements which will not be in full lactation.

It will be noted that the highest production figure in any month is 11.11 tons. Since this is an average, and due to lactation fluctuations, it is possible that there will be days on which 15 tons of milk is produced.

These figures are calculated on 360 days but the dairy processing plant will operate on about 340 days in a year and so economic throughput from the projects' own herd will be achieved in year 4. However, as detailed below, it is the intention that additional milk will be brought in from other farms giving an economic throughput early in the second year.

(ii) Milk from other sources

In order to operate on an economic basis the dairy plant should process about 9000 litres minimum per working day (340 days a year approx). However the same unit can process some 40,000 li. per day and progressively, as throughput approaches this figure, the processing costs will be less per litre. This results in a higher profit or an opportunity to reduce the wholesale price.

It is therefore recommended that additional milk be brought into the plant provided its quality is acceptable.

Once the project is operating smoothly the farm and dairy managers will have time to gradually improve other local herds and collecting centers.

As soon as such a herd, or centre, and the conditions under which the milk is produced, has reached the required standard, an offer can be made to purchase milk under contract.

Such contract would set out the standards of quality of milk required, and would offer the benefit of advice from the basic projects.

This will ensure the quality of milk required whilst at the same time allowing local farmers to benefit from the project. In this way, if the throughput of milk increases from 9,000 li. per day to 40,000 litres per day, local farmers can be supplying 31,000 litres per day or three quarters of the requirement.

Conservatively this additional milk has been budgeted as rising progressively from 500,000 litres in year 1 to 3,000,000 litres in year 6 though it could increase to over 10,000,000 litres before the plant capacity is filled.

MILK TO BE PURCHASED
FROM OUTSIDE SOURCES

YEAR 1	500,000 litres
YEAR 2	1,000,000 litres
YEAR 3	1,500,000 litres
YEAR 4	2,000,000 litres
YEAR 5	2,500,000 litres
YEAR 6	3,000,000 litres

(and subsequent)

Subsequent further expansion can be catered for in the same manner to suit the market demands.

It is likely that the farm or collection center price for milk in the early stages can be 40 - 42 piasters per litre.

F. PACKAGING OF MILK

The milk will be packaged aseptically into ½ and ¼ litre cartons.

At the time of writing the only machines proven in commercial use to be capable of aseptic packaging operate with paper cartons.

Other machines packaging into plastic containers are being developed and are likely to be available in the near future.

In either case the containers, paper or plastic, are non-returnable, and so there will be no requirement for collection or washing of bottles.

All milk produces will be stored on site for a minimum of four days to ensure that there are no leakages and to enable samples to be laboratory tested before despatch. All milk leaving the premises will therefore be known to be up to the required standard.

Because of the keeping quality of the milk, daily deliveries to a particular customer are not necessary and deliveries will be made as required in suitable loads. This keeps delivery costs and accounting to a minimum.

G. THE BUILDINGS

(i) The milk Plant

a) The Dairy

The principal equipment for the treatment and packaging of the milk will be housed in a building 24m x 36m with an upper floor 24m x 5 m.

It will have a steel frame, corrugated asbestos roofing and side cladding with locally built walls to a height of 2m. The internal partitions of blocks, glass and timber will be constructed by local labour. It will be fitted with filtered powered ventilation for hygiene.

It will be divided into ten sections as follows:-

1. Milk reception area which will house the milk reception and standardising equipment.

2. Bulk milk tank room. Milk received at the plant will be stored in a large insulated bulk milk tank until passed through the plant.

3. Main milk plant room housing the ultra high temperature treatment plant.

4. Packaging room housing the packaging machines.

5. Storage area housing all packaged milk before despatch. This area will also house the crate washing machine for washing the plastic crates.

6. Boiler house housing the boiler for provision of steam and hot water.

7. Refrigeration room housing the equipment for the chilled water system for cooling purposes.

8. Paper store housing the raw materials for the packaging machines.

9. Offices for the manager and administrative staff, and laboratory.

10. Toilet facilities and cloakroom.

b) Complete electrical wiring

From mains intake point, including site distribution, wiring to all points and light fittings, including installation.

(ii) The Farm Buildings

a) Central Block 19m x 45m.

This building will have a steel frame and corrugated asbestos cement roofing, with asbestos cement cladding to the gable ends down to the lean-to's and a lean -to on each side 9m wide covering the cow collecting areas.

The parlours only will have walls of local materials, and will have lofts for concentrate food storage.

Other pen and passage divisions will be tubular steel fencing and gates.

The accommodation will comprise six milking parlours, six holding pens, six loose boxes and six bull pens.

b) A lean-to building at one end of a) above 19m x 7.5m of steel and asbestos housing the milk cooling equipment and collection point, cloakroom, toilet facilities, and herdsmens room. This building will have walls of local materials to a height of 2.5 m.

c) Six buildings extending outwards, three on each side of the central block a) above each measuring 7.5m x 60m and having a concreted open yard of 7.5m x 60m each to house 100 cows. These buildings will be of steel and asbestos, with walls of local materials at the ends and one side.

d) Two buildings extending outwards, one each side, from a) above, each measuring 7.5m x 60m with roof insulation and powered ventilation to give the improved conditions required for housing the calves. The walls will be of local materials.

e) A lean-to building to the remaining end of a) above 19m x 7.5m to house six loose boxes for calving cows. The roof will be insulated and the building will have powered ventilation in order to give improved conditions for cows during periods of abnormal strain. It will have walls of local materials.

