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Republic of Lebanon

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

A PRE-FEASIBILITY STUDY OF THE INDUSTRIAL POSSIBILITIES FOR THE LEBANESE PRODUCTION OF SUNFLOWER PRODUCTS

G.S. BOULTER

April 1971

المشروع ا**لاختر** الرق<u>ا 1900</u> ارب الورود 60/1/

MFN = 440

مختصر تقرير السيسد بولتر ======

- الا يجد السيد بولتراى لزم لاقامة مصنع للزيوت في منطقة البقاعات ان الانتاج لا يمكن ان يكفي لادارة اى مصنع مهما صفر عجمه وبرايه ان في لبنان زيادة كبيرة جدا في المعامل تزيد عن امكانات التصنيع في دخا البلد .
 - ٢) يقترن ويشدد على قفية انما الرى في منطقة بعلبك الهرمل بالانمافة الى اعمال زراعية دوار الشمس .
 - متابعة تشجيع زراعة دوار الشدس الى حين تأمين مياه الرى في المنطقة حيث تأخذ زراعات اخرى مكان الزراعات المنبعة ودوار الشمس في ان واحد مثل الاشجار المثمرة والخضار الموسمية والموسمية والم
 - ٤) يقتن دراسة تأمين معمل حليب والبان واجبان في المناقة بناء على تقرير الام المتحدة الذي وضعته موسسة BEI Agrer
 - ه) يطلب مراجعة تقرير مواسسة SICORES فيما يتعلق بتجفيف الفاكمة .
 - ٦) يقتر اعفا مصانع الزيوت من الرسم على البذور المستوردة وذلك بفية تشجيع التصدير
 - ٢) تأمين خزانات للسوائل المستوردة لصناعة الاسمان المختلفة •
 - ٨) تأمين خزانات انهافية على تلك الموجودة في المرفا و لخزن البذور الزيتية المستوردة •
 - ٩) يقتن اشراف مشدد على نوعية وتصنيع الزيوت من الوجهة الصحية ووضع برنامج لتسويسة
 - ١٠) تشجيع توظيف رو وسالاموال الاجنبية لهذا الحقل وضمانها من قبل الدولة •
 - ١١) لفت النظر الى زيادة زراعة النباتات العلفية الشتوية من جهة وبعد تأمين مياه الرى بشكل خاصود لك بنية تحسين الانتاج الحيواني .

وقد فصل السيد بولترزياراته الى مختلف المصانح واعطي مزايا ومساوى كل منهــا وعن ماركتها والتحسينات المتوجب على اصحابها اضافتها عليها ٥ كما اعطى اسما مختلف الاشخاص الذى زارهم ٠

A PRE-FEASIBILITY STUDY

OF THE

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FOR

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SUFFLAME PRODUCTS

AN ECONOMIC AND INDUSTRIAL

SURVEY

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G.S. BOULTER

APRIL 15

1971

"This report has not been cleared with the Bureau of Technical Assistance Operations of the United Nations, which does not, therefore, necessarily share the views expressed."



PREFACE

It was my personal privilege and pleasure to have been given this very interesting and challenging assignment in Lebanon. I want to thank the Committee consisting of the

- Director General of the Internal Security Forces
- The President of the Green Plan
- The Director General of the Ministry of Agriculture
- The Director of the Wheat Office for courtesies extended.

I am deeply indebted to Dr. Malez Basbous, the President of the Green Plan, to which I was attached, to the other members of the Green Plan's executive committee and to the staff for their friendliness and their wholehearted support and co-operation.

Mention also must be made of Mr. Nizar Husseini, the Counterpart, who, despite disappointments and discouragements, never hasitated to exert himself to the utmost and whithout whose efforts this report could not have been completed.

Finally, my sincere thanks to all interested persons we met in Lebanon who were in any way connected with this survey, the memory of whose generosity and gracious hospitality will ever remain an unforgettable experience.

G.S. BOULTER
HAMILTON, CANADA
APAIL 15, 1971

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I. INTRODUCTION

- 1. Initially, the Sunflower project was undertaken with the view of reglecing the cultivation of Indian Hemp in the Northern part of the Bekaa's valley (Baalbeck-Hernel region) by a non-prohibited crop, namely Sunflower.
- 2. Specifically, the present study was requested to investigate the industrial possibilities of producing marketable products from the total Sunflower plant. The Sunflowerseeds to be converted into edible oil and meal residue. The dried stems, heads and leaves into livestock fodder or other industrial uses.
 - Sunflower was nor purely economic but rather a socio-economic development project. Sunflower so far is the only crop that can be grown with any success under the severe semi-arid conditions existing in the area in question. Cannabis is grown not for local consumption but for selling to smugglers who export the product for consumption outside Lebanon.

To effectively combat the cultivation of this "cash crop" some other equally remunerative alternative must be provided.

4. In the international campain against drugs, Lebanon has made a valiant effort to combat Cannabis growing by Sunflower cultivation, and with some success. Various economic incentives as well as technical assistance has been provided to the farmers. The pivotal factor in all this has been the very high support price paid for the Sunflowerseeds to the farmers of 75 piastres per kilo. The selling price of course must be the world market price which fluctuates very considerably:

35 piastres per kilo in 1968
42 " " " 1969
61 " " 1970

It was estimated that by 1973 when hopefully all the Cannabis is replaced by Sunflower, that production of Sunflowerseeds would reach 5,000 tons and the price support program then would amount to 2,000,000 Lebanese pounds.

- feasibility of increasing, by modern processing technology, the value of the Sunflower products with the expectation that the "value added" would off-set completely, or at least substancially reduce, the annual subsidy required.
- possible. Therefore, other means of combating Cannabis must be found. It is the opinion of a very substantial number of knowledgeable authorities in the fields of agronomy and water resources that a variety of viable alternatives could become available if sufficient irrigation for the area were provided.
- 7. There were also two light industrial projects suggested as being worthy of serious consideration as a further means of improving the agricultural economy of the region. These are a milk and cheese processing plant and a fruit drying factory.

8. Because the terms of reference for this report stressed the industrial aspects of the Sunflower scheme, a great deal of attention was paid to the present vegetable oil industry and secondarily to the feed industry in Lebanon.

Both of these are intimately invloved in the processing and additional of Sunflowerseed and its resulting oil and meal. Transpare, a substantial part of this report deals practically with the situation in, these areas. An attempt is made to offer firm recommendations for improvements which require immediate attention.

