

UNITED NATIONS
ECONOMIC
AND
SOCIAL COUNCIL



Distr.
LIMITED

E/CN.14/INR/145
18 August 1967

Original : ENGLISH

ECONOMIC COMMISSION FOR AFRICA

THE FOOD PROCESSING INDUSTRIES OF NORTH AFRICA

PART I

M67-959

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1 - 4
PART I	
CHAPTER	
I. THE FOOD PROCESSING INDUSTRIES OF NORTH AFRICA . . .	5 - 19
General conclusions	5
A. The need	5
B. The possibilities	5
C. Under-employed productive capacity.	6
D. Fish and fish products.	7
E. Milk products	9
F. Meat products	10
G. Cereal products	11
H. Edible oils	12
I. Sugar	13
J. Fruit and vegetable products.	14
K. Planning and organization	15
L. Capital investment problems	16
M. Training.	17
N. Research.	17
O. Food processing in the general picture.	19
II. MOROCCO	20 - 59
Population estimates.	20
Summary of food processing in Morocco and estimates for 1970 (Table M. 1)	21
Estimated agricultural production of Morocco (Table M.2)	22
Production, import and export of processed foods, 1965 (Table M. 3)	23
Milk and milk products.	26
Butter, cheese and other milk products.	29
Meat.	30

TABLE OF CONTENTS (cont'd)

CHAPTER	Page
Fish products	33
Edible oils	45
Cereals	48
Sugar	50
Fruits and vegetables	57
III. ALGERIA	60 - 96
Population estimates.	60
General use of land (Table A. 1).	60
Use of land available for agriculture (Table A. 2).	61
Food imports into Algeria (Table A. 3).	62
Production, imports and exports of processed foods in Algeria (Table A. 4)	63
General situation	64
Milk production	68
Meat processing	74
The fish and fish processing industry	77
Edible oils	84
Cereals milling and baking, etc.	87
Sugar manufacturing and refining.	91
Fruit and vegetable processing.	93
IV. TUNISIA	97 - 147
Population estimates	97
Production, imports and consumption of agricultural products (1964), (Table T. 1)	98 - 99
Production, imports and exports of processed foods in Tunisia (Table T. 2)	100 - 101
Cost of food and average expenditure (Table T. 3)	102
General situation	103
Milk and milk products.	109
Meat products	118

TABLE OF CONTENTS (cont'd)

CHAPTER	Page
Fish and fish products	121
Cereals.	128
Beer	132
Baby foods	132
Edible oils.	132
Sugar.	135
Confectionery and chocolate	136
Fruit and vegetable preservation	137
V. LIBYA	148 - 181
Population estimates	148
Production, imports and exports of processed foods in Libya (Table L. 1)	149
Statistics of food manufacturing in Libya (Table L. 2)	150
Milk and milk products	155
Meat	160
Poultry	164
Fish	166
Edible oils	167
Cereals.	169
Sugar	171
Fruits and vegetables	172
VI. UNITED ARAB REPUBLIC	182 - 247
Population estimates	182
Agricultural production (Table U. 1)	183
Main crop areas and yields in UAR (Table U. 2)	184
Food consumption (Table U. 3)	184
Food imports, 1964/65 (Table U. 4)	185
Production of processed foods (Table U. 5)	185
The value of production in the years 1960-65 compared with the value expected in 1970 (Table U. 6)	186

TABLE OF CONTENTS (cont'd)

CHAPTER	Page
Investments in food industry (Table U. 7)	187
Food in the first industrial programme (Table U. 8)	187
Food in the second industrial programme (Table U. 9)	188
FAO World Indicative Plan: gross domestic consumption target (Table U. 10)	189
World Indicative Plan: commodity balance for UAR (Table U. 11)	190 - 191
General situation	192
Milk.	200
Meat.	204
Poultry	208
Fish.	209
Edible oils	217
Cereals	221
Sugar	230
Starch, glucose and yeast	237
Fruit and vegetable processing	238
VII. SUDAN	248 - 288
Population estimates	248
FAO World Indicative Plan: gross domestic consumption targets (Table S. 1)	249
World Indicative Plan: commodity balance for Sudan (Table S. 2)	250 - 251
Sudan: food industrial activities, 1965-66 (Table S. 3)	252
Livestock population estimates for North Africa (Table S. 5)	25
General situation	255
Milk.	261
Meat.	265
Fish.	269

TABLE OF CONTENTS (cont'd)

CHAPTER	<u>Page</u>
Edible oil	274
Cereals.	276
Sugar	277
Fruit and vegetable processing	283

ANNEXES

- I. THE PRINCIPAL FOOD PROCESSING METHODS AND TERMS USED
- II. PERSONS CONSULTED
- III. LITERATURE AND REPORTS CONSULTED

INTRODUCTION

Terms of Reference

As part of the series of sub-regional studies for the industrial development of Africa by E.C.A., a three-months assignment (October - December 1966)

"To prepare a report on food industries in North Africa: Libya, Tunisia, Morocco, Algeria, Sudan and the United Arab Republic"

was accepted by Dr. C.L. Cutting, then Director of Research of the British Food Manufacturing Industries Research Association, Leatherhead, Surrey, U.K.

The immediate object of this mission was to endeavour to fulfil so far as the food industries sector was concerned the protocol of the agreement between the Kingdom of Libya, the Tunisian Republic, the People's Democratic Republic of Algeria and the Kingdom of Morocco signed in Tangier 27 November 1964 as follows:-

"In order to prepare the conditions for far-reaching industrial harmonization, the Conference of Ministers of Economic Affairs of the Maghreb has decided.

1. To recommend the Economic Commission for Africa to establish contact with the Permanent Consultative Committee, and to provide the latter as soon as possible with the following studies:
 - a) a detailed comparative study of existing industrial potentialities, in particular from the view point of production capacities, volumes of production and their uses, as well as prime costs, etc."

In consequence of discussions with ECA personnel, the emphasis of the enquiry has been on industrial food production, processing and preservation. Particular attention was given to the technical possibilities of installing new and additional production units wherever the prospects seem favourable.

Agricultural production has not been considered except where the possibilities or limitations of primary products have a specially important bearing on the prospects of processing industries. Similarly, production and use of fertilizers has been practically ignored.

Commodities and processing in the six countries of the sub-region have been studied under the following headings:

- a) Milk (pasteurized, sterilized, dried, etc.). Milk products (butter, cheese, etc.)
- b) Meat products (canned and frozen, including also in some cases slaughtering and chilling equipment and facilities); also processed feeds (oil cake, fish meal, cereal offals, etc.)
- c) Fish products (canned, frozen, dried, etc. and also including fresh fish distribution requiring equipment, e.g. mechanized fishing vessels, refrigerated transport, ice factories, etc.)
- d) Edible oils and fats (olive oil, vegetable seed oils and fish oils) considering both extraction/crushing and refining. Also hardening to produce margarine, ghee and compound cooking fat.
- e) Cereals (milling of rice, wheat, etc.) and cereal products (e.g. bread, pastas, cous-cous and biscuits).
- f) Sugar - both refining of imported "raws" and extracting of home-grown beet and cane.
- g) Fruit and vegetable products (canned, dried, juice, concentrates, etc.)
- h) Drinks - Information was not specially sought, but was not refused when conveniently available, having regard to the possibility of home produced fruit drinks to supersede wines, oolans, etc. Tea and coffee were not considered. Such information, along with incidental data on tobacco, was passed on to ECA staff concerned.

Efforts were made to gain an appreciation of the above as regards:-

- a) Present levels of production;
- b) The immediate plans approved for increasing production;
- c) The additional potentialities that might be commercially exploitable by the food processing industries.

Wherever possible, information was obtained on costs of production.

Enquiries were made from three distinct groups:-

- a) Government administrators and technical officials.
- b) FAO Technical Experts.
- c) Working industrialists, both in the private and public sectors.

Enquiries were made regarding the sources of finance for investment anticipated (e.g., World Bank, bilateral arrangements, U.N. Special Fund, etc.).

Special attention was given throughout to aspects where some form of North African co-operation might be envisaged in the future, not only in actual production of processed food but also as regards research and training.

In the limited time available, it was possible to obtain only a bird's eye view of the problems and possibilities of the main food industries of each of the countries. Even to have read properly all the relevant reports already existing would have taken much longer than the three months allocated to the enquiry. For example, one paper on the meat industry of Libya refers to 21 previous reports on the same subject. Again a detailed survey in 1964 in 85 separate reports of the food industrial possibilities in Algeria must have consumed well over ten man-years.

In such a rapid and relatively superficial survey as the present it has been impossible to check all statements and impressions and it is therefore possible that there are a number of significant omissions and even errors. However, it is hoped that a quick outside opinion may nevertheless furnish some helpful comments on North Africa's food processing problems.

Part I of this report presents an account of the observations made and conclusions drawn regarding the food processing industries of the six countries.

Part II draws on this material for a contribution of the food processing industries, as defined in the International Standard Industrial Classification, to the integrated projection of the needs for industrialization in the North African sub-region by 1980 being derived for ECA by Professor H.C. Bos of Rotterdam. Part II will be completed towards the end of 1967.

Acknowledgements

In carrying out the above assignment, the consultant received assistance and information from numerous people, including those listed in ANNEX II. Special acknowledgement is due to various Divisions of the Food and Agriculture Organization in Rome and to their numerous regional and country specialists in the field, without whose co-operation and interest this mission would have been much less informative.

CHAPTER I

THE FOOD PROCESSING INDUSTRIES OF NORTH AFRICA

General Conclusions

A. The need

The diet of the peoples of the North African Sub-region is in general deficient in the nutrients essential to health. This situation will worsen as population rises unless still more urgent attention is given not only to increasing food production, but also to better methods of utilization by processing, preservation, storage and distribution.

B. The possibilities

All the North African countries import considerable quantities of processed foodstuffs and their projections for the future in many cases assume considerable increases in such imports by 1980. Many of these foodstuffs could be supplied within the region if better use were made of natural resources.

The climate throughout the sub-region is generally favourable for the growth of many foodstuffs. Natural productivity has deteriorated considerably as a result of soil erosion caused by past agricultural practices. But various irrigation schemes, United Nations Special Fund projects, technical advice from FAO and bilateral assistance measures for short and long term rehabilitation can be expected to provide the conditions required for steadily increasing agricultural output. Even at present most of the basic articles of diet could be home-produced on a much larger scale, although the monetary cost would often be relatively high under present conditions. However, as the century advances all countries will find it increasingly obligatory to produce as much as possible of whatever foods the physical conditions permit, subject of course to reasonable priorities, and without reference necessarily to prevailing "world market prices" which may reflect only the most favourable conditions for production.

In order to prepare for this increasing reality, it is imperative for all developing countries to develop as rapidly as possible the necessary range of industrial skills and managerial abilities so as to make the most of whatever their natural environment and circumstances permit. Aided by the more economically advanced countries, the pace of development must be telescoped to accomplish in decades changes that took centuries of laissez-faire evolution elsewhere. It is only to be expected that this accelerated training will have to be paid for in above-average costs of production at the outset and that there will be a proportion of failures, from which however the necessary lessons must be learnt.

C. Under-employed productive capacity

At present many food processing industries throughout North Africa are operating well below capacity for the following main reasons:-

(a) The departure of the colonists and their armies since independence has resulted in a reduction in demand for certain established industries (e.g. cereal products such as white bread, pasta and biscuits, and also wine, especially in Algeria).

(b) Processing units have been established before organizing supplies of suitable raw material (e.g. milk in UAR and fruits and vegetables generally) or in some cases markets for the products. For this reason some factories have actually closed down (e.g. one for meat canning in Sudan), or never even started up (e.g. one for tomato canning Central Libya).

(c) Technicians and managers are not available to operate existing installations properly. This is a particular complaint in Algeria and Libya and also applies to sugar in Sudan.

(d) Partly as a result of (b) and (c), products intended primarily for export are not cheap enough, or of a sufficiently high quality to compete in the world market. This applies to Moroccan sardines and fish meal and to canned fruit and vegetable products generally.

Contributory factors are the high cost of importing practically all processing equipment and packaging, cans and ancillary materials, and the high transport and handling charges in exporting. Also in some cases import duties and excise taxes (on sugar for example) add to the difficulties.

However, these difficulties must be overcome, and the lessons digested, if the best is to be obtained from the present state of industrialization and the most favourable conditions and prospects created for further capital investment in food processing industries. Of course "over-capacity" ultimately cures itself by becoming "obsolescence". And "competitiveness" is difficult to judge in markets where "protection" and "dumping" occur. Nevertheless, uncertainty on these issues is a disincentive to external investors.

D. Fish and fish products

The fisheries of South West Morocco stand out in the Sub-Region as the prime example of an under-utilized natural resource. Fish are little eaten inland in North Africa. Presumably this is largely because formerly they could not be carried far from the coast in a fit condition to eat owing to the high atmospheric temperatures, at which fish goes bad very quickly. Now, good roads and insulated and refrigerated vehicles have overcome this difficulty. Several countries (Algeria and Tunisia) are developing such patterns of inland distribution. However, publicity campaigns are required in schools and villages to bring dietary habits into line with modern technical possibilities.

Most of the Moroccan fish catch consists of sardines, which are chiefly exported to France, canned and as fish meal, with favourable customs arrangements. Prices are high and quality uneven for effective competition in the world market, but both these aspects could be improved if the Government took the necessary steps.

At the same time, the sardine canneries of Algeria, Tunisia, Libya and UAR are under-employed because of shortage of supplies of fish. Although it might seem that Morocco could therefore export frozen sardines to the rest of North Africa, there are obvious difficulties. All the countries are trying to build up their own fisheries. And all are mainly canning sardines for export, in which they are competing with one another.

However, the hard facts are that:-

(a) Nearly half of Morocco's fish catch of 200,000 tons has to be converted into fish meal for animal feeding at a quarter of the price it fetches for canning and freezing because there is no other market for it.

(b) The present catch could probably be doubled with existing resources.

(c) Morocco is well situated to exploit the lucrative fisheries off West and South West Africa, if only the markets could be created.

In the meantime, Algeria, Tunisia, Libya and UAR are all planning to send vessels equipped for freezing and even canning at sea into the Atlantic where fisheries are more prolific than in the Mediterranean.

Although fresh-water fisheries are particularly important for UAR and Sudan, there is no co-operation as yet over the exploitation of the new Lake Nasser being formed by the Aswan High Dam.

FAO and UNICEF have been concerned in promoting cheap but nutritious baby foods, the greatest progress being made in Algeria. It was hoped that a purified fish flour made from surplus sardines could be used in these formulations, and a \$1 million plant was set up in Morocco. However, the product does not yet come up to expectations and the process must be improved before general use can be recommended.

E. Milk products

Processing milk to render it safe to consume is relatively undeveloped throughout the Sub-region, although over a dozen of the largest towns have some pasteurizing facilities. Those in Cairo and Tunis seem to be operating particularly successfully. In Casablanca and Khartoum operation is not so good, so that in Morocco, for example, prudent parents still prefer to bring pasteurized milk to the boil before feeding it to infants.

The collection of sufficient supplies of milk of satisfactory quality is a widespread problem, causing many plants to operate below capacity. To overcome this, cattle stocks need to be improved by better breeding, feeding and veterinary services. Then there is need for more hygienic milking and networks of refrigerated collecting centres, as well as improved transport services to the processing plants. Finally, retail distribution needs to be controlled if pasteurized milk is to supplant raw milk delivered by pedlars, which still accounts for about 95 per cent of the fresh milk trade.

Although obviously a large expansion in milk processing is practically a certainty for the future, the provision of the necessary material requirements must be supported by timely legislation and enforcement.

Sudan has several times as many cattle as the rest of North Africa, but they are not used effectively for their milk. Attempts are being made to tap the potential at seasonal nomadic gathering points which, although currently facing difficulties, could eventually lead to a more settled and productive existence for millions. In view of the geographical isolation, these operations are based on separation of cream for butter-making in one case and milk drying in another. Although intended for import substitution in the first place, if successful and suitably developed, these trials could make Sudan the chief milk products manufacturer of North Africa. However,

although milk powder is imported generally, the average price of the million tons produced annually, mostly in USA as a by-product, is only around .300 a ton.

There is also an enormous additional potentiality for dairying of a large tract of practically virgin pasture extending into the Central African Republic which has not yet even been surveyed.

There is need generally for more integrated dairy husbandry, embracing production of a full variety of milk products, including cheese.

There are between 30 million and 40 million sheep in the Sub-region (about 13 million of them in Morocco), but their milk is largely wasted. Although some products are made in rural areas, ewes soon "dry up" from sheer lack of milking in outlying districts. High quality Rochefort cheese is being made from sheep's milk in Tunisia, but it is too expensive (nearly .2 per kg.) for the local population. Units should be established with FAO assistance to develop the collection of milk from wandering flocks and convert it into cheese of types acceptable locally and into fermented products. By better feeding and management, too, and perhaps the introduction of new breeds, sheep would give several times as much milk as they actually do.

F. Meat products

There is a general shortage of fresh meat and heavy imports of live animals for slaughter as well as of fresh and frozen meat **except** in Sudan, which therefore seems to have the best potential for meat products. However, on account of the risk of spreading contagious animal diseases, only canned meat, which is sterilized by heat, could at present be generally exported. Complete eradication of cattle diseases will take a long time. Export possibilities of fresh and frozen meat therefore depend on establishing recognized "disease free zones", acceptable to international authorities. If this came about,

Sudan could supply the beef requirements of the whole of North Africa. The quality of the meat would have to be improved by breeding programmes and better feeding and attention. The transport system also needs improvement if cattle are to arrive at processing centres in good condition.

Abattoirs, chilling and cold storage arrangements generally for the proper handling of meat need improvement. Refrigerated transport is required for mutton from inland to the coastal urban areas, (the reverse of the situation with fish).

G. Cereal products

The processing of staple articles of diet, such as cereals, has to be on a scale to meet the demand. There are large imports of imported soft wheat which is milled industrially with a fairly high extraction rate for the "balady" type of Arabic bread, mostly baked in small-scale bakeries. Imported flour of low extraction goes into the smaller quantities required of European-type bread, made in larger, more mechanized bakeries which are generally under-employed since most of the Europeans have left.

Home-grown durum wheat, which provides "couscous", the standard cereal dish, is also milled in numerous small mills in the villages. Durum is also used for the manufacture of pastas, again operating well below capacity since the French and Italians left.

Flour mills in most cases can cope with the demand and new mills are being installed to keep pace with it as the population rises. Milling offals make valuable ingredients for animal feed.

Attempts are being made in the UAR to automate the production of "balady" bread as the only means of standardizing it. If successful, there may be a general trend away from the present labour-intensive system of producing this basic food stuff.

A few thousand tons of biscuits a year are made in nearly all the countries and again production is below capacity. Although not of high quality, they rank as luxury goods on the home markets and

there is some export. The continuous equipment required has to be purchased in countries prepared to meet currency difficulties, e.g. by payment in the goods produced, which, however, means that the best is not always obtainable.

Beer, as a cereal product, was drunk mainly by Europeans. In Morocco and Algeria there is over capacity while in Tunisia and UAR production is increasing. European beers are still imported, but there does not seem much likelihood of imports-exports within the sub-region.

H. Edible oils

Oil is another staple necessity for which all the countries have developed industries for extraction and refining, and production capacity is being steadily expanded from local resources. Olive oil, a traditional product over most of North Africa, is generally preferred by consumers, but commands a high price for export (which is particularly important for Tunisia) and other seed oils are therefore important substitutes. Cotton seed, produced principally in UAR and Sudan, is limited in output by the export market for cotton lint. The outputs of groundnuts and sesame could be increased several times during the next ten to twenty years.

The more efficient solvent extraction of oil seeds to be used in UAR could well be adopted elsewhere in the sub-region.

Olive oil is primarily a rural industry so that there are many primitive small-scale and domestic olive crushing and extraction plants, which are wasteful as they leave too much of the oil in the press-cake which is later extracted by solvent to yield a low grade oil, mostly suitable only for industry. Co-operation of small producers, as in Tunisia, permits production units with up-to-date equipment. New extensive olive plantations planned for Morocco and Tunisia will not be bearing fruit in sufficient quantities to require much new equipment before 1980.

As most of the countries are accustomed to a liquid cooking oil, no greatly increased demand is foreseen for chemically hardened fats, such as margarine.

Oil seed cake is mostly exported to Europe for animal feeding. Transport for this is difficult and expensive in the case of Sudan. However, it should properly be employed for stock raising for milk and meat production at home in Africa rather than for subsidizing the fattening of European livestock.

I. Sugar

There is a relatively high consumption of refined sugar throughout North Africa and especially in Morocco. All, except Libya and Sudan, are largely self-sufficient in sugar refining. But, in addition all are newly growing, or planning to grow, sugar beet and/or sugar cane for local extraction and building and planning further factories with the object of achieving increased self-sufficiency in sugar. 70 per cent to 80 per cent of the capital expenditure devoted to food processing is for sugar factories. The cost of the product is certain to be above the price at which it can be bought at present on the world market. (In Europe, too, beet sugar is hedged around with "protection").

As sugar is not a balanced food, it may be doubted whether this emphasis on sugar production is nutritionally desirable.

Morocco is planning a steady increase in beet production and cane as well after irrigation is provided by the Sebou Scheme around 1974, although it is not foreseen that home production will ever overtake demand.

The United Arab Republic anticipates an exportable surplus of cane-sugar by 1972, but it is expected that this will disappear by 1980 as a result of increasing home consumption. In Sudan, where climatic conditions are even more favourable for the growth of cane, production has hitherto been making much slower progress than was

hoped when it was started in 1963. However, if the lessons learnt from this are applied in the new factories built or planned, production should meet home needs by, say, 1970. In the present state of the world sugar market there are commercial hazards in planning to produce a large exportable surplus in competition with such established producers as Cuba, Brazil, Venezuela and Mauritius. Transport would present problems in the south of Sudan.

J. Fruit and vegetable products

A considerable portion of the North African sub-region is climatically favourable for growing a great variety of fruits, from apples and pears in Algeria to mangoes in UAR and pineapples in the south of Morocco and Sudan, whilst citrus fruits are grown generally. Dates are a major crop in which further improvements in packing and processing are possible. There are sub-optimal units producing date syrup etc. in Libya and Sudan. Amongst vegetables, tomatoes (really a fruit also, of course) and onions predominate, followed by beans, artichokes (as a luxury pack) and okra (ladies fingers) etc. There is a considerable export fresh and all the countries process appreciable quantities by drying, canning and jam-making and, to a lesser extent, freezing mainly in competition with one another, of course, in exports, which account for the bulk of production. Most factories are under-occupied for the reasons outlined in C. above. Larger units of production are required for better quality and prices. But this would necessitate much greater production of better quality raw material, specially grown for factories, conditions which are not met as yet.

Tin containers often cost more than the contents. Only UAR produces its own tin-plate for cans, and this might perhaps present a possibility for sub-regional co-operation as also would its production of refrigeration equipment on a larger scale.

For home consumption, prices are high in relation to the average levels of wages. Furthermore, fresh fruits and vegetables are available for much of the year, and much could be done by cold storage to extend seasons further. Nevertheless, as incomes rise with industrialization, the market for "convenience foods" will doubtless increase as it has done elsewhere.

Wine can be regarded as a special fruit product evolved entirely to serve the former colonial connections in the Maghreb countries. Production of grapes for wine in Algeria is being scaled down by about 15 per cent per annum because of lack of overseas markets. At the same time, UAR is planting vineyards in some of the land newly recovered from the desert.

K. Planning and organization

All the countries, except Algeria so far, have evolved national plans for a 3, 5, 7 or 10-year period, which include detailed plans for the food processing industries as well as for agriculture. In several cases these plans have had to be radically modified (although this is by no means unusual even in "developed" countries).

However, the chances that such a plan can be successfully achieved depend on:-

- (a) the effectiveness of the political control exercised over the development of the economy;
- (b) the factories and equipment that can be acquired as a result of capital investment;
- (c) the availability of trained people to operate the factories and equipment;
- (d) creating a political spirit conducive to winning from people their utmost personal endeavour.

In most countries, governmental responsibility for the food industries is divided between the Ministry of Agriculture, concerned with the primary raw materials, and the Ministry of Industry, concerned with the factory processing of foodstuffs other than fish, which either come under the control of the Ministry of Agriculture or else are organized independently as an entity including both catching and processing. Agriculture and food processing are interdependent and in more than one country this dichotomy has presented difficulties both in planning future production and in organizing its implementation.

L. Capital investment problems

All the countries of the sub-region have recently become independent and are anxious to govern their own economic policies by varying degrees of state control, varying from measures of public ownership of the principal means of production, including land, (in Algeria), to state control of export trade in Morocco and majority holding in new companies in Libya. To a varying extent, the conditions attached to the acceptance of foreign investment in the food industries act as a deterrent to the attraction of capital from overseas. In some cases there is uncertainty regarding possible future political action affecting profitability. In others there are doubts regarding industrial capabilities and efficiency, particularly whilst the teething troubles encountered in various recent technical developments still have to be resolved.

Some industries therefore have difficulties in securing new equipment. Various types of bilateral arrangement are entered into to overcome these. UAR, for example, is prepared to pay for equipment with the output of the new factory over a period. However, the most suitable equipment for a particular purpose cannot always be obtained in this way.

M. Training

The greatest need in North African food processing industries today is not for increased capital investment but for more people to operate existing equipment more effectively, at all levels, from management, through middle grades down to factory workers. However, although much useful indoctrination can be effected in training centres and the like, the only real training in factory operation can come from actually operating factories, and the numbers of people who can be trained to take decisions will be few, unless there is a goodly number of factories. Something might be said in favour of deliberately installing small-scale pilot factories, not expected to be competitive, in which both workers and managers of various grades can receive training under practical conditions. It is perhaps in this context that the Russian equipped factories in Sudan must be viewed. In any case, it must be realized that acquiring all the necessary abilities will be a long, slow business, and that more harm than good can be done by trying to force the pace of industrialization faster than the personnel available can cope with it. An excessive number of failures could lead to frustration and disillusion on the part of both developer and developing.

Possibly, individual countries in the sub-region might be able and prepared to invite other countries to attend permanent training centres in some subject in which the host country is specially experienced e.g. sugar-beet technology in Morocco, although language is a problem. The recommendations affecting North Africa in the FAO Report (of October 1964) on "Food Technology Education and Training in Africa" need following up.

N. Research

Each country is anxious to carry out a food research and development programme to meet its own particular requirements. At present only Morocco and particularly UAR are set up to do much food research.

However, resources are distributed unevenly and there is some duplication of effort even within a country.

In Sudan, FAO is establishing a Food Processing Research Centre under the UN Special Fund, and there is also a new UN Industrial Research Centre which, it is to be hoped, will integrate its programme with that of the Food Centre.

However, it is questionable whether Tunisia, with a population of $4\frac{1}{2}$ millions and a G.N.P. of around \$1,000 million, or Libya with only $1\frac{1}{2}$ millions, can afford to support an effective research programme, however practically oriented, that can cover the entire field of its food industrial interests.

In the four Maghreb countries, which constitute a distinct sub-unit of the North African sub-region, the UN Special Fund has approved the institution of a Central Industrial Research Institute which will be located, apparently, at Tripoli. However, at the outset and for the foreseeable future, this is envisaged only as an economic intelligence unit rather than as a laboratory establishment. Obviously, such an intelligence unit could provide valuable service in collating and comparing information on economic costs and the most suitable locations for particular types of activity, food amongst the rest. However, it is to be hoped that the economic exchange and co-operation that should thus be engendered by such communal activity will in good time lead to a decision to co-operate also in technological research, although only for the Maghreb area and not for the whole of the North African region, as sub-divided by the Economic Commission for Africa.

In future food research it is imperative that the attitude of the technologists should be more "down-to earth" and applied than is the case in some of the work that is at present underway.

Large increases of productivity are possible merely by application of scientific common-sense and what has already been established elsewhere. Food research workers should get out into "the field", i.e. the food industry, to an increasing extent rather than stay in their laboratories making scientific discoveries of mainly theoretical and academic interest. Although this potential divorce between theory and practice is by no means confined to the North African countries, they are less able to afford the luxury than some others where it is prevalent.

O. Food processing in the general picture

In assessing the possibilities of economic co-operation within the sub-region, the food processing industries cannot be considered in isolation from the rest of the industrial pattern in each country. For example, the discovery of mineral oil in Libya in 1960/61 has led to a scarcity of labour that is unique in the sub-region, but at the same time an influx of wealth which allows substantial food imports alongside subsidies for machines and fertilizers. On the other hand, in Algeria, which also has oil, there is considerable unemployment. It may be that in any sub-regional framework, both these countries would be better off exchanging oil and petrochemicals for manufactured foods, than in endeavouring to set up, staff and organize their own food industries to meet most of their own requirements.