These loose boxes will be additional to the six holding pens and six loose boxes in a) above.

f) Seven buildings similar to c) above but each measuring 6m x 60m with an open yard 6m x 60m to house heifers and bulls being reared. These buildings will be sited to that they could be used for housing cows if the herd is expanded.

g) One building 4.8m x 19m containing a range of six loose boxes for animals housed in f) above. Adjacent to this building there will be a spray race and handling area. This area will also be used for routine veterinary tests and weight recording. It will have walls of local materials.

h) A range of three buildings of simple portal frame type for the storage of hay. Each building will be 12m x 60m x 6m high. This will give a total capacity of about 1900 tons of hay.

i) One building 60m x 12m x 5m high similar to h) above, but with fully clad sides and large sliding doors for the storage of purchased concentrate feeds, implements and workshop.

j) Four Bunker Silos each 125m long x 10m wide x 2m deep.

k) One office block 9m x 19.4m of prefabricated construction providing offices for management and administration.

l) Accommodation for locally employed labour in two blocks, one for skilled men 10mx80m, and one for unskilled men 100m x 20m, built in traditional materials by local labour.

m) House for manager

n) Guest House to be used for visiting specialists.

o) Complete electrical wiring from main intake point including site distribution, wiring to all points and all light fittings including installation.

(iii) Building not necessarily on Site

Four houses for dairy manager, engineers and laboratory expert.

H. THE EQUIPMENT

(i) The Dairy

a) One stainless steel vertical uninsulated balance tank with a capacity of 9,000 litres complete with intake flow-meter.

b) One clarifier.

c) One plate heater-exchanger to cool milk on arrival, complete with pump.

d) One totally enclosed hermetic separator complete with pump and meter and fitted with remixing and standardising devices.

e) One vertical, insulated, stainless steel cream storage tank with 1,000 litre capacity.

f) One double compartment wash trough and two wash down hoses.

g) One horizontal cylindrical standardised insulated milk storage tank, 9,000 litres capacity, with stainless steel inner vessel, complete with motor driven agitator and connecting pipework.

h) Hand operated in-place cleaning equipment for above.

i) One complete auto-aseptic U.H.T. processing plant. All operations to be programme controlled from an electronic panel. The plant to include 3,500 litre aseptic tank, homogeniser and all pipework, and in-place auto cleaning equipment.

j) Two machines 1@ ¼ litre, 1@ ½ litre, for the aseptic packaging of milk, complete with air intake, all pipe - work, dating unit and time recorder.

These machines cannot be purchased out-right but are supplied on a basic down payment and subsequent throughput rental charge.

The basic down payment is included as a capital charge and the rental charge is included in the annual costings.

These machines remain the property of the suppliers.

k) One chilled water plant for milk cooling. This refrigeration plant has a designed heat extraction of 431,000 B.T.U.'s/hour which is equivalent to cooling 45,000 litres of water per hour from 4°C to 1.5°C.

It is supplied complete with compressors, motors and pumps.

l) One boiler with a rated capacity of 5,000 lbs. per hour from and at 100°C with a maximum operating pressure of 155 p.s.i.g. a normal pressure of 150 p.s.i.g. and hydraulic test pressure of 285 p.s.i.g. It is complete with fuel oil tank outflow heater, fuel pump and steam distribution manifold.

m) One water treatment plant being a fully automated base-exchange water softener with a capacity of 25,000 gallons (110,000 litres approx.) per day at a water hardness of 695 p.p.m. (49° approx.).

n) One crate washer for plastic crates, complete with hood and steam take off ducting, and crate conveyor.

o) One roller crate conveyor 18m long and four two wheel hand barrows.

p) One fork lift truck complete with 50 timber pallets for handling and loading packaged milk.

q) Sundry laboratory equipment including centrifuge, Gerber bath, sterilsing oven, incubator, autoclave, water bath, Hamay colour counting chamber, steamer for bottles chemical balance, glass ware and chemicals.

r) Sundry office equipment including desks, chairs etc. to be purchased in Lebanon.

s) Fire equipment including extinguishers and hoses.

t) Sundry tools for workshop, and storage racks for spare parts (included with all equipment).

u) One 12 seater station wagon as a general duty vehicle.

v) One medium category car for manager.

w) One flat bed, long wheelbase lorry for transport of packaged milk, ten ton payload capacity.

(ii) The Farm

a) Three large capacity forage boxes for feeding green fodder.

b) One tractor-drawn concentrates trailer for metering and feeding concentrates direct to managers of heifers and beef units. It will have a variable delivery rate from 3 kg. per metre to 25 kg. per metre and a variable discharge height of from 1 metre to 3 metres.

c) Two tractor-mounted manure scrapers for attaching to three point link of tractors, (k) below, to scrape cow collecting yards and other concreted areas.

d) Six hand manure scrapers to be used for scraping manure from narrow passages and corners.

e) One excavator for manure and sand to be lever operated, without gears, forward and reverse being controlled by variable speed disc clutches (0-11 km per hour), with a turning circle of not more than 2.5m, and fitted hydraulic lift and tip mechanism to lift to a height of 2.5m.