II. THE VEGETABLE OIL INDUSTRY

- 9. In order to assess the industrial feasibility of processing the Lebanese production of Sunflower products, a brief survey was made of the present processing and vegetable oil refining industry. There are ten or eleven firms engaged in this type of operation, although only six are active at present.
- 10. In 1969 they handled 55,000 tons of imported oilsceds.

 During the first 8 months of 1970 (the latest statistics avaolable), 41,000 tons were processed.

Imported Bilseeds

'n	Λ	11	a
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	1969	1970 (8 Months only)
Cottonseed (undecorticated)	42,202	32,468
Groundnuts	1,743	2,926
Soyabeans	4,890	4,081
Copra & others	6,287	1,497
	5 5,12 2	40,972

In 1969, 2,500 tons of Lebanese produced Sunflowerseed was processed. In 1970 only 1,600 tons were available. Both these crops were handled by EMAD - Savonniers et Huiliers - Sarba.

- oil production amounts to 10,000 11,000 tons exclusive of clive cil. About 2,500 3,000 tons of the cottonseed, groundnut and possibly soybean oils are blended with olive oil each year. The amount of blending varies from year to year depending on the success or failure of the clive crop.

 On an average there is approximately 8,000 tons of the oils crushed marketed as liquid oils, e.g. cottonseed, sunfloxerseed, coconut, groundnut and soybean oils. These are generally packed in 7 and 15 kilo tims.
 - 12. In addition to the aforementioned production of vegetable oils there are significant quantities of liquid végétable oils imported such as corn, groundnut and coconut oils as well as hydrogenated and processed fats.

Imported Refined Vegetable
Oils & fats

	Tons	
	1969	1970 (8 months only)
Sunflowerseed oil	113	71
Corn oil	776	417
Soybean oil	135	74
Groundnut oil	165	90
Coconut oil	832	595
Hydrogenated Shortening & Ghee Substitute	1098	1638
	2789	2835

(rapeseed) which are subject to an 8% import customs duty (Decree 962-14-12-59), all other oilseeds are admitted free of duty. However, as a means of recovering part of the subsidy required to maintain the support price for the locally grown Sunflowerseeds, the following import tax schedule applies on raw materials (oilseeds), (Decree 11009-7-10-68).

Cottonsees	1 piastre	per	kilo
Soybeans	1 "	"	ti.
Sunflowerseed	1½ "	Ħ	n
Groundnut	2 "	ŧŧ	11
Colza	2 "	11	ti
Copra	21 "	11	11

14. The following customs duty applies on imported oils and fats for edible purpose, Decree 2558-9-10-68.

- 41 piastres per kilo or 28% ad valorem Sunflower oil whichever is higher 43 Corn cil 43 Soybean oil Cottonseed oil 43 Groundnut oil 41 Coconut (timed) 56 34 Palu oil Hydrogenated oil - 46

Animal fat (tallow) 25 piastres per kilo or 18% ad valoren whichever is higher

15. With one exception, all the oilseed processing is done by expellers or screw presses. At present, only one processor is handling soybeans by solvent extraction.

- nated that the total capacity amounts to 185,000 tons per annum; currently only one quarter to one third is being used. The expeller equipment is of varying age. The recent models are doing a reasonably good job within the limits of pressing technology. The older machines are definitely obselete and consequently, inefficient.
 - 17. The following factories were visited where an exchange of ideas relative to the industrial, technical and economic aspects of their operations took place.
 - 18. ELAD. Sarta Crates 2 Rosedown expellers, capacity
 50 tons per day. The large Mark III model has not performed
 satisfactorily since it was installed a couple of years ago.
 As with the other processors, the bulk of operations
 throughout the year is on undecorticated cottonseed. While
 all the pressing plants visited were equiped with delinters,
 dehullers and decorticators for cottonseed, none were being
 used. When processing cottonseed, it was being pressed ...

extremely low protein and high fibre cake. It appears, that there is a good demand for the undecorticat con cake in the export market (Cyprus, Lybia and Market and the prices realized would not permit the production of the better quality cake. The export of cake amounts to 40% - 60% of production.

19. This was the mill that has processed the locally grown Sun-

flowerseed for the last two years. As a matter of fact, it was operating on the 1970 crop of Sunflowerseed while we were there. For the Sunflowerseeds, this mill was using a Cotton-seed doubler - a Disc mill built by Bauer Brothers of Springfield, Ohio - as a decerticator. This operation was reasonably good but the hull and meat operation was not what was required to bring the fibre down to the level required to produce a first class cake of meal.

20. Since Sunflowerseeds contain 20% - 25% hulls, dehulling is one of the most important operations in their processing.

The particular process to be used is dependent upon the desired results, i.e. the amount of the oil left in the hulls

and the amount of fibre to remain in the meal. The disc huller requires a uniformly sized seed; when this is the case, fibre content in the finished meal can be reduced to about 12%. We prefer impact dehulling particularly in respect of the Lebanese Sunflowerseeds we observed, as they definitely lacked uniformity of size and were excessively contaminated with foreign material and pieces of broken heads.

21. We also felt the rolling and cooking were less than optimum. However, when we tried to modify these operating conditions, we were unable to get a good performance from the expeller - oil residuals were markedly increased when temperatures were lowered and moistures were increased. Consequently, while, the oil yield was poor (8.0% left in the cake), the quality was not too.bad. However, the cake was scorched - high in fibre and low in protein, so that it could only be used as a cattle feed ingredient and that at cottonseed cake price.

- 22. Sunflowerseed processing variables will affect the quality of protein, deneturation and relative protein efficiency.

 Like other oilseed proteins, the nutritive value of Sunflowerseed meal is greatly affected by conditions employed in processing. There is no question that the relatively poor quality in the Sunflower meal is due to excessive processing temperature. It has been well established that less lysine, arginine and tryptophan were obtained from Sunflower meal processed at 240 260°F, than from low or medium temperature meal processed at 200 220°F, or 220-240°F, respectively.
 - area where by good processing techniques, the "value added" could be significantly improved. The amino acid profile of Sunflowerseco meal is not too different from soybean meal, so that by careful seed preparation and processing it should be possible to approximate soybean meal quality and therefore obtain soybean meal price, which at this time is 45 plastres

per kilo, versus 23 piastres per kilo for cottoned cake, and 28 piastres per kilo for sunflowerseed cake.