CHAPTER II

MOROCCO

Population estimates

1959-61	. . . . .	11,625,000
1963	. . . . .	12,212,000
1970	. . . . .	14,959,000
1975	. . . . .	17,162,000

TABLE M. 1
Summary of Food Processing in Morocco and
Estimates for 1970

	1964			1970		
	Production Capacity (1000 tons)	% Utili- zation	Net Imports (+) Exports (-)	Production Capacity (1000 tons)	Net Imports (+) Exports (-)	Investments (DH.m)
Sugar refining	336.7	365	96 + 45.3 (+ 298 raw)	420	446 (+ 320 raw)	280
Yeast	3.8	5	76 + 2	7.7	12	2.5
Oil seed crushing	113.9	15	92 + 43.3 (as seed and oil)	40.3	45 (+ 46.2 (crude oil))	20
Oil refining	52.7	96.9	54 6	82.6	125	2
Margarine	1.9	3.8	50 -	2	3.8	-
Canned fruit and vegetables	44.1	55	80 -37	50	60	11
Canned fruit juices	14	27	51 -15	25	37	10
Canned fish	53.8	99	55 -51	64.8	99	6
Confectionery	3.4	7.5	45 - 0.2	4.4	7.5	1
Chocolate	0.8	1.7	48 + 0.2	0.9	1.7	-
Drinks - malting	4.2	6.0	70 - 1.1	4.0	6.0	-
Drinks - beer	29.7	47	63 + 1.4	30.5	47	-
Drinks - carbonated	28.4	55	51 -	36	55	3.5
Fishmeal and oil	29.5	100	30 27.2	50	140	3.2
Oilseed cake	22.8	25	91 19.4	45	50	-
Total					38.5	339.2

TABLE M. 2

Estimated Agricultural Production of Morocco
(1000 tons)

	1961-62	1964-65
Soft wheat	322.8	306
Durum wheat	924.6	1010
Maize	347.5	270
Barley	1185	1200
Tomatoes	270	225
Sunflower	2	8.6
Cotton	144	31.7
Sugarbeet	-	175
Esparto	100	80
Olives	140	172
Citrus fruits	488	590
Eggs	52	49

TABLE M. 3
Production, Import and Export of Processed Food (1000 tons)
(Morocco, 1965)

	Production	Imports	Exports
Prepared and preserved meat	1	sm.	0
Milk, evaporated and condensed	0	9	0
Milk, dried	0	11	0
Butter (factory)	0.1	4	0
Eggs (packing stations)	0	0	0.2
Canned fish (1963/64)	56	sm.	51
Canned crustaceans and molluscs (1963)	0.6	0	0.2
Flour and semolina	636	62	0
Biscuits	3	0.2	0.1
Pastas	20	sm.	0.6
Dietary and baby foods	0	0.4	0
Jams and preserves (1964)	4.5	0.1	2.7
Jams and pulp (1964)	5		
Fruit juices	15	sm.	19
Preserved and prepared fruits and nuts	8	0.1	15
Preserved vegetables (1964)	10	sm.	7
Canned olives (1964)	14	0	10
Sugar (raw) (1964)	20	298	0
Sugar (refined) (1964)	337	51	6
Yeast	4.3	0.8	0
Chewing gum	0.4	0	0
Sugar confectionery	4	sm.	0
Chocolate	0.5	sm.	0
Fish meal (1964)	23	0	22
Fish oil (1964)	6.5	0	5.3
Crude vegetable seed oil	13)		
Refined vegetable seed oil	62)		
Soya		41	
Cottonseed		25	0
Sunflower		2	
Cocoanut		2	
Palm kernel		1	
	Total	71	

(sm. = small)

Morocco has been described as "the California of the Eastern Hemisphere", and indeed there are some close similarities and all the potentialities for corresponding developments. The climate is hot and advantageous for a variety of fruits and vegetables, although it is relatively cool in winter, even freezing at times, so that only one crop can be grown per year. The low rainfall in the more arable lowlands is a limitation which can be overcome by irrigation schemes to harness the rainfall in the mountain areas. Marine fish is plentiful around the coast as a consequence of the up-welling of the Canaries current in the southern part, but it is little eaten, particularly inland. The heat and flies are a hazard for perishable foodstuffs such as fish and meat.

Population is increasing faster than increase in food production, despite current propaganda for "Planification Familiale." There are already over 100 experts of FAO and other international agencies in Morocco, quite apart from numerous bilateral arrangements, and numerous reports have been written on the technical problems of increasing food production and utilization. There is one major project, the Sebou Barage scheme with three dams financed by the United Nations Special Fund, which will have an immense influence on the future production of both animal and vegetable products, including rice and sugar cane as well as animal and meat production, with four and five year rotation of crops and reorganization of villages along with a new distribution of the land. However, it will be 1974 at the earliest before water is available from this scheme.

Politically, the Kingdom of Morocco, since it achieved its independence in 1958, has been concerned to "Moroccanize" its basic industries, including food processing. Industrial developments employing State or Moroccan capital are therefore given preference over those employing foreign capital. There is also a drive towards self-sufficiency in certain food commodities which results in protective measures that effect the competitiveness of other food industries dependent on exports. Legislation with the object of protecting employment can

also bear heavily on the efficiency of operations in the private sector. There is, however, a "Triennial Plan 1965-67" and a national projection for output for the food preservation industries as far as 1970. Other estimates look as far ahead as 1985 and in the case of the Sebou Scheme to 2,000 A.D.

As is the case throughout most of North Africa, the European colonists built up a pattern of sophisticated production based on their own requirements. With the exodus of the colonists, the industries are left running below the capacity because the purchaseable needs have decreased and also because of the loss of trained technical staff capable of keeping equipment operating efficiently and continuously.

In most sectors of the food industry, the capacity of existing processing facilities considerably exceeds present levels of production. This situation was referred to in the report of December 1965 on Morocco by the International Bank of Reconstruction and Development.

Fish canning, baking, and the production of fish meal, margarine, beer and carbonated beverages are 50 per cent utilized or less. Cereal milling and oil seed refining exceed 80 per cent of capacity and sugar extraction and refining are practically fully employed. It is difficult to say how much of this surplus capacity is marginal in efficiency and utility and the extent to which out-of-date equipment needs replacement to be fully economic. There is also the question that some of the surplus capacity may be in foreign hands, whereas new capacity going in is in Moroccan hands. Furthermore, in some cases certain measures may be necessary more for social or political than economic reasons. Nevertheless, in most sectors it would be possible to increase total production if the demand existed. Again, it is difficult to be certain of the statistical value of estimates of unused capacity. Ministries tend to underestimate it in order to advance arguments for further development projects, whilst businessmen are tempted to over-estimate in order to deter new competitors from entering the business.

The following table lists the food manufacturing projects for which the Banque Nationale pour le Développement Economique agreed to give loans in 1965, usually for a minor proportion of the capital cost at seven per cent interest repayable over 5-10 years.

TABLE M. 4

Dossier No.	Description	Place	Investment in DH.(1000)	New (N) or Extension (E)
657	Cannery	Casablanca	1,054	N
669	Mill	Casablanca	235	E
678	Co-operative Dairy	Marrakech	26	E
695	Fish Meal (OMACI)	Agadir	1,125	E
696	Mill	Agadir	3,530	N
718	Confectionery	Casablanca	80	E
721	Mill	Taza	102	E
722	Oils (SEPO)	Casablanca	380	E
723	Fruit Juice (IMACO)	Kenitra	468.5	E
729	Sugar Factory (SUTA)	Tadla	105,515.6	N
739	Animal Feed (PROVIMA)	Casablanca	245	E
742	Mill	Fez	281	E
751	Yeast	Tangiers	498	E
770	Maize Derivatives (SOMADIM)	Casablanca	7,380	N

14 out of a total of 109 projects were concerned with food manufacture. 42 of these were for investment of more than DH. one million of which 31 were between DH. one and five million.

Milk and milk products

Stock-raising is widespread but pastures are often over-grazed. Average milk consumption is low (0.04 tons/1,000 inhabitants per year), compared with Europe and North America (0.3 - 1.1 tons/1,000 inhabitants per year). Only about five per cent of the total supplies of cows' milk is treated in pasteurizing plants (24 million l., or 24 thousand

tons, in 1964 and 1965 out of a total of about 470,000 tons of which 40 per cent is sheep and goats' milk compared with 17 to 18 million l. in the years 1959-62). There are three plants in Casablanca and other small ones in Kenitra, Marrakech, and Oujda, and one in Meknes which were closed in 1964. The largest establishment is the Centrale Laiterie Marocain in Casablanca which processes 60,000 l. a day of pasteurized milk, yoghourt, butter and fermented milk. In 1965 there were supposed to be altogether 20 establishments processing milk in Morocco, employing 579 people of which, however, only four employed more than 20 and two alone employed 485 people.

At the same time imports of evaporated milk and condensed milk have risen from 5,000 to 8,000 - 9,000 tons per year and those of dried milk powder from 2,000 - 11,000 tons in the same period, which together are equivalent to about 100,000 tons of liquid milk per year.

The majority of raw milk is distributed by pedlars, many of whom in the large towns are motorized. The commodity they purvey is of poor, bacteriological quality and along with ice-cream, etc., made from it, without suitable heat treatment, spreads diseases. But the pasteurized milk is about 30-40 per cent dearer, the cost of pasteurizing being about DH 0.3 in a retail price of DH. 1.0 per l. Strict control and enforcement of hygienic and compositional standards would be necessary before pasteurized milk could become widespread. However, at present the pasteurization process is not always supervised and carried out effectively so as to free the milk from all health hazards. Prudent parents are therefore constrained to boil the pasteurized milk before giving it to infants. Distribution of pasteurized milk must be strictly controlled and delivery by pedlars would make quality less reliable still, so that pasteurized milk has to be collected from a shop which involves additional trouble for the consumer.

Obviously, the first essential is to ensure proper supervision of existing plants and suitable training of operatives. However, in any case pasteurization is only one step in the sequence of necessities between animal and the consumer if a clean milk supply is to be assured.

These are, control over the raw material arriving at the plants by proper management, backed by selection, veterinary attention, breeding, feeding, proper housing and milking of the animals, and then a system of refrigeration and collection to ensure arrival at the factory in good condition and with the minimum delay. After it leaves the plant, it should not be displayed in the retailers' but should be kept refrigerated. Although probably without first the provision of a pasteurizing plant there is no incentive to progress in the other departments, there seems no immediate call for capital investment in the new plants until steps are taken to improve the management of the present plants and bring about the ameliorations necessary to improve the raw material. Awareness of the need for greater attention is spreading as a result of top-level educational activities. Thus Prof. Buttiaux of the University of Lille and D. Mossel of TNO, Netherlands, both eminent food bacteriologists, recently addressed a two weeks seminar in Morocco attended by leading health, agriculture and veterinary authorities as well as representatives of industry. It was suggested as a result that the Ministry of Health should form a Commission for the improvement and amelioration of the quality of food stuffs in Morocco. Obviously suitable instruction needs to be brought to the level of the plant manager and operative also. Certainly one would hope and envisage that before 1980 there would be a demand for large-scale, if not universal, pasteurization of cows' milk.

At the same time, the Sebou scheme alone plans to produce 200-300 million litres (200,000 - 300,000 tons) of milk by the end of the century for which, ultimately, suitable processing plants will be required. The FAO dairying expert who is consultant for the Sebou scheme is preparing a report which will be available soon for implementation year by year of the dairy industry developments in the Rharb area which will benefit largely from the scheme.

In the meantime it is significant that the plan for 1970 envisages no increase in average consumption of milk per head.

Other relatively minor barage and irrigation schemes, such as that on the Moulouya River in the North East of Morocco have already been completed and possibly something could be learnt, or perhaps already has been learnt and put to good advantage, about the impact of such schemes on the need for processing factories. Furthermore, other similar schemes such as that for the River Sous in the extreme South West, are under consideration for the future. It is imperative that such agricultural developments should also integrate full consideration of the facilities required for preservation of the increased production anticipated from irrigation and more productive methods for farming.

Recommendation

Intensive efforts should be made to improve animal husbandry with a view to providing increased supplies of milk of improved quality for organized collection and processing by new and expanded dairies in urban areas staffed by suitably trained workers, technicians and managers.

Butter, cheese and other milk products

Morocco imports about 5,000 tons of butter annually and a quantity of cheese for the luxury market. Industrial production is only about 200 tons and small-scale rural another 2,000 tons. It is of course wasteful to produce butter from home-produced milk until the market for milk is saturated, since it takes about 25 litres of milk to make one kilogramme and 15-30 litres for one kilogramme of cheese, depending on the actual type.

However, apart from some rural production of cheese from sheep's and goats' milk the utilization of this potential source of protein is largely neglected. The possibilities of developing a new industry to provide food that is already acceptable to the local dietaries should be actively investigated. The supply of milk in wandering flocks often dries up long before it need, from sheer lack of milking. In Israel, 1,100 litres (i.e. over one ton) of milk can be produced by one lactation of 6 - 7 months. This yield may only apply to special

conditions, but even 200 - 300 litres would be worthwhile exploiting. A training centre has already been established in Lebanon for training in dairy technology for the Near East. In view of the fact that there are many millions more head of sheep than cattle in North Africa, special attention should be given to the problems involved. Mobile units would be necessary to tackle the problem of milking the flocks as they move about. The product would be cheese and fermented milk. Money could possibly be obtained for a pilot scale field unit either from the United Nations Special Fund or from individual countries or a group of countries that are interested. The target might be 100 mobile units in the next ten years.

Recommendation

A project for investigating the possibilities of maximizing the utilization of sheeps' milk seems suitable for co-operation on a sub-regional basis.

Meat

There seems little call for investment in meat processing plant. Present consumption is about 165,000 tons per annum in fresh unprocessed state and it is sold at about twice the world price. Per capita consumption is only one third of that in Europe. Present plans aim at importing breeds to be reared in farm buildings operated by the State and distributed to farmers in the new, irrigated areas. Cake from sugar beet and oil-seeds will be used for feeding. Forage could also be grown in the rain-fed area. As part of a U.S. project in the southern part of Morocco, five quintals of maize is being distributed free to farmers as seed to compensate for guaranteed deliveries of the crop for fodder. About 20,000 hectares is being cultivated in this way, but the demands are for 60,000 hectares, and this scheme might collapse if the five quintals free issue were withdrawn.

It seems also that better use might be made for fodder of some of the natural vegetation such as esparto grass of which 2.8 million hectares is available, whilst the traditional market for paper

manufacture is declining. Other forage crops from the desert region can be got to produce 300 - 400 tons per acre with a feeding value as good as lucerne at about half the price of the equivalent of barley. In fact it could be more advantageous for Morocco to grow forage rather than grain, the yield of which per hectare is relatively low compared with, say, France. With irrigation, yields could be much higher. If marketing were organized, it is considered by the Bureau d'Exploitation et de Participations Industrielles in Rabat that a considerable export trade in forage could be built up. However, it would be more to the point if Morocco were to use its supplies of forage in its own dairying and cattle industry. Under the Sebou scheme it is anticipated by the end of the century that $3\frac{1}{2}$ million tons of the more usual types of forage will be grown annually. Something more might be done to investigate BEPI's ideas.

Home produced fish meal (see below) could obviously also be used instead of being exported. Even if it were not necessary to convert edible fish into fish meal at all, except as an interim measure for the next ten or fifteen years, there would still be an appreciable fish meal production from unusable fish and fish offal waste from canneries.

The cattle herds resulting from the Sebou scheme will require organized abattoirs for handling their meat. However, processing would not be called for otherwise apart, possibly, from chilling as part of the abattoir equipment and distribution chain.

At the present rate of progress, these developments will go very slowly with no question of self-sufficiency, much less of entering the world market, unless farmers develop much greater cost-consciousness and take advantage of the world shortage of meat that is anticipated by 1985. There is a possibility of some marginal activities springing up in buying up cattle for feeding and fattening prior to sale at a profit. Such an activity, however, is not integrated with agriculture, and there are no complementary operations, no manure, etc., so that it can only be regarded as a side issue.

Morocco exported 2 - 4 thousand tons of eggs a year in 1959 - 61 and, although statistics are uncertain, it is estimated that some 50,000 tons a year of eggs are already produced. It might well be that chicken and egg production could be further developed.

Mutton and goat meat could perhaps be better utilized for home consumption by centralized slaughtering and refrigerated storage. A considerable quantity of camel meat is also eaten.

The plan for 1970 assumes that although there will be some increase in the consumption of meat, this will be supplied by imports, not by augmented home production. At present over 50 per cent of the cattle are kept in "herds" of 1 - 4. A complete reorganization of farming along modern lines is called for if the potentialities of livestock raising in Morocco are to be fully utilized. It is difficult to predict at present when this might be brought about.

Recommendation

As in the case of milk, intensive action is called for to improve and expand meat production by increased attention to breeding-feeding-husbandry and management. Larger farms and herds will be required, which will necessitate a radical outlook towards agrarian reform. Apart from provision of properly equipped and staffed abattoirs and a system of refrigerated distribution and depots, this is all that seems to be called for in the form of meat processing proper.

The poultry and egg production potentialities are worth further detailed consideration with the object of establishing a scientifically managed industry based on compounded food rations made from oil cake and fish meal that are at present almost entirely exported. Proper production lines will be required for grading eggs and slaughtering, dressing, packing, chilling and freezing, together with refrigerated transport and buffer cold storage arrangements at ports and inland towns for export and internal distribution, complementary to those proposed for fish. Selective breeding trials to select the most economic varieties for local conditions and proper veterinary control of diseases would be necessary.

Fish products

Fish is one of the chief food resources of the country, but one of the least utilized for the benefit of the inhabitants. This is partly because fish is foreign to the dietary, and the reason for this no doubt is its extreme perishability in a hot climate, which prevents it from penetrating into the interior.

The waters off Morocco, particularly on the Atlantic side, (which has 835 kilometres out of the 1300 kilometres of coastline), are very productive of fish, as a result of the up-dwelling of nutrients depending on the Canaries current. This is the basis of a prolific fishery for sardines landed chiefly at Safi and Agadir. In addition, there are supplies of bluefin tuna, and shrimps, both found in the Mediterranean east of Tangiers, which are highly priced export items. Morocco in fact catches more fish than all the West of North Africa combined together - and exports nearly all of it to Europe. However, the export markets are declining. Algeria is now re-organizing its own fisheries and is no longer buying as much fresh fish, while Greece and Italy, formerly good markets, are not renewing orders.

According to the latest statistics, there were 3,376 vessels, mostly unpowered, with a total tonnage of 21,941 as compared with 2,460 vessels and 15,000 tons in 1961. Every year fewer boats are owned and manned by Europeans, but foreign boats can fish Moroccan waters with a special permit. There are now nearly 200 trawlers, but their owners complain that high costs, taxation and difficulty in selling their fish make it scarcely worth their while to put to sea.

Out of the 200,000 tons of fish landed in 1965, 80 per cent was sardines which are either canned or made into fish meal and oil, both for export, largely to France. Only about 10 per cent of production is home consumed and mostly localized amongst the two million of the population living near the coast. However, the uneven quality of the Moroccan canned product does not enable it to compete easily with producers such as Portugal and although there are at present favourable

customs relations with France, these may come to an end as the European Economic Community develops. The improvement of methods of handling and processing and standards of hygiene in the sardine canning factories was recently the subject of investigation and recommendations for improvement in a report by an expert from the U.K. commissioned by the World Health Organization.

TABLE M. 5

No. of enterprises	48			
No. of employees	7610			
	<u>DH.m</u>			
Value of production	154.5			
Cost of production	126.3			
(excluding taxes, depreciation and profit)				
of which: fish	29.0			
oil	18.0			
cans	40.0			
	<u>Exports</u>			
	<u>1964</u>		<u>1965</u>	
	1000 tons	DH.m	1000 tons	DH.m
Total	51	134	26	73
of which: sardines	41.9	114	22	62.9
tuna	3.4	12	1.6	6.3
mackerel	5.5	7.3	2.2	2.7

As a result of the 50 per cent decline in the export trade, many of the sardine factories are now closed. In the circumstances it is not likely that the recommendations for improving methods can have been followed out. Nevertheless, l'Office de Commercialization et d'Exportation, which is responsible for control and inspection of

the standards of production and quality of Moroccan sardines intended for export, now expresses itself as satisfied, very little being rejected because, it is considered, manufacturers know to submit for inspection only lots of acceptable quality.

The situation regarding fish and fish meal and oil manufacture in Morocco will now be treated in some detail as regards costs for the light it throws on the impact of commercial policies in newly independent countries on their commercial prospects.

Firstly, although competitiveness in the world markets would be improved by concentration of production into a relatively few large factories, nevertheless for internal political reasons the government has recently authorized the re-opening of five or six factories, with existing equipment, which were closed earlier because of their low profitability. This is bound up with the policy of the Moroccanization of industry.

Further, foreign capitalists complain that they are not allowed to close factories that would result in loss of employment even although this would cut costs and export prices. For example, a foreign controlled group of fish canners, with five factories, three in Safi, one in Agadir and one in Essaouira could sensibly be reduced to about three and another group with four in Safi and one in Agadir (and seven already closed) could well be reduced to a total of four. Some other factors which appear to restrict the competitiveness of Moroccan sardines in the world market appear to include the following. The cost of production DH. 48 = 48 New French francs/1000 tins for edible oil packs, (olive oil being more expensive) is greater than the selling price on the world market. This is only possible because the French quota, customs free, is sold at considerable profit. Thus a case of 100 tins sells at 66 francs in France but only at 40 - 42 in other countries. The quantity sold in France and its price determines how much can be sold in other markets which in any case provide a necessary outlet, even at a book loss, to keep up production at economic levels.

The general cost could be reduced by a process of concentrating production into fewer units, and also by lower costs of raw material, i.e. fish, oil, tins and cartons. For cartons, for example, fish canners are compelled to pay about twice the world price, because material of Moroccan manufacture is favoured by the government. There are two factories, one of which imports its raw material whilst the other manufactures it here. There are also exports of cartons at lower than cost of production which are subsidized by forcing manufacturers to pay a higher price at home (i.e. Morocco's own position vis-à-vis exports of canned fish to France, only in reverse).

Imported vegetable oil is not obtainable at world price (olive oil is produced in Morocco and the local price is paid). It is refined locally and then sold to canners at above world market price. Canners do not see why they cannot simply import their oil in drums at world price and then export it again in tins at the same price without detriment to the national economy. Although it is understandable to wish to protect the local refineries, this should not be allowed to operate to a disadvantage of an export industry. Oil is thus sometimes 10 - 15 per cent above world price. Recently the government ordered some reduction in the price of refined oil, but it is still above world market price. Regarding tins, tin plate is imported at the European world price fixed by the EEC. However, costs of assembly in Morocco are DH. 1 - 1.5 per 100 tins, including carton, higher than in Portugal. Carnaud have a factory in Casablanca and Courvenec in Mohammedia, and there is also some talk of an American aluminium firm setting up a third can making factory.

The inefficient organization of the Moroccan fishing industry itself adds considerably and unnecessarily to the cost of fish. Before independence in 1958, the crew of the fishing vessel was normally between 13 and 15. In order to increase the number of jobs available, it is understood that this has now been increased to 24 or 25. 40 per cent of the sum realized by the catch goes to the vessel owner and 60 per cent is distributed amongst the fishermen. Reduction of

crew to the previous level would permit a considerable reduction in the price of fish. Furthermore, the installation of power blocks on the vessels, which by further reduction in labour would enable crews to be further reduced to, say, 7 or 8, has been successfully resisted with government backing.

Similarly, in the case of the use of pumps (Yeomans and French manufactured pumps are installed) for unloading fish for fish meal manufacture, at Safi the use of the single pump available is forbidden and the fish therefore have to be basketed by human chain so as to provide the maximum possible amount of employment. At Agadir, where two pumps have been installed, their use is only authorized after 400 tons have been discharged manually by normal means. Although Morocco is not alone in suffering from inflated labour content of its productive processes for political or social reasons, nevertheless it prejudices severely their ability to compete in these particular world markets.

The operation of fish meal manufacture is bound up with that of canning and the prices are fixed by the government at the beginning of each season. In Agadir the price of fish for fish meal was DH. 0.125 per kilogramme (including 0.005 bonus) plus port and other charges (i.e. "taxes") equivalent to 0.0140 per kilogramme. At Safi, for canning, freezing, salting and export the price was 0.40 plus 0.0243 for taxes, and at Agadir 0.36 plus 0.022 (these prices including a bonus of 0.04 paid to the boat owner).

A canner can consign for fish meal any fish considered unsuitable for canning ("non-usinable") and at Agadir these fish were charged at 0.100 and at Safi at 0.115.

Several thousand tons of otherwise perfectly edible fish are used for fish meal every year when supplies exceed demand, as determined by prospective markets.

The season at Safi commences in May and goes on until the end of December, although only between about June and October are the fish

sufficiently oily for canning. In Agadir, the fishing period is February or March until December. For the period up until 17 October 1966 the total quantities of sardines delivered to canning factories were:-

"Usinable"	30,342 tons
"Non-Usinable"	<u>12,280 tons</u>
Total	42,622 tons

In the same period the amount going direct to fish meal for the whole of Morocco was 53,550 tons. At Agadir, the proportion of sardine going for fish meal is greater than at Safi. 1966 was a very abundant year for sardines (a record of 2400 tons being landed at Safi by 84 vessels on July 25th) and this happened to coincide with a poor fishing off Portugal, Morocco's main competitor in sardine canning.

The world market price of fish meal which stood at \$178 per ton (on a 65 per cent protein basis) is now only \$145 as a result of the enormous production of Peru. The French quota of Moroccan fish meal exhausted by October 1966 was taken at 0.86 to 0.90 francs per kilogramme. In April 1966, the price fetched was 0.92 francs per kilogramme. (\$184 per ton). The last lot went to 0.82 to 0.85 (= \$170 per ton). The reason for this price being above the world market price seems to be partly that it is delivered in small quantities. Also the quality is said to be better, i.e. in colour and consistency and calculated as 65 per cent protein. The cost of production is about 0.75 francs per kilogramme f.o.b. Freight costs add 0.072. This is the cost price for 1966 calculated on the basis of the usual average production rate. When the fish become less oily in the latter part of the year, the yield does not pay for the expenses.

The analysis of the material may only be carried out by one official laboratory, and as this takes some time, the shipments are sometimes delayed by as much as one month to the annoyance of customers. Tests include freedom from salmonella.

A new fish meal plant (SONAFAP) was created in 1966 with capital provided by the Banque National pour le Developpement Economique largely

for the fish protein concentrate (FPC) aspects (see later) but as a result of the abundant fishing there has still been enough fish for everyone and the FPC itself has taken very little fish although ordinary fish meal for animal feeding is also being made.

The analysis of the cost of sardine canning is as follows:-

Fish (with taxes and making allowance for deduction due to waste delivered for fish meal) 8.52 Dh. per case of 100 tins.

soya oil (3 kilogrammes per case) 6.477 Dh. per case of 100 tins
tins with lithographed labels in two colours 14.99 Dh. per case
of 100 tins.

These figures are roughly in line with the averages for 1965 included in the Ministry of Industry's plan for 1970.

The price paid to the fishermen for fish for canning is increased by about 20 per cent as a result of various port charges and other obligatory payments. Thus the account for fish for one firm at Safi for the week 4-10 October 1966 was as follows:-

TABLE M. 6

			Total (DH)
150,141 kilogramme	of "usable" (U)sardines at DH.0.36 per kilogramme		54,050.76
<u>36,698</u>	" of "non-usable" (NU) " " DH.0.115 " "		<u>4,335.27</u>
Total 187,839	"		58,386.03
Tax for brine at	DH. 0.025 per litre	1,975.00	
Federal tax	DH. 6.50 per ton	1,220.95	
Special taxes	DH. 5.00 per ton	750.71	
Special tax	DH. 2.50 per ton	94.24	
Other charges (specified)		<u>6,427.99</u>	
			10,473.95
		Grand total	<u><u>68,859.98</u></u>

The "special taxes" and "special tax" mentioned are for finance of the Institute of Fisheries and the industrial canning laboratory in Casablanca.

Before the majority of the Europeans left, fish consumption was 3 kilogrammes per head per annum, now it is only about 1 kilogramme (compared with about 20 kilogrammes in the U.K.) Attempts have been made in the past ten years to encourage the consumption of fish in Morocco, where very little is in fact eaten despite the shortage of other animal protein foods. At one time the military ran refrigerated vehicles containing fish inland to Marrakech, but in spite of very favourable prices at which it was offered, apparently about half of the supplies were not taken up by the population -- no doubt because of its unfamiliarity and bad experiences regarding unsatisfactory preservation in the past. Even at Casablanca, despite its $1\frac{1}{4}$ million inhabitants, there is often surplus fish on the market. Fishermen also complain at the mark-up in prices during distribution, whiting sold at the fish market for DH. 0.50 per kilogramme being retailed for as much as DH. 3.50 per kilogramme. Co-operative organizations are called for in both catching and marketing. Although further government-sponsored propaganda efforts and price control schemes should be organized to sell more fish, dietary habits often change only slowly. Of course supplies would have to be organized to back any publicity campaigns, which was not the case in the FAO supported scheme of 1959.

