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The Feed-Livestock Economy of Lebanon
With Projection to 1976 and 1981

Republic of Lebanon
Office of the Minister of State for Administrative Reform
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BEIRUT, LEBANON

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THE FEED LIVESTOCK ECONOMY OF LEBANON
WITH PROJECTIONS TO 1976 AND 1981 (1)

by

Brook A. Greene and Hafez Farhat (2)

INTRODUCTION

The livestock industry in Lebanon is not meeting the demands of the population for animal products. Over the 1967-1969 period, over 80% of the apparent meat consumption was imported. For the same period, around 60% of the apparent consumption of milk and milk derivatives was imported (Table 1).

One of the major problems is the high cost of feed required in the livestock industry. An average for the 1967-1969 period showed that Lebanon imported over 150,000 tons of feeds valued at over L.L. 49 million per year (Table 2).

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1. Approved for publication as Journal Number 417 by the Faculty of Agricultural Sciences of the American University of Beirut.
 2. Respectively, Assistant Professor of Agricultural Economics and former graduate student in Agricultural Economics. Thanks are due to Drs. N. Dagher, H. Henderson, S.T. Stickley and A. Bhattacharya, Faculty of Agricultural Sciences, A.U.B., for reviewing and commenting on this manuscript.

Table 1. Apparent consumption of meat (1) and milk (2) in Lebanon, 1967-1969 (Average).

Category	Meat (000 ton)	%	Milk (000 ton)	%
Domestic Production	8.10 (3)	19.9	114.4 (4)	39.6
Imports	32.56 (5)	80.1	174.2 (6)	60.4
Total	40.66	100.0	288.6	100.0

Sources: Republic of Lebanon, *Agricultural Statistics, 1967-1969*,
 ———, *Statistiques du Commerce Extérieure 1962-1969*,
 ———, Office of Animal Production, unpublished data for 1969.

1. Including beef, veal, mutton, lamb, goat and pork.
2. Including all milk derivatives.
3. Figures related to carcass weight.
4. All kinds of milk (cow, sheep, goat).
5. Including meat equivalent of live animals, chilled and frozen meat.
6. Converted to liquid milk.

Table 2. Quantity and value of livestock feed imports and exports in Lebanon, 1967-1969 (Average).

Feed Category	Quantity (000 tons)		Value (000 L.L.)	
	Import	Exports	Import	Exports
Feed grains	132.2	4.9	24,121	1,245
Oil seed meals	62.0	5.9	21,420	3,311
Food by-products	6.8	41.8	971	1,943
Cakes and others	38.0	32.1	16,201	7,059
Total	239.0	84.7	62,713	13,558
			Net- imports	Net- imports
			127.3	22,876
			56.1	18,109
			-35.0	-972
			5.9	9,142
			154.3	49,155

Source: Nimr, S. and A. Otabi, p. 30.

PURPOSE OF THE STUDY

The general objective of this study was to estimate what contribution to the feed-livestock economy of Lebanon would be possible by greater use of local agricultural by-products and under-exploited range, fallow or abandoned land.

More specific objectives were :

1. To estimate the total nutrient requirement for all different classes of livestock;
2. To estimate the quantity, cost and feed value of various feed-stuffs produced locally and imported;
3. To estimate the potential total feed value from local agro-industrial by-products;
4. To estimate the potential total feed value from fallow or uncultivated (1) land reclamation;
5. To determine whether overall standard nutritive requirements of existing livestock in Lebanon are being met by imported plus locally produced feeds;
6. To estimate the extent to which processing of agro-industrial by-products plus reclamation of potential grazing lands could replace feed imports;
7. To project feed import requirements in 1976 and 1981 assuming optimal processing of agro-industrial by-products and reclamation of fallow lands.

1. This refers to range land, abandoned fallow areas and marginal lands, potential and natural grazing land.

SOURCES OF DATA AND METHODOLOGY

SOURCES OF DATA

Number of Livestock

Number, classification and terminology used by the Lebanese Ministry of Agriculture were used. Animals imported alive and slaughtered locally were excluded.

Feeding Standards

These were obtained with adjustments to local climate and breeds from the National Academy of Sciences, Washington, D.C. The basic measure used was digestible energy (DE) measured in Megacalories (Mc) where one Mc equals 1,000 kilocalories.

Amount of Feedstuffs Produced in Lebanon

Except for animal-origin protein concentrate by-products (1), all quantities of concentrate feedstuffs were obtained from the Lebanese Ministry of Agriculture annual statistical series. Estimates of roughage production from rangeland were obtained from appropriate faculty members, School of Agriculture, American University of Beirut (AUB).

Amount of Feedstuffs Imported

Figures from the Arab Chamber of Commerce, the Customs Office of the Beirut Port and the APO were consulted.

1. These were obtained from research reports of semi-autonomous government departments such as the Animal Production Office of Beirut (APO)

Amount of Potential By-products produced in Lebanon

Primary data were obtained by applying questionnaires to 36 producers of by-products and to 10 processors of by-products. Where a large number of firms were involved as in olive pulp processing, a sample was taken. Processing conversion factors were obtained from local processors and experimental results.

Feed Value of Feedstuffs

Values were obtained from the National Academy of Sciences; from Morrison; and from feed analyses and feeding trials conducted by the Faculty of Agriculture, A.U.B.

Costs and Prices

Processing costs and prices of by-products were obtained from processing-plant managers. Wholesale feed prices were obtained from annual Lebanese Ministry of Agriculture publications. Prices of imported feedstuffs were estimated by dividing total values by total quantities.

The DE content of one ton of a grass-legume mixture was used to estimate the nutritive value of roughage produced from reclaimed land.

METHODOLOGY

Data Analysis

The year 1969 was used since complete data was available up to this year. Secondary data was used throughout except where primary data was required. Calculations made were :

1. Total number of livestock;
2. Total amount of DE required per year by all categories of livestock;
3. Total amount of DE contained in locally produced feedstuffs;
4. Total amount of DE available annually from imported feedstuffs;
5. Total amount of DE potentially available from locally processed agro-industrial by-products;
6. Total amount of DE potentially available from uncultivated land reclamation;
7. Average cost of DE from all sources.

Projections

Simple linear regression analysis of time series data was used. Projections included : livestock numbers; cultivated area, production and yield for each feed; volume of by-products; and total amount of DE available from all feed categories and all feed sources.

RESULTS

A. The Feed-Livestock Situation in Lebanon, 1969

The total nutritive requirements in terms of DE needed by all livestock categories in 1969 were estimated at 1,881,088,600 megacalories (Mc) (Table 3). This represents an optimal level required for one year. On the other hand, the total feed value for all categories of feedstuffs produced and consumed locally was estimated as 598,333,500 Mc (Table 4). This included energy-concentrates, protein-concentrates and roughages. (1)

Even when the total feed value of imported feedstuffs, estimated at 654,801,800 Mc (Table 5) was added to the value of local production, it was found that a deficit existed between what should be fed and what was fed. This deficit amounted to 33.4% of the estimated total nutritive requirements for all livestock categories in 1969. Furthermore, of the total feed consumed in Lebanon by all livestock in 1969, 52.3% was imported at an estimated cost of roughly LL 41 million. (Table 6).

Looking at specific categories of feeds, it was shown that locally produced feedstuffs were cheaper, especially for protein-concentrates, than imported feedstuffs. Imported protein-concentrates cost over double the local product. Except for roughages, imported feeds were clearly of major importance in the feeding of livestock in Lebanon as 80% of the energy-concentrates and 70% of the protein-concentrates were imported (Table 7).