Complete with fork bucket, general utility bucket and leveling blade.

f) Two four-wheel-drive station wagons, one standard size for manager, and one twelve seater for general duties.

g) One bale and sack elevator for stacking sacks of concentrated feed and for stacking hay bales.

The first section (dual purpose) to be 5.5m approx. in length.

The second section (for bales only) to be approx. 7.5m long, of the single chain type, driven from the first section.

h) One cattle lorry (10 adult animal capacity) complete with roof, cattle body and ramp.

i) Eleven two wheeled barrows for feeding calves and other general duties, five standard sack barrows and 80 plastic buckets for calves.

j) Workshop tools including air compressor, bench grinder, two electric drills, arc welder, steam cleaner, extending ladder, complete sets of small tools, and racking spare parts.

k) Six tractors 65 B.H.P. and six tractors 35 B.H.P., category II linkage.

l) Two ploughs.

m) One Cambridge roll three section (5.5m operating width)

n) Two spring-tined cultivators (3m operating width).

o) One drill (4m. operating width) complete with light harrows attached at rear.

p) One spin type fertiliser spreader (1.5cu.m. capacity hopper, 7.5m. spreading width).

q) Two mowers (1.5m. cutter bar).

r) Two side delivery rakes (3m. operating width).

s) One forage harvester (short chop 40 ton per hour capacity 1.5m. operating width).

t) Three hay balers, high output, string tying, complete with two bale collectors.

u) One bale loader for handling stacked bales.

v) Three general purpose trailers, six ton capacity, with wide tyres, and all steel bodies.

w) Three bale trailers, six ton capacity with wide tyres.

x) One high capacity manure spreader, to handle semi-liquid or solid manure.

y) One cattle spray race, complete with spray booms, nozzles, piping, valves and pump.

z) One weigh crush for cattle complete with tail gate, head catcher, and side access panels.

aa) Fencing and gates all of heavy duty hot-dipped galvanised steel tube complete with all posts, fixing bolts, fasteners and clamps for the farm buildings area (references below are listed in G above).

G(ii)a) Six holding pens, six loose boxes, six bull pens, and 36 hurdles for collecting area.

c) Six runs of 60m feed fencing and yard gates.

d) Two runs of 55m feed fencing and 150 demountable calf pens.

e) Divisions and gates for six loose boxes.

f) Seven runs 60m feed fencing and yard gates.

g) Divisions and gates for six loose boxes together with fencing and hurdles for the handling area.

bb) Milking parlour equipment, complete for six herringbone milking parlours each having ten stalls and five milking parlours each having ten stalls and five milking units with wall-mounted, remote controlled feeders, mangers, water heaters with spray hoses for washing cows' udders. The parlours will be set up in pairs, each pair being powered by one pumping unit operated electric motor.

The equipment will include reserve air indicators, pressure gauges, pulsators, stainless steel teatcup clusters, six - gallon graduated lidless recording jars, glass milk lines within parlours and approximately 150m. (total length) glass delivery line from milk pumps to collection point, three stainless steel centrifugal electrically operated milk pumps with receiving jars, switches and interceptor vessels, complete boiling water acid cleaning equipment for circulation cleaning including jetters and shut-off devices, three water heaters 114 litre capacity with header tanks.

The equipment will also include three stainless steel bucket milking units for use in loose boxes complete with 20 stall taps and approx. 100m. of 1" galvanised tube and all bends, connections, brackets and valves.

cc) One water storage tank of pressed steel panel constraction with a capacity of 75,000 gallons (330,000) litres) and the tank material shall be in accordance with British Standard 1564 amendment No 1/1966. It will be divided into two sections, one of 25,000 gallons (110,000 litres) and one of 50,000 gallons (220,000 litres), and will be complete with centrifugal pump and motor with push button start, level control, and suction and delivery pipes.

dd) Sundry office equipment including desks, chairs etc. to be purchased in Lebanon.

ee) Fire equipment including extinguishers and hoses.

ff) 60 hot dipped galvanised steel water troughs for cattle yards and 24 water bowls for loose boxes.

gg) Aluminium alloy piping in sections, 6 inch (15cms) and 4 inch (10cms) outside diameter x 6 length, with pressure seal couplings, hydrants, bends, tees, sprinkler line filters, pressure gauges, valves, 16 twin nozzle brass sprinklers with 13mm x 6.3mm nozzles, to be complete pipeline equipment to irrigate 200 hectares every 10 days.

hh) 1 pump, for pumping water from water source to the site and the irrigation equipment, with a capacity of 100 cu. m. per hour complete with motors.

ii) Veterinary equipment including cold branding set, ear tag pliers, de-horners, forceps various, scalpels various, scissors various, tumor extractors, teat tubes, teat plugs, syringes various, flutter valves, catheters, calf extractors, calving chains, bulldogs, electric goads, pulley set, bull poles, bull rings, suture needles, Bagshaw hoist (cow lift), hoof cutters, metal detector, microscope glass slides, laboratory kit, enema pumps, miltidose syringe, leading reins, halters and special clothing.

I. LOCAL BUILDING WORK

The work under this heading will be carried out by a local contractor under the general supervision of the site supervisor.

It will include:-

General site works.
Erection of frame buildings supplied.
Fixing of roof sheeting and cladding.
All drainage works.
Foundations.
Floors of local materials.
Walls of local materials.
Erection of fencing and gates.
plumbing for water and steam supplies.
Internal road works.