Nevertheless in view of the complete reliance on export markets, and the special difficulties being encountered in maintaining the present level of exports of canned fish, the plan for 1970 only envisages an increase in production of canned fish from 54,000 to 65,000 tons mostly of sardines, all but about 4,000 tons of which it is hoped will be exported. On the other hand, the production of fish meal and oil is expected to increase from 30,000 to 50,000 tons per annum, 95 per cent of which, as at present, will be exported. These may be perfectly realistic economic estimates based on past trends but merely continue to accept a disastrous wastage and gross misuse of one of the greatest

natural resources of Morocco. The capital investment envisaged is DH. 6 million for fish canning and DH. 3.2 million for fish meal and oil manufacture. This will mean that, neglecting the minor element of raw material from canning waste, well over 50 per cent of a total catch of about 400,000 tons - double that at present - would be converted into a low-grade and relatively unremunerative product for animal feeding overseas. Although this dilemma is only a Moroccan aspect of a world situation in which 20 per cent of the global fish catch, 50 million tons per year, is similarly diverted to animal feeding, it seems clear that, in the long run, this wastage could no longer be allowed to continue, and determined steps will have to be taken to organize the utilization of an increased proportion of the fish catch in direct human nutrition by every conceivable means.

In view of the abundant fish supply and difficulties of organizing local consumption, UNICEF and FAO have been very interested in encouraging the production in Morocco of edible fish flour (so-called "fish protein concentrate" or FPC for short). There has been world-wide interest in the past fifteen years in developing a tasteless fish protein product which could usefully supplement the diet of protein deficient populations. So far, however, there has been no marked commercial success to report anywhere. In USA, where the greatest technical progress has been made, the type of surplus fish used has had a high bone content which has raised doubt in official quarters as to whether the fluorine content of the product is excessive for high consumption rates to be desirable particularly by children and infants.

So far as the Moroccan attempt to produce an acceptable fish flour is concerned, after pilot plant experiments at Safi, a full-scale plant costing \$ one million was erected at Agadir. However, for various technical reasons, this has not yet produced a satisfactory product and seems unlikely to do so unless the defects pointed out by FAO's specialist are put right. The flour being produced at present is grey in colour and somewhat fish-mealy in flavour. Even when incorporated into macaroni and similar products at a few per cent level, it produces a disagreeable

darkening and change in texture and also in the water absorption of the product on cooking. If the operation and hygiene of the plant were improved, if only headed fish were used, and the extraction process were carried out as advised, it would then be possible to judge whether the product had any chance of being acceptable. Even so, with such a small fish as the sardine, which presents a high ratio of dark skin surface to flesh, and possesses a dark flesh in any case, even the best product would still be noticeably grey in colour, which would become more marked when moistened. Furthermore, it would be optimistic to expect that all trace of fishy flavour could be removed by extraction on a commercial scale with organic solvents. Although no doubt the improvements suggested would result in a considerably improved product, it still remains to be seen from actual samples whether the differences would critically increase its acceptability for ordinary uses. It is likely that the colourless, odourless, flavourless fish flour that is being sought would prove rather elusive for a price at which it can reasonably be anticipated that it can be sold. Of course, even with a high grade produce, there are still problems of marketing and incorporating into the diet of the people most in need of protein. So far, there is not sufficient interest in the possibilities of this new commodity, either in Morocco or the other countries of the North African sub-region.

Nevertheless, it can only be recommended that, this project having proceeded so far, it is essential to make the additional capital investment required to ensure the maximum possibility of its success. FAO and UNICEF are already putting considerable effort into the development of a mixed weaning food for the North African countries, consisting of variants of cereals, legumes, skimmed milk powder, sugar, vitamins and flavouring. If FPC proved suitable for use in such a compounded food mixture, it would obviously be nutritionally advantageous to North Africa and elsewhere, as well as ensuring an outlet for the product of the Agadir factory and correspondingly an economic return for the capital hitherto invested.

It is accepted in Morocco that twice as much fish could be caught if the market existed. Although Morocco could reasonably expect to participate in the fisheries for sardinelles and hake of Central and South West Africa, as well as increasing the productivity of its inland waters, the marketing difficulties at home and abroad are not encouraging for capital expansion for further fisheries development schemes. Nevertheless, a 100 ton trawler has recently been ordered from West Germany, compared with the present maximum tonnage of about 40. There is talk of further vessels being assembled in Moroccan shipyards and payment being in fruit, vegetables, canned fish, etc.

The production of ice, mainly for the fishing industry, has fallen from 50,000 tons in 1959 to 32,000 tons in 1965, perhaps largely as a result of the decline in the quantity of fish processed, or else associated with the progressive departure of many French people with independence. Ice cost DH. 48 per ton at Safi, but DH. 70 at Agadir.

The location of the bulk of the fish landings in Safi and Agadir in the South West of Morocco is relatively inaccessible from the standpoint of distribution throughout the country and the sub-region.

Cold stores at present exist only in Agadir, Safi and Casablanca.

Capital expenditure on refrigerated vehicles and cold stores in all the main centres would be necessary before Moroccan fish resources would be effectively distributed except in canned and salted condition. The export of frozen sardines to France is diminishing and in fact is being discouraged as a competitor to the export of canned fish.

Further attempts at canning cheap products suitable for home consumption, and consumer trials and propaganda campaigns to publicize them, are called for. And supplies of fresh and frozen fish and suitable storage facilities must be organized to enable the propaganda to be followed by action, namely purchase on the part of the consumer.

To conclude, technically the fisheries of Morocco could already provide a notable contribution to protein nutrition of the whole of North Africa, if only economic, political and social problems were

overcome. Furthermore, Morocco provides the best location in the whole of North Africa for the further developments of the fishing industry that are perfectly well within the bounds of possibility. However, no doubt in face of the non-technical aspects listed above, no account has been taken of these technical possibilities, neither in the short-term plan for 1970, nor it seems for the long-term future to 1985 and beyond. Although it would be possible to plan in broad outline an industry based on larger fishing vessels, refrigerated trucks and vessels, and cold storage and distribution centres in all the main ports and towns throughout North Africa, it seems practically certain that no capital would be forthcoming for such an ambitious scheme without some more positive evidence regarding demand. In the meantime, it seems probable that the potentialities of Morocco as a front-rank world centre for the fishing industry will be largely neglected. At the present time, the home consumption of fish in Morocco is around 25,400 tons a year, which with 2,600 tons of canned fish totals 28,000 tons. Distributed amongst the two million people who live near the sea and are therefore familiar with fish, this gives an annual consumption of 14 kilogrammes per head per year, i.e. quite a considerable figure. If only the rest of Morocco, or North Africa, consumed fish on a comparable scale, the industrial situation in the South West portion of Morocco would be transformed. However, fish is not a part of the traditional national diet of Morocco, or of North Africa generally, in the same way that meat is and this is a social aspect of the situation that needs to be resolutely tackled by the authorities.

Recommendation

In order to maximize the exploitation of the abundant marine fish resources, greater attention than is as yet envisaged must be given to its distribution in chilled and frozen state by provision of more freezers, ice factories and refrigerated transport for land and sea for home consumption and export to other North African countries.

Quality and price of canned products must be made more competitive by improved procedures, both before and after the fish reaches the factory. Considerable new investment in new units of production would then be justified.

Edible Oils

About 15,000 tons of edible oil is extracted from oil seeds annually and over 50,000 tons is refined. In addition 150,000 to 200,000 tons of olives are produced and there is a wide-spread small-scale production of olive oil, the production of which fluctuates considerably from year to year, but is usually in the region of 15-20,000 per annum of crude oil, a little of which is refined and exported, but most is consumed locally.

Most of the oil that is refined is imported as crude oil of which soya and after that cotton seed accounts for by far the greatest proportion: 38 factories employ 1,682 people but ten alone employ 1,244. There is a French company (SEPO) producing oil and Unilever also processes imported soya and coconut oil. There is little demand for hardened fats such as margarine which has remained steady at around 1,500-2,000 tons a year although the production capacity is twice as great, and it is not envisaged that this will increase at all by 1970. At present, in the case of extraction of oil from sunflower seeds, 82.5 per cent of the production cost is due to raw material and 3.5 per cent labour cost, the remainder being incidental costs. In the case of groundnut oil the figures are 90.5 per cent and 2.5 per cent. For the refining process, 78 per cent represents the cost of the raw oil and 3.5 per cent labour.

Extraction is expected to increase to 40,000 tons and refining to 82,500 tons by 1970, but home production of vegetable seed oils is only expected to be 22,000 tons. Cotton is to be grown at Sebou when irrigation is available and quite apart from machinery to deal with the fibre, a new mill will be required to extract the oil from the 50,000 tons of seed which it is anticipated will be obtained from the 80,000 tons of raw cotton expected. Before irrigation, sunflower seed is being

grown which will be replaced by cotton when water becomes available. An oil seed plant at Kenitra to extract the raw oil, unrefined, is expected to cost DH. 10 million and it is thought that this might be financed by private capital. The total additional capital investment envisaged in oil crushing by 1970 is DH. 20 million plus DH. two million in refining for modernization of existing plants and creation of new decentralized units (but only a small number of these presumably).

Moroccans, however, like their own olive oil, particularly if it has a high acid value (5 to 10 per cent) and it is doubtful whether it can be assumed in planning that its substitution by imported vegetable seed oils can be automatically assured, as the Ministry of Economic Affairs and Finance has assumed in a report on vegetable oils by basing its conclusion on the observation of a recent period when the price situation caused people to buy sunflower and cotton seed oil, etc., for a short time in place of olive oil.

According to another estimate, anticipated increases in demand are as follows:-

TABLE M. 7

	Refined seed oil	Olive oil, crude and refined	(000 tons) total
1965	59,200	20,800	80,000
1970	76,400	24,500	100,900
1975	95,500	29,000	124,500

Even if existing refineries were brought up-to-date a little, there will be need for additional refining capacity at this rate of increase in demand. New units will probably be in the Sebou region.

First of all, to ensure regular supplies of raw material for these factories, contract cultivation will be necessary at prices remunerative to the cultivators. Considerable investments will be required at the

right time, co-ordinated with the other developments, so as to achieve an economically sound and technologically modern industry.

The extraction of olive oil also needs rationalizing in the face of social difficulties arising from a subsistence industry ("maslas"). The installation of three, pilot-scale, oil extraction plants has been recommended (one in the Rif and two in the Pre-Rif) at a cost of DH. one million each. By 1970 the existing pressing and refining industries are expected to be saturated and by 1985, 50-60,000 tons of new capacity will be required that will justify the creation of a new industry in the Rharb and will require the investment of DH. 155 million.

The production will need to be suitably sited and backed by services, roads, electricity lines, water supplies and drains. If the oil production in 1985 is as foreseen, one could instal 24 new oil pressing plants of capacity 480 tons per day or 45,000 tons for the 90 day season anticipated. 170,000 tons of olives for oil is envisaged by all this scheme.

The production of oil seed cake is an important by-product of the oil seed crushing industry. Production in 1964 was nearly 23,000 tons of which nearly 20,000 tons was exported and only about 3,500 tons home consumed in Moroccan stock feeding. It is anticipated that by 1970 production will reach 45,000 tons of which only 6,500 tons will be used in Morocco, and the rest exported.

Recommendation

As regards olive oil, there is a need for new crushing plants to replace the handicraft mills. This would require larger scale production units and co-operatives which involve an accelerated rate of social and industrial development. Otherwise, no great capital investment in new equipment seems called for until the 1980's when new plantations being planned on the basis of future irrigation are expected to yield production that will require processing.

Cereals

Cereals are by far the leading crop, accounting for more than 90 per cent of the total sown area, but scarcely half the value of the total crop, largely because of the poor yields of traditional farming. Nearly three quarters of the wheat is hard wheat (i.e. durum) and the proportion has been increasing since 1958 owing to the system of higher guaranteed prices on the French domestic market. Yields fluctuate by a factor of more than two from year to year. More cereals could be sown if irrigation were provided. The total production target for the four main grains for 1970, 3.3 million tons, is 340,000 tons below anticipated consumption; which deficit will therefore have to be imported.

Flour milling is the largest food processing industry in both value and output. In 1965 Morocco had a total of 1,745 mills employing 7,150 people, of which however over 1,000 were operated by one or two people. 24 employing more than 50 people each accounted for one third of the total employment. Considering only the commercial flour mills, which are controlled effectually by the State, but only account for one third of all flour milled, there were 46, of which only five had an input of more than 30,000 tons of wheat a year. These accounted for about 620,000 tons of flour and semolina (in the ratio of about 2 : 1). There has been a 50 per cent increase in output since 1959. The installed capacity, based on 24 hours a day working for 300 days a year, in 1965/66 was 850,000 tons, so that the average degree of utilization was about 78 per cent. This however is not regarded as an excessive margin, so that there is no "over-capacity". Flour imports have also been rising to 60,000 tons, although a good deal of this includes free US aid. Extraction rate is about 78 per cent.

There were no mills in the North of the country before 1958, but now mills have been erected in Tangiers and Tetuan. In 1960, the Commission of Investments decided that to keep up with the increase in population of 3.5 per cent per annum it would be necessary to construct two new mills a year. It has been decided to erect new mills

near the centres of production or consumption rather than to continue to increase constantly the capacity of existing factories. On account of the closely controlled and guaranteed margins, numerous Moroccans are anxious to invest capital in new mills for the certainty of its return. However, permission is not given unless there is a real demand for new productive facilities. 76 per cent of all mills are now Moroccan-owned and slightly less than half the total production can be attributed to foreign capital.

It is envisaged that the family and handicraft mills will be progressively suppressed, because of the perturbations they cause in the market for flour. As population continues to grow steadily, obviously there will be a continuous call for more and more mills and equipment, but it is presumed that the capital for this expansion can be found within Morocco.

The milling capacity is planned immediately to increase as follows:-

TABLE M. 8

	Capacity	Production	% Utilization
1967/68	896,000	650,000	72.5
1968/69	929,500	685,000	73.7

This increase will be assured by new mills already under construction. The production of pastas, chiefly macaroni, is fairly steady at around 20,000 tons a year, of which 1,000 - 2,000 tons is exported.

Production of biscuits is negligible (3,000 tons a year). These are too expensive for average Moroccan consumers and household use accounts for nearly 80 per cent of flour consumption. There are nearly 1,000 bakeries employing 4,173 persons of which 600 employed less than five people, 23 more than 20 and only two more than 50 persons. The industrial bakeries could easily double their production. In 1965/66

the bread production used just over 70,000 tons. Although it would be possible to envisage the installation of large mechanical bakeries, or at least one in say, Casablanca, it does not really seem justifiable to recommend this at present in all the circumstances. Probably the production of couscous, the local cereal dish will gradually give way to bread.

A factory partly financed by ENDE is being set up to produce maize, starch and glucose and to extract oil and utilize the residue as animal feeding stuff.

Rice ("paddy") is to be produced under the Sebou scheme, the total amounting to 186,400 tons by 2,000 A.D. Several rice mills are at present in existence with a capacity of 70,000 tons and these being post-war are fairly modern. By 2,000 A.D. extra capacity of 120,000 tons of new mills will therefore be required. The International Bank is not lending money for more than six years ahead. At present 4,000 hectares of rice paddy is grown which at five tons per hectare is anticipated to amount to 20,000 tons. At the expected rate of expansion it will be more than 15 years, i.e. after 1980 before production reaches the present milling capacity, so that no capital requirements under this head can be foreseen before 1980.

Recommendation

The normal rate of expansion anticipated in this staple industry seems to be provided for by the normal sources of finance available within the country.

Sugar

Morocco is the largest consumer of sugar in North Africa, consumption per head being 32.7 kilogrammes (in 1963) compared with 17.4 kilogrammes per head for the entire world, 10.8 for Africa as a whole (and only 5.8 for Asia).

Next to cereal milling, sugar refining is the second largest food processing industry for Morocco. This is mostly imported as "raws" from

Cuba (cane sugar) and Czechoslovakia and elsewhere (beet sugar). The principal capital investment in the food industry is going into the refining of sugar and the extraction of sugar from sugar beet which is now being grown for the first time whilst eventually it is anticipated that sugar cane will be grown in the area irrigated as a result of the Sebou scheme.

In 1964 the national production was about 337,000 tons of refined sugar, 20,000 tons of which came from Moroccan beet, whilst 50,000 tons of refined sugar were imported. Most of the production of refineries is in the form of loaf-sugar in 2 kilogrammes lumps, which although preferred in country districts is rather costly to produce. The remainder is granulated and, lastly, in the form of cubes.

There are three privately owned refineries employing 4,084 people, with processing capacities in thousands of tons as follows:-

TABLE M. 9

	Loaf	Granulated	Cubes	Total
COSUMA (French-owned, Casablanca)	250	15	20	285
OIM (Jewish capital, Casablanca)	50			50
GAAMSA (Tetuan)		15		15
Total	300	30	20	350

COSUMA has equipment recently valued at over DH. 100 millions. The government has offered to purchase the whole concern at about one tenth of this figure. OIM is only being allocated raw material equivalent to 36,000 tons, so that costs of operation are correspondingly increased.

Additional refining capacity amounting to 35,000 tons of granulated sugar has now been installed at the SUNAP factory at Sidi Slimane, using Polish equipment which has however not proved altogether suitable for the purpose. This is also equipped to deal with 300,000 tons a year of sugar beet. Further, the new SUTA factory at Tadla, using up-to-date

German equipment, began in June 1966 with a beet slicing programme of 3,500 tons of beet per day and should produce 43,000 tons of loaf sugar per annum.

The consumption for 1965 showed a slight down-turn compared with 1964, possibly because of an increase in price to the consumer. However, the potential productive capacity of refineries at present well exceeds present demand as the following figures show (in thousands of tons):-

TABLE M. 10

	Loaf	Granulated	Cubes	Total
Consumption 1965	291	41	9.5	341.5
Possible output (Oct. 1966)	343	65	20	425

(N.B. Other estimates give 15,000 tons of cubes and less of loaf sugar).

Estimates of likely demand by 1970 vary from 411,000 by the Ministry of Industry to 438,000 by the Banque Nationale pour le Developpement Economique. It is anticipated that 320,000 tons of "raws" will still be imported.

Investment before 1970 is estimated at DH. 280 millions out of a total for all the food processing industries (excluding flour milling) of DH. 340 million. In addition an annual sum of DH. 4 million is allowed for renewal of equipment of refineries.

The future sugar production from home sources as far ahead as can be foreseen is as follows:-

TABLE M. 11

Factory	Year Operations commenced	Normal full production by 1968	Normal full production by 1970	Product	Site	Cultivation	Area cultivated (000 ha)
UNAF	1963	1968	35	Granulated	Sidfi	Dry, beet	10
SUTRA	1966	1968	43 ^{1/2}	Loaf	Slimane	Irrig., beet	9 ^{1/2}
Pharb I	1968	1970	48	Raw and Granulated	Tadla	Dry beet	14
Tadla Extension	1969	1970	17	Loaf	Tadla	Irrig., beet	3.5
Sucrierie II	1970	1970	60	Loaf or Granulated		Dry, beet	17.5
Sucrierie III	1971	1973	48	Raw	Doukhala	Irrig., beet	12
Sucrierie - Refinery - III	1972	1974	30	Loaf		Irrig., beet	7.5
Sucrierie IV	1972	1975	30	Raw	Lucus	Irrig., cane	5
			<u>311</u>				

N.B. Note effect of irrigation on productivity.

After irrigation is available from the Sebou scheme:-

	Area (ha)
Pharb II	10,000
Beet 40,500)	6,300
Cane 37,500)	11,500
Rharb III	6,700
Beet 50,600)	19,600 ha. = 3,920
Cane 40,500)	5
(a) Beet with 5 years' rotation:-	
at 35 tons per hectare = 137,200 tons per annum of beet	
(b) With 4 years rotation:-	
at 30 tons per hectare = 534,000 tons per annum	
With 75 days' season = 9,600 tons per day = 2 plants of 4,500 tons per day capacity.	

Cane

21,900 hectares - of which 13,140 (60 per cent) cane, 4,380 (20 per cent) leguminous and 4,380 (20 per cent) under cotton. At 60 tons per hectare = 788,400 tons - 75 days season also = 10,512 tons per day (worked up in the same two factories).

It is assumed that the yield of sugar from beet is 13.5 per cent and from cane ten per cent. Therefore beet produces 90,000 tons and cane 78,840 tons, a total of 169,400 from Sebou, by 1974 or later whenever irrigation is available. This also depends on obtaining the necessary credits.

Obviously all these estimates of future production depend very much on the assumption for the actual yields per hectare. The yields obtained in trials may fall by 75 per cent under commercial conditions, (as has been found in Sudan). The calculations made in predicting the production of sugar resulting from the Sebou Scheme, too, assume that three additional cuttings ("ratoons") are possible after the first harvest before replanting is necessary, whereas only two are likely as compared with six (or even sometimes up to nine) in Cuba after which yield degenerates by as much as 40 per cent.

By the end of the century it is estimated by the FAO staff planning the Sebou Scheme that it alone will be producing 671,200 tons of sugar beet and 1,146,000 tons of sugar cane a year yielding respectively 90,000 and 114,000 tons of sugar, i.e. a total of 204,000 tons.

But pilot trials are badly needed so that these predictions can be checked and corrected as necessary, otherwise future projections are practically valueless. The cost of an expert to arrange these would be perhaps about \$1,000 per month for salary for three years plus \$200 per month for car allowance. An office would be required and several one hectare plots in order to establish the best date of planting, date of cutting, in different places. Two good varieties are available that would need separate testing, and fertilizing and watering

regimen would also need to be settled. The climate in winter is such that freezing can occur and this makes proper watering of cane all the more important. One - two ancillary staff would be required. Five different locations would require a total of only 10 hectares. Some equipment, e.g. a plough, etc., would be required but all analyses could be carried out in the "micro-sucrerie" at the Institut National pour la Recherche Agricole (INRA) which has pilot-scale equipment for extraction, milling, crystallization and chemical laboratory estimations. No insects or microbial pests have been noticed yet, but the bacterial contamination at one factory refining sugar is so bad that the product is not accepted by some buyers; the measures to be taken to cure this were obvious but attention needs to be paid to advice given. It is hoped that a United Nations Special Fund project may be secured for this pilot-scale experimentation.

A sugar industries school has been proposed by the FAO expert in charge of advising the Moroccan Government on this sugar development scheme. A two-year course could be provided under on-the-spot conditions. At present each new factory that is erected will have to pay the contractor DH. 1.6 million for training staff to operate the factory. One class in such a school for trainees from all French-speaking North African countries would seem to be a good project for sub-regional collaboration.

Regarding cost of production, sugar produced at Sidi Slimane currently costs DH. 1.33 per kilogramme. If working at its full capacity of 3,000 tons per day this could be reduced to DH. 1.15 per kilogramme. If various ameliorations were made to improve operation this could be expected to fall to DH. 0.96 per kilogramme. The selling price of sugar in Morocco is DH. 1.84 per kilogramme of which 0.88 is tax so that the true cost is 0.96. It therefore seems possible that sugar could be produced at home economically. An estimated break-down of the cost of producing granulated sugar (excluding taxes) from beet is, 41.5 per cent of raw materials, 17.5 per cent for packing and other consumable materials, 11.5 per cent for labour, 18.5 per cent for other charges and one per

cent for depreciation. For loaf sugar produced in Morocco from raw sugar imported at USc. 3.8 per kilogramme, the raw material cost is 62.25 per cent, labour 13.5 per cent, other expenses 22 per cent and depreciation 2.25 per cent.

State capital will probably be required to finance these new factories that are projected. The BNDE lent 20 per cent of the total of more than DH. 100 million required for the Tadla factory at seven per cent interest repayable over 15 years. In the case of SUNAP, the capital was lent by the constructors, namely the Polish Government and Morocco is repaying at six - seven per cent interest over ten years. In 1963 the International Bank was asked to finance capital for the sugar factories but it refused as it requires repayment in six years. The State will therefore have to borrow the money for the capital required. The costs of each of the mixed beet and sugar cane factories are estimated at about DH. 96 million for the production of raw sugar, not refined. For the factory for cane sugar only it is DH. 68 million, so that the total cost on this basis is DH. 260 million.

Yeast is grown as a by-product from the molasses.

Only about 5,000 tons a year of sugar confectionery and chocolate are produced, chiefly Arab confections for the occasional delicacy or luxury market.

Recommendation

Although the nutritional wisdom may be doubted of placing so much emphasis on home sugar production and refining in a developing country where animal protein production seems so backward, nevertheless sugar is a traditional part of the dietary pattern. On the other hand, FAO is working in school-feeding programmes in the realization that improved nutrition is essential if communities based on semi-nomadic grazing existence, in which not much physical work or sustained labour is required, are to become capable of the effort demanded by the agricultural and industrial efforts required to raise the standard of living.

However, the drive towards self-sufficiency in sugar seems well-planned but it is making considerable demands on capital investment and technical skill, in both of which external assistance will be required.

Fruits and Vegetables

Fruits and vegetables are one of the principal food resources of the country. The climate favours early season's exports to Northern Europe, and also ripens citrus fruits, grapes and olives. In the Southern parts pineapples and bananas can be grown. All these could be considerably developed. However, the market is geared to the export of fresh fruit with only secondary and irregular supplies available for processing. Apart from packing and grading stations for export of fresh fruit to Europe, there are two large and numerous small citrus fruit juice plants, usually ancillary to a jam factory. Canned, peeled tomatoes and tomato purée and juice are produced. All these are working well below capacity, probably about 50 per cent in the case of citrus juices on account of the low price to producers. Fruits such as apricots and peaches are also canned. Cherries, beans, peas and spinach are all available but the processing factories are not very well equipped. The quality of the product is very variable. In one spot test taken by an FAO expert, the seaming was not good in 33 per cent of the cases tested and unacceptable in nine per cent of cases. Larger units should permit better quality control. Onions can also be dehydrated.

Jam is manufactured (about 5,000 tons a year with a further 5,000 tons of pulp for export) but the product is not very well "set". Canned jams could be produced similar to the South African with expert assistance to develop suitable processes. The total quantity of fruit juice being canned is about 15,000 tons per year and of canned fruit about the same, together with 10,000 tons of canned tomato products. Almost all of this is exported. Preserved table olives also amount to about 15,000 tons. Taken altogether the industry is only working at about 70 per cent capacity.

For export, it should be possible to interest some of the international freezing groups such as Findus or Bird's Eye in purchasing supplies or setting up factories. Heinz are always interested in the possibilities of buying products for their subsequent use in the U.K. and elsewhere. With fresh fruit available nearly all the year round, there may seem little scope for the development of a home consumption of fruit juices. However, greater effort could be made to encourage consumption of locally produced fruit drinks that might replace branded colas which not only have no nutritional value, but also waste transport in the carriage of water and empty bottles.

A detailed scheme with full costing was presented in July 1964 by an FAO expert working in conjunction with BEPI (the Bureau d'Etudes et de Participations Industrielles) for a factory working ten months of the year for the production of 13,750 tons of the six main fruits (including 5,000 tons each of oranges and tomatoes) with provision for doubling capacity to 27,500 tons at the end of two or three years. Such a factory would practically double the output of the Moroccan fruit processing industry. It is pointed out that, by comparison, Israel, with an annual production of 700,000 tons of citrus fruits, processes between 12 and 15 per cent of them, whereas Morocco in 1961/62 converted only 3.4 per cent of its 500,000 tons production into juice. Furthermore, it is anticipated that production will reach one million tons by 1970. It is also proposed that there should be three other complexes for fruit processing; one unit in East Morocco, one in the Casablanca region, and one in the region of Sous which will be formed by uniting and re-organizing existing factories. It is presumed that these additional products would all have to find an outlet on the world market.

In the South of Morocco, at Taroudarit, the industry is being integrated as a part of a US project whereby the producer has an obligation to supply the processing industry with certain quantities of fruits. There are quite a number of small factories which should combine into bigger units with better control and stricter standards. But as soon as prices rise, all the old factories start up again. For local

consumption, the government is working on the improvement of domestic processing schemes.

The government now wishes to erect a fruit juice factory in the Rharb area as part of an integrated scheme with its own plantations under the Sebou plan, with a capacity of 45,000 tons of fresh fruit input. The cost of a packing station for 27,000 tons of fresh oranges is estimated at DH. 2 million and the juice factory DH. 8 million.

By 1970 it is anticipated that fruit and vegetable canning will have risen from 44,000 to 50,000 tons per annum, of which 85 per cent will still be exported, and that DH. 11 million of investment will be required. In addition, production of juice and concentrates is expected to rise from 14,000 to 25,000 tons a year of which all save about 1,000 tons will be exported, the capital investment amounting to DH. 10 million.