1. Energy-concentrates produced locally included barley, corn and sorghum grains; wheat bran, dried beet pulp and beet molasses as by-products. Protein-concentrates produced locally included vetch seed; the meals of peanut, sunflower, soybean and cottonseed; feather meal and bone meal. Roughages produced locally included alfalfa and clover hay, the fine broken light straw or tinn from wheat, barley, vetch, lentils, chickpea; grasses and legumes; corn and sorghum silage.

Table 3. Total nutrient requirements needed by all livestock categories in Lebanon, 1969* (DE in 000 Mc)

Category	Total DE required per year (000 Mc)
Bovine	625,034.0
Sheep and goats	684,408.2
Swine	46,112.6
Poultry	362,420.0
Horses, mules and donkeys	163,118.8
GRAND TOTAL	1,881,088.6

* Details can be found in Appendix A, Tables 1, 2, 3.

Table 4. Total feed value and cost of all feedstuffs produced in Lebanon, 1969*

Feedstuff	Total DE (000 Mc)	Total Value (000 L.L.)
Energy concentrate	158,461.5	7,203.2
Protein concentrate	62,847.1	5,103.2
Roughage	377,024.9	15,618.9
Grand Total	598,333.5	27,925.3

* Details can be found in Appendix A, Tables 4, 5, 6.

Table 5. Total feed value and total costs of all net imported feedstuffs into Lebanon, 1969.

Class	Total Quantity (m.t.)	DE/Ton (Mc)	Total DE/ Class (1000 Mc)	Cost/Ton (LL)	Total cost/ Class (1000 LL)
ENERGY CONCENTRATE					
Grains					
Barley	85,612	3316	283,889.4	143.0	12,242.5
Corn	73,865	3624	267,686.7	185.5	13,702.0
Sorghum	1,307	3395	4,437.2	213.4	278.9
Others	2,103	3220	6,771.7	285.7	600.8
By-Products					
Wheat screenings	879	30022	2,656.3	97.2	85.4
Dried beet pulp + dried spent grains	5,061	2750	13,917.7	275.7	1,395.3
Beet + turnip feed	190	3100	589.0	237.0	45.0
Dehydrated barley malt	1,160	2830	3,282.8	360.0	417.6
TOTAL			583,230.8		28,767.5
PROTEIN CONCENTRATE					
Plant Origin					
All cakes	7,741	3000(1)	23,223.0	422.0	3,266.7
Other Concentrates	12,402	3100	38,446.2	630.8	7,823.2
Animal Origin					
Fish + meat meal	1,536	2970	4,561.9	477.5	733.4
TOTAL			66,231.1		11,823.3
Roughage					
Tibn	2,824	1850	5,224.4	102.6	289.7
Plant « wastes »	169	920	155.5	50.3	8.5
TOTAL			5,339.9		298.2
GRAND TOTAL			654,801.8		40,889.0

1. Average.

Sources: Direction Centrale de la Statistique : «Recueil de Statistiques», 1969; United States — Canadian Tables of Feed Composition, N.A.S., 1969; Nimr and Olabi, 1970.

Table 6. The Lebanese feed-livestock situation in 1969.

Feed items	Total DE (000 Mc)	%	Total Cost (000 L.L.)	%
1. Total livestock feed req'ts	1,881,088.6	100.0	—	—
2. Value of local feed production	598,333.5(1)	31.8	27,925	40.6
3. Value of feed imports	654,801.8(2)	34.8	40,889	59.4
4. Value of total feed consumed (2+3)	1,253,135.3	66.6	68,814	100.0
5. Deficit (1-4)	627,953.3	33.4	—	—

1. This is 47.7% of total feed consumed in 1969.

2. This is 52.3% of total feed consumed in 1969.

B. The Processing of Agro-Industrial By-Products

In 1969, an estimated 391-272,800 Mc of DE could have been obtained by local processing of agro-industrial by-products(1) at a cost of LL 16 million. This feed value would have come mainly from protein-concentrates which made up over 90% of the total DE (Table 8).

It was further estimated that all DE from imported protein-concentrates and from imported roughages could have been replaced by local processing of by-products. In these two categories, in fact, a surplus of DE could be obtained locally. However, with regard to energy-concentrates, local production from by-products would replace only 0.7% of the amount imported in 1969. Assuming that protein-concentrates and roughages could replace on the average for all species of livestock 319,702,600 MC of DE, then one can conclude that roughly 60% of total imported DE could be replaced by processing local agro-industrial by-products at a net gain of around LL. 11 million (Table 9).

C. Reclamation of Uncultivated Lands

Given an estimated total area in 1969 of 236,147 hectares for fallow and poor range land in Lebanon, only 61,600 hectares were used as natural pasture for livestock leaving 174,547 hectares as fallow land (El Mursi, 1972, pp. 3-4).

Assuming that : (1) 1/4 of the fallow land or 43,636 hectares could be reclaimed to give a yield of 10 tons of forage per hectare;

(2) 1/4 of the 1969 acreage of natural pasture of 15,400 hectares could be made to increase production from the present 5 tons per hectare to 10 tons per hectare;

1. Estimates of the quantities of selected by-products produced locally can be seen in Appendix B, Tables 15-21.

Table 7. Percent distribution of amount and cost of feedstuffs locally produced and imported into Lebanon, 1969.**

Feedstuff	Energy concentrate			Protein concentrate			Roughages			Average cost
	1	2	3	1	2	3	1	2	3	
Locally produced	21.4	20.0	45.5	48.7	30.0	81.4	98.6	98.1	41.4	46.7
Imported	78.6	80.0	49.3	51.3	70.0	178.5	1.4	1.9	55.8	62.4
Total	100.00	100.0	—	100.0	100.0	—	100.0	100.0	—	—

1. Percent of total amount of feedstuff consumed.

2. Percent of total cost of feedstuff consumed.

3. Estimated cost per unit of DE in L.L. per 1,000 Mc.

4. Average cost per unit of DE of locally produced and imported feedstuffs over all categories of feedstuffs in L.L. per 1,000 Mc.

De — digestible energy Mc = megacalorie.

** Details of % distribution of total feed value and costs for all categories of feedstuffs produced in Lebanon, imported, and consumed can be seen in Appendix A, Tables 7, 8, 9.

Table 8. Percent distribution of total feed value end costs for all potential by-products in Lebanon, 1969*.

Feedstuff Category	DE (000 Mc)	% of total DE	Cost (000 L.L.)	% of total cost
Energy concentrate	3,552.9	0.9	102.3	0.6
Protein concentrate	365,075.5	93.3	15,791.2	95.3
Roughages	22,644.4	5.8	686.2	4.1
Total	391,272.8	100.0	16,579.7	100.0

* Details for each feed category can be seen in Appendix B, Tables 10, 11, 12, 13

Table 9. Potential gross and net gain obtained by replacing feed imports with local by-products, 1969.

Feed Category	Total imports DE (000 Mc) (1)	% of Col. (1) (2)	DE replaceable with by-products (000 Mc) (3)	% of Col. (1) (4)	Gross Gain (1) (000 L.L.) (5)
Energy concentrate	583,230.8	89.0	319,702.6(2)	48.7	15,761.3
Protein concentrate	66,231.1	10.1	66,231.1	10.1	11,823.3
Roughages	5,339.9	0.9	5,339.9	0.9	298.2
Total	654,801.8	100.0	391,273.6	59.7	27,882.3
Net Gain (000 L.L.)	Gross Grain 27,882.8	Est. cost of processing by-products (3) -16,579.7			11,303.1

1. Gross gain = amount of DE replaceable (i.e. Col. (3) multiplied by the price per unit of DE. Prices per unit of DE for all feedstuffs locally produced, imported or processed are given in the Appendix B, Table 14.