Unloading and placing of machinery but not the fitting up of machinery or pipework in the dairy plant or milking parlours which will be carried out by specialist engineers.

J. THE WATER SUPPLY

(i) At the Dairy Plant

The water requirement will be about 110,000 litres per day (110 cubic metres).

In view of the likely water analysis it will be essential for this water to pass through a treatment plant before use.

(ii) On the Farm

a) For the livestock and milking parlours the requirement will be less than 100,000 litres per day (100 cubic metres).

b) For irrigation of the fodder crops the requirement will be about 9,000 cubic metres per hectare per year or, over the 180 hectares, 1,620,000 cubic metres per annum. This is in addition to the rainfall.

The source of the water can be either wells or a river, dependant upon the site which is finally selected. Wells producing 800 cubic metres per hours during on eight hour day will produce sufficient water even making allowance for the fact that the rain occurs principally during a 5-6 month period.

K. ELECTRICITY REQUIREMENT

(i) The Dairy Plant

The dairy plant will require an electricity supply of 200 K.V.A. capacity.

It has been assumed that this will be brought to the site free of capital charge.

To use of electricity has been costed in the annual charges.

(ii) The Farm Buildings

The farm will require an electricity supply of some 50 K.V.A. capacity for power and lighting.

L. LABOUR REQUIREMENT

(i) The Dairy Plant

The dairy plant will require 14-16 employees in addition to the expatriate specialist engineers and manager.

Two of these will be skilled men employed on machine operation.

The remainder would be unskilled men with some basic training, for checking in, stowing the milk cartons in t the boxes, stacking the boxes, loading lorries, driving the lorry and general washing down and cleaning duties. Also office and secretarial staff and nighwatchman.

The expatriates are listed under the heading of management below.

(ii) The Farm

The farm will require a total of about 16 skilled men and 20 unskilled men employed on the duties shown below:-

7- cowmen to milk the cows and carry out general duties tending them. 6 would milk each day working a six day week with the seventh man doing one day relief for each per week.

Because of the highly technical work of these men it is considered essential that they receive training on the site and account has been taken of this under section N below.

1 man feeding and tending calves.

6 tractors drivers, four working in the area of the buildings, carting food for the cattle, removing manure and other general duties, two employed on field work, preparing for and sowing the fodder crop, harvesting it, applying fertiliser and assisting with irrigation.

1 irrigation foreman controlling the pumps and irrigation work.

20 unskilled labourers, men or boys. Seven to assist the seven milkers, one to assist the mechanic, three to assist the tractor drivers, one to assist with calves, one to act as gate man and office boy, six to assist with field work and general duties and a nightwatchman.

1 secretary, fluent in Arabic and English required to carry out secretarial duties.

M. MANAGEMENT

The whole project is a complex one requiring the highest possible level of management in order to ensure its success.

Therefore it is considered essential that the management shall be by highly skilled U.K. personnel, until such time as others have acquired the necessary skills to take over from them. It is considered that this will be at least five years.

It is not considered adequate simply to supply managers on the site. Such men working in the U.K. would receive tremendous assistance from the vast technical resources available there from extension services, research laboratories, Universities and Government sources. It is essential that they should also have the benefit of such support for this project.

Therefore it is proposed that management as supplied under the contract shall include this factor, undertaking the responsibility of supplying expertise in the form of specialist technical advisers for any particular problem which may arise, and also undertaking the general supervision and guidance of the U.K. managers and engineers on the site. In order to achieve this successfully, the managers and engineers must be employed as part of the management contract, and therefore their salaries are included in the management charge.

The management staff on site will be:-

(i) Dairy Plant

a) Manager responsible for the overall reception, treatment and packaging of milk.

b) Specialist U.H.T. engineer responsible for the operation of the U.H.T. plant and supervising packaging during the absence of the packaging engineer.

c) Specialist packaging engineer responsible for the operation of the two packaging machines and supervising the U.H.T. plant during the absence of the U.H.T. engineer.

d) Laboratory technician responsible for carrying out routine laboratory tests, and for product analysis and development. He will also carry out certain laboratory tests for the farm.

It is suggested that, in addition to these staff, there shall be at least one local trainee on the management staff who will eventually take over responsibility for the plant.

(ii) The Farm

a) Farm manager who will be responsible for the livestock and the production of fodder. He will be responsible for all aspects of the farm including purchases and sales and will be responsible for milk production up to the point of its delivery to the plant.

b) Veterinary Surgeon who will work under the manager and be responsible for the general health and breeding of the livestock.

It is suggested that in addition to these staff there shall be one local trainee manager who will eventually take over responsibility for the farm.

N. TRAINING

(i) Dairy Plant

Training of staff and trainee manager will be carried out on the site. The two skilled men should be employed in time to be on site whilst the equipment is being installed.

(ii) The Farm

Training of staff and trainee manager will be carried out on the farm. It is considered essential that four expert milkers from U.K. be employed for the first year to train local milkers up to the required standard. They will also be capable of giving training to the men responsible for rearing calves.

(iii) General Training

A Government supported training programme can be incorporated which could support a National Extension Service taking advantage of the project for practical knowledge, technical information, demonstration and experimentation.