- 24. EMAD also operates a complete vegetable oil refinery including winterizing, hydrogenation and margarine manufacturing.
- of handling 40 tons per day. This was the best pressing operation we saw on costonseed. They have, in the past, also handled both imported as well as locally grown Sunflowerseed. They are equipped with a copy of the Russian dehuller using an impact design which they themselves duplicated. The analytical results on their Sunflower meal were vastly superior to those of EMAD, as the following indicates.

	-	E:IAD	SALTI
D	ecember 1969	<u>1971</u>	December 1969
Oil	a . 9	8.4	4.7
Moisture	7.5	9.4	6.4
Protein	38.0	37.1	45.8
Fibre	13.0	16.3	9.6
Colour	Very dark	Very dark with a scorched odor	Dark but uniform

The 1969 analyses were reported by British Oil Cake Mills of London.

The 1971 analyses were reported by Canadian Vegetable Oil Processing of Ramilton.

- 26. MOUKARZEL has 4 arc Olier presses and 1 French press
 handling 50 tons per day. They also have a batch type extraction plant for producing "acid oil" from pressed olive
 cake (containing 9 11% high acid olive oil).
- 27. FAUAD TAMER operates 2 Resedown presses one Mark III
 model and one Mark II model capable of handling 25 30
 tons per day. This plant is having difficulty operating
 more than half time and is concentrating on flax (Iraq) for
 the production of linseed oil for the paint trade.
 - 28. SCCIETE NATIONALE D'HUILE VEGETALE (Philippe Tamer)
 - has a working capacity of 50 60 tons per day with 6 Titan model Clier presses.
 - 29. They also have a continuous Alfa-Laval alkali refining operation. However, because of the intermittent nature

- of their production, this equipment sits idle while they do their neutralizing in a batch system.
- 30. MIZAL GLANDOUR TRIPOLI has two Olier (HS) presses and five Resedown (auplex) expellers. This equals a daily capacity of 150 tons.
- 31. They also have on site but not installed, one Olier 150 ton(baskets-band) solvent extractor. This equipment has been
 4 years in the process of installation and according to
 the owners it will be another year or two before they are
 ready to operate.
- 32. The equipment for a complete continuous refinery including hydrogenation and esterification is also on site but not installed. When ready for operations, this plant will be quite up-to-date and capable of handling a full range of pilseeds, including soybeans, by pre-pressing or direct extraction. The refinery will be able to produce refiner, hydrogenated oils and fats as well as margarine.

- 33. SINNO-JEBBOUR is operating the only solvent extraction unit. It is an old allAG (baskets-band) extractor and is handling 50 70 tons per day of imported soybeans.
- 34. Because this unit is old and is equipped with inadequate meal drying and toasting equipment, difficulties have been experienced with poorly toasted or untoasted meal. The quality of their meal is extremely variable. Attention needs to be paid to standardizing production procedures as well as adding proper desolventizing-toasting equipment.
 - 35. We were informed that they are investigating the purchase of a new Olier (Carousel) extractor along with pre-presses so that they can handle other oilseeds in addition to soybeans.
 - 36. They also operate a second-hand oil refinery and seemed to be experiencing decodorizer problems because of the lack of sufficient temperature. Consideration was being given to the production of Lecithin. This is discouraged under

present conditions because of the very small amount of oil produced — less than 10 tons per day. This would not permit an economically sound lecithin operation. The present gums can be disposed of along with the soap-stock from the alkali-refining of soybean oil.

- 37. M.O. GHANDOUR at present is operating three Mark III

 Rosedown presses at 70 tons per day on both copra and
 cottonseed.
- their plant with the addition of four Mark III presses for pre-pressing and a 200 toms Desmet solvent extractor. They are planning on handling a minimum of 50,000 tons of imported soybeans per year through the solvent extractor direct. They will also continue to handle other oilseeds by pre-pressing and solvent extraction. This will be a fully integrated operation in conjunction with a modern vegetable oil refinery including continuous neutralization, bleaching winterizing and semi-continuous deodorizing and hydrogenation.

A full range of modined oil products will be produced: liquid oil, shortening and margarine.

- 39. The engineering design, layout, and equipment, are very impressive and will match in quality and cost of production, as well as efficiency, anything of comparable size anywhere in the world.
- this plant to produce soy protein products for human consumption as well as the traditional meals 44% and 49% protein for livestock feeding. Soya flour, soya grifts, soya protein concentrates as food additives, or the base raw material for meat and dairy analogs should rate high for serious consideration in the future. The ancillary equipment to produce these items is available and a cost benefit analysis would be simply a routine matter to determine the economic feasibility of such an expansion to the product line of this plant.
 - 41. Operating continuously at its rated capacity of 150 200 tons

per day on soybeans, this mill will be in the position to produce commercial grades of lecithin if the market requirements so indicate that this is desirable and profitable.

QUALITY CONTROL AND HOUSEKEEPING

42. During our visits to the various vegetable oil manufacturers, while we concentrated our efforts primarly on the handling of Sunflowerseeds, especially the pressing procedures used, we could not fail to observe the other aspects of the operations - namely, the oil refineries. Here, with the sole exception of M.O. Ghandour, we were struck by the apparent lack of basic sanitary and hygienic regulations. We also found that quality control needs immediate attention to bring it up to international standards. The technicians we met have had good basic training but need to be exposed to the most recent developments in analytical methods and quality standards. One example will serve to illustrate the point.

- 43. The only method at present being used to determine the rancidity of an oil or fat is Kries test. This test was rejected for quantitative purposes by the American Official Analytical Committee in 1931 for the following reasons:
 - a) It is qualitive rather than quantitive in its expression of results as it can only be read as "positive" or "negative".
 - b) It is an indication of secondary rather than primary exidation based on the formation of ketones and aldehydes as end products of exidation. This means that a certain degree of exidation can take place before this test is positive.

 We would recommend that the Peroxide Value determination be substituted as a more reliable indication of rancidity.

 (See Appendix).

III. ASSISTANCE FOR THE VEGETABLE OIL INDUSTRY

44. There are a number of areas where improvements could be made to increase efficiency and reduce costs thus making it more

competitive as far as export possibilities are concerned.