2. This figure was estimated a 48.7% of total DE imported or 48.7% x 654,801,800 Mc. This assumes that surplus in the protein concentrate and roughages locally produced could be used in place of 319,702/582,230 or roughly 50% of the DE in the energy concentrate feedstuff.

3. See Appendix B, Tables 10 - 13.

(3) each ton of green forage would provide 723 Mc of DE (1) and had a value of LL 30/ton;

then, a total of 371,164,700 Mc of DE could have been produced from this source valued at over LL 15 million (Table 10).

Furthermore, assuming an average cost of reclaiming fallow land to be LL 465/ha, (2) then, the total estimated capital investment for reclaiming 1/4 of the total area of fallow and natural rangeland would be LL 27 million. (3) Estimating an average green forage yield of 10 tons/ha valued at LL 30 per ton, gross returns per year would be LL 15 million (4), a very high rate of return on the initial fixed cost investment.

With regard to the value of this potential forage production in replacing DE from imported feeds, total roughage imports would certainly be replaced. If we assume that the remaining DE could be used to replace DE from energy concentrate feed imports, then the net gain would be roughly LL 3 million (Table 11).

Table 10. Estimated forage production and value from 1/4 total fallow land reclamation in Lebanon, 1969.

Land type	1/4 of total area (ha)	Est. yield green forage (ton/ha)	Green forage production (ton)	DE (1) (000 MC)	Est. value(2) (000 LL)
Follow	43,636	10	436,367	315,493	13,091
Actual pasture	15,400	5 (3)	77,000	55,671	2,310
Total	59,036	—	513,367	371,164	15,401

1. 723 MC/ton. 2. LL 30/ton for green forage (Source : Animal Production Office, Beirut).
3. Increase in yield is 5 ton/ha over present yield.

1. Nat'l Academy of Sciences, p. 57. This refers to a grass-legume ensiled mixture.
2. See Appendix C, Table 22 for detailed reclamation costs.
3. 59,036.75 hectares x LL 465/ha. gives 27,451,740 LL.
4. See Table 10. 15/27 would be a rate of return of 55%.



Table 11. Potential gross and net gain obtained by replacing feed imports with 1/4 land reclamation production, 1969.

Feed category	Imports of DE (000 Mc)	DE Replaceable (000 Mc)	Gross gain (000 LL)
Energy concentrate	583,230.8	365,824.8	18,035.2(1)
Protein concentrate	66,231.1	—	
Roughage	5,339.9	5,339.9	298.2(2)
Total	654,801.8	371,164.7	18,333.4
Annual net gain (000 LL)	18,333	—15,401 (3)	= 2,932

1. DE 365,824.8 x value of DE from imported energy concentrate at LL. 49.3 per 1000 Mc of DE.
2. DE 5,339.9 x value of DE from imported roughages at LL 55.80 per 1000 Mc of DE.
3. Estimated cost of production. See Table 10.

D. Local Feed Production as a Substitute for Feed Imports

In terms of digestible energy, all feed imports could have been replaced in 1969 by processing potential agro-industrial by-products and reclaiming 1/4 of total fallow lands with a net surplus of 107,363,000 Mc and a net gain of LL 8.9 million (Table 12).

Looking at the total feed value for all available feeds in 1969 including : imports, local production in 1969, potential production from by-products and 1/4 of the reclaimed fallow lands, it was shown that the total potential DE available exceeded the estimate of total livestock requirements of DE for optimal production by 134,484,200 Mc (Table 13).

The poultry industry has a position of dominance in the livestock economy of Lebanon. Even though a surplus of DE could have been produced locally thus theoretically replacing all imports of DE, in fact an estimated 43,311 tons of feedgrains would still have been required from imports to meet the DE requirements of the poultry industry (Table 14). This tonnage would have represented, in terms of DE, 21.6% of total energy-concentrate feeds, imported into Lebanon in 1969(1). Should the excess protein-concentrate DE obtained from processing of local agro-industrial by-products be used to manufacture livestock feeds, then further imports of energy-concentrate feeds would be required. The overall effect would be to use some of the excess capacity available in local feed manufacturers and thus increase efficiency of local feed production.

Table 12. Potential gross and net gain from local feed production in Lebanon, 1969.

Category	DE (000 Mc)	% of Imports	Value (000 LL)	% of Imports
1. Feed imports	654,801.8	100.0	40,889(1)	100.0
2. Local by-products	391,272.8	59.8	16,580(2)	40.5
3. 1/4 fallow lands reclaimed	371,164.7	56.7	15,401(3)	37.7
4. Gross gain (2+3)	762,437.5	116	31,981	78.2
5. Net gain (4—1)	107,635.7	16.4	8,908	21.8

1. See Table 6. 2. See Table 8. 3. See Table 10.

1. 126,225,000 Mc/583,230,800 Mc = 21.6%.

Table 13. Total feed value of all available feeds in Lebanon, 1969 (DE in 000 Mc).

Feed category	Imports	Present local production	Potential by-product production	Potential 1/4 land reclamation	All Feeds
1. Energy concentrate	583,230.8	158,461.5	3,552.9	—	745,245.2
2. Protein concentrate	66,231.1	62,847.1	365,075.5	—	494,153.7
3. Roughages	5,339.9	377,024.9	22,644.4	371,164.7	776,173.9
4. Total	654,801.8	598,333.5	391,272.8	371,164.7	2,015,572.8
5. Estimated total livestock requirements					1,881,088.6
6. Difference (4—5)					134,484.2

Table 14. Feed grain DE and tonnage needed by all poultry in Lebanon, 1969.

Category	DE (000 Mc)	%	Tonnage
1. Total poultry nut. requirements	362,420.0(1)	—	—
2. Total DE from energy-concentrate	253,694.0(2)	100.0	—
3. Local energy-concentrate production of DE	127,469.0(3)	50.2	43,616 (4)
4. Import requirement (2-3)	126,225.0	49.8	43,311

1. See Table 3 and Appendix A Table 2.
2. Assuming 70% of the DE requirements are provided by energy-concentrate feed grains. Thus, 70% of 362,420,000 Mc gives 253,694,000 Mc.
3. See Appendix A, Table 4. DE from barley, corn, sorghum and wheat bran sums to 127,469,000 Mc.
4. Assuming 2,915 Mc/ton as an average figure; then, 127,469,000/2,915 equals 43,616 tons.

E. Projections to 1976 and 1981

Assuming that expected changes in prices, numbers or production variables and technology will continue to follow the same trend as before simple linear regression analysis of time series data was used to determine : future numbers of livestock; future area, yield and production of local feed producing crops; future volume of local by-product production; and the future feed livestock situation in Lebanon for 1976 and 1981.

With regard to livestock numbers, the present trends lead to a decline in all livestock except poultry and swine where significant increases were forecast (Appendix D, Table 23).

With regard to feed crops, acreage is expected to increase significantly for lentils, alfalfa, sugarbeets and peanuts, while that for corn and sorghum, should decline rapidly. (1) Acreage for other crops is expected to remain constant. Only alfalfa and sugarbeet yields showed an upward trend (Appendix D, Table 24).