0. THE PRODUCTS AND BY-PRODUCTS

(i) Milk

The principal product will be the production of some 5,800,000 litres of milk per annum processed by the U.H.T. method and aseptically packed. The milk will be standardised to 3.0% and 2% butterfat. Initially this will be marketed at a wholesale price of 68-72 piasters per litre in ½ and ¼ litre packs for retailing at 75 - 80 piasters per litre.

By making available two grades of milk the project will give the consumer a wider choice and make available a lower-priced milk for the low income groups.

(ii) Cream

The milk produced on the farm or purchased will have a butterfat content of between 3.5 and 4%. Since some of the milk will be standardised to 3.0% butterfat and some to 2.0%, there will be a surplus of cream.

This will be packaged through the packaging machines and sold as 30% butterfat cream. There will be some 183,500 litres cream produced each year.

It will be marketed at a wholesale price of L£ 4.00 per litre for retailing at L£ 5.00 per litre.

(iii) In-calf Heifers

If all heifers are reared there will be a surplus of heifers over and above those required for normal herd replacements. This situation will arise in the third year when there will be a surplus of 40 rising to 135 per annum in the seventh year. These will be sold for L£ 1850 each and will be equal in quality to imported heifers.

(iv) Bulls

There will be 270 bulls for sale each year. It is suggested that 26 per year be selected as suitable for sale for breeding. These will be offered at LL 1056 at 12 months old. They could be kept until two years old when they would command a substantially higher price, though this entails additional housing and feeding. The remainder will be sold at 12 months old as beef at about LL 735 weighing 210 kg. dead weight.

(v) Culled cows

There will be a wastage of cows from the herd due to deaths or barrenness. Most of these will in fact be barren (or so delayed in calving time as to be uneconomic). The average price obtained will be LL 780. This allows for half to be sold as meat for human consumption, and the other half as carcass meat of negligable value, diseased carcasses being incinerated.

There will be about 30 in the second year, 60 in the third year, 90 in the fourth year and about 120 annually thereafter.

(vi) Sundries

In addition to the normal sales there will be some income as a result of the managers and the veterinary surgeon's services to local farmers.

APPENDIX XIII INVESTMENT AND RETURN

1. The capital requirement for the project, (including contingencies) is £ 961,775 (LL 7, 117,135) if housing is rented or £ 1,030,775 (LL 7,627,735.) if housing is provided for the principal workers. With a five instalment seven year 7% loan scheme (3/4 years for the livestock) the working capital requirement will be £ 121,500 (LL 900,000) and the interest payments will total £ 160,440 (LL 1,187,250).

2. The first pages of each section of the cash flow tables show the capital investment requirements. Some of the payments of the initial investment may not have to be made until year 1 and this is indicated in the cash flow summary at the end of the tables.

3. The remaining tables show the expected income and expenditure and the profits before and after depreciation.

4. Taking year 6 as a typical year, it will be seen that there is a projected profit of £ 183,755 giving a return on capital of 17.8% after depreciation. The surplus before depreciation would be £ 245,000, a return on capital of 23.8%.

5. No allowance has been made for any increase in costs during the ten year period due to normal price rises. It has been assumed that these will be proportionately compensated by increased selling prices; therefore, as technique and efficiency improves, the return should also improve.

6. The projection of cash requirement table is based on a ten instalment (two payments a year for five years), seven year loan with interest at 7%. For the cattle it will be a six instalment, four year loan.

7. It will be noted that the peak cash requirement with this type of credit deal at £ 845,500 is considerably less than the peak requirement of a cash deal which is estimated at £ 1,075,000 and that surplus is achieved only just over a year later at the cost of foreign exchange interest payments of £ 160,440.

APPENDIX XIV

TEN YEAR CASH FLOW
IN £ STERLING

LIVESTOCK FARM SECTION

ITEM	YEAR 0	1	2	3	4	5	6	7	8	9	10
CAPITAL											
Buildings, Site Development	379,785										
Plant & Machinery	131,850						68,050				
(i) Long Term	5,800										
(ii) Medium Ter	[illegible]						68,050				
(iii) Short&Mobile	68,050										
Static Productive Livestock	226,700										
600 Heifers	215,400										
6 Bulls	11,300										
TOTAL STERLING	738,335						68,050				
LEBANESE	5,463,680										
TOTAL WITHOUT HOUSING-Sterling	693,335										
Lebanese	5,130,680										

ITEM	YEAR 0	1	2	3	4	5	6	7	8	9
EXPENDITURE:										
Wages & Salaries	7,500	21,350	24,400	24,400	24,400	24,400	32,400	32,400	32,400	32,400
Management Services	7,000	19,500	19,500	19,500	19,500	19,500	------	------	------	------
Staff Expenses, Training	1,850	16,550	5,075	5,075	5,075	5,075	5,075	5,075	5,075	5,075
Concentrated Feed	1,400	25,250	39,250	41,250	44,700	45,410	45,775	45,775	45,775	45,775
Seed, Fertiliser	750	1,925	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250
Fuel, Power, Water	2,800	8,585	8,585	8,585	8,585	8,585	8,585	8,585	8,585	8,585
Disinfectant, Chemicals	800	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Insurance, Licencing	575	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250
Audit	600	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Spares	-----	-----	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600
Rent on land for fodder	3,500	19,530	19,530	19,530	16,530	19,530	19,530	19,530	19,530	19,530
Sundries	500	2,650	2,650	2,650	2,650	2,650	2,650	2,650	2,650	2,650
TOTAL	27,275	121,590	131,090	133,090	136,540	137,250	126,115	126,115	126,115	126,115