45. a) The present levy on imported oilseeds is viewed as discriminatory. This levy is used to offset to some extent the subsidy paid to encourage the growing of Sunflower as an alternative to Cannabis or Indian Hemp. Is it right to saddle one segment of the industrial economy with the responsibility for a social problem which is both national and international in its consequences? It is quite true that the levy on the raw materials has been compensated by an increase in the customs duty on imported oils in order to protect the oilseed processor in the local market. This increase, of course, is ultimately passed on to the consumer. Nevertheless, any levy on raw material precludes rhe possibility of competing for export markets. Due to the limited domestic market and the large idle capacity, participation in the export market would seem essential if medium sized modern processing units are to be established and flourish.

46. b) We understand a substantial market exists in the

Arab countries for cooking fats and margarine. The imports

of these products have risen as follows.

	1961 tons	<u>1968</u> tons
Lebanon	2,741	6,880
Other Arab countries	26,853	42,683

Saudi Arabia grants a preferential tariff to Lebanon.

There is a sizable market in Kuwait for hardened vegetable oil products. These markets would be competitively available to Lebanon if provision were made to receive imported tallow and other materials in bulk rather than the present very costly method of shipping in drums.

47. As of March 1, 1971 the following is a cost comparison for tallow from the U.S.A.

Bleachable Tallow	in druns	Bulk \$
Per metric ton	198.00	198.00
Cost of druming/drums	26.50	
Cost F.O.B./F.A.S.	224.50 (FAS)	198.00 (FOB)
Freight	73.00 (on tallow + tare)	25.00
Total cost C & F Beirut per metric ton	297.50	223.00

- 48. The cost of a small tank farm installation amortized over 10 or 20 years plus the pumping and heating charges for bulk discharge would be only a small fraction of the present difference in cost of \$74.50 per ton. Estimated cost of installation depending on capacity of tanks and vessel tank space available would be LL. 150,000 200,000.
 - 49. We are informed that it is not possible for a private firm to acquire a site in the free zone area of the Port of Beirut for this purpose. Why?
 - 50. c) For an industry that is so dependant on imported raw

الجمرورية اللبنانية محت وزير الدولة لشؤون الشمية الإدارية مَركز مشاريع ودراسات القطاع العام

materials, in addition to being made free of import levies, it should also be able to locate at the point of cargo discharge. In this way, it would be in a position to avoid the very costly handling and transport charges which at present apply, estimated at LL. 10 - 20 per ton on material purchased.

- 10cation for a vegetable oil processing installation in

 Lebanon, so as to maximize both the domestic as well as the

 export opportunities, would be adjacent to the new silo

 installation (wheat office property) where duplication of

 handling and storage facilities would be reduced to a bare

 minimum.
 - 52. d) In addition to the items mentiones above, a production and quality control program should be instituted. Strict control measures should be developed for all stages of processing, E.g. analyses and specifications for raw materials,

in process goods, and finished products; production standards, packaging specifications, etc...

53. Hygienic and sanitary regulations should meet the exacting demands od good housekeeping. Scrupulous cleanliness in food handling should be vigorously enforced.

IV. THE FEED INDUSTRY

- has expanded until to-day it is a very important factor in the national economy. Its progress in the last five years, together with the establishment of a modern slaughtering and broiler packaging plant, has not only provided for a donestic demand but now also supplies a substantial revenu through exports to Arab countries. In 1969 Lebanon received over 100 million Lebanese pounds from the poultry industry.
 - 55. Paralleling this spectacular expansion an annual growth rate of 10% for the last 5 years has been the demand for

poultry feed. The feed industry seems to be soundly based. Integration both horizontal and vertical is taking place and should lend stability to this rapidly growing segment of the economy. We were particularly impressed with its form(s) of organization or corporate structure. With one exception the whole of the industry operates either as collaborative agencies or joint ventures with outstanding international feed companies. In this way, the feed manufacturers in Lebanon have met the very strict specifications for quality feeds, especially for poultry and have played an extremely important supportive role in making the poultry industry the success it has become. In this they have been ably assisted by the Faculty of Agricultural Sciences, American University of Beirut and the Lebanese Government Experimental Research Institute at Terbol.

56. The following firms were visited and much helpful information obtained as to the use and relative value of Sunflower-seed meal and soybean meal in livestock rations.

1

Firm	Person	International Associate
Purina Lebanon	Z. Kurdian F. Rinnu	Ralston Purina - Antwerp
Sinno-Jabbour	N. Sinno	Spillers, London
Assayed	M. Assayed	British Oil and Cake Wills, London
Vitasni	A. Abdoun	Beechams Laboratories, Britain
Provini	Mr. Ghanen (Sr.) Mr. Ghanen (Jr.) Mr. A. Sanaha	Provini, Ansterdan
Androos	Philippe Androos	Central Soya, Fort Wayne, Indiana, USA.
Ghorra Trading Co.	N. Ghorra	

At the present time the above firms produce 150,000 tons of complete feeds annually. Most of this is for poultry, but serious efforts are being made to produce and distribute dairy and beef cattle feeds. There is a lot of resistance at the local level to the acceptance of commercially produced balanced rations for cattle and sheep. Rations in the form of pellets or cubes are difficult to sell. An intensive and continuous educational program is being promoted in order to break down the present apathy. The complete separation

- agriculture is an obstacle to good feeding practices. Any steps toward integrating these two cannot be anything but helpful in increasing the efficiency of both.
- plays such an important part in feed formulation

 (a minimum of 20% of the complete feed), four of the feed

 firms operating jointly have recently been chartering vessels

 and importing soymeal in bulk direct from the U.S.A. In

 addition to thus supplying their own requirements, because

 of the economies realized through bulk movement, they are

 also favourably situated to make trans-shipment sales to

 other Arab countries.
 - 59. These four firms see attractive possibilities in substuting the importation of soybeans for the soymeal. By setting up an extraction plant, they would be in a position to produce

their own sogmeal. As oil is a highly protected item under the present customs Act, its disposition should not present too many difficulties. However, as we have already indicated, others are also planning on extracting soybeans in a substantial way, so that the competitives factors need to be weighed very carefully.

V. PRESSING VERSUS EXTRACTION

developing in processing soybeans rather than importing soymeal estimated at 40,000 tons per year. As soybeans are not satisfactorily processed by the pressing method, there is serious attention being given to expanding the Solvent extraction segment of the oilseed industry; this in spite of the excess capacity already existing. By thus modernizing oilseed technology, a number of benefits would immediately accrue to Lebanon.