With regard to by-product production, all results pointed to an increase in local production (Appendix D, Table 25). Estimated tonnages for 1976 and 1981 are shown in Table 15.

Putting all these elements together, the total feed livestock situation in 1976 and 1981 was estimated.

Table 15. Production projections to 1976 and 1981 of selected local agro-industrial by-products in Lebanon (metric tons).

By-product(1)	Year		
	1971	1976	1981
Poultry blood and bone meal	1,025	1,466	1,903
Feather meal	644	925	1,204
Dried spent grains	340	434	528
Citrus tonnage (2)	24,300	43,100	61,600
Tomato tonnage (2)	2,450	3,990	5,420
Dried kharob pulp	1,050	1,690	1,980
Cottonseed meal	(30,745) (3)	37,936	46,143
Soybean meal	(3,769) (3)	9,645	12,145

1. Production of dried whey, left-over from the canning industry and corn cobs were not projected. The yield function for olive pulp production was the least significant. Volume of slaughterhouse wastes were assumed to be constant over time due to insufficient data. See Appendix D, Table 28.
2. This refers to tonnage used in the juice industry in Lebanon. Citrus yields 55% wet pulp while tomato yields 15% wet pulp.
3. 1969 figures.

1. Averaging prices over 1967-1969, local corn sold at LP 26.5/kg and sorghum at LP 24/kg as compared to imported corn at LP 18.5/kg and imported sorghum at LP 21.4/kg.

For locally produced feedstuffs, total DE is forecast to increase by 40% of the 1969 figure in 1976 and by 58% of the 1969 figure in 1981. Thus, in 1981, energy concentrate production would have doubled, protein concentrate production would have tripled and roughage production would have increased 1 1/2 times over the 1969 figures (Table 16).

Projections for the potential processing of agro-industrial by-products showed that total feed value from these sources could increase by 36% and 68% of the 1969 figures for the years 1976 and 1981, respectively (Table 17).

Assuming that fallow-land reclamation would begin in 1973 and that 1/4 of the total area or 59,036 hectares were reclaimed by 1976 and 1/2 by 1981, then total feed value from local feed production, by-product processing and fallow land reclamation would give a surplus of three percent over the total feed value required by all livestock in 1976. For 1981, the surplus would be 61% (Table 18). However, as local feed grain production is presently declining, imports of grain (1) would be required for the poultry industry. These were estimated at 121,000 tons in 1976 and 150,000 tons in 1981. Assuming that this increases the total available supply of DE and therefore increases the surplus DE available over and above the estimated total nutrient requirements, then a possible 53,000 and 159,000 more dairy cows could be supported in 1976 and 1981, respectively, just on the basis of available DE units (Table 19).

1. Assumed to be primarily corn.
2. Since most of the imported corn might go to the poultry industry, the lower estimate of 6,000 and 100,000 more dairy cows might be a possible maximum unless further corn is imported.

Table 16. Projected total feed value of all locally produced feed-stuffs in Lebanon (DE in 000 Mc).

Feed category	Year					
	1969 (1)	% 1976 (2)	1976 (3)	% of (1) (4)	1981 (5)	% of (1) (6)
Energy concentrate	158,462	100	136,575 (1)	86.1	181,514 (1)	114.5
Protein concentrate	62,847	100	155,794	247.9	203,705	324.1
Roughages	377,025	100	548,696	145.5	563,958	149.6
Total	598,334	100	841,065	140.5	949,177	158.6

1. The only feed grain produced is barley. Corn and sorghum production vanish in 1976 while beet pulp and beet molasses production begin to increase thereafter.

* Details of these projections can be seen in Appendix D, Tables 26 and 27.

Table 17. Projected total feed value of all potentially processed by-products in Lebanon (DE in 000 Mc).

Feed category	1969	%	1976	(3)% of (1)	1981	(5)% of (1)
	(1)	(2)	(3)	(4)	(5)	(6)
Energy concentrate	3,553	100	18,558	522.3	25,317	712.5
Protein concentrate	365,076	100	463,658	127.0	578,705	158.5
Roughage	22,645	100	47,590	210.1	52,835	233.3
Total	391,274	100	529,806	135.9	656,857	167.8

* Details of these projections can be seen in Appendix D, Table 28.

Table 18. Projected feed-livestock situation in Lebanon in 1976 and 1981 excluding imports.

Item	Feed value		%	Feed value 1981 (000 Mc)
	1976 (000 Mc)	1981		
1. Total nutrient requirement for all livestock (1)	1,685,223	100	100	1,520,633
2. Local production (2)	841,065	50	50	1,053,097
3. By-product processing (3)	529,806	31	31	656,857
4. Land reclamation	371,165 (4)	22	22	742,330 (4)
5. All local production (2 + 3 + 4)	1,742,036	103	103	2,452,284
6. Surplus (1 + 5)	+ 56,813	3	3	+ 931,651

1. See Appendix D, Table 26.

2. See Appendix D, Table 27.

3. See Appendix D, Table 28.

4. This assumes that 59,036 hectares would be reclaimed by 1976 and double this amount by 1981. The estimated feed value would be 371,165,000 Mc per 59,036 hectares. The total possible area 236,144 hectares.

Table 19. Estimated number of additional dairy cows supported by projected DE surpluses in 1976 and 1981 (DE in 000 Mc).

Item	Year	
	1976	1981
1. De req'd, all livestock	1,685,223	1,520,633
2. DE from local sources (1)	1,742,036	2,452,284
3. Surplus DE (2-1)	56,813	931,651
4. DE from corn imports (2)	434,000	540,960
5. Total surplus DE (3 + 4)	490,813	1,472,611
6. No. dairy cows supported by row 3 above (3)		
7. No. dairy cows supported by row 5 above (3)	53,060	159,201



1. Including local production, by-product processing and 1/4 land reclamation in 1976 (59,000 ha) and 1/2 land reclamation in 1981 (118,000 ha). Excluding imports.

2. Assuming 121,000 tons and 150,000 tons of corn in 1976 and 1981, respectively, at 3,586.8 Mc per ton (average for white and yellow Dent Corn).

3. Assuming a requirement of 9,250 Mc/year/mature dairy cow.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

Shortages in local feed production in Lebanon are accompanied by the costly import of feeds.

Local production could be increased by processing agro-industrial by-products and by reclaiming uncultivated lands.

The effect of increasing local feed production on the feed-livestock economy of Lebanon was evaluated. The year 1969 was chosen as the base year. Data were primarily from secondary sources except for primary survey data on by-product production.

Simple linear regression analysis using time series data was used to project the various facets of the feed-livestock economy to 1976 and 1981 under certain assumptions.

CONCLUSIONS

General conclusions were :

1. Both the processing of agro-industrial by-products and the reclamation of 1/4 of the total area of uncultivated lands could be used to augment locally produced and imported feeds such that the estimated total nutrient requirements of all livestock would have been met and a surplus of feed value available for the support of large numbers of livestock such as dairy cattle. The net gain in 1969 would have been around L.L. 10 million.
2. Projected local feed grain production is declining. However, should by-product processing and uncultivated land reclamation be undertaken, the overall feed-livestock situation in 1976 and 1981 could be very promising.

3. The promotion of feed and livestock industries should have beneficial effects on other supporting industries and help alleviate the unemployment problem in Lebanon.