Item	YEAR 0	1	2	3	4	5	6	7	8	9
INCOME:										
Milk Sales to Dairy Plant	----	100,215	127,025	142,205	165,255	168,470	168,470	168,470	168,470	168,47
Sale of Surplus Heifers	----	----	----	9,250	39,000	30,500	33,750	33,750	33,750	33,75
Sale of Culled Cows	----	----	3,165	6,330	9,495	12,660	12,660	12,660	12,660	12,66
Beef Sales	----	----	24,055	23,365	23,065	24,055	24,055	24,055	24,055	24,05
Bull Sales	----	----	3,900	3,750	3,600	3,900	3,900	3,900	3,900	3,90
Sundries	50	250	500	500	500	500	500	500	500	50
Total	50	100,565	158,645	185,400	240,915	240,085	243,335	243,335	243,335	243,33
Total Expenditure	27,275	121,590	131,090	133,090	136,540	137,250	126,115	126,115	126,115	126,11
Surplus (Deficit)	(27,275)	(21,025)	27,555	52,310	104,375	102,835	117,220	117,220	117,220	117,22
Depreciation	----	38,690	38,690	38,690	38,690	38,690	38,690	38,690	38,690	38,69
Profit (Loss)	(27,225)	(59,715)	(11,135)	13,620	65,685	64,145	78,530	78,530	78,530	78,53
Cash flow IN (Out)	(27,225)	(86,940)	(98,075)	(84,455)	(18,770)	45,375	123,905	202,435	280,965	359,49
Actual " " "	(27,225)	(48,250)	(20,695)	31,615	135,990	238,825	287,995	405,215	522,435	639,65

* Short term and mobile equipment replaced - cost of £ 68,050

DAIRY PROCESSING SECTION

ITEM	YEAR 0	1	2	3	4	5	6	7	8	9	10
CAPITAL:											
Building and Site Development	106,090										
Plant and Machinery	186,350						16,000				
(i) Long Term	58,350										
(ii)Medium Static	112,000										
(iii) Short and Mobile	16,000						16,000				
TOTAL STERLING	292,440						16,000				
LEBANESE	2,164,055										
TOTAL WITHOUT HOUSING-Sterling	268,440										
Lebanese	1,986,455										

ITEM	YEAR 0	1	2	3	4	5	6	7	8	9	10
EXPENDITURE:											
Wages & Salaries	2,500	11,650	11,650	11,650	11,650	11,650	30,150	30,150	30,150	30,150	30,150
Management Services	7,500	45,000	45,000	45,000	45,000	45,000	-----	------	-----	-----	-----
Staff Expenses, Training	2,950	4,550	4,550	4,550	4,550	4,550	4,550	4,550	4,550	4,550	4,550
Milk Purchase-Ex farm	-----	100,315	127,025	142,205	165,255	168,470	168,470	168,470	168,470	168,470	168,470
Milk Purchase-others	-----	27,705	55,410	83,115	110,820	138,525	166,230	166,230	166,230	166,230	166,230
Rent of Machinery	-----	6,640	7,980	9,355	10,110	10,695	11,460	11,460	11,460	11,460	11,460
Purchase of Materials	10,265	44,280	58,595	76,455	92,950	99,125	112,570	112,570	112,570	112,570	112,570
Fuel, Power, Water	1,050	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Disinfectant - Chemicals	500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Insurance, Licencing	150	600	600	600	600	600	600	600	600	600	600
Advertising	2,500	12,500	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Audit	200	1,500	1,750	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Spares	-----	-----	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500
Sundries	1,000	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
TOTAL	28,615	271,540	343,860	406,230	474,235	511,915	527,330	527,330	527,330	527,330	527,330

ITEM	YEAR 0	1	2	3	4	5	6	7	8	9	10
INCOME:											
2% Milk Sales	-----	102,745	145,890	180,030	220,240	244,775	266,510	266,510	266,510	266,510	266,51
3% Milk Sales	-----	111,410	158,260	195,230	238,870	265,435	289,080	289,080	289,080	289,080	289,08
Cream Sales	-----	38,205	54,270	66,960	81,945	90,990	99,090	99,090	99,090	99,090	99,09
Sundries	-----	500	500	500	500	500	500	500	500	500	50
TOTAL	-----	252,860	358,920	442,720	541,555	601,700	655,180	655,180	655,180	655,180	655,18
TOTAL EXPENDITURE	28,615	271,540	343,860	406,230	474,235	511,915	527,330	527,330	527,330	527,330	527,33
Surplus(Deficit)	(28,615)	(18,680)	15,060	36,490	67,320	89,785	127,850	127,850	127,850	127,850	127,85
Depreciation	-----	22,625	22,625	22,625	22,625	22,625	22,625	22,625	22,625	22,625	22,62
Profit(loss)	(28,615)	(41,305	(7,565)	44,695	67,160	105,225	105,225	105,225	105,225	105,225	105,22
Cash Flow(Out)	(28,615)	(69,920)	(77,485)	(63 620)	(18,925)	48,235	153,460	258,685	363,910	469,135	574,36
Actual " "	(28,615)	(47,295)	(32,235)	4,255	71,575	161,360	273,210*	401,870	528,910	556,760	684,61

*Short term and mobile equipment replaced - cost £16,000.