- 61. a) Cost savings would result as the economies of scale NAN will require a minimum capacity of 150 200 tons per 24 hour day. This is in contrast to the present average plant capacity of about 50 tons per day.
- 62. b) There could be an increased yield of oil as the expeller method leaves 5 8% oil in the residue whereas the solvent method reduces the oil content of the meal to under 1.0%.
 - meal as produced by the solvent process is superior to that of the older method. This is particularly true of the meal.

 More heat is required for expelling and this heat damages or destroys some of the very essential nutrients in the meal, such as the amino acids lysine, histidine and arginine.
 - 64. d) Increased expert opportunities will be available because production efficiency and the quality of the products will be competitive with the best technology available elsewhere.

65. e) Inexpendent we greable protein in the form of soyaflour and soyaprotein concentrate for human consumption will easily become available. The technology of production of these products follows naturally downstream from the solvent extraction of soybeans.

VI. PROCESSING SUNFLOWERSEEDS

66. Now to turn specifically to the locally produced Sunflower-seed, the production of which for the last five years has

1956 - 41 tons

1967 - 530 tons

1968 - 1,671 tons

1969 - 2,538 tons

1970 - 1,565 tons

67. The estimated production for 1971 is 3,300 tons and for 1973 onward 5,000 tons. Such quantities cannot possibly justify either technically or economically the establishment of a separate operation. To scale a plant for such a small

quantity of raw material would limit the process to using (one) expeller. As we have suggested, this is not a satisfactory method of recovering oil as it destroys or degrades the very valuable protein nutrient factors (essential amino acids) of the cake or meal residue.

In any case, there is already a superabundance of this type of equipment available in Lebanon. This is the method presently being used to process the Lebanese Sunflowerseed resulting in poor quality meal - usable only as cattle ration. If processed by the solvent method, the Sunflowerseed meal would be similar to soyneal and thus more valuable as an ingredient in poultry feed. It therefore seems obvious that in order to exploit to the full the return on Sunflower seeds by improved quality products and maximized "value added", only the solvent extraction method is feasible (requiring a minimum annual tonnage of 30,000 tons). It is conservatively estimated that the total revenue received

11

from processing Sunflowerseed by the solvent method rather than by expeller would increase by approximately 20% - at to-day's values.

EXTRA REVENUE REALIZABLE USING EXTRACTION VS. EXPELLER

Cost of one ton Sunflowerseed - LL. 600

Cost of one ton Sunflower	raced - nn.	000			
	Expeller	Solvent	Difference		
Oil yield por ton	320 kg	348 kg	+ 28 Kg		
Meal yield per bon	400 kg	372 kg	- 28 kg		
Additional oil 28 kg x 200 piastres/kg = LL. 56					
Increased value of neal -					
current price for Sunflower expeller cake	28 piastre	es/kg			
current price for soymeal expeller cake	45 piastre	es/kg			
Difference	17 piastr	es/Kg			
control neal					

Additional revenue from solvent meal

372 Kg x 17 piastres = LL. 62

Total extra
$$\frac{LL, 118}{LL, 600} = 19,7\%$$

70. We have already mentioned that there is one firm using the solvent method on soybeans - Sinno and Jabbour - although their equipment is not operating entirely satisfactorily. They intend to buy a new unit. There is also a group of

feed manufacturers who are new importing bulk shipments of soybean neal (7,000 - 8,000 ton cargoes) and who are seriously considering establishing a soybean processing plant.

- 71. We have described the development already underway at 16.0.

 Ghandour's. It therefore only seems logical that arrangements should be negociated with one or other of these firms to process whatever Sunflowerseeds become available rather than build a separate plant. Mr. Rafic Ghandour has indicated a willingness to co-operate for an annual minimum quantity of not less than 4,000 tons, which simply represents less than one month's operations for his new unit.
 - 72. If it is thought desirable or advantageous, the Sunflowerseeds could be processed for the government account. In
 this manner, ownership of the products (oil and meal) could
 be retained and disposition made of them at the government's
 discretion. The oil could be used for the army or other
 government agencies as food aid or in the form of a subsidy.

VII - SUNFLOWER PLANT PRODUCTS (OTHER THAN SEEDS)

- 73. The idea of processing Sunflower by-products that is the leaves, stems and empty heads into a filler type of animal fodder similar to Tibn, or for poultry litter or stall bedding - is still being investigated at the American University of Beirut - (AUB) - and at the Research Institute at Tal Amara. Samples of these materials were taken to the laboratories on February 22 for proximate analysis - cellulose, lignin, carbohydrates, crude protein, digestible protein, Ca, P, Fe, Cu, Mn, Mg, noisture and density. We are awaiting the analytical results before making any attempt at evaluation. However, the preliminary examination by Dr. A.N. Battacharya of the Animal Nutrition Department of American University of Beirut is not very encouraging.
 - 74. Another possibility for utilizing the vegetable material of the Sunflower plant might be in fibre board or chip board products. Samples of this material have been supplied to

the Pressed Wood Society - Tripoli - a local chipboard plant - for their appraisal.

VIII. COMBATING CANNABIS BY IRRIGATED CROPS PRODUCTION

- In a study by S.T. Stickley, published in 1969 by American University of Beirut entitled "Analysis of the Socio-economic Factors associated with levels of Living of People in the Rural Areas of Western Asia, Northern Africa and Southern Europe", it is stated: " In a study in Lebanon on hashish and its replacements, the findings showed that Sunflowers are not more profitable than hashish. Of the irrigated crops (wheat, lentils, potatoes, onions, beans and sunflower) considered as replacements for hashish, none was found to be as profitable as hashish. Possibly by double cropping (lentils with beans), the net profit per unit of land could equal that of hashish."
- 76. Our discussions with cultivators of Sunflowers and others who

The same of the sa

have intimate knowledge of the local situation seemed to confirm this view. It was suggested by some of the present growers of Sunflowers that the current subsidy, although very costly, was not sufficient to entirely take them out of growing hashish.

- 77. At the same time, we found a very substantial segment of the agricultural authorities arguing that water (irrigation) was the basic problem and that in its solution lay the ultimate where to an effective replacement for Cannabis.
- 78. Having regard to these divergent viewpoints, perhaps it is the right time to carefully review the cost of the present program. First of all, it should be said that even by the application of the most advanced and efficient techniques for processing Sunflower products, one could expect to recover more than a small fraction of the subsidy.
 - 79. If it is thus concluded that Sunflower production cannot compete economically with Indian Hemp, can we look for other

and water resources are convinced that water for irrigation is available in the Baalbeck-Hernel area. If these resources are developed, then a number of viable crop alternatives are possible, which could effectively compete with Cannabis in financial return to the growers. This would permit the discontinuance of the present subsidy payments.