Specific conclusions were :

1. A deficit of 33.4% existed in 1969 between the estimated total nutritive requirements of all livestock categories and the total feed value actually available from locally produced feeds and from imported feeds.

This deficit would decline to 18% in 1976 and would become a surplus of 12.4% in 1981 should processing of agro-industrial by-products and reclamation of 1/2 of all uncultivated lands be undertaken.

2. Of the total amount of feed consumed by all livestock in Lebanon in 1969, 47.7% was from locally produced feeds and 52.3% from feed imports.
3. Total feed costs in 1969 amounted to L.L. 69 million of which imported feeds made up 59.4% or L.L. 41 million.
4. The processing of available by-products could have replaced 60% of the total DE imported in 1969 at a net gain of L.L. 11 million.
5. Reclamation in 1969 of 1/4 of the total area of fallow land and natural pasture could have replaced 56% of the total DE imported at a net gain of L.L. 3 million.
6. A combination of processing of local by-products and reclaiming 1/4 of the fallow lands could have produced in 1969 a surplus of DE over that imported with a net gain valued at L.L. 9 million.
7. Combining local feed production and imports in 1969 with potential production from processed by-products and land reclamation would have provided sufficient DE to exceed the estimates of total nutrient requirements for all livestock with a net gain of L.L. 10 million.

8. All feed imports in 1969 could have been replaced by processing by-products except for 43,300 tons of feed grains required for the poultry industry. Surplus protein concentrates from by-products could have been used to increase the working capacity of the animal feeds industry.
9. Projections to 1976 and 1981 showed an increase in poultry and swine and a decrease in all other livestock numbers.
10. Projections to 1976 and 1981 showed an increase in the acreage planted to alfalfa, sugarbeets, peanuts and entils; and a strong decrease in acreage planted to corn and sorghum with other crops remaining constant.
11. Projections to 1976 and 1981 showed an increase in yield only for alfalfa and sugarbeets with other crop yields remaining constant.
12. Projected total feed value of locally produced feeds showed an increase of 40% and 58% in 1976 and 1981, respectively, over the 1969 figure.
13. Projected total feed value of by-products that could be processed locally showed an increase of 36% and 68% in 1976 and 1981, respectively, over the 1969 figures.
14. Due to expected future shortages in local production of feed grains, an estimated 121,000 and 150,000 tons of cereal grains would need to be imported for the poultry industry in 1976 and 1981, respectively.
15. Assuming only total DE available from projected local production, by-product processing, and 1/4 to 1/2 of available uncultivated land reclamation, a surplus over the total feed value required by all livestock could be obtained in the future. This surplus would amount to 3% of the total requirements in 1976 and 61% in 1981. These surplus amounts of DE could theoretically support an additional 6,000 dairy cows in 1976 and over 100,000 in 1981.
16. Should total feed value of projected cereal grain import requirements be included with the projected total value of DE

available in 1976 and 1981, sufficient DE would exist to support an additional 53,000 dairy cows in 1976 and 159,000 in 1981.

RECOMMENDATIONS

1. Since imported feeds are expensive, substitution with locally available feeds should be attempted. This is specially of interest due to inefficiencies in the present livestock economy of Lebanon. Thus upgrading livestock, reclaiming fallow and uncultivated lands and processing agro-industrial products can improve the efficiency of this very important sector of the Lebanese economy.
2. The large local feed processing plants should be encouraged to establish drying plants.
3. Farmers should be encouraged and assisted to produce more forage crops. This encouragement could include : price incentives, efficient marketing arrangements, greater credit availability, long-term dairy production, price protection from imported sources for local corn and sorghum, introduction of high-yielding cereals and an intensive research program to promote all aspects of production.
4. Research should be encouraged to study all possible forms of natural resources that are not at present being adequately exploited. For example, many other waste products not studied here do exist such as animal manure, banana leaves and stalks, carrot and apple pulp and wood shavings. The latter is used as a base for the majority of the poultry litter in Lebanon. In addition, hatchery waste products are available.

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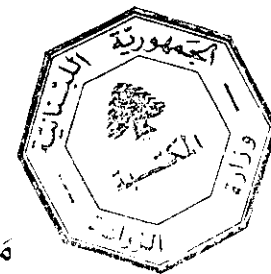
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الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

LIST OF ABBREVIATIONS

Animal Production Office, Beirut	A.P.O.
American University of Beirut	A.U.B.
Cotton Seed Meal	C.S.M.
Digestible Energy	D.E.
Gross Domestic Product	G.D.P.
Kilogram	Kg.
Lebanese Pound	L.L.
Lebanese Piastre	L.P.
Megacalorie	Mc.

APPENDICES



APPENDIX A

Table 1. Total nutrient requirements, (DE) needed by all bovine classes in Lebanon, 1969.

Class	Number of heads	DE req./head/day (Mc)	DE req./subclass/year (1000 Mc)	DE req./class/year (1000 Mc)
Dairies				
Over 15 months	30,035	12.6 (1)	264,848.6	
Below 15 months	15,774	12.0 (2)	68,090.1	
TOTAL :	45,809			332,938.7
Working				
Males	11,323	27.2 (3)	112,414.7	
Females	12,065	24.0 (4)	105,689.4	
TOTAL :	23,388			218,104.1
Other Cattle				
Over 15 months	3,431	15.6 (5)	19,536.2	
Below 15 months	13,087	11.4 (6)	54,455.0	
TOTAL :	16,518			73,991.2
GRAND TOTAL :	85,715			625,034.0

1. Assuming that the animal average weight is 350-400 kg, milk prod./year is 3000 kg, 12.6 + 10.2 Mc required daily during the last 65 days of pregnancy, 12.6 + 13.4 Mc required daily during the lactation period which is 300 days on average.
 2. Assuming that the animal average weight is 150-200 kg.
 3. Assuming that the animal average weight is 400 kg.
 4. Assuming that the animal average weight is 350-400 kg.
 5. Assuming that the class includes breeding bulls and other dry pregnant cows (350-400 kg).
 6. Assuming that 50-60% of this consists of fattening calves of 150-200 kg average weight.
- Sources : Direction Centrale de la Statistique : « Recueil de Statistiques Libanaises » 1970.
Nutrient requirements of Domestic Animals No. 3, N.A.S. publication 1349, 1966.
Nutrient Requirements of Domestic Animals No. 4, N.A.S. 1970.

Table 2. Total nutrient requirements (DE) needed by all sheep, goats, swine and poultry in Lebanon, 1969.

Category	Number of heads	DE req./Head/day (Mc)	DE req./subclass/year (1000 Mc)	DE req./categ./year (1000 Mc)
Sheep (1)				
Males	35,264	3.8	48,593.8	
Females	177,640	4.0	259,354.4	
TOTAL :	212,904			307,948.2
Goats (2)				
Males	62,833	2.8	64,215.3	
Females	285,155	3.0	312,244.7	
TOTAL :	347,988			376,460.0
Swine	13,160	9.6 (3)		46,112.6
Poultry				
Layers	2,713,200	0.22 (4)	217,870.0	
Broilers	14,750,000	0.23 (5)	144,550.0	
TOTAL :	17,463,200			362,420.0

1. Assuming male average weight 45 kg and female average weight 45 kg.
 2. Assuming male average weight 30-35 kg and female average weight 25-30 kg.
 3. Assuming average weight of breeders and fattening pigs is 150-160 kg.
 4. Assuming average weight is 1.6 kg.
 5. Assuming average weight is 1.3 kg fed for 45 days on the average.
- Sources: Direction Centrale de la Statistique : « Recueil de Statistique Libanaises », 1970.
 Nutrient Requirements of Domestic Animals No. 5, N.A.S., 1968.
 Nutrient Requirements of Domestic Animals No. 2, N.A.S., 1967.
 Nutrient Requirements of Domestic Animals No. 1, Sixth revised ed., N.A.S., 1971.