Fruit and vegetable canning and fruit juice manufacture is visualized practically exclusively as an export activity for the European market without, it seems, considering whether this is likely to be saturated from other sources of supply, or whether something could not be done to increase consumption within North Africa.

Developments comparable with California depend on irrigation, organization, research and its application and of course trained technicians. The size of production units at present is really insufficient to compete economically in the world market. 500 - 600 tons per day is the maximum, compared with 2,000 tons per day in the USA, for example. The price of the commodity depends very much on the size of throughput and Morocco therefore cannot compete with Israel, say, which has 25 juice factories of economic size. According to an industrial expert in this field, the chief economic difficulty standing in the way is the Moroccan government's control of external trade which discourages investment of foreign capital.

Recommendation

Larger scale production units, able to take advantage of modern equipment and methods, are called for along with improved organization of supplies and technical supervision of factory processing, combined with a marketing drive to improve showing in world trade.

CHAPTER III

ALGERIA

Population estimates

1959/1961	10,963,000
1963	11,185,000
1970	13,736,000
1975	15,759,000

TABLE A. 1

General use of land

	North		South		Total	
	million hectares	%	million hectares	%	million hectares	%
Total area	28.9	100	208.7	100	237.6	100
Land used for agriculture	13.3	45.9	29.2	14.0	42.5	17.9
Forests	2.4	8.4	0.5	(-)	2.4	1.0
Esparto grass	3.0	10.5	-	-	3.0	1.3
Unproductive	10.2	35.2	179.5	86.0	189.6	79.8

TABLE A. 2

Use of land available for agriculture

	(1,000 ha)	%
Cereals	2,924	77.9
Horticultural crops and dry legumes	128	3.4
Industrial crops	18	0.5
Artificial forage	60	1.6
Vines	364	9.7
Citrus fruits	45	1.2
Other tree fruits	<u>213</u>	<u>5.7</u>
	3,752	100.0
Rough pasture	37,418	
Unproductive agriculturally	<u>1,280</u>	
Total	42,450	

TABLE A. 3
Food imports into Algeria

	1965	Total 1963/1965
<u>Live animals (1,000)</u>		
Milking cows	12	33
Cattle for butchering	3	34
Sheep for butchering	-	618
Day-old chicks	1,500	4,133
<u>Animal products (1,000 tons)</u>		
Fresh beef	2.8	11.1
Fresh mutton	0.5	2.1
Fresh pork	0.35	0.9
Pork products	0.5	1.3
Frozen meat	0.17	0.17
Poultry	1.1	2.6
Fresh eggs	0.35	1.31
Hatching eggs	0.24	0.24
Margarine	1.3	3.6
Fresh milk	29	72
Evaporated milk	22	32
Dried milk	1.5	4.4
Butter	6	12.9
Cheese	5	13.5

TABLE A. 4

Production, imports and exports of processed foods in
Algeria

(1,000 tons)

	Production			(Capacity)	Imports			Exports		
	1963	1964	1965		1963	1964	1965	1963	1964	1965
Meat - prepared and canned		0.1			1.6					
Milk - evaporated and condensed					14	14				
Milk - dried					2	3				
Butter					7	4				
Eggs (in shell)						1				
Canned fish		1	3		1	1	-	1	1	-
Prepared and canned shellfish		0.3	0.1	(1.2)						
Flour	250	299	355							
Semolina	206	364	340							
Total	456	663	695	(1,025)	2	1	-	2	-	-
Biscuits	4	4	5	(12)	5	4	-			
Pastas	15	21	23	(50)						
Couscous	10	5	3	(18)						
Total	25	26	26	(68)	1	-	-	8	2	-
Jams	1	-	1	(11)						
Pulp	-	-	-	(6)						
Total	1	1	1	(17)	1	1	-			
Fruit juices	3	1	2	(7)						
Concentrates	Sm.	Sm.	Sm.							
Total	4	1	2	(7)	Sm.	Sm.	-	15	9	-
Preserved vegetables	1	1	1	(10)	6	10	-	3	1	-
Preserved olives	7	3	21	(30)	Sm.	2	-	18	13	-
Sugar	1	3	7	(22)	193	222	-	-	-	-
Sugar confectionery	1	2	1	(5)	5	6	-			
Chocolate	5	1	1	(2)	2	1	-			
Vegetable seed oils	32	35	65	(116)	2	2	1	-	-	-
Olive oils	(10)	(10)	(10)					1	2	4

Sm. = Small.

General situation

Algeria is still suffering from the aftermath of the struggle for independence.

The population is very young, with a preponderance of children and adolescents, and women are mostly non-productive in the industrial sense. Of say, 4 million active males, a high proportion is unemployed, perhaps something like one half, largely of course as a result of the disorganization of war. The remainder are mostly under-employed, doing only, say, 90 days' work a year on farms. There seems to be no organized unemployment relief, although many ex-FLN soldiers are in receipt of pensions. In many villages, whole populations are dependent on remittances from Algerians working overseas, of whom there may be perhaps half a million in France. In general, too many people seem to be employed on the jobs that are being done and many could be dispensed with if other work were available.

As formerly an integral part of metropolitan France, the industry and economy revolved round the needs of France and the French settlers and of course the army. This orientation towards France still curiously permeates the outlook. As Algeria was administered from France there is no legacy of civil servants and administrative "know-how" which has therefore to be built up from nothing. Furthermore, the infrastructure left by France, and still functioning, is still unrealistic in relation to the economic productivity of the country. Algiers still goes on as it always did, and the streets are full of cars, although because of lack of repairs they are in bad condition; the lifts in government offices are out of order and so on.

At the same time, enthusiastic and competent young men seem to be mostly in charge in government departments and one feels that there is some hope for the future.

Nearly everything in the food field, both agricultural and processing seems to be working at below capacity for several reasons:

- (1) Firstly, there is the disorientation from the needs of France and the French colonists. In the view of Algerian officials, the industries formerly complementary to French agriculture now have to be liquidated, or else made to become competitive in the world market. The withdrawal of the purchasing power of the French colonists and that of the French army, and the fall in purchasing power of Algerians following the war of independence has affected most industries, but some more than others. Certain sectors are too large and need to be reconstructed in conformity with the needs of the nation rather than external needs. Other sectors can be regarded as well developed. Again, people in the south are not well served and a proper balance is required between all regions.
- (2) Secondly, there is a lack of trained technical Algerian personnel, and also of farm and factory operatives. FAO is engaged in schemes to advise on the training of some hundreds of teachers in agriculture. Another United Nations Special Fund project aims at training 12,000 to 20,000 skilled farm hands by 1968 or 1969. A new FAO scheme, the Hodna Scheme, concerned with the development of Central Algeria, has just started with the recent appointment of a hydro-geologist expert to commence survey work. This will obviously not have any impact on production of agricultural raw material for processing for many years.

But as Algeria only became independent in 1962, there has been insufficient time since the upheaval for FAO to implement programmes of technical assistance. Very few FAO reports on Algeria are available as yet. FAO does not have a "country representative" in Algeria and there are at present only about 15 experts working there (compared with over 100 in Morocco) although this figure will increase to 50 when the Hodna Scheme gets under way and also the training project.

It seems, however, that much more attention is being devoted to training in respect of Agricultural production than for food processing. Although this is probably the correct priority at this stage, the need for training factory workers and managers should not be neglected. There are just not enough technicians and engineers able to handle machinery. There are possibilities of importing foreigners for three years. Under the Special Fund, Algerians are being trained at the Polytechnic, each specialist having a counterpart. But more remains to be done. One estimate given of the technicians needed in the food industry is 75 engineers a year for ten years. It was said that ECA's assistance in locating suitable experts would be appreciated. ILO also has a training project, not specifically related to food industries.

- (3) Thirdly, Algeria is still in a state of rapid political evolution. The relative responsibilities for the food processing industry of the Ministries of Agriculture and Industry are still being debated. There is no overall long-term national plan yet, although it is hoped that one will be developed by 1967. Each Ministry is pursuing its own individual plan so that development is piecemeal. In general, the policy as expressed by "le Directeur du Plan" in charge of food production is to get industry moving again with existing equipment. It is not regarded as realistic to consider installation of additional units until full utilization of present equipment has been achieved. Future productivity and investment requirements can only be a guess at the present juncture, because so much depends on experimentation not yet completed (e.g. on the most suitable types of soil for certain crops, as in the case of sugar-beet growing and the possibilities of overcoming the overwhelming shortage of trained technicians.

Data and information are much more scanty and difficult to come by than in either Morocco or Tunisia. Officials were in fact not yet able to give figures for future production sector by sector. As one puts it, they were more concerned with production itself. Nevertheless, in all branches, both short- and long-term studies are going on in preparation for expansion by modernization of existing production units.

The Ministry of Agriculture in surveying the food processing field in 1966 commented on the following:

1. The lack of information in certain branches;
2. The lack of co-ordination between agricultural production and the food processing industries;
3. Certain small-scale units are no longer profitable, and others are not operated so as to make full use of their capacity;
4. The quality of products leaves something to be desired - quality control should be more frequent and effective;
5. The lack of technicians and specialists is felt at all levels.

Particular emphasis is laid on the urgent need for trained food technologists and engineers. It is estimated (Bulletin des Industries Agricoles et Alimentaires, No. 2, April 1966) that it is necessary to train every year for the next 10 years at least: 15 engineers specializing in the food and agriculture industries, plus 15 middle-grade technicians in various branches, mechanics, refrigeration, laboratory work, etc.

To aid in this it was recommended that the Institut du Froid de Birmandseis, near Algiers, founded in 1954, which already has laboratories equipped for physical, chemical and biological research, together with work-shops and library, should be reanimated and enlarged so as to become a complete Institut des Industries Agricoles et Alimentaires. It is recommended that this should pursue a programme integrating three types of activity:

1. Research
2. Training
3. Extension work.

The budget envisaged is DA. 400,000 for running expenses and DA. 300,000 for equipment.

Milk and milk products

It is recognized that the present level of milk production and processing is quite insufficient. The quantity treated is only 30,700 tons per annum. About 120,000 litres a day (totalling 29,000 tons in 1965) are imported from France in the liquid form and apparently pasteurized in Algeria. The liquid equivalent of 60,000 tons is also imported in concentrated and dried forms.

Milk production

Statistics for animal populations are uncertain but total home production of cow's milk is estimated at 250,000 tons on the basis of 600,000 cattle of which 250,000 are assumed to be milking cows yielding 1,000 litres per annum each. Together with imported fresh and concentrated milk this gives an average consumption of 34 litres per head per year. Sheep, goat and camel's milk is additional. A special study would have to be made to obtain a really accurate estimate of milk production. However, total supplies from all sources are much below the real needs of, say, 300 litres per head per annum.

Serious study is now being given to the possibilities of increasing local production of milk and this will be part of the forthcoming Three-Year Development Plan, but sufficient funds are not yet available for this to be done properly.

12,000 head of milking cows were imported in 1965, 11,200 in 1964 and 9,800 in 1963. With a view to improving the quality of the dairy cattle population, 200 dairy cattle from the United Kingdom were imported in the middle of October 1966 and a further 800 were to follow. Others were expected to come from Holland.

The three requirements for future development are:

- (1) Buildings for housing cattle (which are relatively easy to provide);
- (2) Feeding, and
- (3) Provision of technicians, which means creating schools and organizing courses for all grades from vets to cow-minders.

A start is being made at Annaba (Constantine region) and on the basis of this it is intended in future to extend operations. A project is under way there, whereby 10,000 or 12,000 cattle are to be imported from Europe. There are doubts in some technical quarters as to the advisability of this scheme prior to supplies of forage being assured although FAO is already helping considerably on fodder production, based on lucerne and mixed legumes and cereals - 12,000 hectares are being set aside for this. This project could make an important contribution towards solving the problem of providing Algeria with milk and cheese and the ministry is still working on it. It is hoped to get it going by 1967/68 or possibly 1969/70. This appears to be part of an integrated scheme for growing cotton, sugar-beet, tomatoes, lucerne and trefoil d'Alexandrie, and also some maize.

The middle-term objective in the view of the ministry should be to double or treble the present milk cow population of around 250,000 in order to avoid the necessity for current imports of fresh and concentrated milk.

However, it is impossible to envisage by 1970 enough cattle to provide all Algeria with enough milk. In 1966 the number of cattle was still only the same as it was in 1960. Fodder in some regions is sufficient, in others deficient, and in some non-existent. It is very expensive and nothing as yet is well enough organized on this aspect. Statistics for manufactured animal feeding-stuffs indicated that full capacity of 30,000 tons a year was being approached in 1965. At the same time, consumption is increasing and the gap between production and consumption is growing.

The Ministry of Agriculture wish urgently to recruit an experienced French-speaking expert to help develop milk production by organizing supplies of animal foodstuffs, and also industries to convert some of this into butter and cheese where it is not consumed directly as pasteurized milk. FAO has apparently not been asked about this because it is thought that they would not be able to help for financial reasons and it is appreciated that they are already heavily committed on a number of other projects in Algeria. It is therefore hoped that some bilateral arrangement may be made to further this project whereby the expert would have an Algerian contract, but the other government would make up the difference.

Milk processing

Although the provision of pasteurizing plants is not the only step required for organizing good, clean milk supply, it is probably the first step - the other steps, such as control and improvement of live-stock and refrigeration at the farm and collecting centres then coming more easily.

There were in September 1964 seven milk processing plants in Algeria of which the following five were in the vicinity of Algiers.

Colaital (at Birkhadem) capacity 8.76 million litres of pasteurized milk a year. (This was closed in 1963 but opened again in May 1964). Milko, capacity 5.11 million litres/year, Soladif, capacity 5.84 million litres/year, Central Laiterie, 5.84 million litres/year and Betoucha Laiterie, 8.76 million litres/year.

In addition, there was the Central Laiterie at Oran and Le Lait Pure near Annaba in Constantine Province.

It was anticipated in the SERMI development proposals that by 1975 the needs would have increased as follows:

TABLE A. 5

	Algiers	Oran	Constantine	Total
No. of plants 1963	5	1	1	7
Pasteurizing capacity (million litres/year)	34.3	36.5	5.1	75.9
Needs 1975 (million litres/year)	160.2	93.5	13.3	267
Needs 1975 (1,000 litres/day)	437	255	36	728
Existing capacity 1963 (1,000 litres/day)	94	111	14	218
Increased daily capacity (1,000 litres) required before 1975	343	145	22	510

According to other figures given in the SERMI Survey, in 1963 the volume of pasteurized milk produced was 30.4 million litres/year (apparently only about 40 per cent of capacity) and of sterilized milk 1.1 million litres/year. Of the pasteurized milk: 9.3 million litres were imported at a price of 0.6213 DA./litre, total DA 5.8 million and 22.1 million litres were produced in Algeria at a price of 0.68 DA./litre, total DA. 15.027 million.

It was recognized in this survey that the problem of investment was urgent. The immediate action recommended was:

1. Modernize the equipment in the Central Laiteries.
2. Create a new unit of 100,000 litres/day in the Algiers region.
3. Study secondary centres in Oran and Constantine.

In addition, refrigerated collecting centres would be required for the proposed new factory in Algiers.

Government regulations would also be required to control milk processing and distribution.

For the middle-term future, it is estimated by the Ministry of Agriculture that DA 20 million of investment will be required for the construction of milk plants, including buildings and equipment for all the factories required. Although total requirements are perhaps one million litres a day, it is felt that a start could be made with a target of half a million litres per day. Seven main factories would be required and some smaller ones. Constantine, for example, needs 100,000 litres/day; at present the very badly appointed factory there is producing only 3,000 litres/day out of 40,000 litres/day reaching town. The cost would be at least DA. 2 million. Studies in all this have been under way in connexion with a Russian milk project, which has now apparently been "frozen", at any rate for the time being. Again, the output of the poor factory in Oran was said to be 60,000 litres/day of pasteurized milk but the need was for more than this.

At present, probably less than 10 per cent of all milk is pasteurized. Producers get only DA. .62/litre from the pasteurizing plant which then sells it at DA. .82; but they can receive DA. 1.20 (or even DA. 1.50) by selling direct to consumers unpasteurized. Religious observance in the month of Ramadan was said to have a bearing on this.

The condition of pasteurized milk, too, is not always all that it should be, because the bottles are not invariably returned clean, although consumers are liable to complain even when the milk is perfectly good. Pasteurized milk has to be collected from the shops, whereas the other is delivered by pedlars, as in Morocco.

It is intended to continue to import dried skimmed milk alongside the increased production of fresh milk, and to mix the two so that the local production with 3.8 per cent of fat is brought down to a standard level of 2.8 per cent. At present the condition of the imported French liquid milk is often very bad, when received sometimes six days after

milking, and repasteurization cannot remedy this. Also transport costs are DA. 0.20 per litre for the 30 million litres per year imported. It would be preferable to transport milk powder and replace this in future by liquid milk when home production reaches a sufficient level.

Next in priority to providing factories comes attention to social psychology in order to ensure the public preference for pasteurized milk. At present even the authorities do not understand enough about the basic issues and they therefore also need to be educated.

Sheep's milk

The yield of milk per cow is much greater than that of a sheep but the population of sheep (6 million) and goats (1.7 million) is much greater than that of cattle (0.6 million). Goat's milk cheese already fits in with the nomad's economy. Money would be required, however, and the increased exploitation of sheep's milk would appear to present only a marginal opportunity, although there might be some possibilities with self-managed farms at Bubah Ali in the North and Tadmit in the South.

Milk products are also important. 6,000 tons of butter and 5,000 tons of cheese (as well as 6,000 tons of eggs) were imported in 1965.

The total investment required for milk processing for the whole of Algeria has been estimated to be of the order of DA. 1,700 million. No capitalist, however, is anxious to sink capital into Algeria at present in case it is lost in further measures of nationalization.

Recommendation

Algeria's attempts to establish a dairy and milk processing industry merit support. Consideration will need to be given to the financing of the considerable expenditure on animal husbandry and processing equipment that will be required to put things on a sound technical and economic basis.

Meat processing

Meat production is related to milk production although requiring a different feeding regimen, and the question of forage and training of farm workers are of course just as important as for dairy cattle. There is no really reliable information about the total animal population of Algeria that would provide an estimate of the potential raw material for a meat processing industry. However, it is figured by the Ministry of Agriculture that the consumption possibilities in 1966 are as given in the following table:

TABLE A. 6

Possibilities of meat consumption in Algeria (1966)

	Total stock (1,000 head)	Approx. No. slaughtered (1,000 head)	Meat per carcasse (Kg.)	Total yield of meat (1,000 tons)	Imports of fresh meat (1,000 tons)	Total meat supplies (1,000 tons)
Cattle	600	150	90	13.5	4.5	18
Sheep	6,250	1,500	13	19.5	0.5	20
Goats	1,650	400	12	4.8	-	4.8
Camels	175	45	140	6.3	-	6.3
Poultry	10,000	40,000	1	40	-	40
Total			(+800 million eggs)			89.1

This gives a total possible average annual consumption of nine kilogrammes of meat and 18 eggs per inhabitant. The relative importance of poultry meat and eggs is noteworthy.

Meat consumption is increasing. Baby beef is being imported - not only it is said for consumption by better-off people. A total of over 11,000 tons of fresh beef was imported during the three-year period 1963/65 as well as 34,000 head of live cattle and 618,000 live sheep for

butchery. 480,000 of the latter were in 1963 and none were imported in 1965, and in general Algeria is now self-sufficient in sheep for mutton, although many of the sheep are in the hills up to 400 kilometres from the abattoirs, which need to be situated nearer to the centres of production. 2,600 tons of poultry and over 4 million live birds were also imported over the same period. In 1964 French exports of live animals, including presumably a fairly large proportion of animals for slaughter, were valued at DA. 72.2 million. Meats (fresh, frozen and canned), imported from France in 1964 totalled DA. 53.8 million.

Appreciable amounts of camel and goat's meat are also eaten. The consumption of fresh meat is so large that demands cannot be met.

Three private concerns in Algiers import meat, both live cattle and carcasses. The Ministry of Commerce has not sanctioned attempts to import carcass beef from outside the french zone on grounds of lack of convertible currencies.

The retail and wholesale meat trade is reported by the Algerian Chamber of Commerce in 1965 to be somewhat chaotic, although efforts are being made to organize it by the Corporation des Boucheries.

The cost of a young cow in full milk or in calf, suitably health certified, in the autumn of 1964 was DA. 2,000 for a 400 kilogramme beast. The wholesale price of top class beef was about DA. 8/kilogramme - the retail price being about DA. 12.5/kilogramme.

Although no detailed Algerian import statistics have been published since independence, the information given above has been obtained from published summaries.

This meat is all distributed fresh, there being little call for any form of preservation, when supply is so short. There is not much in the way of charcuterie (pork butchery products), particularly in a moslem country, and although there are several projects in hand to develop this market, it is not likely to be large.

Cold storage

Refrigeration is essential for satisfactory meat distribution, particularly for stocks held at a port. It is also necessary for the fruit and vegetable trade. 51,700 m.³ of cooled space are available throughout the country. The present cold storage facilities at Algiers are:

- 12,250 m.³ of general storage space;
- 4,580 m.³ for meat;
- 4,750 m.³ for fruits and vegetables plus El Asnam 900 m.³

The total cost of a new scheme worked out (see Bulletin des Industries Agricoles et Alimentaires, No. 9, November 1966) for extended facilities is DA. 1,300,000.

Recommendation

Although every effort should be made to improve and increase the supplies of home-produced meat, it seems that for some time to come this will all be marketed in the fresh condition, which will need abattoirs, chilling and transport facilities of course, but that there is no immediate cause to consider meat processing as such in the foreseeable future.

At the same time, looking at matters on a sub-regional basis, although every country needs to develop its own dairy milk industry, wherever possible, because dried milk and condensed milk are not perfect substitutes for fresh milk, there is less need for a country to be self-supporting as regards meat, because imported, chilled and frozen meat (and to some extent canned meat) can largely replace home slaughtering. In this context Sudan, with the largest animal population in the region, would, subject to the improvements discussed under that country heading, be the natural source eventually for a substantial proportion of such supplies.

The fish and fish processing industry

General situation

Three main types of fish are available in Algerian waters. "White fish" are caught by trawlers chiefly to the east of Algiers. "Blue fish", including sardines, tuna and mackerel are caught by surface nets, aided by lights to attract the fish at night in the case of the lamparos, mostly to the west of Algiers. This type of fish is more plentiful but less valuable. Crustaceans, chiefly shrimps, are available in smaller quantities but are highly priced.

The marine fishery is generally recognized to be under-exploited, not only due to lack of fishing vessels but even more to lack of qualified personnel.

The fishing industry was left in a difficult situation after independence from which it is only now recovering. In 1962, 75 out of 150 trawlers and 100 lamparos left Algeria. Partly as a result of this the total catch of fish had fallen from 30,700 tons in 1961 to 17,500 in 1964, which was distributed as follows:

TABLE A. 7

Distribution of fish catch in Algeria in 1964 (1,000 tons and DA. millions)

	Oran Region		Algiers Region		Constantine Region		Total	
	Tonnage	Value	Tonnage	Value	Tonnage	Value	Tonnage	Value
Blue fish	5.5	3.7	6.1	5.9	1.6	1.4	13.2	10.9
White fish	1.6	6.3	0.9	3.7	0.6	1.5	3.2	11.5
Crustaceans	0.4	2.3	0.5	2.3	0.2	0.6	1.1	5.3
Total	7.6	12.3	7.6	11.8	2.4	3.5	17.5	27.6
Estimated demand	31		13		8		52	

The composition of the fishing fleet in 1965 is summarized below:

TABLE A. 8

	Trawlers	Ring netters	Smaller vessels	Lamparos
Oran	30	18	50	108
Algiers	26	1	112	110
Constantine	19	-	52	29
Total	75	19	214	244

It is considered that total production of fish even with existing resources could be increased considerably as follows:

Blue fish	14,850 tons
White fish.	8,800 tons
Crustaceans	<u>1,130 tons</u>
	<u>24,780 tons</u>

L'Office National des Pêches, which is responsible for directing fisheries industrial development, comes under the Ministry of Agriculture and Agrarian Reform. 90 per cent of the fishing is in the hands of the private sector and the white fishing in particular is largely dependent on over 200 small vessels with only one or two fishermen on board. There are however now 10 "socialist co-operatives" of which that in Benisaf seems particularly successful, and it is intended to give these the monopoly of the wholesale trade which will permit the rationalization of the market for fish.

The factories attached to the fish industry in 1965 were as follows:

TABLE A. 9

Region	Ice production (tons/day)	Total	Sardine canning factories			Anchovy salting Houses
			Abandoned	Nationalized	Private	
Oran	174	10	1	3	6	12
Algiers	425	14	8	1	6	5
Constantine	145	5	5	0	0	1
Total	744	29	14	4	11	18

The total capacity of these sardine canneries has been estimated at:

	<u>Tons/day</u>	<u>Tons/150 day season</u>
Oran	52	7,800
Algiers	55	8,250
Constantine	40	<u>6,000</u>
Maximum capacity per season		<u><u>22,050</u></u>

In 1963 production was estimated as 152,000 cases of 100 x 1/4 club cans, which was about half of total capacity. In 1964 production was only 70,000 cases, production falling largely as a result of the departure of French technicians. Sardines were not exported in 1964, but this trade has now started up again. The production planned for 1965 was 87,000 cases and this figure was probably exceeded. In 1966 it was expected to be higher still. Factory hygiene in Benisaf is fairly good, but it is not so good in the canneries of Oran itself and Ghazaouet.

In 1963, 395 tons of salted anchovies were produced and in 1965, 350 tons. There are ample facilities for producing more. There is a very limited market for salted sardines, the inland population not being very interested in this type of product. Some fish is exported salted to Italy and Greece. Quick freezing is very limited except for shrimp, cooked and shelled, which is mostly exported.

There is one fish meal factory operating on offal and condemned fish. Domestic fish consumption is very limited, amounting to only 1.25 kilogrammes/head per annum; of this Algiers itself; with only one-eighth to one-ninth of the population, accounts for about 30 per cent, mostly in the form of fresh and canned fish. Equipment for distribution of fresh fish inland is at present very limited although communications from the coast to the interior are now good owing to the needs of the oil industry and the army. (This is actually the reverse problem of the meat trade, which is to bring sheep or mutton from inland to the coast).

The average prices for the various types of fish are as follows:

TABLE A. 10

	Price to fishermen (DA./kg.)	Price to consumer (DA./kg.)	% increase in price in distribution
Blue fish	0.85	2.0	135
White fish	3.30	12.0	263
Crustacean	4.70	7.0	48

The Three-year Plan 1966-1969

L'Office National des Pêches has established a short-term plan in which it is hoped to build up the total catch to 43,000 tons in 1968/69 and then to 52,000 tons (regarded as the present demand) by 1970, with utilization as follows (units 1,000 tons):

TABLE A. 11

	1965	1966/67	% increase	1967/68	% increase	1968/69	% increase
Production	18.2	25	43	31.5	26	43.5	38
Canning (tons)	1.8	3.6		6.6		6.6	
Canning (1,000 cases)	-	120		165		165	
Salted anchovies	1.5	4		4		4	
Fresh distribution	14.3	16.2		20.9		32.1	
Fish meal	-	1.2		1.65		1.65	

In order to fulfil this plan, corresponding investments are being arranged in equipment for transport of fish to the interior as indicated below:

TABLE A. 12

	1966/67				1967/68				1968/69			
	No. of N	Units R	Cost Total (DA.m.)		No. of N	Units R	Cost Total (DA.m.)		No. of N	Units R	Cost Total (DA.m.)	
Trawlers	5	3	8	4.0	3	5	8	4.0	7	10	17	8.5
Sardine catchers	3	4	7	4.2	5	4	9	5.4	8	13	21	12.6
Canneries	2	5	7	0.3	0	7	7	0.3	-	-	-	-
Ice factories	-	-	7	0.13	-	-	6	0.11	-	-	-	-
Ice crushers	5	-	5	0.22	-	-	5	0.22	-	-	-	-
Fishing gear, etc.	-	-	-	2.0	-	-	-	2.0	-	-	-	2.0
Freezing factories	-	-	2	1.4	-	-	-	-	-	-	-	-
Training	-	-	-	1.0	-	-	-	1.0	-	-	-	1.0
Refrigerated trucks	-	-	-	-	-	-	6	0.12	-	-	7	0.14
Total				13.25				13.15				24.24

N = new

R = renovated

As a beginning, five trawlers have already been obtained from Yugoslavia, of which two are already functioning with crews trained in Algeria and the other three have been delivered. These are all of 75 tons gross and 60 tons net, and 19 metres in length and carry a crew of nine. Two of these will fish from Algiers, one from Oran, one from Djidjelli and another from Annaba. Similar vessels will be constructed in Algeria, and it is hoped that five others will be available in 1967. Although this is for the Ministry of Planning to decide, obviously unless they can be made available the plan as set out above cannot be achieved.