80. The following are some of the irrigated crops that would be feasible. The annuals - corn, peas, beans, onions, potatoes and other small garden vegetables. The perennials - fruit trees (apricots, plums, cherries, etc.), mulberry trees, perfume (essential oil) plants. We were also reliably informed that the reason—the quality of Lebanese hashish is so choice is that it grows in areas—where semi-arid conditions preveil. It was suggested to us that by providing sufficient water for the whole region then the cultivation of Cannabis would result in an inferior product because of the tendancy for the Indian Hemp plant, when provided with

than tender florets and leaves. It is from these tender, succulent parts which make up the corolla of the plant, that tetrahydrocannabinol - the main physically active constituent - is extracted.

- 81. If the view of these authorities is substantially correct, then the final solution is not necessarily limited to supplying only one single crop alternative (Sunflowers), which presently with subsidy cannot agronomically compete as a "cash crop" with Cannabis.
- 82. On this subject, the writer is very much a layman and therefore can do nothing more than bring this matter to the
 attention of all concerned. It is positively asserted that
 adequate water supplies are the key of the best, and may very
 well be the ultimate answer to the problem of fighting hashing.
 - 33. It therefore obviously follows that any contemplated assistance to continue this fight might better be spent in this way than

on the approach which was the original objective of this ANAN **
survey - viz. a Sunflower Industrial Complex.

- 84. So then to be very definite and very specific, we strongly recommend that a program of water development using both underground aquafers, by means of wells, and diversion waters from the Gronte, through reservoirs, be initiated immediately.
 - As a first step in such an undertaking, and through the kind offices and appearation of Mr. Fathi Shatilla of the Ministry of Water and Electricity Supply, a proposal has been prepared. Mr. Shatilla is eminently qualified to make such a positive proposal. He is a hydrogeologist who has spent the last ten years in water exploration and development in the northern Bekk'a district specifically Baalbeck Hermel where Cammabis is grown.

IX. OTHER PROJECTS TO ASSIST IN IMPROVING THE AGRICULTURAL ECONOMY OF THE AREA

there are other ways of immediately advancing the Agricultural economy of the part of Lebanon where Cannabis cultivation is most prevalent. It was suggested that while these would not directly influence the production of hashish, they might have an indirect bearing on the problem by raising the whole economic level of the community. These then would remove some of the present constraints which are counterproductive and which force growers to eye the attractive returns from a "cash crop" which is nevertheless prohibited.

87. a) <u>Dairy</u>

Reference is hereby made to an excellent study on the possibilities for a 10,000 litre per day processing and cheese production factory in Hermel. This dairy project is outlined in detail in the report of FAO-UNDP experts from BEI. Agrer-

August 1969, entitled bevelopment Project of Hermel-El Qua region.

86. b) Fruit Drying

We were handed a recently completed proposal for the manufacture of dried fruits prepared for and presented to the Green Plan by Mr. C.G. d'Esdra, President/Directeur General, Societe Internationale de Cooperation pour Realizations

Economique et Sociales (SICORES) of Paris.

89. While this scheme is not a particularly profitable venture at present prices for fresh fruit (apricots), it would seem to merit some attention as there is an excellent market for dried apricots available in France.

X. SUMMARY AND CONCLUSIONS

90. There are ten or eleven firms engaged in vegetable oil processing and refining in Lebanon, although six are active at the moment.

- 91. In 1969 they handled 55,000 tons of imported seeds mostly cottonseed with lesser amounts of copra, groundnuts and soybeans. For the first eight months of 1970, 41,000 tons of oilseeds were processed. The locally produced Sunflowerseeds amounted to 2,700 tons in 1969 and 1,600 tons in 1970.
- of vegetable oils other than olive oil results, of this 2,500-3,000 tons are blended with olive oil. The remaining 8,000 tons are blended with olive oil. The remaining 8,000 tons are marketed as liquid oils such as cottonseed, Sunflowerseed and soyceans oils. There are also significant quantities of refined liquid oils imported such as corn, groundnut and coconut oils, in addition to hydrogenated and processed fats.
 - 93. There is a large excess of processing capacity both pressing and refining. Only one quarter to one third is being used.

 The pressing equipment represents all vintages. The more recent models do a satisfactory job within the limits of

pressing technology. The older machines are obsolete and inefficient.

- 94. As a result of visiting each plant and after extensive consultation, certain technical and economic problems became evident. There are several places where improvements could be made to increase efficiency and reduce costs.
- 95. The processing of the 1970 crop of Sunflowerscods was observed and deficiencies noted, particularly with regard to the quality of the meal. The processing variables were reviewed in detail and some adjustments made but we could not escape the conclusion that both inadequate dehulling and high temperatures were reducing the energy value and degrading the amino-acids the active protein nutrients in the meal and thus reducing its value.
 - 96. There were very aparent short comings noted in the matter of quality control and housekeeping. Specific recommendations are offered in these areas.

97. We are of the spinion that some assistance should be given to this industry, which if forthcoming will make it much more competitive as far as export possibilities are concerned.

These relate to:

- a. The present levy on imported oilseeds
- b. The necessity of a small tank farm installation
- c. Handling and transport charges as affected by location
- d. Quality control and Housekeeping regulations

See Section III - Assistance for the Vegetable Oil Industry for complete details.

98. A somewhat more cursery survey was made of the feed industry.

Its technology leaves very little to be desired. One plant
in particular, Phillipe Androcs, stands out as being a model.

It is a fully automated unit only five years old, equipped
and installed by Buehler Bros. of Uzwil, Switzerland and is
reputed to be the finest in the Middle East.

- 99. The outstandingly distinctive feature of this industry is

 the very fine operating arrangements it has established with

 firms of international repute, thus assuring itself of a

 constant flow of the very latest technological "know-how"

 and expertise in the exacting field of livestock feeding and
 enimal nutrition.
 - and production of soyneal as a consequence of the rapidly expanding poultry industry. This brought us to an examination of the present processing methods for oil recovery versus the newer and more versatile extraction techniques as related to both soybeans and Sunflowerseed.
 - 101. By adopting this modern oilseed technology, some very real benefits would result for the Lebanese industry.
 - a) Cost savings as a result of the economies of scale
 - b) Increased yields of oil
 - c) Improved quality of products especially the meal

- d) Increased export opportunities
- e) Provides the possibility for the production of relatively cheap vegetable proteins for human consumption
- Sunflowerseed and Sunflower plant by-products was thoroughly studied. As stated in the Introduction, we were particularly concerned to determine whether such an undertaking, performed by designing and constructing a separate operating unit, could describe with economic viability and show efficient "Value added" to enable a significant reduction in the present subsidy being paid to the Sunflower growers. This was not the case because of the small production tonnage available now, or expected in the future, relative to a minimum-sized plant.
 - 103. Alternatively, it is recommended that any future Sunflower seed production be processed by one or other of the new

solvent extraction plants which are to be installed shortly.