Table 3. Total nutrient (DE) needed by all horses, mules and donkeys in Lebanon, 1969.

Class	Number of heads	DE req./head/day (Mc)	DE req./head/year (Mc)	DE req./class/year (1000 Mc)	Assumption
Horses	2950	15.0	5475	16,151.3	Average weight 400 kg (Race Lig. work)
Mules	3445	16.2	5913	20,370.3	Average weight 250-300 kg (medium work)
Donkeys	27970	12.4	4526	126,592.2	Average weight 150-200 kg
TOTAL :				163,113.8	

Sources: Direction Centrale de la Statistique : « Recueil de Statistique Libanaises » 1970.
 Nutrient Requirements of Domestic Animals, No. 6, N.A.S., 1966.

Table 4. Total feed value and total cost of energy-concentrate feedstuffs produced in Lebanon, 1969.

	Total Production (tons)	DE/ton (Mc)	Total DE (1000 Mc)	Price/ton (LL)	Total cost (LL 1000)
Grains					
Barley	6,750	3,116	21,033.0	200	1,350.0
Corn	1,111	3,624	4,026.3	260	288.9
Sorghum	611	3,395	2,074.3	240	146.6
By-Products					
Wheat Bran	35,144 (1)	2,855	100,336.1	110	3,865.8
Dried Beet Pulp	6,104 (2)	2,890	17,640.6	160	976.6
Beet Molasses	4,794	2,785	13,351.2	125	575.3
TOTAL	54,514		158,461.5		7,203.2

1. Local production was higher; 35% of it was exported.

2. 6.4 percent of the whole beet's weight.

Sources: Direction Centrale de la Statistique : « Recueil de Statistiques Libanaises » 1970.

United States — Canadian tables of Feed Composition, N.A.S., 1970.

Table 5. Total feed value and total cost of protein-concentrate feedstuffs produced in Lebanon, 1969.

	Total production (tons)	DE/Ton (Mc)	Total DE (1000 Mc)	Price/ton (LL)	Total cost (LL 1000)
Plant Origin					
Vetches (seed)	2,558.0 (1)	2,822	7,218.7	260	665.0
Peanut Meal	833.0	3,300	2,748.9	320	266.5
Sunflower Meal	1,523.0	2,910	4,431.9	180	274.1
Soybean Meal	3,769.0 (2)	3,200	12,050.8	400	1,507.6
C.S.M.	12,783.0 (3)	2,814	35,971.4	180	2,301.0
Animal Origin					
Feather Meal	110.0	2,728	300.0	420	46.2
Bone Meal	475.0	264	125.4	90	42.8
TOTAL	22,051.0		62,847.1		5,103.2

1. Local production was higher; 28 percent of it was exported.

2. Seeds were imported.

3. Seeds were imported and cake production was 30,745 tons.

Sources: Direction Centrale de la Statistique : « Recueil de Statistique Libanaises » 1970.

United States — Canadian Tables of Feed Composition, N.A.S., 1969.

Table 6. Total feed value and total cost of roughages produced in Lebanon, 1969.

	Total Production (tons)	DE/Ton (Mc)	Total DE (1000 Mc)	Price/Ton (LL)	Total cost (LL 1000)
Alfalfa, Clover, Bers. Hay	3,527.5	2,400	8,466.0	160	564.4
Wheat tbn	65,912.0	1,860	122,596.3	95	
Barley tbn (1)	3,375.0	1,900	6,412.5	95	
Vetch tbn (1)	3,572.0	1,910	6,822.5	95	7,282.8
Lent tbn (1)	2,131.0	2,050	4,368.6	95	
Chickpea tbn (1)	1,671.0	2,040	3,408.8	95	
Grasses and Legumes (Natural Pastures (2))	308,000.0	723	222,684.0	25	7,700.0
Corn Stover (3)	2,122.0	672	1,426.0	20	43.4
Sorgh Stover (3)	1,167.0	720	840.2	25 (4)	29.3
			377,024.9		15,618.9

1. Light straw

2. Area is 61,600 hectares

3. Ensiled; 1.91 kg per 1 kg of grain

4. Estimated value.

Sources: Direction Centrale de la Statistique : « Recueil de Statistiques Libanaises » 1970.
United States — Canadian Tables of Feed Composition, N.A.S., 1969.

Table 7. Percent distribution of total feed value and costs over all categories of feedstuffs produced in Lebanon, 1969.

Category	DE (1000 Mc)	Percent of total production	Costs (1000 LL)	Percent of total costs
Energy concentrate	158,461.5	26.5	7,203.2	25.8
Protein concentrate	62,847.1	10.5	5,103.2	18.2
Roughages	377,024.9	63.0	15,618.9	56.0
GRAND TOTAL	598,333.5	100.0	27,925.3	100.0

Table 8. Percent distribution of total feed value and costs over all categories of feedstuffs imported into Lebanon, 1969.

Category	DE (1000 Mc)	Percent of total production	Costs (1000 LL)	Percent of total costs
Energy concentrate	583,230.8	89.0	28,767.5	70.4
Protein concentrate	66,231.1	10.1	11,823.3	28.9
Roughages	5,339.9	0.9	298.2	0.7
GRAND TOTAL	654,601.8	100.0	40,889.0	100.0

Table 9. Percent distribution of total feed value and costs over all categories of feedstuffs consumed in Lebanon, 1969.

Category	DE (1000 Mc)	Percent of total production	Costs (1000 LL)	Percent of total costs
Energy concentrate	741,692.3	59.2	35,970.7	52.3
Protein concentrate	129,078.2	10.3	16,926.5	24.6
Roughages	382,364.8	30.5	15,917.1	23.1
GRAND TOTAL	1,253,135.3	100.0	68,814.3	100.0

APPENDIX B

Table 10. Total feed value and total cost of energy-concentrate by-products in Lebanon, had they been processed in 1969.

Feed	Total Quantity (m.t.)	DE/Ton (Mc)	Total DE (1000 Mc)	Cost/Ton (LL)	Total Cost (1000 LL)
Citrus pulp	211.2	3450	728.6	110	23.2
Citrus molasses	162.2	2207	360.2	100	16.3
Kharob pulp	852.0	2866	2,441.8	70	59.6
Dried whey	6.5	3422	22.3	500	3.2
TOTAL			3,552.9		102.3

Sources: Personal interviews with selected processing plants' managers.
United States — Canadian Tables of Feed Composition, N.A.S., 1969.

Table 11. Total feed value and total cost of protein-concentrate by-products in Lebanon, had they been processed in 1969.

Feed	Total Quantity (m.t.)	DE/Ton (Mc)	Total DE (1000 Mc)	Cost/Ton LL	(1000 LL) Total cost
Feather meal (1)	434.0	2,728	1,184.0	420	182.3
Poultry blood and bone meal	865.6	2,970	2,570.8	700	605.9
Poultry litter meal	120,000.0	2,440	292,800.0	80	9,600.0
Blood and meat meal	1,149.7	2,650	3,046.7	800	919.8
Fish meal	n.a.	2,960		n.a.	
Tomato pulp	107.5	2,490	267.7	75	8.0
« Spent grains »	304.0	2,406	731.4	60	18.2
« Fat »	209.0	8,540	1,784.9	1,000	209.0
C.S.M. (2)	17,962.0	2,670	47,958.5	180	3,233.2
Other meals or cakes (2)	5,799.0	2,540	14,729.5	175	1,014.8
			365,073.5		15,791.2

1. 75% of the total production.