The assumptions for the output (in tons) of the various types of unit during the first year of the plan are as follows:

TABLE A. 13

Means of production	Number	Capacity per day	per unit per annum	Increase per year	Total production (tons)
Trawlers	8	2-3	130-150	5,640...	23,140
Sardine catchers	7				
Canneries	7		10-15,000 cases	84,000 cases	-
Ice factories	7	6-10	-	18,000	-
Ice crushers	5	4-7	-	7,500	-

It is hoped that other improvements would result in an additional 2,040 tons of fish per year, totalling 25,200. The question of training is regarded as particularly urgent, otherwise the plan cannot be achieved. There is an Ecole des Pêches which is in need of an instructor for training the young fishermen required after 1967. No one has been found to fill this position bilaterally. It was originally hoped that

France would be able to provide someone. Now FAO has been asked. This is considered more important than the provision of finance. It was calculated that ten trained men would be required by 1967, but none will now be available. In the case of fishing vessels purchased from Italy or Yugoslavia, there is a clause in the contract to the effect that they must also train the men to operate them.

With regard to canned fish, the cans, which are made by a Carnaud factory about seven kilometres from Algiers, (and said to be losing money) the cost of the sardine size is DA.0.21 each (no credit being allowed) compared with DA. 0.16 in Morocco. It is understood that concerns canning apricots and fruit juice on a large scale have more satisfactory price arrangements for their cans. Labour is also said to be cheaper in Morocco at 0.85 cents/hour compared with 1.20 cents in Algeria. Consequently the selling price is about DA. 0.75 can, as compared with DA. 0.60 in Morocco. The Tunisian product is also about 20 per cent cheaper in the world market. It is also realized that quality must be improved if the product is to be made competitive in the export markets.

With regard to fresh fish distribution, people in general prefer meat to fish, but it is hoped that in future they will consume more fish, because the standard of living is very low and there is a real need for more nourishing food. One of the main problems in distribution is that there are too many middlemen.

There is need for a greater awareness of the value of ice in fish distribution. Fishermen particularly need to learn this because at the present they may only spend one day at sea. The planned increase in total catch will necessitate fishing further from port, so that better icing will be essential to preserve the fish properly. Furthermore, in land distribution only two kilogrammes of ice may be added to 14 kilogrammes of fish for say, a 200-kilometre journey. Fish therefore go bad much more quickly than if more ice were employed throughout. It is not known whether a market could be developed inland for fresh

or frozen sardines. Attempts are being made to interest Algerian businessmen in the purchase and equipping of fishing vessels and canning factories, either privately or in association with the Algerian State.

Fish meal production is also being expanded. At present fish meal is being imported from France and Germany. The present plan seems to be restricted to converting offal, which amounts to about 30 per cent of the catch of sardines and anchovies. There is obviously scope for two or three small factories strategically sited along the coastline. However, there are no apparent potential supplies of raw material for a fish meal factory based on industrial fishing, i.e. for converting freshly caught fish straight into fish meal. At an earlier period a United States firm had carried out a feasibility study of the latter possibility and there was recently an enquiry abroad about supplying equipment.

Recommendations

Although each country should catch whatever it reasonably can of the nutritionally valuable fish provided by its local waters, the potential surplus of sardines available in neighbouring Morocco would seem to be a natural import as frozen fish for home consumption (and fish meal for livestock feeding). Some assurances might need to be given regarding competition with canned sardines in the export market. The training requirements for fishermen, factory operatives and managers need underlining. Expansion in refrigerated transport and storage arrangements are obligatory for inland distribution, combined with a powerful propaganda campaign to popularize the consumption of fish.

Edible oils

About 18,000 tons of olive oil are produced annually, of which a proportion is exported (4,400 tons in 1964/1965). Otherwise there is no local vegetable seed oil industry although experiments have been carried out for the past two or three years with growing cotton,

sunflower and soyabean. However, although the results of these experiments so far are said to be promising, complete results will have to be awaited before it can be decided to launch out into large-scale production. Local needs generally are met by imports of crude oil which is refined and oil seeds are also imported and crushed and the oil expressed. The current consumption of all edible oils in Algeria is around 80,000 - 85,000 tons of which about 10,000 tons is olive oil and 70,000 tons oil from various other vegetable seeds all made from imported raw material. Margarine is not eaten so there is no manufacture. The total imports are somewhat as follows:

Colza seeds, 70,000 tons, crude colza oil, 20,000 tons, crude sunflower oil, 15,000 tons from France and USSR. The 15 establishments in 1964 in Algeria sold products worth DA. 60.2 million raw materials costing DA. 44.6 million, labour DA. 6.6 million.

Thirteen per cent of the total output is accounted for by L'Huileries Moderne d'Algerie which is in the Algiers harbour area and was built in 1949. All activities stopped during 1962 and there was no production during 1963. The factory was nationalized in October 1963 and in the preceding period the owner, anticipating this, had accumulated no stock and made no investment. At that time there were only 28 workers. By October 1966 this number had risen to 150. Since the concern could not accumulate sufficient funds on its own, aid was given by the Algerian Government through the CAD (Caisse Algerienne pour le Developpement) by means of a loan of DA. seven million. Another loan for DA. 200,000 was obtained from the Prefecture of Algiers which had to be reimbursed within two months, to support the purchase of equipment, such as a boiler. Another DA. 1.5 million was also forthcoming in 1963 to permit purchase of pipelines and installations from port to factory and also storage facilities. They are also now anxious to buy a safety boiler for refining, but this is not yet possible for financial considerations.

The company both extracts and refines, using as raw material colza, sunflower and olive oil. Recently grape seed oil has been extracted

successfully to give a yield of seven to eight per cent which is used for the manufacture of soap. The crude raw material is nearly all imported, olive and colza from France and sunflower seed oil from USSR. Small quantities of soya oil have come from USA. The raw material for olive oil manufacture consists of "grignons", i.e. the residual "cake" after the first crude, cold expression. The production of this factory consists of about 80 per cent colza and sunflower oil and 20 per cent olive oil.

Imports are all arranged through the medium of L'Office National de l'Action Commerciale (ONACO) and so also are exports. About 50 per cent of the olive oil produced is consumed at home and 50 per cent exported.

In 1966 the factory produced about 8,000 tons of refined oil worth DA. 20.65 million from raw material costing DA. 19.2 million, the labour and social charges being DA. 1.1 million. Their total operations were in fact greater than had been expected. The ratio of extraction to refining was about 3.4. Owing to the fact that demand has been in excess of supply, by means of working overtime and on Sundays the activities have been increased to 70-75 per cent above normal working for extraction and 95-100 per cent for refining.

Production could not be increased further without new equipment. The present equipment is very old and new is badly needed to improve production. 12,000 tons would be a reasonable target for a re-equipped factory. The cost of this new equipment very approximately would be about DA. 1 million for the production of soap and toilet soap alone and DA. 2 million for other re-equipment. The capital for this sort of operation is in general obtainable from banks backed by the Government, and has to be paid back in five years. Three years ago requests were made for capital for such modernization but permission could not be granted by the Ministry of Industry and there seems no immediate prospects of this decision being reversed, although it would be possible for the capital to be provided within the actual organization if the ministry agreed.

The type of new equipment for olive oil production envisaged in the official Bulletin des Industries Agricoles et Alimentaires, (No. 3, May 1966) is the Westfalia process with a capacity of 400 kilogrammes of olives per hour, costing, complete, DA. 84,000 f.o.b., a double unit costing DA. 160,000.

Recommendations

More conventional equipment is obviously needed by the edible oil industry of Algeria. In re-equipping, attention should be given to the installation of up-to-date processes, employing solvent extraction. Alternatively, on any sub-regional basis Sudan might be made the centre for edible oil production leaving mineral oil and petrochemicals to Algeria. At the same time the olive oil industry needs to be put on a more efficient technical footing by a planned campaign of modernization and installation of several new units after 1970, as recommended in the SERMI Survey of November 1964.

Cereals milling and baking, etc.

Algeria is one of the world's largest producers of durum wheat, (along with Italy, USA, Canada, Turkey and Syria). About one million tons of durum wheat was grown in 1955/56 and over 300,000 tons of soft wheat. 60 per cent of the durum and 36 per cent of the soft wheat is consumed directly in the rural areas and does not therefore enter into the industrial sector. Algeria is usually self-sufficient in durum, but depending on the harvest, some has to be imported some years (80,000 tons in 1965/66 for example). Other years it is exported in similar quantities (84,000 tons in 1964/65). Larger amounts of soft wheat (280,000 tons in 1965/66) are imported, mainly from France.

Many of the mills were nationalized after July 1962, although some private firms were still allowed to operate profitably on quotas. The Government controls production and distribution and builds up reserves which encourages hoarding by farmers. The threat of further agrarian reform also discourages development. However, there are

problems in properly assimilating the farms vacated by Europeans and taken over by the Government.

In 1961 there were 49 mills, mostly electric, with a capacity to mill 75,000 tons a year. The total capacity of all cereal mills is given officially as 1,321,500, but this must include small and handi-craft mills in the rural areas, producing semolina for household consumption as couscous. Milling capacity is more likely to have decreased rather than increased since 1961. Much of the milling machinery needs renewing and representatives of firms of milling engineers have recently been interested in the possibilities of supplying equipment. Large amounts of semolina flour, made from durum wheat are exported to France cheaply (at DA. 0.91/kilogramme) because the Algerian export is not taxed and therefore sells at below the price in Algeria. Rice milling equipment is also in need of some improvements. The commercial mills make flour mainly for bread, pasta and biscuits for the domestic market and export. Bread consumption has been reduced as a result of the departure of most of the Europeans and the army. Similarly pasta production has fallen from about 50,000 tons in 1961, of which 30,000 tons were exported, 6,000 tons going to France, to 17,300 tons in 1963/64, only about 40 per cent of total capacity. However, with the rise in population, demand for flour can be expected to increase and also with urbanization demand for couscous may be expected to fall and that for cereal and pasta to rise.

There is a national monopoly of cereals manufacture (S.M.SEMPAC). There is a large factory in Algiers which was only one of 22 factories producing pasta and couscous in Algeria before nationalization. Two of these were in fact stopped because their equipment was so old that they were not useful and they were therefore obliged to close. At the present time there are only three factories operating, one of which is at Blida (40-50 kilometres inland from Algiers). Most of the machinery is very old. Early in 1966 a new machine was installed, but mostly it is a matter of trying to get the best possible out of out-of-date

equipment. For example, a piece of equipment originally rated to produce 500 kilogrammes/day might actually now only be capable of 250 kilogrammes/day. Thus, in spaghetti manufacture the drying process is very complicated. The method used is very old and much labour has to be employed to obtain a satisfactory result. Again with vermicelli the method of work employed is very antiquated so that there are 11 persons in the team where three should be sufficient. On the other hand it may be queried whether this matters greatly at the present time where there is a surplus of labour. However, the drying process takes 36 hours instead of 24, so that production normally 500 kilogrammes/day falls to a little over 300 kilogrammes/day.

To modernize the enterprise would entail new equipment, and there are difficulties at present over obtaining new machinery. Home demand is increasing while exports have been falling. One reason for the latter is that in 1959-61 there were two large companies operating in Algeria which have now newly established themselves in France.

Again, Tunis, Morocco and Italy, which formerly imported considerable quantities of pasta from Algeria, are now producing more and more for their own consumption, and furthermore transport rates are very high. It is, therefore, practically impossible in present circumstances to export the manufactured product which is therefore made entirely for home consumption. The factory in Algiers is working 24 hours a day to meet demand. Also products have been improved in colour and flavour from what they were like previously. Much of the flour used is from imported wheat milled in Algiers. Bad weather in 1965 made it necessary to import as flour, but this situation is not expected to continue for more than a limited period. The best wheat for pasta manufacture is the home-produced; Russian, Canadian and Argentine wheats are not so good.

It was planned to build another factory in Oran, which would be modern, with a production of 200 quintals (20 tons)/day - i.e. 6,000 tons per annum of 300 days.

The pasta production of all Algeria is now about 30,000 tons/year, all organized under SEMPAC, and it is hoped to reach 40,000 tons for pastas only, at the establishments in Oran, Algiers and Constantine. The relative importance of these at present varies according to prevailing conditions.

The factories at Algiers and Blida produce 300 quintals/day each, i.e. 9,000 tons/year each.

Modern machinery would increase not only the quantity produced but also the efficiency of production. It is hoped to be able eventually to install equipment producing 50,000 tons/year in eight-hour days instead of having to run for 24 hours a day as at present.

If new equipment were authorized for future production, this would most likely be concentrated into two or three existing factories say, at Algiers and Blida instead of starting up entirely new units elsewhere. Each unit required would cost DA. 60,000 to 70,000. The total cost of buildings etc. would be about DA. 400,000. This equipment would also provide for exports of pasta and couscous. All this would of course need government sanction. However, the SERMI survey of November 1964 envisages two new units for 1970-75 of capacity 10,000 and 12,000 tons a year and costing DA. nine million.

There is a small biscuit industry (capacity 11,000 tons/year) running at about 50 per cent capacity. At the same time a considerable proportion of total supplies is imported from France, presumably of a better quality than home-produced. Rusks (biscottes) and sliced bread are also imported but could be produced locally given technical training and the necessary equipment. However, biscuit consumption is growing less rapidly than that of pastas.

Recommendations

The pasta industry of Algeria seems to be operating well under difficulties and fully justifies the relatively modest expenditure of capital required to modernize practically worn-out equipment without

necessarily proceeding towards full automation for which there seems no need in a country with a large surplus of labour.

Some of the heaviest capital expenditure recommended in the SERMI study (1964) was in flour milling (DA. 20 million for modernization in 1965-70 and DA. 80 million in 1970-75 for two or three new units). The preponderant role of wheat flour in any diet makes it necessary to support these recommendations to cope with future requirements.

Sugar manufacture and refining

Sugar is not being home produced at present but efforts are now being made to build up this industry.

The French had pioneered beet sugar production on a small scale. A white sugar factory near Sfizef in Oran province has a daily beet processing capacity of 900 tons and the refinery plant attached can process 50 tons of imported raw sugar daily. This had had to be closed in 1961 as a consequence of the war of independence but the refinery is now reopened, working of course on imported "raws". Production is about 15,000 to 20,000 tons a year whilst consumption is about 220,000 tons. A new factory was opened in July 1966 at El Khemis using French equipment with a capacity of 1,500 tons of beet a day for a season of 100 days which will increase the crude sugar refining capacity to 30,000 to 40,000 tons a year. It is intended that this factory will be supplied with beet grown on an irrigated area of 6,000 hectares yielding a minimum of 25 tons/hectare. With a three-year rotation, 18,000 hectares of irrigated land will be required. It is hoped that the factory will soon be treating about 80,000 tons of beet produced by 2,500 hectares of irrigated cultivation and 1,000 hectares of dry culture. Tenders are now also being called for a further factory at Guelma of about the same size as that at El Khemis. Although commencing operation as a refinery this is also planned to take about 1,500 tons of sugar-beet daily, the growing of which will be extended as a result of tests which have been going on now for the past three years.

Extensions to El Khemis are being considered with more plant to utilize raw cane sugar. About 200 tons of granulated sugar and 100 tons of loaf will then be produced per 24 hours. Of the total, only three new capital projects amounting to DA. 72 million for the food processing industry authorized for 1966, DA. 60 million is for sugar production, the other two being DA. 9 million for fruit juice and DA. 3 million for mineral water. It was, however, said not to be official policy to give special priority to sugar production amongst the food industries.

It is hoped as an ultimate objective to cover the whole local consumption of sugar. For this an investment of the order of DA. 500 million would be required. In order to produce the total requirements of about 230,000 tons from sugar-beet, the Ministry of Agriculture envisages planting: 115,000 hectares in dry culture with a yield of two tons of white sugar per hectare plus 57,000 in irrigated culture to obtain four tons of sugar per hectare. With three year rotation 161,000 hectares in irrigated culture and 345,000 in dry culture would be necessary. It is realized that such an extension of the cultivation of sugar-beet could only be obtained in the long term.

For the present, however, it is intended to learn about the problems from the performance of the El Khemis plant. People also have to be trained for any future extensions. Since the world price of refined sugar is so low, it is possible that the existing factories will be regarded as sufficient for the time being. With regard to financing, it is envisaged that when plans are ready for future projects they will be financed through the Algerian budget, although bilateral arrangements are quite conceivable.

Recommendations

It is debatable both economically and nutritionally whether at the present time it is justifiable to incur the capital expense required for beet sugar production and refinery at the sacrifice of other sectors of the food industry requiring new investment. It would seem to be

more sensible for Algeria to continue for the time being to import sugar from the Eastern bloc and Cuba (or with the sub-region from UAR between 1970 and 1980, after that from Sudan) rather than to engage in a long-term plan to achieve self-sufficiency in the way that Morocco has set about things; and to concentrate instead on getting its livestock and milk processing industries on a sound footing.

Fruit and vegetable processing

Although 1.2 million tons of fruit and vegetables are produced in a year, processed products only amount to 10,000 to 15,000 tons.

There are 19 factories for citrus juice, canned products and jam with a total capacity of 91,500 tons input and 32,000 tons output of product on an eight-hour a day basis (and treble these figures for a 24-hour working day). In fact, these have been operating very poorly since the French left, at only about 25 per cent of capacity; only 3,000 tons of all products were produced in the first nine months of 1965. One of the principal reasons for this is that irrigation and spraying have not been as regular as formerly. Nevertheless, over 150 per cent increase in demand is forecast for 1975, chiefly in the home market, as the following table shows.

TABLE A. 14

(1,000 tons)

	Raw material capacity (1966)	Product capacity (1966)	Actual Production (1963)	Estimated market (1975)		
				Home	Export	Total
Canned fruit and jam	3	3.6	4.2	9.0	0.9	9.9
Fruit juice	42.6	18.0	6.5	6.6	5.0	11.6
Canned vegetables	45.7	10.5	1.3	9.1	1.3	10.4
Total	91.5	32.2	12.2	24.7	7.2	31.9

At Bou Farik there is a citrus juice plant capable of a production of 6,700 tons a year which in the first ten months of October 1965 had produced only 1,300 tons. This is in need of new equipment.

At the same time the future prospects for the processing industry should be good, although there would be difficulties in the short-term in producing at a price that would compare with those in the world market. Sugar supplied by ONACO (Office National de l'Action Commerciale) is criticized as being of too impure a quality for fruit processing as well as being too dear at DA. 348/ton. Carnaud cans are also said to be too expensive (whereas l'Office National des Pêches considers that fruit processors obtain preferential rates).

The price structure (at November 1964) was as follows:

TABLE A. 15

(Per cent)

	Fruit	Juice	Vegetables
Raw material	55	30	40
Packing	20	40	15
Labour	20	15	30
General expenses	5	15	15

The total for 1962 was:

	<u>Million dinars</u>	<u>Per cent</u>
Raw material	9.3	40
Packing	7.0	30
Labour	4.3	18
General	<u>2.7</u>	12
Total	23.3	

A new, large fruit and vegetable processing plant, built by Yugoslavs has now been completed at El Asnam and is capable of a production of 5,280 tons a year.

Further factories are being planned. Special attention is being given in a tomato juice factory to vertical integration between growing and processing arranged jointly between the Ministries of Agriculture and Industry.

Wine is a specially important fruit product in Algeria which presents problems. About 350,000 hectares are given over to viniculture with an average yield of 38 hectolitres, which it is hoped to stabilize at 7 million hectolitres a year whilst production is still about 12-13 million hectolitres. In consequence, about 15 to 20 million hectolitres of wines have been stocked up since independence.

It is intended to limit annual production to about 10 million hectolitres by reducing the area planted to 250,000 hectares. This will permit recropping of 100,000 hectares with cotton and other alternative crops and at the same time enable the best vineyards to be selected for superior wines for export. The reduction planned for the 1965/66 season was 25,000 hectares. Experiments are also proceeding at a small factory at Oran on the production of an unfermented grape juice product preserved by deaeration, sulphur dioxide and heat treatment, on the results of which it is intended to base further production. This would enable the grapes surplus to the inflated wine industry to be usefully employed.

Dates are an important product of which around 100,000 tons are produced annually and mostly home consumed. However, many of the date packing sheds for export are poor and the product has to be repacked at Marseilles. Attempts are being made to improve this product.

Recommendations

Given trained technical supervision, large, up-to-date units, supplies of varieties suitable for processing and markets at home and abroad, Algeria could well develop its fruit and vegetable processing industries. Of all these requirements the most important is the need for trained factory hands and managers.

CHAPTER IV

TUNISIA

Population estimates

1959-61	4,247,000
1963	4,202,000
1970	5,132,000
1975	5,888,000

TABLE T. 1
Production, imports and consumption of agricultural products (1964)
(1,000 tons)

	Production	Imports	Total	Export
Soft wheat	422	0	422	2
Durum wheat	111	76	187	90
Barley	236	13	249	23
Oats	6	0	6	
Maize and sorghum	4	2	6	
Cereal offals	67	0	67	50
Beans	42.6	-	42.6	
Chick peas	14.2	0	14.2	
Lentils & other legumes	3.8	0.5	4.3	
Artichokes	16.4	0	16.4	
Tomatoes	107.2	0	107.2	
Potatoes	57.6	6.3	63.9	
Pimento	42.7	0	42.7	
Other vegetables	122.9	1.5	124.4	
Citrus fruits	107.6	0	107.6	
Table grapes	16.5	0	16.5	
Wine grapes	252	0	252	
Dates	30	0.3	30.3	
Melons	92	0	92	
Olives	440.1	0	440.1	
Other fruits	76.4	4.5	80.9	
Linseed	1.4	0	1.4	
Cotton seed	0.36	0	0.36	
Sugar-beet	41	0	41	
Poultry and rabbits ('000)	(9.5)	(0)	(9.5)	
Milk				
" Fresh	135.3	0	135.3	
" Pasteurized and sterilized	5.7	0	5.7	
" Dried	0	4.1	4.1	

TABLE T.1 (Cont'd)

	Production	Imports	Total	Export
Eggs (m)	(180)	(2)	(182)	
Cheese	0.8	0.8	1.6	0.2
Butter	0.4	1.6	2.0	
Meat	20.31	0.6	20.9	
Fresh fish	20	0.1	20.1	0.9
Canned fish	3.8	0.1	3.9	2.4
Olive oil	90	0	90	51.4
Oil of grignons	13	0	13	
Margarine	0.2	0	0.2	
Other oils and fats	0.4	20.2	20.6	
Flour	133	0	133	
" rural products	36	0	36	
Semolina and malt	122	1.6	124	
" rural products	196	0	196	
Cereal offals	67	0	67	
" rural products	61	0	61	
Pastas and couscous	37	0	37	2
" rural products	196	0	196	
Bread (rural)	116	0	116	
Industrial Bakeries	103	0	103	
Biscuits, confectionery (OOODR) Chocolate	(1,240)	(1.3)	-	
Patisserie & confectionery (OOODR) handicraft	(4,170)	-	-	
Canned fruit & vegetables	20.4	0.8	21.2	
Sugar	69.5	102.2	171.7	
Coffee roasting	1.6	0	1.6	
Wines	18.4		18.4	
Beer	17.1	0.4	17.5	
Alcoholic drinks (OOODR)	(700)	(73)	-	
Mineral water (OOODR)	(1,300)	(164)	-	

TABLE T. 2

Production, imports and exports of processed foods in Tunisia
(1,000 tons)

	Production			(Capa- city)	Imports			Exports		
	1963	1964	1965		1963	1964	1965	1963	1964	1965
Meat - prepared and canned	0.1				0.3	0.2	0.1			
Milk - evaporated and condensed					3	3	2			
Milk - dried					1	1	3			
Butter					1	2				
Canned fish	6	4	2	(19)				6	2	1
Prepared and canned shellfish	0.1	0.2	0.1	(0.4)						
Flour	121	148	126							
Semolina	162	102	148							
Total flour	283	250	274	(404)	-	-	1	-	7	1
Biscuits	1	1	2	(1.4)						
Pastas	33	17	21	(57)						
Couscous	3	14	14	(10)						
Total manuf. cereals	36	31	35	(67)	-	-	-	2	2	1
Jams	6	4	7	(14)						
Pulp	1	1	1	(1)						
Total jam and pulp	7	5	8	(15)				4	8	4
Fruit juices	0	-	-	(2)				1	1	5
Pickled fruit and vegetables	sm.	sm.	1	(1)						
Canned fruits in syrup	2	1	1	(2)				1	2	1
Tomatoes (concentrate and peeled)	8	11	12	(17)						
Artichokes	1	1	2	(4)						
Other preserved vegetables	1	1	1	(2)						

TABLE T. 2 (Cont'd)

	Production				(Capacity)	Imports			Exports		
	1963	1964	1965			1963	1964	1965	1963	1964	1965
Total canned, etc. vegetables	10	12	15	(24)		1	1	sm.	5	5	4
Preserved olives	1	1	1	(4)					1	1	1
Sugar	44	59	13	(84)		58	101	61	1	-	-
Sugar confectionery	3	3	4	(10)		sm.	sm.	-	sm.	1	1
Chocolate	1	1	1	(1+)		sm.	sm.	sm.			
Pimento	3	2	3	(10)							
Fish meal	sm.	sm.	sm.	(6)							
Vegetable seed oils (excluding olive oil)	11	10	12								
Soya						24	15	11			
Cottonseed						4	-	-			
Total seed oils						28	15	11			
Olive oil - table	3	1	9	(10)					29	51	46
- grignons	4	8	10	(14)							
- Total olive oil	7	9	19	(24)							

TABLE T. 3
Cost of food and average expenditure

	Cost of production	Retail price	Average expenditure	
	(Millimes/kg)		DR/yr	Millimes/day
Pasta & couscous	79	91	4.094	11.21
Bread	48	52	2.552	6.99
Sugar	114	122	2.758	7.55
Potatoes	24	38	0.506	1.38
Beans	60	157	1.153	3.15
Chick peas	75	149	0.348	0.95
Lentils, etc.	60	288	0.094	0.25
Pimento	53	89	0.561	1.53
Melon	21	41	0.608	1.66
Tomatoes	12	29	0.240	0.65
Citrus fruit	29	50	0.659	1.80
Dates	45	62	0.341	0.93
Grapes	57	96	0.334	0.91
Olives	35	66	0.109	0.29
Canned fruit and vegetables	-	-	0.350	0.95
Meat	666)	672)	4.855	13.30
Poultry and rabbit	196)	230)		
Eggs	287	375	0.511	1.40
Fresh fish	193	395	1.374	3.76
Canned fish	-	-	0.202	0.55
Fresh milk	32	64)	1.668	4.56
Pasteurized milk	45	75)		
Milk powder	-	-)		
Cheese	362	602	0.176	0.48
Butter	540	714	0.321	0.87
Olive oil	203	237)	0.964	2.64
Margarine	-	-)		

General situation

The Government is involved in a Ten-Year Plan (1962-1971) in three parts of which the present phase, a Four-Year Plan (1965-1968) is the middle phase. To implement this, Tunisia is anxious to secure foreign components to finance the projects envisaged in the current plan. Meetings were held in Washington in October 1965 and in Paris in December 1965 at which several countries interested in aiding Tunisia under the auspices of the International Bank of Reconstruction and Development (the "World Bank") decided to give loans to Tunisia of up to \$100 million as and when projects were submitted for financing.

There is also a considerable amount of bilateral assistance, Tunisia is one of the seven countries to which the United States Agency for Industrial Development (USAID) is contributing about 2/3 of its resources. In the past 9 years \$447 million have been so allocated of which \$372 million had been disbursed at December 1965. Italy has made commercial loans up to \$32 million and also medium-term credits. The Federal Republic of Germany contributed about DM 31 million for agricultural projects including mountain dams, the total sum allocated since 1960 being DM 140 million. France has contributed numerous staff, secondments, etc.

FAO is responsible for three United Nations Special Fund Projects concerned with agricultural investigations in central Tunisia, integrated rural planning in central Tunisia and a reforestation institute.

The manufacturing industry generally is on a very small-scale, foods being the most important group with the sugar refinery, flour mills, vegetable oil plants and fish canneries prominent.

The possibilities of agricultural development in Tunisia are determined to a large extent by the climate, particularly the rainfall. The country, which is the smallest in the sub-region, may be divided into three main portions, North, Central (where there are 800,000 people) and South with the Cape Bon and Coastal (Sahel) areas

in the central portion. The rain falls mainly with the prevailing south-west wind on the mountains before it reaches the Central region. East winds bring rain more rarely.

Decolonization, too, has resulted in considerable disorganization. Large 1,000 ha State co-operative farms have been instituted which are specially supported by the Government as long as they are not self-supporting, which means that they are not likely to become so for a long time. Book-keeping and discipline generally also need to be tightened up if productivity is to be increased.

Although with irrigation and better management the output of Central Tunisia could certainly be increased; further South the waters are saline and the land consists merely of desert with cacti, of which the only product is dates, although these, too, could be better managed. In the Coastal region, olive groves and vegetables furnish a large trade. Also on Cape Bon there are oranges and vineyards.