Through processing the Sunflowerseed by the latest techniques, the "value added" will be increased by 20%.

- Sunflower plant by-products, other than seeds, were not very encouraging. However, this is not a field in which the writer has any special knowledge. It will be up to others to follow the tris sabject, and pronounce definitively on its feasibility. Mr. Nizer El Musseini has a keen interest in this matter.
 - neither technically or economically sound and being further infermed that sunflower production could not compete economically with Cannabis, we stepped outside the terms of reference as outlined in the Job Description and sought to explore other approaches and methods to discourage the cultivation of this prohibited crop.

- weight of authority seems to suggest that a number of viable alternative crops could be offered to the present cultivators of Cannabis if sufficient water by irrigation (wells and reservoirs) were provided. In pursuing this line of reasoning, we were ably assisted by Mr. F. Shatilla of the Ministry of water and Electricity Supply. We expect to attach to this report his very definite and specific proposals.
 - of experts from other agencies. Those were brought forward as further possible ways of improving the agricultural economy of the region. These are simply added with a minimum of comment for the benefit and scrutiny of those interested.

XI. RECOMMENDATIONS

- 108. A. Requiring outside assistance
 - 1. Water for irrigation

It is strongly recommended that the appropriate agencies concerned give urgent attention to water resources development. Funds should be immediately forthcoming in order to make a start in supplying irrigation water by both wells (underground water) and reservoirs (diversion water). In this method of approach lies the ultimate solution to the problem of diverting acreage from Cannabis to other more profitable "cash crops".

- 2. Dairy see report
- 3. Fruit Drying see report

B. Requiring only Lebanese action

- 1. Remove the levy on imported raw materials to encourage the expansion of the exports of vegetable oil products.
- 2. Provide a port site for the installation of facilities for receiving and discharging bulk raw materials.
 - a) Tanks for liquids such as bulk tallow, marine oils, etc.

- b) Silos for bulk oilseeds such as soybeans, flax, colza, etc.
- 3. Institute quality and sanitary control standards and inspection for edible oil food products and the processing thereof.
- 4. Continue the present subsidy on Sunflowers for the time being, but initiate a program of phasing it out as soon as possible after irrigation has been provided and other substitutes for Cannabis become viable.
- 5. Investigate the possibility of the government setting up a complete program for regulating and controlling the production and marketing (distribution or disposition) of Cannabis, similar to the plans operating for tobacco and alcohol in other countries.
- 6. Provide iron-clad assurances in the form of foreign capital guarantees to encourage more joint-ventures and collaborative entreprises financed by outside capital, particularly as this applies to opportunities within the

vegetable oil manufacturing industry. The feed manufacturing industry in Lebanon is an excellent example of the value and success of collaborative ventures.

7. Every attention should be given to effecting an integration of forage crop cultivation and animal husbandry. The dischotomy that exists between these two segments of agriculture is very distressing. The bringing together of these two will be made easier when irrigation is provided and winter cover crops, such as vetches, clovers and medics, are made possible.

APPENDIX " A "

TEST FOR RANCIDITY

The Peroxide Value (A.O.C.S. Nº Cd 8-53) has replaced the Kries test. It has the advantage of detecting primary oxidation and expressing it quantitatively as an index of rancidity. Although the Peroxide value is not an absolute measure of rancidity it has the additional value of being the most simple.

As a general standard the following values are currently being used.

For curle wile being transferred to the refinery operations, a maximum peroxide value of 5 mill-equivalents of peroxide per 1000 grams of sample 2 - 3 milli-equivalents is considered normal.

For <u>finished</u>, deodorized <u>oil products</u>, a peroxide value of zero is normal with 1.0 allowable as maximum.

A . O.C.S. Official Method Cd 8-53 Official 1960

Peroxide value

DEFINITION: This method determines all substances, in terms of milliequivalents of peroxide per 1000 grams of sample, which oxidize potassium iodide under the conditions of the test. These are generally assumed to be peroxides or other similar products of fat oxidation.

SCOPE: Applicable to all normal fats and oils including margarine. This method is highly empirical and any variation in procedure may result in variation in results.

A APPARATUS :

- Pipet, Mohr, measuring type, 1-ml. capacity.
- Erlenmeyer îlasks, glass-stoppered, 250 ml.

B. REAGENTS :

- 1. Acetic acid-chloroform solution. Mix 3 parts by volume of glacial acetic acid, reagent grade, with 2 parts by volume of chloroform, U.S.P. grade.
- 2. Potassium iodide solution, saturated solution of KI, A.C.S. grade, in recently boiled distilled water. Nake sure the solution remains saturated as indicated by the presence of undissolved crystals. Store in the dark. Test daily by adding 2 drops of starch solution to 0.5 ml. of the potassium iodide solution in 30ml. of acetic acidchloroform solution. If a blue color is formed which required more than one drop of 0.1N sodium thiosulfate solution to discharge, discard the iodide solution and prepare a fresh solution.
- 3. Sodium thiosulfate solution, 0.1.N, accurately standardized.
- 4. Sodium thiosulfate solution, 0.01 N, accurately standardized. This solution may be prepared by accurately pipetting 100 ml. of the 0.1 N solution into 1000 ml. volumetric flask and diluting to volume with recently boiled distilled water.
- 5. Starch indicator solution, 1.0% of soluble starch in distilled water.
- C. PROCEDURE FOR FATS AND OILS :
- 1. Weigh 5.00 + 0.05 g. of sample into a 250 ml. glass stoppered Erlenmeyer flask and then add 30 ml. of the acetic acid-chloroform solution. Swirl the flask until the sample is dissolved in the solution. Add 0.51 of saturated potassium iodied preferably using Mohr type measuring pipet.
- 2. Allow the solution to stand with occasional shaking for exactly 1 minute and then add 30 ml. of distilled water.
- 3. Titrate with 6.1 H solium thiosulfate adding it gradually and with constant and vigourous shaking. Continue the titration until the yellow color has almost disappeared. Add ca. 0.5 ml. of starch indicator solution. Continue the titration, shaking the flask vigorously near the endpoint to liberate all the iodine from the chloroform layer. Add the thiosulfate dropwise until the blue color has just disappear.