2. Processed and exported.

n.a. Not available.

United States — Canadian Tables of Feed Composition, N.A.S., 1969.

Sources: Personal interviews with selected processing plants', slaughter-houses' and breweries' managers. Animal Office, Ministry of Agriculture, Republic of Lebanon (report) 1968 by El-Mursi.



Table 12. Total feed value and total cost of roughage by-products in Lebanon, had they been processed in 1969.

	Total Quantity (m.t.)	DE/Ton (Mc)	Total DE (1000 Mc)	Cost/Ton LL	Total cost (1000 LL)
Beet tops	4,800.0 (1)	493	1,183.2	5	24.0
Olive pulp	12,675.0	1,606	20,356.0	50	633.8
Gr. corn cob	278.0(2)	1,910	531.0	50	13.9
Left-overs of vegetable can industry	290.0	1,980	574.2	50	14.5
TOTAL			22,644.4		686.2

1. 5.1 percent of the whole beet's weight.

2. 20 percent of the cob's weight.

Sources: Personal interviews with selected processing plants', slaughter-houses', and breweries' managers.

Animal Office, Ministry of Agriculture, Republic of Lebanon (report) 1968 by El-Mursi.

United States — Canadian Tables of Feed Composition, M.A.S., 1969.

Table 13. Total feed value and total cost of all by-products in Lebanon had they been processed in 1969.

Category	Total DE (1000 Mc)	Total Cost (1000 LL)	Cost of DE LL/1000Mc
Energy concentrate	3,552.9	102.3	28.8
Protein supplement	365,075.5	15,791.2	43.3
Roughage	22,644.4	686.2	30.3
TOTAL	391,272.8	16,579.7	42.8

Table 14. DE cost in each feed category produced locally, imported, processed, and in pasture reclamation, 1969 (LL/1000 Mc).

Type of DE	Local production	Imports	Processed by-products	Pastures
Energy concentrate	45.5	49.3	28.8	—
Protein concentrate	81.4	178.5	43.3	—
Roughages	41.4	55.8	30.3	41.4
Average cost	46.7	62.4	42.8	41.4

Table 15. Tonnage of citrus, tomatoes and apples used in the juice industry in Lebanon, 1967-1971.

Year	Citrus (a)	Tomatoes (b)	Apple (c)
1967	9,750	1,250	—
1968	13,250	1,850	3.0
1969	17,400	2,150	4.0
1970	21,200	2,300	5.0
1971	24,300	2,450	8.0

a. Produces 55 percent as wet pulp.

b. Produces 15 percent as wet pulp.

c. Produces insignificant percentage of wet pulp.

Source: Managers of Bon Juice and La Fruta.

Table 16. Total production of kharob ears and kharob pulp in Lebanon, 1967-1971.

Year	Quantities* (ton)	Dry pulp (ton)
1967	1,225	735
1968	1,375	825
1969	1,520	852
1970	1,630	978
1971	1,750	1,050

* Not available at the Ministry of National Economy.

Source: Manager of A'msheet, Sil'ata, Tal Za'tar processing factories.

Table 17. Imports of barley malt, quantities of « spent grain » produced, and their selling prices in Lebanon, 1967-1971.

Year	Imported barley malt (tons)	Local spent grains produced (tons)	Selling price of spent grains LL/ton	Dried «spent grains» that could be produced (ton)
1967	1200	780	12	266
1968	1270	825	15	281
1969	1370	890	15	304
1970	1445	940	18	321
1971	1470	995	18	340

Source: Managers of Almaza and Laziza factories.

Total 18. Total quantities of poultry by-products that could have been processed in Lebanon, 1967-1971.

Year	Total Number of slaughtered birds (1000)	Total live weight of slaughtered birds (ton)	Total weight of feathers (ton)	Total weight of feather meal (ton)	Total weight of blood and bone (ton)	Total weight of blood and bone meal (ton)
1967	9,200	11,040	496.8	447.1	2,846.7	711.7
1968	9,040	10,840	487.8	439.0	2,795.0	699.0
1969	11,040	13,250	604.3	543.9	3,462.6	865.6
1970	12,400	14,880	669.4	602.5	3,838.0	959.5
1971	13,280	15,900	715.5	644.0	4,100.0	1025.0

1. Excluding heart and liver, i.e. 25.8 percent liveweight.

Source: Reda (1971) table 27. Items weights computed by the author.

Table 19. Total area, total production and yield of olives in Lebanon, 1957-1971.

Year	Total area (Hectare)	Total Production (ton)	Yield/Hectare (ton)
1957	22,000	13,000	0.6
1958	22,500	44,000	2.0
1959	22,600	18,000	0.8
1960	27,000	30,000	1.1
1961	27,000	65,000	2.4
1962	27,000	18,000	0.7
1963	27,500	60,000	2.2
1964	28,618	30,000	1.1
1965	28,618	49,000	1.7
1966	29,965	29,376	1.1
1967	26,837	67,773	3.0
1968	26,863	32,184	1.4
1969	27,663	46,268	2.0
1970	27,663	21,300	0.8
1971	27,663	38,200	1.4

Sources: Direction Centrale de la Statistique: « Recueil des Statistiques Libanaises », 1965 and 1970.

Ministry of Agriculture, Bureau of Agricultural Economics.

Table 20. Number and classification of olive pressing plants in Lebanon, 1970.

District and Kada'	No. of trad'l factories	% of total dist.	No. of mech. factories	% of total dist.	No. of idle factories	% of total dist.	Grand total
North Lebanon							
Akkar	35		18		5		
Tripoli	—		12		1		
Kurah	3		96		17		
Zgharta	7		94		33		
Batroun	20		35		35		
TOTAL	65	15.8	255	62.0	91	22.2	411
Mount Lebanon							
Shouf	19		69		46		
Kisrwan	1		3		2		
Metn	1		8		19		
Jubeil	2		12		13		
Aley	—		49		27		
Ba'abda	—		23		20		
TOTAL	23	7.4	164	52.2	127	40.4	314
South Lebanon							
Tyre	11		14		7		
Jezzine	—		12		1		
Hasbaiya	5		11		—		
Bint Jbail	9		5		—		
Sidon	14		25		14		
Nabatieh	10		6		4		
Marjeyoun	7		14		3		
TOTAL	56	16.0	87	56.5	29	27.5	172
GRAND TOTAL	144		506		247		897

Source: Ministry of National Economy, Industrial Section.

Table 21. Production of C.S.M. and soybean meal in Lebanon, 1965-1969.

Year	C.S.M. (ton)	Soybean meal (ton)
1965	20,746	4,838
1966	24,908	3,928
1967	26,411	4,415
1968	21,206	11,116
1969	30,754	3,769

APPENDIX C

Table 22. Estimated costs of reclamation for tillable and untilable fallow lands.