The traditional foods are couscous and olive oil, with bread becoming increasingly popular and relatively cheap (at say US10c. per loaf).

According to estimates made in conjunction with an FAO expert nutritionist, average expenditure on food is about 0.5 DR per head per week.

The average diet only contains about 9 g of animal protein (dry weight) per head per day compared with 20 g regarded as essential for health, and this average is no doubt very irregularly distributed.

However, considerable increases in agricultural production are projected as part of the Ten-Year Plan and corresponding developments are proposed for food processing.

Investments required in the food industries under the Plan are as follows:

TABLE T. 4

	In DR 1962 - 65 (DR.m.)	1962 - 71 (DR.m.)
Canning	0.66	2
Butter, cheese	0.4	0.5
Bakeries		0.65
Semolina and malt		0.15
Sugar	1.5	5
Vegetable oil refining		0.15
Animal feeding stuff		0.05
		8.5
Beer		0.75
Ice and mineral water		0.85
		1.6

It is not known whether actual developments are keeping in step with the progress called for by the Plan. However, it is still not half-way through the period of the Plan and taking it at its face-value the details of investments proposed for the period 1965-68 are:

TABLE T. 5
Four-Year Plan (1965-1968) for investments in food industries of
Tunisia

	(DR. 1,000)
<u>Fruits & vegetables</u>	
Fruit juice factory (extension)	130
Pea canning unit	30
Haricot bean canning unit	30
Factory for vegetable dehydration	120
Unit for manufacture of date paste	100
<u>Sugar</u>	
Store for white sugar (extension)	60
Complementary equipment	150
Water reservoir (5,000 m ³)	40
Construction of buildings	100
<u>Fish</u>	
Production unit at Bizerta (10 tons per day sardines)	50
Production unit at Gabes (300 tons per year tuna)	50
Modernization of 6 units at Sousse & Mahdia	200
Unit for fish meal (for the North and Cape Bon)	20
<u>Milk Industry</u>	
Cheese unit	150
Unit for manufacture of margarine, mustard & mayonnaise	200
Dairy at Makhtar (complementary equipment)	30
<u>Oil and derivatives</u>	
Pilot factory for treatment of by-products	90
Factory for treatment of by-products	50
Store for 30 m. kg of oil	900
Total	2,500

The planning control and finance of the food industries by the State is in a process of evolution as a result of the recent establishment of a number of sub-groups, on which food producers, industrialists and the agricultural and development banks are represented for the following sections:

- Cereals and derivatives;
- Fish canning;
- Edible oils and derivatives;
- Sugar, chocolate and confectionery;
- Fruit and vegetables;
- Drinks and mineral waters.

The section on the food industries in the Four-Year Plan 1965-68 admits that these industries are mostly between 30 and 60 per cent under-employed.

All contracts, e.g. for tomatoes for processing, have to be approved by these sub-groups. Maximum prices are fixed. They work with the Government on limiting the minimum prices for exportation, below which export is forbidden. They also advise on how to diversify and increase production per hectare.

The sub-groups are concerned with food research laboratory work to help their industry. They supervise the co-ordination of industrial food products and help to try to open up new markets on a broad basis instead of individual industrialists all endeavouring to find export orders and overlapping and competing with one another (but see however later under "Fruit and vegetable preservation"). They attend to buying up surplus products, and also arrange for cans or bags, to be ordered for all factories. Differences between the fixed prices agreed and those actually realized by sales are used to promote development. Export prices are at present increasing. The Fisheries Department functions in a similar manner. These sub-groups which have been in existence for only six months, will, it is hoped, help to evolve more realistic plans as a result of drawing in the industrialists, rather than plans being projected down from the summit.

It is intended in 1967 or 1968 to re-group small plants concerned with tomatoes, vegetables and other fruits.

The food industry is not nationalized, but is a 100 per cent private sector. However, the industry is now 100 per cent Tunisian without nationalization.

The National Office of Cereals is responsible for the three sectors; milling, pastas and bakeries, and is concerned with replacing traditional baking equipment with modern bakeries. Reorganization of the oil industry is also proceeding similarly, e.g. in improving methods of crushing olives, so that all the by-products can be effectively utilized.

Tunisia is anxious to develop its own independent industrial food research programme and hopes for assistance from the United Nations for this although it would welcome any background help that might be given by some central Maghrebian Research Laboratory concerned with more distant projections into the future. Nevertheless it feels strongly that it is essential also to have national laboratories to interpret and apply results to local national conditions. At the present time for example, the chemical laboratory which works for the fruit industry has equipment for checking quality of product and all exported food must have a certificate that the product conforms with the legislation of Tunisia. For canned fruit there are technical specifications for each product. Again it is hoped that freeze-drying can be adapted under Tunisian conditions for processing red fruits to obtain a powder. An industrial food research laboratory would also have to be concerned with diversification, improvements in production and detection and suppression of frauds. It could also serve to train engineers and technicians. The cost envisaged is DR 500,000 to 600,000 of which DR 200,000 would be for construction. There should be 2 or 3 engineers and 8-10 additional staff. The food research laboratories would be organized so as to deal with particular problems of a section of industry leaving the general problems to a central research laboratory.

The oil laboratory is already concerned particularly with the utilization of olive oil by-products and with productivity.

However, it is dubious whether a country of only $4\frac{1}{2}$ million people with a GNP of less than DR 1,000 million (\$2,000 million) can effectively engage in a food research and development programme on a scale sufficient to cater for the needs of its main industries even as regards ad hoc and applied research and "trouble-shooting." In any case it is strongly suggested that basic and original research is not justifiable at the present juncture.

There seems to have been no "cost benefit analysis" in the Plan's proposals for expansion of production. Most of the investment so far has been of a political and social content, e.g. housing, and there has been little productive investment as yet.

Milk and milk products

The factory of the Société Tunisienne des Industries Laitières (STIL) in Tunis is the only one in Tunisia at present processing fresh milk. It is managed by Mr. Burki who is a Swiss. Its growth is shown by the following figures:

TABLE T. 6

	Fresh milk (m.l.)	Regenerated milk powder (m.l.)	Total milk processed (m.l.)	Production % of 1960	Consumption % of 1960
1960	2.9	0.6	3.6	100	100
1964	7.7	1.1	8.8	260	247
1965	8.4	11.0	11.0	285	310

In 1964 when it appeared that production of fresh milk was going to exceed the demand for it, it was planned to build an extension as a cheese factory to utilize the surplus milk. This was to cost DR. 600,000 with equipment and technical assistance from a Danish firm divided equally into DR. 300,000 for equipment and DR. 300,000 for the building.

The cheese produced was to be principally of the Edam type. 40,000 litres of milk a day was to produce 4 tons of cheese daily. But in 1965 with a deficit of milk in relation to demand for fresh milk the policy had to be changed and they now propose to realize the cheese factory in easy stages. First of all, however, they intend to increase the capacity for fresh products, which are easily sold, by installing further milk processing equipment.

At the time (November 1966) 40,000 litres/day could be processed. (= 40 tons a day or 14,000 tons/year of 350 days). With new equipment this will now be increased to 60,000 litres (in January 1967), and 2,000 litres/day will be used to produce 2,200 kilogrammes of cheese daily. Investments for these improvements will amount to:

DR.50,000 for milk processing equipment

DR.50,000 for cheese equipment

DR.50,000 for the building

By January 1967, too, it was hoped that two Tetrapak machines for disposable cardboard milk containers would be delivered and that these will be in operation by August 1967. The Tetrapak was intended for all the pasteurized milk and only the sterilized milk would then still be sold in glass bottles. In November 1966 the new cheese factory was practically equipped and delivery of machines was expected shortly.

A very important programme for collecting milk is also being worked out, with refrigerated storage facilities and collection by lorry. There will be three collection centres to begin with, at Beja, at somewhere in the Medjerda Valley (El Habibia), and La Soukra. The

cost of each centre is DR.10,000. Equipment is being given by Germany under a technical assistance arrangement.

It is expected that production will increase, but not in the Medjerda area, where there is a technical problem in that the quality of the milk there needs to be improved. In Beja it is hoped to obtain an additional 3,000 litres/day and the same also in La Soukra.

If this experiment is successful, it is intended to apply the experience thus gained throughout the whole of Northern Tunisia. And in a similar fashion the cheese factory will also be increased if the possibilities of development seem promising. In this way it is hoped that STIL could handle as much as 100,000 litres/day with the existing complex and the cheese factory and the collection units (of which presumably 40,000 litres/day would be for cheese production). After this, if there is a demand for still further production, it would be proposed to develop the whole organization. Beja is really too far away for satisfactory collection. A great deal will depend on whether suitable cattle are available for milk production and it would therefore be preferable to expand slowly in step with supplies of raw material. It is expected that the Office d'Elevage will prove very useful in furthering such developments.

With regard to the establishment of further factories in Tunisia, six years ago trials were instituted at Makhtar, inland in the North of Central Tunisia with the object of developing a milk processing unit there. But the grass was very poor in the area, there were very few cattle available and very few people about either. Therefore, STIL are now going to close this establishment and take the equipment to Sfax. There is already in this area considerable vegetable production (by some 6,000 producers). They are now experimenting with fodders, such as lucerne, for which the considerable amount of water required will be made available by irrigation. Some of this fodder will be used for the production of milk. Each producer will be given 2/3 cows. As a result, it is expected that a factory at Sfax will produce 5,000

litres/day from the equipment from Makhtar along with some more equipment from Denmark, which will enable a maximum of 10,000 litres/day, to be treated and this will be further increased later.

In the general programme for the future of the milk industry there will certainly be a requirement for further capital investment before 1985. It is difficult to predict further possibilities and demand in any detail.

For fresh products, the profitability is good. Raw milk is now bought at 55 millimes/litre. The manufacture of concentrated milk, however, is less profitable.

The fundamental issue governing the future development of the milk processing industry is government policy, because help will be required in providing finance for production and distribution.

Local consumption is likely to be limited, but there is also the possibility of exports, depending on the price of production in Tunis.

The factory at Tunis at present also handles 600 tons of butter a year (chiefly US butter, imported and repacked) and 800 tons of cheese.

Before devaluation of the Dinar in 1964, cheese sold in the shops at 600 millimes/kilogramme whereas STIL's cost of production worked out at 819 millimes. Milk at 48 millimes/litre at that time amounted to a raw material cost for Edam type cheese of 528 millimes/kilogramme. In November 1966 milk was 55 millimes/litre and in addition other costs have also gone up by 20-25 per cent, resulting in an additional 160 millimes/kilogramme. The present cost of production of cheese is therefore at least 1,000 millimes/kilogramme, and at that price the profitability is not promising because cheese from Holland and France now still costs only 665 millimes/kilogramme.

Making an allowance for 13 grammes of butter per litre and processing costs gave the figure of 819 millimes/kilogramme.

The main reason for the relatively high cost in Tunisia is the present limited scale of operations required in supplying the market for fresh products. The cost of the treatment of milk, including raw material, labour, sugar (for Yoghourt), cans, rooms for maturing, etc. all amounts to about 23 millimes/litre, (presumably taking all milk products together and not just relating to pasteurized milk, although this is the bulk of the production).

If STIL could produce say, twice as much, it would be somewhat cheaper. But their economies on increasing from small-scale production in 1964-65 were all swallowed up by the depreciation of the Dinar in 1965, in spite of the increase in production by 10,000 litres/day. This was largely because all raw materials and equipment have to be imported (apart from the milk itself), including of course chemicals such as caustic soda and quaternary ammonium compounds.

A survey of domestic milk production in Tunis was made recently by STIL with police co-operation. Although it is known that a lot of mistakes were made, it was nevertheless estimated that something like 10,000 litres of raw milk a day was being distributed by pedlars compared with 42,000 litres/day sold by STIL.

The raw milk price has been constantly increasing. In 1961 it was 42 millimes/litre. STIL was then asked by the Government to pay 50 millimes. Last year it was 55 millimes without any corresponding increase in production to offset costs.

The Tetrapak conversion next month will cost 2-3 millimes/litre more, without any increase being made in the price. Although it would not be difficult to eliminate the pedlars completely, STIL feel that competition with private enterprise must develop continuously and that it would be a bad thing for the Government to take drastic measures that would put private enterprise out of business.

At present the pedlar sells his milk at 70 millimes/litre whereas the price of STIL milk is 72 millimes/litre retail, and 67 millimes wholesale. The pedlar's milk is of poor quality, water is added to it,

germs flourish in it and formaldehyde is used as a preservative (as can often be detected). Pedlars, too, still sell the same milk at 4 p.m. that was taken from the cow at 4 a.m. by which time it has a high acidity. (STIL's maximum acidity for acceptability is PH 6.4). However, cheese is obviously a luxury item beyond the purchasing capacity of a worker with an average wage of DR.10 per annum.

Production of 125 millilitres cartons of Yoghourt has increased from 2.8 million in 1960 to 10 million in 1966.

Other figures given in February 1966 for investments foreseen for increase in scale of STIL is 386,000 DR. of which 235,000 is for equipment.

The only other significant dairying enterprise in Tunisia is the Société Tunisienne de la Laiterie et du Fromage (SOTULAIFROM) at Mateur. This is managed by a Frenchman, Vial, and was originally a subsidiary of the French Roquefort Company. The Société was founded 20 years ago and the factory was erected 14 years ago. Originally set up for the production of mould-ripened blue-veined cheese, there has been some modification in organization as a result of political events with the result that it is now an autonomous company. Its product is chiefly exported to other North African countries and last year the export to France itself was slight. Under the EEC, imported milk products are taxed and therefore Tunisian products are not competitive in the French market. The objectives of the company now are chiefly to organize an export trade with Morocco and Algeria and to develop consumption in Tunis. Therefore they are increasing the variety of their production and in addition to blue cheese they are also producing "casacavalle", similar to the Italian product, ("caciocavallo" - "horse-cheese") and also a white Bulgarian type of cheese as well as some fresh "cottage cheese" which is sold in Tunis. Their cheeses are produced entirely from sheep's milk.

Since the Government took the farms over, livestock has become less important. Formerly all the producers were either French colonists or Italians. Now the producers are either the Government office itself or private Tunisian farmers as well as two Algerian farmers who will however be in Tunisia for a further year only and will then return to Algeria.

During the last four years the Roquefort factory has been facing competition from Tunisians. This is less severe now, but the latter were buying sheep's milk to turn into Italian type cheese and sour cheese. The competition decreased this year but STIL still hopes to collect 600,000 litres to turn into 120 tons of cheese which will be sold on the retail market. In 1965, the corresponding figure was 537,000 litres and in 1964, 389,000 litres.

The price depends on the variety; blue cheese (which requires $4\frac{1}{2}$ litres of milk for one kilogramme) costs 823 millimes per kilogramme at the factory door, including taxes; "casacavalle" (5 litres per kilogramme), 880 millimes; "orientale" cheese costs 592 millimes ($3\frac{1}{2}$ litres per kilogramme) and Mateur fresh cheese costs 548 millimes (3.4 litres per kilogramme). The milk itself costs 61 millimes/litre.

Milk collection is by the company's own vehicles in cans. Seven vehicles are used for collecting within a radius of 35 kilometers. There are 110 producers covering about 10,000 sheep and two collections are made daily. The season is from the end of November until about 15 June. After this it becomes too hot and the milk is too acid by the time it is processed. The milk is not pasteurized before use so that quality is very important.

The blue and casacavalle cheese retail at about 1 DA. 10 M. per kilogramme. Only a slight reduction in price would be obtained by an increase in the size of operations. The main factors in the price are the milk, and gasoline, etc. which have to be imported. They also have to import the enzymes from calves' stomachs required for the process.

The penicillium is obtained from Roquefort and permission and "know-how" have also come from Roquefort for the production of blue cheese.

Over a lactation period of 120 days, one sheep should give 100 litres of milk, that is 0.8 litres - one litre per day. This was the production under the former French management. But as a result now of bad management and feeding the yield has dropped to about 0.2 litres per day. Imports of a suitable variety of Australian sheep should ultimately result in an improvement in yield. However, the French succeeded with the local Sicilian variety in producing much higher yields than are at present current in Tunisia.

A pilot farm supported by STLF has very recently been established to undertake trials with a view to demonstrating the profitability that can be obtained by rational methods of management and feeding. However, if factories similar to that at Mateur were to be set up elsewhere, there would be difficulty in finding markets quite apart from getting the necessary "know-how" from Roquefort. It is considered that they will probably create this year a new unit for the production of processed ("fondu") cheese of which 300 tons is imported annually into Tunis. It is hoped to increase the collection of milk and thus produce 150 tons per year of this. The equipment is being obtained from France now and a good market is expected. The product will be more expensive than ordinary cheese but presented in small portions of 30 grammes should be readily saleable.

The product would be cheaper if there were less tax to pay. Taxes on production and consumption amount to about 36 per cent of the cost in the case of both blue and casacavalle cheeses. This is quite apart from social insurance charges. Costs would also be lower if they undertook their own distribution, thus avoiding middlemen.

The wholesale price allows 80 millimes/kilogramme profit margin, a further 100-110 millimes/kilogramme is added for the retail price.

The producer's profits are fixed at 65 millimes/kilogramme for blue cheese and 67 millimes/kilogramme for casacavalle.

The factory has 20 workers. The capital cost of the factory was DR.135,000. The cost of imported materials is high. Thus, a wooden box to hold six cheeses costs 40 millimes, compared to 28 millimes in France. The process is to mix the milk, pass through a heat exchanger, add the ferment, store the curds at 18 degrees centigrade for six days, turning over regularly every two days to allow the whey to exude. Then keep for three months to mature at nine degrees centigrade and 90 per cent r.h. (as in the caves at Roquefort). Finally, it is kept at two degrees centigrade for storage for as long as one year. The lengthy process of maturing adds to the expenses and so does the labour involved in turning each cheese over so frequently.

It is hoped according to the Ten-Year Plan to increase the cattle and sheep population (see also under Meat products, below) with the result that net production of milk and meat in 1971 is expected to be as follows:

TABLE T. 7

	North		Centre and South	
	Milk (m.l.)	Meat (1,000 tons live weight)	Milk (m.l.)	Meat (1,000 tons live weight)
Milk cattle	87.5	-	-	-
Mixed cattle	160	-	-	-
Meat cattle	-	33	-	-
Total	247.5	33	2.2	0.2
Sheep milk	10	-	-	-
Sheep meat	-	15	-	-
Total sheep	10	15	-	10

It is also anticipated in the Plan that there will be a 40 per cent increase in forage supplies between 1958 and 1971.

In addition to increasing the total quantity of milk produced, there are also considerations of quality, including freedom of cattle from disease, as well as problems of refrigerated collecting centres and transport of milk to processing plants. However, if the plans summarized above are anything like fulfilled, and made the basis for further developments, there should be a continuing increase in demand for milk processing plants throughout the 1970's.

Recommendations

The successful development of the milk pasteurizing industry in Tunis should be extended there so as to include all milk supplies. And the other principal towns, such as Sfax, Sousse and Bizerta, should also be provided with pasteurization and milk processing plants. Capital would need to be obtained for these extensions. The training of managers and staff should be proceeded with as soon as possible. Above all, steps should be taken to improve cattle population in numbers and in quality.

The necessary collection and storage arrangements will also need to be provided to match the supplies and processing capacity. Legislation to make pasteurization compulsory in the towns and to control distribution so as to ensure safety should be practicable sooner in a country the size of Tunisia which has already made such strides in milk processing in the capital, than in some of the other countries of the sub-region.

As regards sheep's milk, efforts should be made to develop further collecting units for salvaging the sheeps' milk that is at present lost and turning it into an economical variety of cheese.

Meat products

As has already been commented, the latest nutritional survey data show that the average Tunisian diet is deficient in protein.

Present meat consumption amounts to only about 20 g per head per day, including poultry and rabbits. Nevertheless, as can be seen from the table at the beginning of this section, meat is the dearest food and the most expensive single item in the average domestic food budget. Assuming a population of $4\frac{1}{2}$ million, the total meat consumption of Tunisia is therefore about 33,000 tons a year.

Livestock populations in 1959/60 were reported to be as follows:

Cattle	620,000
Sheep	3,900,000
Goats	850,000
Camels	170,000

According to the forecasts given in the Ten-Year Plan, it is hoped by 1971 to raise the cattle population to 395,000 (cf. 620,000 quoted above for 1959/60) of which 105,000 will be young, and the sheep to 6 million of which 2 million will be young. DR. 69.5 m. investments will be necessary.

The resulting net production of milk and meat planned for 1971, as reproduced above under milk and milk products, anticipates live weights of 33,000 tons of beef and 25,000 tons of mutton, 10,000 tons of which is expected from the Central and Southern areas.

However, apart from the necessary abattoirs and chilling and transport facilities, it does not seem that this level of production is likely to support a significant meat processing industry.

Regarding longer-term prospects FAO has been investigating for the last 5 years whether it was possible to utilize the Central area of Tunisia (which would be regarded as a desert in Australian terms) more effectively. An 800 ha experimental farm was established in a region where the population density was only one person per 3 ha and one sheep per 3 - 4 ha in an average year. The rainfall is very variable and the effects of micro-climate can be significant. As much as 6 in. can fall in the winter. However, in 1965 although 2 in. fell in

December, this was too late for the stock. In these circumstances the sheep have to be taken north on a two-week trek, in the course of which they lose weight, and then have to be taken back again later. This unpredictability is a difficulty. A small part of the experimental farm is irrigated by means of a deep well giving 1 million cubic metres of water in a year. If the output of this were used correctly, i.e. continuously, production could be increased. Further wells could be dug but at present the existing water supply is still not being fully used. With good management of the water it would be possible to increase production so as to have an area of, say, 20,000 ha under irrigation, with 50 people per ha, and thus support the increase in population to 1 million anticipated by 1985 in the central area.

However, watering is expensive, even for a farm of 20 to 40 ha. Expressed on the basis of "fodder units", i.e. the equivalent of 1 kg of barley grain, which costs 10 millimes, forage produced under irrigation costs twice as much. Using water to produce a crop would therefore be more economic than to produce forage for sheep.

Ministerial food industry policy relies on improving their manufactured products so that they can be exported to obtain currency to buy equipment, rather than producing food for home consumption. At the same time, the price of meat is 650 millimes per kg compared with 385 - 400 millimes/day as the salary of an agricultural worker (10 DR. per month) and the average family is about five in number, so that a large part of the family income goes on food.

FAO having proved in the last five years that it is not economically profitable to produce meat on rain-fed forage, it is now intended to test in the North (where rainfall is 21 in.) whether it is profitable on rain-fed forage. Ground-nuts could in fact be grown in Central Tunisia but this would not be of much use because they would only be good for oil extraction, not for table use, and the Tunisians prefer their own olive oil.

There certainly seems a potential for raising production of meat here. However, the selection of suitable breeds of cattle takes a long time. Also managers need to be trained to run farms, which again takes a long time because schools cannot teach this sort of thing, only the experiences of actually running a farm.

Furthermore, successful endeavour depends not only on the soil and the management, but also in the human factor, and an element of determination is required to increase production which does not come naturally, particularly in this part of the world.

Recommendation

Until the results of these further investigations are known, in, say, 5 years time, it would be unsafe to speculate about the possibilities of developing meat processing in Tunisia.

Fish and fish products

Tunisia, like Algeria and Libya, is dependent for its fish on the Mediterranean which is not as rich as the Atlantic. However, it is realized that production is quite low compared with some of the other Mediterranean countries. With the small vessels used, there is often a lack of fish in the winter owing to bad weather because of the prevailing westerly winds blowing off the land.

The Office National des Pêches assumes responsibility for the commercialization of the whole production, both from the private fisheries and the co-operative sector.

Prices are agreed between producers and the ONP (which is itself also a producer) based on the working of 8 regional committees, the chairman of which is the governor in each of the regions - both fishermen and consumers being represented. These decide the initial wholesale and selling prices. The wholesale price is supposed to be 80 per cent of the retail price, which is regarded as a satisfactorily high figure compared with other countries. However, the figures reproduced above for food costs from FAO sources indicate an increase of 104 per

cent between the two prices. The ONP also fixes retail prices for those governorates inland where fish is not caught, taking therefore a broader national view than middlemen would. Regarding the organization of distribution, there are now 150 selling points for fish, including the municipal communal markets and also three overseas selling points in Italy, France and Algeria. Trading relations also exist with Switzerland, Libya, Holland and Greece which receive fresh and deep frozen fish by air. The catch is now about 30,000 tons a year, 1966 being an exceptionally good year. 6,000 tons of sardines and other blue fishes were canned of which 1,500 tons were exported.

Exports of fish including sponges, amounted to about DR. 1 million. There are plans for creation of additional selling points at home in order to sell an extra amount of about 2,000 tons which at present goes for fish meal because there is no market for it. 50 additional selling points equipped with cold stores are to be installed so as to reach the smaller villages. There will in 1967 be 500 such points for fish only in Tunisia.

Prices of fish vary from 10 m. to 1 DR./kg but mostly lie between 200 and 300 millimes. Sardines are as low as 50 M/kg at times, and often only between 80 m. and 100 m. Only four or five types exceed 500 M/kg (including dorade, loup and crevette). For most varieties the retail price is 100-300 M. (cf. the FAO average figure of 395M.). Canned fish costs 60-65 M. per can (for sardines).

For fresh fish distribution there are 60 trucks and small lorries, some insulated and some refrigerated for transport at low temperatures. Liquid nitrogen is apparently considered to be very cheap means for transport at 20°C.

To increase production, new harbours are being created and existing installations improved with a view to stepping up the catch to 40,000 tons by 1970. For example, the area of Kalibia, on Cape Bon, is not yet exploited because there is no harbour. Studies were therefore made

regarding the depth of water. It was concluded that there could be considerable possibilities for production of "white" fish by trawlers and also of "blue" fish.

This harbour, which has just been completed will accommodate ten trawlers and ten other vessels equipped for light fishing. These should result in 1968 in a catch of 1,000 tons of "white" fish (compared with nil at present) plus 1,000 tons of "blue" fish, compared with 600 tons from the light fishing at present. Coastal fish caught by small vessels should likewise increase from 450 to 1,200 tons output per annum and the total catch from 1,260 to 3,550 tons.

In addition, Tabarca, near Algerian frontier, will be more fully exploited so that trawlers will be able to fish from and land there. By this means in 1968 1,100 tons are hoped for, plus 500 tons, from the light fishing, as compared with a very small catch of about 10 tons at present, as well as 250 tons from the coastal fishery (compared to 100 tons at present). Information is lacking as to possibilities along the southern part of the coast line. It could possibly be very rich, because in May and June Italian ships are known to be fishing close by. Prospecting was begun in 1966, considering "blue" fish at first. It is thought that in the next two years trawlable grounds will be located. For harbours, possibilities of Djerba Island, at Sardis, are being studied. It is hoped at the most optimistic that a factory might be built there for "blue" fish. At Gabes also there is a project for a small, new fishing harbour and for improvement of the existing harbour.

Kalibia is being built by arrangement with Sweden. For the other harbours, they do not yet know what arrangements will be made.

The greatest increase in production, however, is expected to be from the various harbours in the Bizerta Governorate, as follows (in tons of fish):

<u>1966</u>			<u>Total</u>	<u>1968</u>			<u>Total</u>
Trawling	Light Fishing	Fish		Trawling	Light Fishing	Fish	
400	150	1,430		2,700	1,800	6,510	

A total catch of 36,740 tons is anticipated by 1968, with a further increase to 48,010 tons by 1971, when the Ten-Year Plan comes to an end. A fishing school has been created at Kalibia to give instruction in use of modern equipment.

It is hoped in the course of the next four years to have more and larger vessels, properly used, with a higher profitability, because production is quite low compared with other Mediterranean countries. FAO has been of considerable help in the North and East by establishing fishery maps.

It is planned to provide ten new trawlers every year for each of the four years 1965-1968. These are expected to result in an increase in total production of 5,000 tons annually. They are being obtained from Yugoslavia (five vessels having already been delivered), Canada, Spain and France. A further ten have also been ordered.

Fish processing presents important problems. Eighteen canning factories at present are working very badly with very old equipment. An attempt is now being made to group these into four or five large factories, with a capacity of 40-50 tons per day each. The intention is to modernize the factories and increase their production from 3,000 to 6,000 tons of "blue" fish and from 500 to 1,600 tons of tuna a year.

The following figures show that there has been no real increase in the output of canned "blue" fish during the past eight years.

	<u>1956</u>	<u>1964</u>
Sardines and sardinelles	3,910	1,862
Tuna and "petit thon"	556	1,900
	<u>4,466</u>	<u>3,762</u>

These factories are over-equipped in relation to the supplies available and it is intended that this situation should be improved. Investments foreseen include a cannery for "blue" fish at Bizerta to serve the Gulf of Bizerta and the waters around Tabarca with a capacity of 10 tons a day, costing DR. 50,000 (guaranteed by ONP). There will also be a tuna cannery at Gabes created on the initiative of the local authorities, and arising out of a regrouping of the handicraft scale canners of Gabes and Djerba. The capacity is to be 10-15 tons per day and the investment DR. 50,000.