OVERALL PROJECT

ITEM	YEAR 0	1	2	3	4	5	6	7	8	9	10
CAPITAL :											
Buildings and Site Development	485,875										
Plant Machinery	318,200						84,050				
(i) Long Term	64,150										
(ii) Medium Static	170,000										
(iii) Short and Mobile	84,050						84,050				
Static Productive Livestock	226,700										
600 Heifer	215,400										
6 Bulls	11,300										
TOTAL STERLING	1,030,775						84,050				
LEBANESE	7,627,735										
TOTAL WITHOUT HOUSING-Sterling	961,775										
LEBANESE	7,117,135										

ITEM	YEAR 0	1	2	3	4	5	6	7	8	9	10
EXPENDITURE:											
Wages & Salaries	10,000	33,000	36,050	36,050	36,050	36,050	62,550	62,550	62,550	62,550	62,550
Management Services	14,500	64,500	64,500	64,500	64,500	64,500	-----	-----	-----	-----	-----
Staff Expenses, Training	4,800	21,100	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625	9,625
Milk Purchase - others	-----	27,705	55,410	83,115	110,820	138,525	166,230	166,230	166,230	166,230	166,230
Concentrated Feed	1,400	25,250	39,250	41,250	44,700	45,410	45,775	45,775	45,775	45,775	45,775
Seed, Fertiliser	750	1,925	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250	2,250
Rent of Machinery	-----	6,640	7,980	9,355	10,110	10,695	11,460	11,460	11,460	11,460	11,460
Purchase of Materials	10,265	44,280	58,595	76,455	92,950	99,125	112,570	112,570	112,570	112,570	112,570
Fuel, Power, Water	3,850	21,085	21,805	21,085	21,085	21,085	21,085	21,085	21,085	21,085	21,085
Disinfectants, Chemicals	1,300	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Insurance, Licensing	725	2,850	2,850	2,850	2,850	2,850	2,850	2,850	2,850	2,850	2,850
Advertising	2,500	12,500	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Audit	800	3,000	3,250	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Spares	-----	-----	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100	8,100
Rent on land for fodder	3,500	19,530	19,530	19,530	19,530	19,530	19,530	19,530	19,530	19,530	19,530
Sundries	1,500	5,450	5,450	5,450	5,450	5,450	5,450	5,450	5,450	5,450	5,450
TOTAL	55,890	292,815	347,925	397,115	445,520	480,975	484,975	484,975	484,975	484,975	484,975

ITEM	YEAR 0	1	2	3	4	5	6	7	8	9	10
INCOME :											
2% Milk Sales	------	103,245	145,890	180,030	220,240	244,775	266,510	266,510	266,510	266,510	266,510
3% Milk Sales	----	111,410	158,260	195,230	238,870	265,435	289,080	289,080	289,080	289,080	289,080
Cream Sales	----	38,205	54,270	66,960	81,945	90,990	99,090	99,090	99,090	99,090	99,090
Sale of surplus Heifers	----	----	----	9,250	39,000	30,500	33,750	33,750	33,750	33,750	33,750
Sale of culled cows	----	----	3,165	6,330	9,495	12,660	12,660	12,660	12,660	12,660	12,660
Beef Sales	----	----	24,055	23,365	23,065	24,055	24,055	24,055	24,055	24,055	24,055
Bull Sales	----	----	3,900	3,750	3,600	3,900	3,900	3,900	3,900	3,900	3,900
Sundries	50	750	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
TOTAL	50	253,110	390,540	485,915	617,215	673,315	730,045	730,045	730,045	730,045	730,045
TOTAL EXPENDITURE	55,890	292,815	347,925	397,115	445,520	480,695	484,975	484,975	484,975	484,975	484,975
Surplus(Deficit)	(55,840)	(39,705)	42,615	88,800	171,695	192,620	245,070	245,070	484,070	484,070	484,070
Depreciation	----	61,315	61,315	61,315	61,315	61,315	61,315	61,315	61,315	61,315	61,315
Profit(Loss)	(55,840)	(101,020)	(18,700)	27,485	110,380	131,305	183,755	183,755	183,755	183,755	183,755
Cash flow in (Out)	(55,840)	(156,860)	(175,560)	(148,075)	(37,695)	93,610	277,365	461,120	644,875	828,630	1,012,385
Actual flow in (Out)	(55,840)	(95,545)	(52,930)	35,870	207,565	400,185	561,205*	806,275	1,051,345	1296,415	1,541,485

* Short term and mobile equipment replaced - cost £84,050.

PROJECTION OF CASH REQUIREMENT BASED ON A TEN INSTALLMENT

SEVEN YEAR LOAN 7%(6/4 YEARS LOAN FOR LIVESTOCK)

ITEM	YEAR 0	1	2	3	4	5	6	7	8	9	10
CASH REQUIREMENTS:											
Deficit(Surplus)	55,840	39,705	(42,615)	(88,800)	(171,695)	(192,620)	(245,070)	(245,070)	(245,070)	(245,070)	(245,070)
Repayments - Principal	170,755	60,453	160,785	160,786	100,332	100,332	100,332	----	----	----	----
- Interest	----	3,174	21,384	32,640	27,391	34,414	41,437	----	----	----	----
Local Contracts	159,000	18,000	----	----	----	----	----	----	----	----	----
Working Capital	----	42,500	22,500	16,000	22,000	18,500	----	----	----	----	----
Replacements	----	----	----	----	----	----	84,050	----	----	----	----
Balance to Find	385,595	163,832	162,054	120,626	(21,973)	(39,374)	(19,251)	(245,070)	(245,070)	(245,070)	(245070)
Cumulative " "	385,595	549,427	711,481	832,107	810,134*	770,760	751,509	506,439	261,369	16,299	Surplus

*Peak requirement reached during year 4 estimated at £845,500

Note : If no loan is required the capital invested will be replaced in Year 8. This is only just over one year before the surplus is achieved on the credit deal basis.