	Cost LL/hectare		Average
	Tillable	Untillable	
Ploughing	20	—	
Seeds	280 (1)	560	
Inoculent	5 (2)	5	
Superphosphate	10 (3)	—	
Spreading	25 (4)	25	
TOTAL	340	590	465
Green forage yield (ton)	12 — 18	8 — 12	10 — 15

1. 40 kg (LL 7/kg).
2. Economic substitute for nitrogen-fertilizer.
3. 40 kg (LL 0.25/kg).
4. Aerial.

Source: Gh. Akl, Animal Office of Beirut.

APPENDIX D

Table 23. Regression t-test for all livestock.

	Regression line equation	Standard error of estimate of b	d.f.	t calculated
Dairy heifers	$Y = 16.63 - 0.48X^*$	0.09	5	-3.87
Dairy cows	$Y = 43.76 - 2.10X^{**}$	0.62	5	-2.19
Traction Cattle	$Y = 25.21 - 2.35X^{**}$	0.48	1	-35.29
Other Cattle	$Y = 51.77 - 5.68X^*$	1.64	5	-3.45
Sheep	$Y = 227 - 3.54X^{**}$	1.45	5	-2.43
Goats	$Y = 490 - 7.26X^{**}$	3.10	11	-2.33
Swine	$Y = 4.96 + 1.19X^*$	0.23	5	5.19
Poultry	$Y = 4.78 + 1.30X^*$	0.18	9	7.17
Horses	$Y = 3.09 - 0.01X$	0.03	5	-0.44
Mules	$Y = 4.98 - 0.19X^{**}$	0.08	5	-2.25
Donkeys	$Y = 39.11 - 1.54X^*$	0.44	5	-3.44

* Regression coefficient is significant at 0.05 and 0.01 confidence level.

** Regression coefficient is significant at 0.05 level.

Table 24. Regression t-test for local feed production.

	Regression line equation	Standard error of estimate of b	d.f.	t calculated
Wheat area	$Y = 66.26 - 0.86X$	0.587	11	-0.79
Wheat yield	$Y = 0.92 - 0.00X$	0.010	11	-0.04
Barley area	$Y = 14.26 - 0.72X$	0.198	11	-0.25
Barley yield	$Y = 0.99 - 0.01$	0.013	11	-0.078
Corn area	$Y = 9.56 - 0.60X^*$	0.109	9	-5.48
Corn yield	$Y = 1.24 - 0.00X$	0.035	9	-0.13
Sorghum area	$Y = 2.78 - 0.18X^*$	0.057	9	-3.16
Sorghum yield	$Y = 1.22 - 0.02X$	0.023	9	-1.00
Lentils area	$Y = 1.78 + 0.10X^{**}$	0.054	11	1.937
Lentils yield	$Y = 0.95 - 0.02X$	0.023	11	-0.654
Chickpeas area	$Y = 1.61 + 0.07X$	0.051	11	1.33
Chickpeas yield	$Y = 1.26 - 0.04X$	0.024	11	-1.783
Vetches area	$Y = 4.72 + 0.01X$	0.083	11	0.137
Vetches yield	$Y = 0.82 - 0.01X$	0.013	11	-0.678
Alfalfa area	$Y = 0.062 + 0.016X^*$	0.004	11	4.02
Alfalfa yield	$Y = 10.07 + 3.70X^*$	0.781	11	4.74
Sugarbeets area	$Y = 0.24 + 0.16X$	0.018	11	8.90
Sugarbeets yield	$Y = 10.33 + 3.40X^*$	0.429	11	7.92
Peanuts area	$Y = 1.06 + 0.16X^*$	0.037	11	4.20
Peanuts yield	$Y = 1.45 - 0.00X$	0.023	11	-0.05
Sunflower area	$Y = 0.40 + 0.05X$	0.086	1	0.577
Sunflower yield	$Y = 3.00 + 1.55X^*$	0.110	1	27.46
C.S.M. production	$Y = 24805 + 1641X^*$	67.104	3	9.32
Soybean Oil meal production	$Y = 5613 + 504X^*$	82.971	3	6.14

* Regression coefficient is significant at 0.05 and 0.01 confidence level.

** Regression coefficient is significant at 0.05 confidence level.

Table 25. Regression t-test for processed by-products.

	Regression line equation	Standard error of estimate of b	d.f.	t calculated
Citrus tonnage	$Y = 6065 + 3705X^*$	97.08	3	38.16
Tomato tonnage	$Y = 1145 + 25.5X^*$	5.40	3	5.26
Kharob tonnage	$Y = 888 + 78.3X^*$	6.94	3	8.74
Feather meal	$Y = 368.2 + 55.7X^*$	8.92	3	6.24
Dried poultry blood and bone meal	$Y = 590.8 + 87.5X^*$	14.74	3	5.93
Dried spent grains	$Y = 246 + 18.8X^*$	5.99	3	31.33
Olive area	$Y = 23.68 + 0.35X^*$	0.095	13	3.605
Olive yield	$Y = 2.49 + 0.03X^{**}$	0.023	13	1.172

* Regression coefficient is significant at 0.05 and 0.01 confidence level.

** Regression coefficient is significant at 0.05 confidence level.

Table 26. Projected nutrient requirement for all livestock in Lebanon, 1976 and 1981 (1000 Mc).

Livestock	1976	1981
Dairy cows	134,261	37,128
Dairy heifers	43,362	24,090
Working cattle	68,876	0.0
Other cattle	0.0	0.0
Sheep	256,960	233,600
Goat	377,775	338,355
Swine	76,036	96,710
Poultry	620,000	772,800
Horses	15,070	14,536
Mules	13,383	8,728
Donkeys	79,500	44,686
Total	1,685,223	1,520,633



Table 27. Projected feed value of all feedstuff that might be produced locally in Lebanon, 1976 and 1981 and 1981 (1000 Mc).

Feedstuff	1976	1981
Barley	40,950	40,950
Corn	0.0	0.0
Sorghum	0.0	0.0
Wheat bran	5,754	5,754
Dried beet pulp	51,156	76,734
Beet molasses	38,715	58,076
Total	136,575	181,514
Vetches	7,580	7,580
Peanut oil meal	4,565	5,500
Sunflower oil meal	5,970	22,332
Soybean meal	30,848	38,801
C.S.M.	106,831	129,492
Total	155,794	307,625
Alfalfa hay	27,918	42,360
Wheat « tibn »	270,654	270,654
Barley « tibn »	9,765	9,765
Lentil « tibn »	5,535	6,355
Chickpea « tibn »	4,690	4,690
Vetches « tibn »	7,450	7,450
Corn stover	0.0	0.0
Sorghum stover	0.0	0.0
Green forages	222,684	222,684
Total	548,696	563,958
GRAND TOTAL	841,065	1,053,097

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Table 28. Projected feed value of by-products in Lebanon that might be processed in 1976 and 1981 (1000 Mc).

By-product	1976	1981
Citrus pulp	8,922	12,758
Citrus molasses	4,756	6,801
Dried kharob pulp	4,880	5,758
Total	18,558	25,317
Feather meal	2,013	2,617
Poultry blood and bone meal	4,369	5,680
Poultry litter meal	40,900	563,625
Blood and bone meal	3,050	3,050
Tomato pulp	500	680
Dried « spent grains »	1.0	1,268
« Fats »	1,785	1,785
Total	463,658	578,705
Beet tops	3,430	5,145
Olive pulp	44,160	47,690
Total	47,590	52,835
GRAND TOTAL	529,806	656,857

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

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الجمهورية اللبنانية

مكتب وزير الدولة لشؤون التنمية الإدارية
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