In addition to sardines, sardinelles and tuna, it is thought that it will be possible to can crevette, calimar (octopus), shellfish and mackerel and anchovy. The critical problem is whether all this can be done profitably.

Attention is also being given to the possibility of canning fish in 5 kilogramme to 10 kilogramme cans to provide cheap food for school feeding and army supplies and also for social assistance in 1967. Trials carried out in 1966 gave good results so far as consumer response was concerned. It is hoped that fish canned in this way in olive oil will cost only 150-200 millimes per kilogramme. This process would be particularly valuable for those fish which cannot conveniently be packed in small cans (e.g. "sorelle"), but which are very acceptable nevertheless.

There used to be a small industry in the South for drying fish hung in the sun on galvanized rods which amounted to about 300 - 400 tons per year. However, this was stopped because the product was too expensive. The process was good for sardines except when there was too much oil in the fish.

The financing of the fish industry development described above will be based partly on existing resources plus credits from Yugoslavia, East Germany and Tunisian Banks. No help is being obtained from the Government, except via the Development Bank, from which a DR. 6 million

credit was obtained. 6,000 small ships are also needed to replace the present fleet, some of which are at present very old, and powered only by sails. It is expected that these will be replaced by plastic vessels and it is hoped at the same time to reduce the number. Fitted with engines, these should increase their catch, which is of the most valuable fish ("poisson de luxe").

Thus, it is hoped at the same time to improve the standard of living of the fishermen and provide a better supply of fish for the population.

As regards fish meal, there are at present three units at Tunis, Monastir and Mahdia, using offal and unsaleable fish, the production being 600 to 1,000 tons a year. This is mostly sold locally for cattle feeding. Production will be going up because as the fishery develops there will be more offal. According to one account, the factory in Tunis will cover Northern Tunisia and one other is sufficient for the centre and south.

According to another, the three above units will be modernized with a view to a better utilization of the raw material in the North and Cape Bon, the capital investments required being DR. 20,000. No further factories are required, the present ones being capable of an output of 2,000 tons yearly.

Additional capital investment of DR. 6 million will be required for about 4,000 of the small plastic boats (the rest being provided from resources), and the 500 per year which have to be replaced. So that for the four-year plan 6,000 are required altogether. Three thousand of these are to be of $6\frac{1}{2}$ metres in length, 2,000 of 8 metres, 1,000 of 10 metres and fitted with engines of 13, 31 and 80 horsepower respectively.

A year was spent in studying plans, and some vessels have now been built and are undergoing trials, in order to convince the fishermen. Including the ten new trawlers each year from 1965 to 1968, a total of

50 is required altogether before 1971. Ice factories are planned in the governorates of Medenine ($2\frac{1}{2}$ tons per day) in 1966, Gabes ($4\frac{1}{2}$ tons per day) in 1967, and Sousse (10 tons per day) in 1968. The total investments envisaged for all these developments year by year are as follows (in 1,000 DR):

TABLE T. 8

	Total	Tunisian currency	Foreign sources
1965 ..	566.55	241.2	325.35
1966 ..	536.85	216.5	320.35
1967 ..	554.3	229.5	324.8
1968 ..	573.3	223.5	348.8
Total	2,231	910.7	1,320.3

Plans are also being studied for fishing for sardines in the Atlantic using Torry-type freezers so that canning factories can operate all year round. Two freezing factory ships are envisaged of 450 tons each. East Germany and Yugoslavia would be building those and they would be paid for by the resulting production.

Recommendation

The various steps being taken and plans worked out to increase fish production in Tunisia will require capital for financing. However, in relation to the more distant proposition to send freezing factory ships into the Atlantic to catch sardines for subsequent canning in Tunisia, it would seem preferable to consider first the possibility of importing frozen sardines from Morocco.

Further steps need to be taken to reduce prices and increase consumption of fish in Tunisia itself, rather than looking on fish such as sardines as raw material primarily for canning and export.

Cereals

Cereals were the French farmers' main crop. But the system of colonization produced special prices and the system of protection falsified the economics. As a result the French cultivated marginal lands in two directions:

- (i) by cultivating with tractors up the slopes of hillsides (thus contributing to soil erosion) and
- (ii) by going further south.

This marginal land is now being converted to cattle range. The official policy of the Ministry of Agriculture is to diminish the acreage given over the cereals in favour of crops that are more profitable, e.g. forage, to produce meat and milk, and also exportable products. The average output has fallen since the French colonists left (the last ones going in 1964 - no foreigner can now own more than 1 ha) as a result of a decline in management. Less fertilizer is being used since 1958 and the farms taken over from the colonists are run by a board, pending the establishment of co-operative.

Cereals do not require much labour in cultivation. The French used machines in a mid-West technique. Tunisians still farm with machines instead of taking advantage of the plentiful supplies of labour that are available.

Agriculture occupies 70 per cent of the male population. In the Ten-Year Plan for 1962-1971, 238 millimes DR. were to be invested in agriculture out of a total of DR. 896 millimes. The Government were managing in 1963, 600,000 ha representing 40 per cent of total production.

The United States surplus cereals are imported (accounting for most of the 210,000 tons of wheat imported in 1964/65) particularly soft wheat for bread, whilst durum wheat is exported. Durum production in 1962/63 was 335,000 tons (about 1 million ha being sown). The

growing of soft wheat for bread was introduced by European farmers, and output has been declining since they left. It amounted to 73,000 tons in 1962/63 so that total wheat production was 408,000 tons. There does not seem much hope of any large increase in production for the future. Furthermore, the French had already selected the best varieties to grow so that there is little progress possible in this direction either.

Flour mills are all privately owned, although their operations are controlled to some extent by the Office des Cereales. Apart from wheat milled for "auto-consumption" and by handicraft scale mills, there are about 20 important small- and medium-sized industrial mills, mainly around Tunis (apart from ones in Sousse, Sfax and the South-West), with a total installed capacity of 380,000 tons/year, whereas the actual production for 1963 was 275,000 tons, i.e. about 72 per cent of capacity, yielding 220,000 tons of flour, and this had been fairly constant since about 1959. Some mills, e.g. that at Beja, are sited near the centre of production rather than centres of urban population, but this is not a success.

The Cereals Office in Tunis considers that there is adequate milling equipment. Regarding silos, a general study is under way of future requirements in relation to the Plan. Fully mechanized stores are envisaged especially for the large towns. New installations can be financed out of the tax of 20 millimes/quintal paid by the consumer. If after three years the sum accumulated is not reinvested, the money goes into a pool. Finance for new equipment is not therefore a problem.

In spite of the increase in population which demands more and more milling capacity, the Ten-year Plan makes no provision for new mills.

However, a fund of an average of DR. 70,000/year is available for this.

The proportion of production that goes through the flour mills varies from 65-90 per cent. When there is a good harvest, "auto-consumption" falls, when it is bad (as in 1965), it reaches a maximum.

Great elasticity is therefore necessary for the capacity of flour mills. Small mills for "auto-consumption" exist over the whole territory. At one time there were a lot of small factories, which disturbed the organization.

There seems no need for large outside investments in the future however and authorization to construct new mills can be obtained when justified.

Pastas

There are 65 factories for couscous and macaroni of which only 32 are functioning, the theoretical total capacity being 66,000 tons a year. The actual production is only about 30,000 tons because exports to France stopped after ECE became effective, and the poorer factories have therefore stopped working. In addition, many of the Italians have also left.

It was hoped in the first three years, 1962-64 of the Ten-Year Plan to raise production to 40,000 tons of which 3,000 tons would be exported by 1964. In fact, the total has still varied from 31,000 to 36,000 tons in this period with 2,000 - 3,000 tons exported.

Bakeries

These number 1,400 mainly for "auto-consumption" as Arabic type flat bread loaves (see section on the UAR for discussion of this). When there is a bad season people tend to buy the finished product, therefore the equipment is sometimes excessive. In a good season, large bakeries are in competition with small producers. Many of the latter however are finding that they cannot survive because they often have to sell bread below the cost of production, and thus contract debts and go out of business.

Attempts have been made to interest small bakers in co-operating to form larger units. Most bread is sold by grocers who as middlemen see only profits and this again is bad for the small bakers. It is

estimated that 50 per cent of the production is wasted by going stale as a result of this. To avoid useless competition and reduce wastage to a minimum is the object of the Commission of Bakeries, supported by master bakers, workers and professional people and involving also the Neo-Destour Party political organization and the village communal administrative system as well as the Ministry of Health. These suggested solutions for local situations and after 2-3 years a better regroupment of bakeries was organized. A special office was established for a training course on how to keep accounts and also general education, including child care, with the object of protecting the producer. The next step now is to protect the consumer.

A specialized centre was created for improving the workers by means of a fund provided by a levy of 60 millimes per quintal of flour. Bakers' societies or co-operatives can then apply for grants from the fund which can amount to DR. 200 per quintal processed daily for the improvement of conditions. If this grant is not sufficient, extra finance can be lent without interest and in fact DR. 80,000 has been invested in this way annually. The problems of the very small bakeries are now under study.

The price of bread is 50 millimes/700 gramme loaf. For people who wish a de luxe loaf, the cost is 52 millimes/kilo, part of the difference going to subsidize the standard loaf.

Flour costs 705 millimes + 60 millimes levy = 760 millimes/kilo as supplied to the baker.

The consumption of bread in the towns is rising but less rapidly than the increase in population (less than 2 per cent increase per annum as compared with 2.3 per cent). There therefore appears no signs of a changeover from couscous to bread consumption as yet.

Biscuit production is increasing due to the rise in the standard of living following economic development. Consumption is now covered by an annual production of 1,500 tons, using modern equipment. Exports

seem quite a possibility. Biscottes (rusks) are still being imported but a factory will soon be created to produce these in spite of the relatively small consumption of 120 tons/year, which may however increase.

Beer

Production has been expanding steadily from 113,000 hectolitres in 1959 to 200,000 hectolitres in 1964.

Baby foods

There are possibilities for the development of protein-rich food mixtures for infants and children in Tunisia. The availability of and needs for weaning foods are as critical as in Algeria, but there seemed earlier somewhat less interest in FAO/UNICEF proposals in Governmental quarters. Now, however, it is hoped that a company may make these foods in Tunisia (along similar lines to the project under S.M. SEMPAC in Algeria). In a recent official paper presented in February 1966, it is stated that two projects will soon be realized with the assistance of groups of foreign specialists. The investments projected amounts to DR. 60,000 for 600 tons production a year, of which appreciable quantities will be exported.

Recommendation

Again, as a staple industry, the cereal milling, flour-utilization and allied industries of Tunisia seem able to provide their own capital for expansion as and when this is necessary and are in no urgent need of outside financial assistance. Further, it does not seem particularly profitable to try and apply a sub-regional approach to such industries.

Edible oils

Olive oil

The average yield is about 40,000 to 45,000 tons a year but production varies with climatic vagaries from 100,000 to 20,000, one year in ten being exceptionally good. The 1965/66 season was particularly bad although it was hoped that 20,000 would be attained. The olive

tree bears a biennial rhythm and also fruits on the new branches, so that if there is no rain one year, the branches are restricted for the next also, and sometimes yield can therefore be doubly low. At the same time it is hoped that exports will amount to 35,000 tons. Soya oil from the USA will doubtless have to be added to the lower consumer grades for home consumption, although this will not be liked by the population, olive oil along with couscous being the staple foodstuffs.

Sfax and Sousse (in the Sahel) are the chief centres for olive oil. But the age of the trees is between 30 and 80 years and the production of the older trees is now due to fall, although many new trees in the north-west, now bearing, have filled the gap.

A production averaging 80,000 to 85,000 tons is envisaged by the Ministry of Industry. A 50 per cent increase is expected in the long-term plan between 1964 and 1971 and thereafter it is hoped that it would be doubled again by 1985, by which time new trees planted in 1971 will begin to bear. It is planned to plant other trees in 1977.

However, some experts doubted the reliability of these estimates as the plan depends on growing olives in ground never previously used for olive cultivation. It still therefore has to be seen whether the increase in production predicted by the plan can be achieved. Irrigation cannot be looked to for an increase in crop because it is always possible that there will be no rain in this area and there is either no subsoil water or else a probability that it will be saline.

The first stage of re-organization is regional regrouping of handicraft units using archaic methods, thus reducing the number of enterprises now standing at 2,500 units. Experimentation is proceeding with new techniques as an alternative to cold crushing and pressing. At Enfida a pilot plant is investigating the extraction of oil by centrifuging the crushed pulp. There is also a factory for the treatment of by-products (cake, seeds, etc.). Investments are to be of the order of DR. 455,000 (for three extraction lines and a by-products unit).

The Office de l'Huile d'olive de Tunisie is also erecting storage tanks for 30,000 tons at a cost of DR. 960,000. "Grignons" are being treated by solvents to extract an oil more or less acid for refining to produce soap. The refinery equipment is sufficient. Since 1962 the coefficient of utilization has increased by importing raw seed oils which are refined before being delivered for consumption.

A project for hydrogenation of animal and vegetable oils is under study. The distillation of fatty acids is also being studied as a possible project.

As regards Margarine the existing unit is of small capacity but modernization will only be envisaged when consumption becomes more important.

In general, olive oil crushing is over-equipped, except sometimes in the north, but it is necessary to take into account of the occasional exceptional season. Extraction of "grignons" is less over-equipped. There is refining capacity for 72,000 tons per year (200 tons a day).

The animal-driven "huileries" need modernization. Removal of surplus equipment to other regions has been considered. The official view is that there is need for more co-operatives.

Training of key people is regarded as of great importance. Already 43 co-operatives of formerly small-scale producers have been formed and 800 factories equipped with new equipment. Equipment generally is considered by the Office de l'Huile to be sufficient until 1980.

The research budget for oil is now about DR. 20,000 a year, whereas a production of 8 million kilogrammes of oil, say, is worth about DR. 20 million, i.e. 0.1 per cent of turnover goes to research.

The world market for olive oil is not expected to increase much, because other oils are in competition. The Office and the international organization (the International Olive Oil Council representing 97 per cent of producers) are working to promote an increase in the consumption of olive oil, both in countries that already consume it and those that do not.

Fourteen years ago Tunisia was in favour of home consumption of its own olive oil. But in 1962, it began to increase supplies of vegetable seed oils for domestic consumption and correspondingly to increase export of olive oil. This latter period was of limited duration (i) because production of olive oil is increasing and (ii) because it is expected that export difficulties will increase. The international market is not large and it is therefore becoming of primary importance for producing countries to consume their own produce. Olive oil costs 50 per cent more than other oils. About 50 per cent of each type is consumed in Tunisia at the present time. The total oil consumption is 50 million kilogrammes a year of which 25 million kilogrammes are olive oil and 25 million kilogrammes are other vegetable seed oils.

Recommendation

The olive oil industry of Tunisia is well organized because of its export value. The new equipment being provided does not seem to necessitate substantial external financial assistance. It is concluded that there is no cause for considering any special arrangements for capital investment before 1980.

Sugar

The consumption of sugar in Tunisia in 1964 was around 100,000 tons (63 grammes/head/day) of which only 5,000 tons was home produced from 4,000 hectares producing 60,000-70,000 tons of sugar-beet. One beet sugar factory began operations in June 1962 with a capacity of 1,500-1,600 tons of beet/day. This culture could be extended and productivity increased. It is not foreseen in the present planning that there will be an increase in the capacity of the units either for extraction or refinery. The only investment foreseen concerns creation of a store (costing DR. 250,000). The factory at Beja extracted 70,000 tons of beet in 1964 and an input of 120,000 tons is foreseen by 1968, corresponding with 8,000 and 14,000 tons of sugar respectively. "Raws" are also imported for refining in preference to importing refined sugar.

There is a factory in Tunis for making sugar loaves, as preferred by Arabs, with two lines of 25,000 tons/year capacity. Over and above home consumption, 10,000 tons of refined sugar can be exported notably to Libya.

A project for utilizing the molasses from the Beja factory is about to be realized. It will have a capacity of 1,300 tons/year, which could easily be increased to 2,000 tons. The investment would be DR. 340,000 to 400,000.

The possibility of a factory for starch and derivatives (including glucose and dextrine) is being studied. The investments foreseen are DR. 520,000 for the production of 1,800 tons of starch and 1,700 tons of glucose/year.

Beja could do better with irrigation, but the beet is mostly grown dry. However, although the refining of imported "raws" is the main objective at present, it is hoped to become 75 per cent independent of foreign supplies eventually.

The cost price of sugar is 35-40 millimes/kilogramme;

The price to industry is 45-50 millimes/kilogramme;

70 millimes is the retail selling price for granulated sugar, and 110 millimes for sugar loaves.

Confectionery and chocolate

The present production meets requirements. Traditional exports to Algeria are about to be re-established. The actual production is 4,000 tons plus 800 tons of chocolate.

Recommendation

Although Tunisia aims at 70 per cent self-sufficiency in sugar production from locally grown beet, it still has a very long way to go to achieve this. It would seem preferable to consider trading relations with other North African countries such as the UAR and the Sudan which should eventually be able to provide much of the "raws"

and refined sugar required in the sub-region, although how the price will compare with what is available on the world market, or obtainable on a short-term basis from Eastern Europe, for example, remains to be seen.

Fruit and vegetable preservation

General background

There is very big potential for fruit and vegetable production and processing in Tunisia, particularly in the Medjerda Valley with its developed irrigation system, which is so important that it has a separate Government department. However, it is alluvial and has problems of drainage and management, and heavy winter rains can cause trouble. Good managers are available, however, and the Office actually receives more money than the Ministry of Agriculture.

Forty thousand hectares of irrigated land is the objective. The area is never completely dry (as in Central Tunisia). There is always some rain and there are almost never frosts and no drying winds such as blow off the Sahara.

Fresh fruit can be exported very easily, but this has to compete with the produce of Italy, Spain and the South of France, where the climate and dates of ripening are roughly similar. However, exportation costs are appreciably higher in Tunisia and the less developed a country is the greater are its costs, because it is necessary to import knowledge, machinery and fertilizers and all these result in higher costs of production.

Projection of possible production and demand for materials such as vegetables is very difficult to arrive at in these industries, as FAO has found in formulating its World Indicative Plan for 1985. Coefficients of elasticity are most difficult to establish, both internally and as regards the possibilities of export. With fruits the planting of many new trees is envisaged in the Plan. This includes citrus and apricots, etc., and, like the olives, these will not come into production for some time.

The forecasts of future tree-fruit production given in the Ten-Year Plan are as follows (in 1,000 tons):

TABLE T. 10

	1962	1971	1985
Olives for oil	75	110	235
Table olives	1-1-2	1-2	32
Apricots (late)	8	30	80
Apricots (early)	sm.	2	12
Almonds	6	7	13
Plums	5	10	25
Figs	60	60	90
Figs for drying	-	0.15	0.15
Palm - "Deglat"	6	18	24
Palm - "Alig"	-	160	166
Peach (early)	sm.	sm.	50
Peach (late)	65	97	110
Apple	5.7	25	25
Pear	1.7	3	4
Cherry	sm.	2	15

Sm. = Small

The total investment required for this was estimated to be about DR. 49 million of which irrigated tree culture amounted to DR. 7.7 m. and dry tree culture, DR. 41.3 m.

It is anticipated that this increased fruit and vegetable production will be largely exported fresh and processed.

For oranges, the production is 100,000 tons a year, and the industrial utilization negligible, mostly for the production of juice which is not yet very important. It is hoped to reach 140,000 tons a year by

1968 which will provide sufficient raw material for all the processing available (see next section). In the case of apricots, 16,000 tons a year are now being produced and 6,000 tons of these go to industry for canning and jam manufacture. Grapes nearly all go for wine, although grape juice preserved with sugar is a possibility of which only a trial 100 hectolitres have so far been produced. One million eight hundred thousand hectolitres of wine is produced (including some 200,000 hectolitres of non-fermented, non-alcoholic juice).

Peaches are not yet available for industrial processing, as they are all being sold fresh at present. Jam is a possible outlet, as it is also for citrus fruit (and although bitter oranges are not much grown this type of marmalade may not be universally preferred, as it is in the UK, for example).

The increase in vegetable production (in 1,000 tons) foreseen by the Plan is:

TABLE T. 11

	1961	1971
Potatoes	27	73.5
Early tomatoes	-	30
Main crop tomatoes	55	141.25
Late tomatoes	-	5
Pimento, early	-	1.5
Pimento, late	37	65.64
Artichokes	8	41.5
Peas	9	17.1
Haricots	0.7	6.6
Cucumbers, early	-	6.3
Cucumbers, main crop	50	94.5
Herbs	3	5.3
Asparagus	0.2	1.1
Winter salads, irrigated	75	227.5
Winter salads, dry	50	50
	<u>314.92</u>	<u>777.40</u>

The investment required for the above is estimated at DR. 12.3 million (at 1959/60 prices) before 1971.

Although all this projected increase in fruit and vegetable production for the future still has to be substantiated, there seems little doubt that Tunisia is a suitable area for such developments, and that there will in fact be a considerable increase in the quantities of fruit and vegetables available for processing. It is equally true that the extra production will still have to be marketed, and that the quality and price will have to be right, whether at home or abroad.

Tomatoes are used for production of 14,000 tons of concentrate, although last year the figure reached 17,000 tons. Pimento, both pulp and concentrate, amounts to 4,000 tons, but production is not specially developed and it should easily be possible to produce 5,000 tons. Pimento is also dried in the sun.

Obtaining sufficient supplies to keep factories busy steadily throughout the season is a problem that affects any consideration of "over-capacity". Only if early, middle and late varieties can all be used can an industry maintain peak production - but the costs of production would not be the same in each case - i.e. they might be losing money in processing expensive raw material merely to keep the factory going.

On the other hand, in 1965 it would have been possible to obtain 20,000 tons of tomato concentrate if sufficient equipment had been available. As it was, not more than 15,000 tons could be packed during the main season. In 1966, climate conditions resulted in the possibility of a longer period of production than usual.

Furthermore, as regards marketing and production costs, considerations of "competitiveness" in the world market do not take into account the taxes imposed in various countries. Thus, Morocco has to pay a tax on exporting into Common Market countries. On the other hand Italy "dumps" its products at below cost price.

The quality of tomato products generally is regarded as good and the equipment reasonably up-to-date. But the size of units is variable. The most important factory produces 1,000 tons/year. It is important that the size of productive units should be such as to support proper control laboratories.

Cans are manufactured in a factory in Tunis, but the metal has to be imported, which makes packing expensive.

As regards investments in further production units, the Ministry of Agriculture considers that the main problem is not to produce more, but better products.

Present production and immediate plans

Fruit juice

Before 1962 there was only one cannery, for orange juice (SICC-
AFRIQUE). Since, the SICOP at Mahdia has been equipped to produce all fruit juices whilst ABIDA at Ebba Ksour has installed a tomato line. Production has risen from 800 to 2,500 tons a year and this can be increased to 10,000 tons a year by a new factory being installed at Grombalia (STOPA) which will specialize in production of citrus and grape juice. This canning plant has just been installed by Germans at Grombalia but it has apparently run into certain difficulties and is not producing yet.

A production of 5,500 tons of orange and lemon juice is foreseen and 3,500 tons of grapes processed to yield 2,500 tons of juice, the rest being apricot, peas, tomato, etc. 1964 production was:

Jam	4,261 tons
Fruits in syrup	698 "
Fruit pulp	511 "
Fruit juice	291 "
Total	<u>5,791 "</u>

Canned fruit

Apricots make up 85 per cent of this total of nearly 10,000 tons. With modifications to the STIL factory in Tunis and a new one at Kairouan (SOLEFRUITS) the capacity will be 20,000 tons/year. Production of apricots is expected to rise from 15,000 tons (fresh) in 1964 to 40,500 tons in 1968 with new plantations.

It is hoped that these will provide sufficient supplies for industrial needs.

For realization of exports to Western Europe, costs of production will have to be lowered. It is thought that the Groupement des Industries des Conserves will create conditions favourable for development.

A unit for production of date paste is also foreseen, for which investments will reach 100,000 DR for a capacity of 4 tons/day.

Vegetable canning

The growth of production has been:

TABLE T. 12

	1956	1964	Present (tons)
Tomato concentrate	708	10,508	1,200
Harissa beans	903	2,462	3,500
Artichokes	176	1,140	
(Chakohouka, etc.)	289	523	800
	2,103	14,624	18,300

The factory installations are modern and the quality of the products is considered to be excellent. It is going into markets in Africa and the Near East. Harissa is a national speciality, greatly appreciated in Algeria and in Europe.

The development of processed pimento (25,000 tons) production is foreseen for 1968 will result from full employment of equipment modernized recently.

Semiconserves

Production of pickled olives, capers, etc., has risen from 810 tons in 1956 to 1900 tons in 1964.

Fruit and vegetable dehydration

After detailed study and experimentation, an industrial scale trial is to be pursued for two seasons at Izdihar at Bejaoua (costing DR. 200,000).

The factories of PACNA at Soliman (private, formerly Italian owned) and Izdihar (co-operative) were visited to get the views of typical industrialists, and provide an interesting comparison.

Pacna packs mainly 3 products:

1. Artichokes both hearts and bottoms in March and April, 1,200 tons maximum capacity.
2. Then apricots of which 2,500 tons of pulp, syrup and jam can be packed. The cost of raw material and inadequate supplies are serious problems, which it is hoped will be solved in 3-4 years as a result of the new plantation of 12,000 trees.
3. Tomatoes, for which there is equipment for 100 tons of raw material a day.
4. Harissa - less important 200-300 tons a year for French and Belgium customers.
5. Now new cooked preparations are being produced - such as CHAKCHOUKA.

This has met with success in Sweden and Germany. It contains special proportions of tomato, pimento, onion and olive oil.

Also sauces are made for rice and pasta, and sauces without meat and curry.

A project for onion dehydration is in connexion with the Dutch Unilever Group. This will be ready next year, starting with a very small unit which will be developed if successful. There is cold store capacity at $2-3^{\circ}\text{C}$ for 400 tons of raw material, to extend the period of treating apricots by 100 per cent, which normally only lasts 2-3 weeks. There is also freezing equipment and storage room at -20°C .

However, for shortage of raw material it is 2 years since the chill stores were used to extend the season, with the result that only 1,200 tons of apricots (of 2,500 tons for full capacity) could be achieved in 1965.

Prices are also too high as a result of shortage of supplies. The exportation is only about 2,000 tons fresh for the whole of Tunisia. The price of apricots varies from 35-70 millimes/kilogramme. To be competitive only 25 millimes can be paid for industrial processing. Similarly the price for tomatoes should be 18 millimes at which it would be possible to export especially to Morocco and Greece. The actual cost is 20-30 millimes/kilogramme, depending on the season, for industry. The fresh price is 3 times this.

The international colling price is \$5.5 to 7.0 per case of 24 large tins, depending on quality for which production capacity is 1,500 tons. Similarly for apricot jam, trade was impossible because the price of apricots was 70 millimes/kilogramme. Possible markets at the right price are England, Sweden, Switzerland, France and Germany. Artichokes goes mainly to USA four times as much could have been sold with raw material at a competitive price. Therefore, it is not so much a question procuring new equipment, which is already semi-automatic, as of raw material, although the company would like to increase its automaticity.

Prices of products (per can) were as follows:

Apricot jam - 120 millimes (60 per cent fruit, 40 per cent sugar) for a kilogramme can - costing 37 millimes empty. Tunisian sugar (crystallized No.3 grade) is used.

Artichokes - heels 180 millimes (220 for luxury pack).

- hearts 120 millimes (24-28 hearts per can - the smaller ones being more expensive of. 18-22 per can)

Apricots 140 millimes (530 grammes of fruit net, 8,000 grammes gross in 220 Brix (syrup)

Peeled tomatoes 55 millimes for A 1 tall can.

It was complained that STIF get preferential treatment, due to contacts with the Bank, and also that they pack material when it is not in good conditions for canning.

Société Izdihar

This factory was created in 1959 for the purpose of commercializing local fruit and vegetables, mainly as tomato concentrate, peeled tomatoes, artichokes, apricots, etc. Originally a co-operative of 33 people, 650 are now members.

TABLE T. 13

	1959	1966
Capacity per day	60 tons	350 tons
Amount treated	3000	20,000
Capital (old Francs)	3.3m.	40m.
Investment (old Francs)	60 m.	400m.

(only 14 millions credit was obtained, the rest being provided by the company itself) Total market (old Francs). 120 millions 1,100 millions 300 workers are employed for 8 months of the year, plus 45 permanent workers, administration, etc.

One-third of the product is exported and two-thirds sold on the home market on average, although in some years none is exported. 18 millimes/kilogramme for canned tomato concentrate. Peeled tomatoes are 70 millimes/kilogramme tin.

The raw material cost is therefore 18 x 4.8 millimes/kilogramme (for 28 per cent solids product, some also being produced at 40 per cent solids. For peeled the raw material cost is something like 18 x 3.5 millimes/kilogramme (figures for reduction ratios in Roebben's report).