NOTE: If the titration is less than 0.5 ml., repeat the determination using 0.01 N sodium thiosulfate solution.

- 4. Conduct a blank determination of the reagents daily. The clank titration must not exceed 0.1 ml. of the 0.1 N sodium thiosulfate solution.
- D. CALCULATION :
- 1. Peroxide value as milliequivalents of peroxide per 1000 g. of sample
 - S x N x 1000
 Weight of sample
 - S = Titration of sample
 - N . Normality of sodium thiosulfate solution
- E. PROCEDURE FOR LARGARINE:
- 1. Proceed as directed above in Paragraphs 1 through 4 after preparation of the sample as directed below.
- 2. Malt sample by heating with constant stirring on hot plate set on a low heat, or by heating in air oven at 60-70° C. Avoid excessive heating and particularly prolonged exposure of oil to temperatures above 40° C.
- 3. When completely melted, remove the sample from the hot plate or oven and allow to settle in a warm place until the aqueous portion and most of the milk solids have settled to the bottom.
- 4. Decant the oil into a clean beaker and filter through a Whatman Nº 4 paper (or equivalent) into another clean baker. Do not reheat unless absolutely necessary for filtration. The sample should be clear and brilliant.

APPENDIX " B "

PERSONS CONFACTED IN LEBANON IN CONNECTION WITH THIS SURVEY

NAME	POSITION	AGENCY, BUSINESS OR GOV'T. DEPARTMENT	PLACE
H. Jawad	Resident Representative	UNDP	Beirut
A. Clement	Deputy Representative	11	ţı
M. Nordmo	Executive Administrative	tt	Ħ
P. Bakhchagian	Financial	Ħ	11
M. El Halfawy	Senior industrial Develop	went "	11
Tran-le-Quang	Regional Advisor	UNESOB	11
Malek Basbous	President/Director Genera	l Plan Vert	11
Michel Khouzami	Ass't Director	"	11
Hicham El-Hage	Executive Committee	ęę	Ħ
Sami Salami	Administration	11	11
J. Gignac	Canadian Ambassador	Canadian Embassy	, n
S.B. Mc Dowall	Commercial Secretary	ti	11
F.I. Wood	Commercial Secretary	Ħ	16
Yves Trepanier	Ass't Commercial Secretar	ry "	\$1
J.W. Carriere	Second Secretary and Vice-Consul	**	tt .
Nizar El Hussein	Director of Sunflower Pro (Counterpart)	oject Plan Vert	Baalbeck
Gabriel Boyagi	Agricultural Economist	H	Beirut
Alfred Feghali	Administration	H	11
A. Yazbeck	Director	11	Zahle
Elias Touma	Director General, Cereal and Sugar Office	Ministry of Economy	Beirut

E. Saba	Minister of Finance	Government of Lebanon Bo	eirut
Riad Saade	Professor of Economics	Lecanese University	11
M.Abasalah	Director of Industrial Development	Ministry of Economy	**
T. Attalah	Bureau of Industrial Development	Ministry of Economy	Ħ
S.E. Klat H.D. Attiyah	Bureau of Industrial Development Director	Ministry of Economy Industrial Research Institut	ıı Çe ^{II}
N. Ladki	Executive Secretary	Association of Lebanese Industrialists	11
N. Emad	Président	Huilieres et Savonnieres NAIEF EMAD	11
E. Emad	Vice-President	11 11	11
G. Habachi	Chemist	n H	11
C.A. Mattar	Technical Manager	p II	11
Messrs. Salti	Partners	Farah Salti & Sons	11
ni. Moukarzel	Oilseed processor and oil refiner		11
P. Tamer	tt .		11
Nizam Ghandour	11	Tri	poĺi
Rafic Ghandour	Chairman	H.C. Ghandour & Sons Bei	rut
Z. Kurdian	Managing Director	Purina Lebanon (feed mfgs)	11
F. hinnu	Manager Production	11	ti
J. Sinno	President	Sinno-Jabbour (feed mfgs.)	11
M. Assayed	Managing Director	Assayed Agricultural & Trading Co. (feed mfgs.)	tr
A. Addoun	Managing Director	Vitasni (feed mfgs.)	11
A. Samaha	lamager	Provimi (feed mfgs.)	11
Messrs. Ghanen	Owners	Provimi "	11

Phillipe Androos	Managing Director	Androos (feed mfgs.)	Beirut
Najib Ghorra	Owner	Ghorra Trading Co. (feed	mfgs.)
E. Hagge	Director	Ministry of Agriculture	11
S. Kasparian	Director	tt tt	H
Mahmoud Hafez	Director General of Security	Government of Lebanon	11
George Saade	Importer of oilseeds		Ħ
J.E. Hardison	Ford Foundation		11
E. Schweiri	Director	Lebanese Government Agri- cultural Experiment Stat	ion Terbol
J. Khazzaka	Soil Specialist	Research Institute	Tel Amara
A.N. Battacharya	Professor of animal Nutrition	AUB	†1
N.T. Daghir	Professor of Poultry Sc	iences AUB	11
D.W. Bray	Professor of Forage cro	ps AUB	11
A.H. Hallab	Professor of Food Techn and Nutrition	ology	ti .
T.F. Breckes	Manager	Royal Bank of Canada	ti
J.K. Tomi	Manager	Bank of America	11
N. Nimer	Director	Animal Production Depart Ministry of Agriculture	uent "
G. Akl		ti st	**
Stephan Fouad	Director of Central Lab	.Department of Public Hea	lth "
J. Poudry	Agricalturist (French Specialist)	Sunflower project	Baalbeck
F. Daher	laywer and sunflower cultivator		Knaisseh
N. Nahas	Director Hydro-Agricola	u.H. Development	Beirut
Fathi Shatilla	Hydrogeologist	Ministry of water and Electrical Supply	tt

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We also spent time with the staff members of the A.U.B. Experimental farm at Haouchaeniad and the Ford Foundation Farm at Kfardane. A number of farmers and bedown were visited in the Chapt and El Qua districta.

Republic of Lebanon

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