SCHEDULE OF DEPRECIATION CHARGES

LIVESTOCK FARM SECTION

Buildings and Site Development		379,785	@ 5%	18,990
Fixed Equipment:	Long Term	5,800	@ 5%	290
	Medium Term	58,000	@ 10%	5,800
	Short Term	68,050	@ 20%	13,610
		511,635		38,690

DAIRY PROCESSING SECTION

Building and Site Development		106,090	@ 5%	5,305
Fixed Equipment:	Long Term	58,350	@ 5%	2,920
	Medium Term	112,000	@ 10%	11,200
	Short Term	16,000	@ 20%	3,200
		292,440		22,625

OVERALL PROJECT

Building and Site Development		485,875	@ 5%	24,295
Fixed Equipment:	Long Term	64,150	@ 5%	3,210
	Medium Term	170,000	@ 10%	17,000
	Short Term	84,050	@ 20%	16,810
		804,075		61,315

NOTES ON CASH FLOW TABLES

A. LIVESTOCK FARM SECTION - CAPITAL

1. The figure of £379,785 for buildings and site development includes £45,000 for housing which could properly he treated as a rental housing charge in lieu of a capital cost. This would increase the staff expenses and decrease the annual profit but decrease the depreciation and the total capital cost which would then be £693,335 or L£5,130,680.

B. LIVESTOCK FARM SECTION-EXPENDITURE

1. The wages and salaries increase in year 6 allows for the employment of the necessary labour at the termination of the management contract. Should the management contract be renewed, the necessary adjustments would have to be made.

2. The £16,550 for staff training in year 1 includes the salaries and expenses of expatriate milkers to train the local milkers.

3. No figure is included for the cost of green fodder as the various costs(labour, cultivations, fuel, rent etc.) are included in the individual items.

4. The insurance, licencing figure includes an estimate of the cost of insuring the livestock.

5. The figure for rent on land used represents a charge made to the project by a farming enterprise for the use of its land to grow the fodder. The land could be owned by the same owners as the project or by one or more separate parties. If it was owned by the project owners, the 'rent' would represent the interest charges for the purchase of this land plus profit expected from its beneficial ownership.

C. LIVESTOCK FARM SECTION - INCOME

1. The relatively high rate of milk production in year 1 will be achieved by delivering the heifers as soon as their accommodation is completed halfway through year 0, so that those that are in-calf calve as near as possible to day 1 in year 1.

2. The milk sold to the Dairy Plant is booked through at 40p. per litre.

3. The culled cowprice is based on approximately half the price of imported beef. Some cows will be sold for beef, but others as valueless carcasses.

4. Beef sales are calculated at 350p. per Kg. which is aimed at establishing a cheaper market for quality home produced beef.

5. The bulls will be selected from the beef animals and will be available for the improvement of Lebanese dairy herds or artificial insemmination.

D. DAIRY PROCESSING SECTION - CAPITAL

1. The figure of £106,090 for buildings and site development includes £24,000 for housing which could properly be treated as a rental charge in lieu of capital cost. This would increase the staff expenses and decrease the annual profit but decrease the depreciation and the total capital cost which would then be £268,440 or LL 1,986,455 as shown.

E. DAIRY PROCESSING SECTION - EXPENDITURE

1. The Wages and Salaries increase in year 6 allows for the employment of the necessary labour at the termination of the management contract. Should the management contract be renewed, the necessary adjustments would have to be made.

2. The milk purchased from other sources has been priced at 47p. per litre average purchase price. The price will vary slightly dependant upon the costs of transport to the dairy plant.

3. The rent of machinery figure consists of the base rent for the two packaging machines plus production rentals.

4. The figure for advertising includes an allowance for coach hire and entertainment of visitors as well as general publicity. It also assumes that any national advertising campaign would be supported and assisted by the government.

F. DAIRY PROCESSING SECTION - INCOME

1. The milk is calculated to be sold at an average price of 70p. per litre wholesale or under contract. Direct retail outlets would produce a higher retun on higher expenditure and could be treated as a separate enterprise.

2. The cream production is achieved by standardising the milk down to 2% or 3% butterfat.

G. OVERALL PROJECT

1. The combined reduction if housing is included as a rental charge would be £69,000 and the total capital cost would be £961,775 or LL7,117,135 as shown.

2. The surpluses and deficits are based on day to day income and expenditure only and take no account of depreciation or interest charges.

3. The profit figure shows the margin after depreciation.

4. The cash flow figure is a theoretical one assuming a sinking fund is established for depreciation of capital investments.

H. PROJECTION OF CASH REQUIREMENT

1. The balance to find figure shows the actual cash flow out(or in) for each year.

2. The cumulative balance to find shows the total cash requirement at any time from the signature of the contract until a surplus is achie-