Exports go mainly to Near East countries, some to Algeria, when French production is poor, and Yugoslavia a little too, although not continuously.

The export price is complicated by the dumping by Italians.

Although it would be possible to increase production, exports would not automatically increase correspondingly. But a potentiality for greater production certainly exists if markets could be obtained.

Of the 16,000 tons of tomato concentrate produced in 1966, 10,000 was home consumed and therefore markets have to be found for the remaining 6,000 tons. Up to date 4,000 tons are sold certainly, but the other 2,000 tons still have to be disposed of. Bulgaria, Roumania, Italy, Spain and Portugal all produce; "dumping" occurs to add to the difficulty.

Home consumption is increasing every year. In 1956 Tunisia used only 3,200 tons of canned fruit and vegetables.

Each factory organizes exports on its own account. However, there are problems when there is only one importer to deal with, as in Eastern Europe, when a central selling organization is called for. However, in general each producer does his own export marketing.

Equipment is satisfactory, as is also the case with other factories, but some investment will be necessary before 1985.

In the fruit and vegetable processing, diversification is always a problem. Production should therefore increase every year and this would in fact need new investments.

	<u>1956</u>	<u>1966</u>
Tunisian production tomato juice (tons)	500	16,000

Future expansion should be based firstly on the improvement of existing factories and eventually by creating new units. Imports of all raw material (fertilizers, cans, equipment) make product more expensive than elsewhere. Only one foreign technician employed now, on an 8-hours' shift.

Recommendation

The main problem seems to be utilizing existing factories by providing more of the right type of raw material. Costs have to be reduced to compete in the world market. However, full-scale continuous production would help to do this. Apart from some re-equipping of existing factories, there seems little purpose in considering additional factories until more raw material is available. Products sampled seemed to be of high quality and if consistently good should be quite acceptable overseas. The home market also needs to be developed.

CHAPTER V

LIBYA

Population estimates

1959-1961	1,195,000
1963	1,517,000
1970	1,858,000
1975	2,132,000

TABLE L. 1

Production, imports and exports of processed foods in Libya
(1,000 tons)

	Production			Imports			Exports		
	1963	1964	1965	1963	1964	1965	1963	1964	1965
Meat - prepared and canned				0.3	0.5	0.5			
Milk - evaporated and condensed				3	3	6			
Milk - dried				-	1	-			
Prepared and canned shellfish				0.1					
Flour	12	7	-						
Semolina	-	4	-						
Total	12	11	-						
Biscuits	-	-	-		2	2			
Pastas	14	16	-						
Couscous	-	7	-						
Total	14	23	-	2	5	4			
Jams				sm.	sm.	sm.			
Fruit juices				1	2	3			
Tomato concentrate	6	8	-	1	-	-			
Preserved olives				1	-	-			
Sugar						18			
Chocolate and confectionery	1	1	-	sm.	1	1			
Vegetable seed oils:									
- Soya				2	5	-			
- Groundnut				3	-	-			
Total				5	5	-			
Olive oil	(5)	(5)	(5)						

Sm. = Small

TABLE L. 2

Statistics of food manufacturing in Libya (1964)

Trade category	Trade	Establishments surveyed	Wages (L.L)	Persons	Gross output	Added value (L.L m.)	Added value (L per head)
202	Macaroni manufacture	15 (2.4% of total)	373	229 (202 employees. 2.1% of total)	1	0.3	1,309
205	Canned and processed fruit & vegetables	5	302	429	1.9	1.0	2,410
206	Bakery products	65	286	538	0.7	0.22	409
208	Cocoa, chocolate and confectionery	9	321	195	0.46	0.13	640
214	Soft drinks	17	344	294	0.75	0.32	1,070
	All food manufacture (4 persons per establishment)	107	308	1,713	4.9	1.8	1,057
	All manufacturing industry	622	392	11,106	20.3	10.1	90
	Food manufacturing (4 or less employees)	1,092	217	2,144	1.6	0.6	274
	Total for all industry	7,332	207	6,012	5.2	2.4	151
	cf. petrol	45	1,720	9,657	238	155	16,050

Source: Report of Industrial Census (1964), Tripoli, 1965.

General situation

Libya has an area of 1.76 million square kilometres of which 1.664 million consists of desert with less than 100 millimetres of rainfall per annum. The country comprises three provinces, Tripolitania in the west, Cyrenaica in the east and Fezzan in the south. There are four

principal zones: (1) coastal (0 to 28 kilometres from the sea); (2) Jebel; (3) semi-desert; (4) desert (including the whole of Fezzan).

About 120,000 men are employed in industry, mining, commerce and government service.

The few principal towns are growing rapidly:

	<u>1954</u>	<u>1964</u>
Tripoli	130,000	376,000
Benghazi	60,000	280,000

This has meant a corresponding drift from the countryside, i.e. from agriculture. The national income in 1964 was L.L 118 million, as compared with a total Libyan budget of L.L 3 million in 1951-52 and only L.L 6 million in 1961-62. Oil revenues are growing rapidly: 1963/64 L.L 23 million; 1964/65 L.L 46.5 million; 1966/67 L.L 138 million (estimated).

An oil output of 50 million tons/year is expected in 1967 rising to nearly 100 million by 1970, which is equal to the present production of Kuwait, the largest Middle East oil producer.

Libya therefore has by far the lowest population and density of any country in North Africa. The discovery of oil in 1960 which now accounts for over 99 per cent of exports has had disrupting effect on agriculture and industry by drawing away manpower and increasing wage levels. Although this new mineral wealth permits imports, the oil industry (with 10,000 workers, plus ancillary workers, possibly 20,000) and the public services (e.g. army and police force, 80,000) strip off most of the adult male working population (estimated unofficially at 130,000).

Statistics are not very reliable, even where they exist.

A new Five-Year Plan is being evolved to supersede the earlier plan. This calls for increased production and the need for more food plants, especially for vegetables, and encourages farmers to produce more fruits and vegetables and also cereals, which used to be exported at one time.

The potential for food production and processing in Libya is regarded by experts as reasonably good, although there is a shortage of water, labour and technical skills. (Drawing women more into production would seem one way of solving the problem of lack of manpower). Food processing is a very young industry and there is said to be considerable interest particularly in the private sector in increasing the variety of processed foods produced because the imports of these are so high. However, most of the raw materials have to be imported, and so also have construction materials and equipment. Libya also lacks technical skills and has to import technicians at high cost. The Government encourages and helps industry by means of loans and tax freedom for a period and exemption from land tax and import duties as well as providing protection. The main problem is how to improve standards of quality.

The value of food imports is £.L 16 million, which is about the same as the value of agricultural output. Although Libyan agricultural potential is not spectacular, it could feed its own population and still have an exportable surplus of some crops for some time ahead. It is considered that the present estimated output could probably be trebled from existing farmed areas, whilst extra production will be coming from new areas, such as Jebel Akdar in Cyrenaica.

One effect of Italian occupation was to drive the Libyans south so that they did not become involved in agriculture and now have to learn it. There are now very few Italians left in agriculture and since independence was granted in 1951/52, the yields of agriculture have been reduced. The Science Department of the University of Libya is in Tripoli (and the Arts in Benghazi) and there is also a College of Applied Technology with a Food Science Department which puts on a five-year course but has, however, not been able to make progress as yet compared with the Civil Engineering and Electrical Departments.

The National Agricultural Settlement Authority is concerned with settling people on farms, including 4,000 ex-Italian colons, at a cost of £.L 10 million. FAO specialists are closely associated with this task.

Private enterprise is encouraged. Most capital is Libyan or joint-bilateral in the ratio of 51 per cent Libyan: 49 per cent foreign. There is no shortage of capital. Only one loan has been obtained from the World Bank and that was not for food; although in an IBRD Report dated 1960, several pertinent comments were made on the food situation.

At the same time, immediately before the discovery of oil, the nutritional status of Libya was very low. The average daily calorie intake in 1960/62 was only 1,850 and total protein intake 48.8 grammes (on a dry weight basis) of which only 10 was animal protein (compared with figures of 2,560, 70 and 20 respectively for adequate nutrition).

An FAO report in 1963 to the Government of Libya on Food and Nutrition Policy set the following targets.

TABLE L. 3

g/head/day	1959	1966
Sugar	78	50
Pulses and nuts	25	40
Meat	28	30
Fish	3	20
Eggs	5	10
Milk	155	200
Fats	21	23
Calories	2,300 (cf. desirable)	2,560
Protein (g)	65	70
Of which animal	18	20

It will be seen that a considerable reduction in per capita sugar consumption was recommended, together with large increases proportionately in the consumption of milk, eggs and especially fish.

To cope with the drift of the population to the towns, urban facilities are being built up by the Government which has set a target of 100,000 houses costing £.L 400 million (the Idris project) 60 per cent of which are to be in rural areas in order to improve the amenities there and help to arrest the drift.

The Ministry of Agriculture's policy is to help to produce anything that can be produced by providing incentives. Thus farmers are paid £.L 5/quintal of wheat and £.L 4 for barley which is then sold at £.L 3/quintal. The same is the case with olive oil. The Government pays 50 per cent of the costs of chemical fertilizer, farm machinery, insecticides, pesticides, concentrated feeds and gas oil used.

As a consequence of the oil revenues, Libya is able to function somewhat as a Welfare State, by building roads, schools, hospitals, etc. The Government has a monopoly of sugar, salt and tobacco. To some extent, tribal rights stand in the way of development, as for example is the case with the commercialization of castor seeds which grow wild in profusion on common land, and with the shortage of labour, no one is willing to collect them.

The desert itself is potentially productive. The question of sand stabilization is important. Underground water and wells could help to convert it into usable soil. The Bedouins constitute a social problem. Their settlement into a more productive existence is difficult to bring about.

Also with increasing affluence, there is a proportion of unemployable labour which is being left behind in the status race. If the infrastructure is allowed to expand too rapidly it is feared that this could well lead to political problems.

The oil company's workers at present live mainly on tinned and preserved foods that are imported and obviously there is an important local market here that could be satisfied by local produce of a high enough quality.

Milk and milk products

The situation regarding milk production and imports in the recent period is indicated in the following tables:

TABLE L. 4
Milk production in 1960
(estimated)

	1,000 heads	% of popula- tion milked	No. of adult females milked ('000s)	Lactation yield (kg)	Total produc- tion (tons)
Cattle	111	25	28	400	11.2
Sheep	1,231	30	369	40	14.8
Goats	1,181	30	354	45	15.9
Camels	244	10	24	200	4.8
Total					46.7

TABLE L. 5
Approximate food balance 1962
(tons)

	Production	Gross imports	Available supplies	Kg/head/ annum
Fresh milk	46,100	358	46,458	32.0
Preserved milk	-	2,475	2,475	1.57
Milk powder	-	181	181	0.125
Cheese	-	0.645	0.645	0.444
				34.139

TABLE L. 6

Imports 1964
(tons)

Fresh milk	1,005
Evaporated and dried milk	4,614
Butter	267
Cheese	912

The estimate of milk production, reproduced above, relates to the period before the oil boom got under way. Despite the subsequent increase in affluence, most forms of agricultural productivity have diminished, that of milk probably included.

A report on the milk situation of Tripoli was made by an FAO expert as long ago as 1956. It was concluded that Tripolitania is climatically unfavourable for large-scale, economic dairy production and that all that can be hoped for is to satisfy the vital necessities of the local population. Even so, progress depended on irrigation and fodder production of the necessary quality and quantity. Milk production could only be increased by means of greatly expanded irrigation in favour of fodder production and improved grazing, followed by other measures for soil improvement. With a satisfactory price, it was felt, producers could increase production by 50 per cent within the same irrigated area, whereas at that time (1956) there was a "feeling of discouragement", with the result that "production had decreased alarmingly". On the basis of an earlier estimate, 63,000 head of milking cattle (cf. 130,000 cattle estimated population for 1960/61) were producing 95 kilogrammes/head/annum, a total of 5,985 tons, which worked out at only 0.31 litres/day for 300 days, whereas even an ewe could be relied on to give at least 0.20 litres/day for 120 days (see milk products sections in Morocco and Tunisia for further discussion of sheep milk yields). The animals used for organized milk production numbered only 1,651 of which 810 served Tripoli.

The consumption of fresh milk in Tripoli was about 5,000 litres per day, which amounted to 7.5 litres/day/cow. For 120,000 inhabitants, at that time, this worked out at 15 litres per head per year - the conclusion being that a large part of the population never sees milk.

The recommendations were that the administration of Tripolitania should create a dairying section to develop all dairy activities and improve the supply; that a dairy technician should be engaged; that a milk co-operative should be organized; that buildings should be renovated and a central dairy equipped; that milk should be sold on the basis of quality and that a "Tuberculin Tested" (TT) campaign should be started; finally, that milk should be pasteurized at 80 degrees centigrade for 15 seconds and sold in three grades, "bulk", "toned" (with the incorporation of a proportion of reconstituted dried milk) and "whole processed". Pursuance of processing of ewe and goat milk was not recommended, apart from the possibility of commercializing pecorino cheese.

An FAO livestock expert, from Australia, has now been appointed. The situation in 1966 is that there is one small milk-processing plant that is not being run technically very well, and there is discussion of another scheme to erect a new milk-pasteurizing plant. The United States base relies on a plant which reconstitutes dried milk along with butter fat. A Dutch company (STILVITA) would do more if there were more certainty of political stability and if they could also get good supplies of local milk. (They had an unfortunate experience in Morocco where a plant was erected but was not eventually approved by the authorities, so that it is now unused and no supplies are obtainable for it). A private plant now operating, is based on the pasteurization of 10,000 litres of reconstituted milk a day. This is viewed with suspicion by the experts because it is feared that if the product is bad it may ruin the market for processed milk in the future.

Distribution is poorly organized, chiefly by pedlars on bicycles. There are several farms, however, where cows are fed in batteries on solid rations, without any grazing at all. The Ministry of Agriculture, as noted earlier, subsidizes feeds, which are sold to farmers at about half-prices.

On the strength of this latter fact, an Italian has been considering importing calves for fattening, but is doubtful whether it is worth the risk because he is doubtful whether he can really count on the organization of regular deliveries of feed and so forth (see under "Meat" for discussion of new animal feeding stuffs factories).

In the meantime, grass is being imported from Italy for feeding 7,000 dairy cows, the milk production being 9,000 litres a day. Under the impact of the prosperity resulting from the oil boom, eating habits are changing rapidly and the demand for milk is increasing. It is in short supply and a lot of milk is imported, 7.5 million kilogrammes in 1965, and most people rely on "Carnation" evaporated milk. The milk industry itself is producing about 9 million kilogrammes a year, including what is used for cheese and butter. There is still no really organized dairy production on the basis of livestock farming. Practically everything that is imported can be marketed more cheaply than home produced.

An FAO dairying expert recently surveyed the local situation in 1962 in some detail and there have been no real developments since that date. Many small farms in the neighbourhood of Tripoli would have held much more stock. Sixteen farms that were surveyed could have supported a total of 1,140 head instead of the actual figure of 221 and in general they had sufficient water and electricity for the increase.

The price of milk at the farm was about four to 4.2 piastres/litre, depending on the distance from Tripoli, but supplementary feeding was regarded as too expensive. [One kilogramme of grain costs 4.5 piastres (cf. barley 2.2 piastres and bran 2.2 piastres)].

The cows were therefore in poor condition and average production per day was 4-5 l, so that production costs were high. Health was also unsatisfactory, with tuberculosis, mastitis and brucellosis prevalent. Housing was poor, so that the milk was dirty and labour was difficult because wages were low as a result of the price of milk being so low.

Some farmers have introduced milking machines but the result has not been very satisfactory, because of lack of technical and hygienic knowledge and in some cases this had led to serious complications, such as the introduction of mastitis into the stable. Co-operation with a guaranteed price and milk policy is a better proposition than an individual business man concerned only with profit as the chief motive and paying insufficient attention to production problems and requirements.

Sheep and goats milk production and utilization seemed to present greater difficulties. Where people keep sheep there is no water for irrigation and milk production therefore depends on seasonal conditions. Also many people are not used to milking sheep which would be something new and unattempted in the area. However it would be worth investigating where sheep can actually be settled (i.e. forgetting about nomadic sheep at the outset).

At present milk is transported in cans, which is unhygienic and the temperatures are high so that bacterial multiplication and consequent spoilage are rapid. There is no regulation and control and the milk is normally watered at least twice before it reaches Tripoli market at 5-5.2 piastres/litre. Other middlemen distribute retail, after further adulteration (with water and possibly milk powder) and it sells to consumers at 6.0 piastres/litre.

There are no statistics but possibly 2,500 litres of cow's milk reach Tripoli daily. With sheep's and goat's milk (and water), possibly a total of 5,000 litres are sold.

Imported fresh, condensed and powdered milk imports increased in value from L.L 85,000 in 1956 to L.L 297,000 in 1961. It is expensive and only foreigners and others with a high standard of living could afford it. A private venture, supported financially by the Government, produces pasteurized milk and sells it at 10 piastres/litre, which is beyond the purse of most people. The products were poor, largely due to lack of hygienic precautions.

The expert proposed a scheme for producing milk by a co-operative of 600-700 cows, the price received being 5 piastres/litre, for a daily production of at least 2,100 litres, using 50 per cent of reconstituted milk to keep the price down (the fat level being 1.7-1.8 per cent). There would be two insulated 3,000-litre tankers and ten cooling tanks (holding 200 litres each), milking machines and milking rooms; and an 18,000 litre/six hours a day pasteurizing plant. The total cost of all equipment with building would have been £.L 112,000.

Recommendation

The scheme FAO recommended in 1962 for a dairy co-operative milk plant in Tripoli should be followed up and extended to other urban areas as soon as conditions warrant.

Meat

Libya, which at one time exported cattle, is now essentially a meat-importing country. There are probably just over 100,000 cattle and a million-odd each of sheep and goats. Camels supply more meat than cattle. However, cattle and camels are used as a source of power as well as meat. On the other hand, animal power is becoming less important since the discovery of oil in 1960-61 on account of the provision of cheap credit and subsidized machinery and equipment to encourage mechanization.

Various estimates of recent trends in livestock and meat supplies are reproduced in the following tables, without necessarily vouching for the reliability of the assumptions, or even of the calculations.

TABLE L. 7

Livestock numbers in Libya

(1,000)

Livestock	1954	1960	1961	1965
Sheep	1,397		1,026	1,460
Goats	1,254		1,238	1,340
Cattle	142		125	109
Camels	158		247	286
Horses		29		
Mules		3		
Donkeys		122		

TABLE L. 8

Animals slaughtered and meat produced
(1965)

Animals	Numbers	Average carcass weights (kg)		
		Male	Female	Young
Sheep	548,000	20	16	14
Goats	338,000			9
Cattle	24,000	150	110	
Camels	55,000	220	170	
Meat (tons)	28,267			

TABLE L. 9

Imports of live animals and meat, etc.
(heads)

Imports	1963	1964
Sheep and lambs	54,062	30,973
Goats	1,457	275
Cattle	3,144	1,226
Camels	3,618	4,326
Poultry (live)	53,139	-
Meat, fresh, chilled or frozen	-	263
Meat, canned, etc.	200	325
Poultry, killed and dressed	-	147
Eggs (dozens)		83,333
Total value (with 2,500 tons of milk products) E.L 1.67 million		
Plus animal feed (tons)	3,960	

TABLE L. 10

Approximate food balance 1962
(tons)

	Production	Gross imports	Available supplies	Kg/hd/year
Mutton	5,982	20	6,002	4.135
Goat	2,914	-	2,914	2.008
Beef	2,452	37	2,489	1.715
Camel	4,982	-	4,982	3.433
Poultry	250	49	299	0.206
Total	16,580			11.497
Eggs	1,350	11	1,361	0.938

The animal population has decreased during the past few years. Whereas at one time there was an export trade in livestock, now they have to be imported. Alongside decreased production there is increased consumption. Thus, before the end of 1966, 60,000 head of sheep had already been imported. The cost of a Barbary sheep was about £ 15. There is not the labour available to look after large numbers of sheep any more.

FAO Animal Health Division has been associated for some years with a project for planning and installation of a slaughter house in Tripoli, which was finally to be erected by a Maltese architect. This abattoir was to be controlled by the municipality and is understood to be under contract, but as at November 1966 the funds had been frozen, so that construction was subject to further delay. The capacity was to be 24 cattle or 20 camels and 240 sheep per hour with a cold store for nine tons of meat and $1\frac{1}{4}$ tons of frozen meat. FAO had some doubts as to whether the trained personnel would be available to operate the new abattoir when completed. Four to six key slaughter men - foremen would need to be given 3-4 months' training which FAO could provide.

The manager too should have in advance of taking up his position about six months' training of modern commercial slaughterhouse management, including a knowledge of livestock markets, slaughterhouses and various systems of management and accounting. The director of the old slaughterhouse was an Italian vet. But even if he were still available, he would need a refresher course so that he could adapt himself to new practices. A local FAO expert, however, felt that it would be preferable to build the abattoir first and then bring teachers in, from Beirut, possibly.

Australia is keen to export meat to Libya. Special slaughterhouses have been established where animals can be killed in the approved Muslim fashion. But Libyans appear to prefer freshly slaughtered meat to that from cold store and the flavour of the local animals is preferred to that of those from Australia. One thousand head were brought in alive recently after shearing in Australia and slaughtered in Tripoli, but they were of the long tail type, not familiar in Libya, and they were not fatty enough for local tastes and only fetched 35-40 piastres/kilogramme - less than half the price of locally bred mutton. However, the whole operation was badly arranged by private enterprise, because the sheep were old, tough and large, with dark meat, and wether lambs might well have fared differently.

The price of mutton from best quality, home-produced Barbary sheep is about L.L 1/kilogramme. That imported from Syria and Tunisia is 80-90 piastres/kilogramme. Beef too is sold retail at about 90 piastres/kilogramme. By contrast, the average wage for an unskilled labourer is about 50 piastres/day and of a skilled worker about L.L 2/day. There is also a wide seasonal fluctuation in the price (and quality) of meat. In March 1964 it cost 45 piastres/kilogramme and was good quality, mostly lamb. Later in the year, old sheep and goats of lower quality were selling at 75 piastres/kilogramme. This is all linked up with feed management (see later).

Poultry

The output of broiler chickens is going up and private enterprise is putting them on the Tripoli market. Chicks are imported and given to farmers at cost price. It will soon be possible to meet the major portion of local demand of some 80,000 broilers per month. One concern alone will be able to handle 45,000 per month under an intensive battery system in the near future. Processing plant will have a capacity of 600-800 birds per day and will be equipped with a blast freezer and cold storage. The lack of an efficient poultry disease diagnostic service has resulted in a neglect of egg production.

The excellent climatic conditions favour poultry husbandry.

A viable livestock industry for both meat and milk production depends on suitable feeding. In the dry period at present pastures are overgrazed. And when there is drought in some areas, animals have to be transferred elsewhere, where they are in competition with goats and donkeys. As a result a loss of weight is incurred in such circumstances. It then costs twice as much in feed to make up the weight. Cattle require grass five inches long to browse but goats can dig up the roots, which is very destructive. Animals in general are starved and stunted and many lambs are still-born. Barley is not a realistic feed as it would probably leak into the black market.

A project was therefore worked out by FAO experts for manufacturing compound animal feed based on the following estimates of requirements:

TABLE L. 11
(1,000 tons)

1 million sheep	25-37
1 million goats	25-37
Cattle	5-7.5
Camels	10 - 15
Horses	7.5-10

The total requirements each summer if all animals were fed would therefore be 70,000-100,000 tons. Assuming 10 per cent acceptance, the requirements would be 7,500-10,000 tons. Adding 25,000 tons for an emergency feed reserve to cater for the one in five years' drought, plus 5,000 tons for expansion of the market, it seemed that a production of 30,000 tons per year would be a sensible target. A factory was therefore proposed near Tripoli to produce 10,000 tons a year, working eight hours a day. Various forms of local waste were considered as possible raw material for the feed, chiefly milling offals of 22,000-29,000 tons if instead of the 87,000 tons of flour imported as in 1963 (from Germany at a subsidized price for the sake of retaining the offals) 104,000-116,000 tons of wheat were imported for milling. One hundred tons of sun-dried fish meal could also have been incorporated. With proper driers, 300 tons might be produced but small and fluctuating fish catches would probably make this come out at above the world price of fish meal. Alfalfa (lucerne) is not available yet, although it has been shown that it can be grown successfully with irrigation in the coastal zone and Jefara plain; up to nine cuts per year are possible, yielding 100 tons of fodder per hectare.

The Government, however, on the evidence presented decided essentially for political and perhaps even personal reasons to construct not one factory, but two, of five tons per hour or nearly 60,000 tons per year capacity, one at Garabull about 40 kilometres east of Tripoli and another at El Alior about the same distance from Benghazi. This will mean that materials will have to be trucked to and from the factory to the main consumers near Tripoli and the populous areas. It still remains to be seen whether this decision was justifiable.

In view of possible delays in the organization of production and distribution, a large amount of storage space has been written into the feed scheme. However, the project really requires a purchasing officer with "know-how" about what materials to buy for blending.

Recommendations

Every country should make as great a contribution as possible to regional supplies by increasing local production by all possible means. Possibly Libya has the means to do this through large-scale developments in alfalfa production and feed-lot fattening of lambs from the semi-arid range areas. What is required is organization which can undertake the development of these enterprises on a large scale in the public interest, based on sound commercial procedures.

The two new animal feed plants should be put on a sound organizational basis and every effort made to line up a home market for the output with the object of increasing working so that the entire animal population can be better nourished and therefore made more productive.

Obviously, however, there is little place for meat processing in Libya in the foreseeable future.

Fish

In spite of over 2,000 kilometres length of coastline, the total fish catch of Libya, which in 1951 was 2,100 tons according to FAO statistics, had fallen by 1965/66 to about 1,000 tons, plus about 200 tons of tuna, which are canned along with sardinelles in small and primitively equipped plants and exported in a small way. At the same time, in 1964 imports of fish came to 1,400 tons, worth L.L 262,000 (or \$733,000).

There have been a number of FAO reports on the Libyan fisheries, including policy and administration, so far with no very tangible results. Libyans in fact do not like fishing and much of the present catch is landed by Italians and Greeks. Moreover, as is the case elsewhere throughout North Africa, fish is not generally liked by the inhabitants, who are traditionally meat-eaters for preference. At the high temperatures prevailing, fish not properly chilled with ice is so highly perishable that its condition must usually be very dubious by the time it is consumed, particularly at any considerable distance from the coast. It is not therefore surprising that it is more than a little suspect, and foreign to the dietary.

About one third of landings at present are sold fresh in Tripoli which has a new fish market and the rest processed. It has been reported that a ring of middlemen conspires to keep the catches down in order to keep the prices high up to 0.80 - L.L 1/kilogramme, and there is not much variety. Imported frozen fish from the United Kingdom and the USA (chiefly Bird's Eye and Stokely Brands) is cheaper in the supermarkets than locally caught.

There are at present proposals for more fishing vessels, fishermen, refrigeration stations and trucks for transport. Two trawlers will be fishing in the Atlantic for tuna, which will be frozen and brought back for canning. This is a private venture by Japanese in which Libyans will be trained. Tuna are caught off the Libyan coast around June-July.

The canned tuna sells locally at 10 piastres/can. It is liked in Libya and some is exported, valued at L.L 30,000 in 1964.

Recommendations

Further attempts should be made to exploit the Libyan coastline with suitable vessels and trained crews. Attempts should also be made to popularize fish and distribute it inland. Moroccan imports should be considered.

Edible oils

Olive oil is the only one produced in Libya and is the main source of fats for the population. Some cotton seed and sunflower oil is imported. Olive oil production varies with the season. From 1951 to 1965 the crop of olives varied between 10,000 and 100,000 tons, with an average of around 20,000 tons, yielding, as in 1964, about 5,000 tons of oil. This olive oil is processed in many mills throughout Tripolitania, although there are none in Cyrenaica. The olive oil obtained is a good quality virgin oil which is sometimes exported although not in the past few years. The Government recently built storage tanks and the farmers sold their crop to a central buying organization. However, a control system had to be set up to check on adulteration with other oils.

The crude oil then has to be reprocessed in the refinery at Tripoli so as to reduce the acid value from around 5 per cent to between half and one per cent of free fatty acid. The Government is erecting a new refinery and the increase in capacity will be sufficient to take the whole Libyan production.

By-products (i.e. press cake, known as "grignon" in French-speaking North Africa) are given a solvent extraction to yield a product with a high "free fatty acid" value, most of which goes for soap manufacture, although some is refined and blended with cold-pressed olive oil.

Although groundnuts can be grown, it is uneconomic to use them for oil extraction because they obtain a premium price as edible table nuts and are exported to Holland and England at over £.L 100/ton (compare Nigerian groundnuts for oil extraction costing £.L 70/ton). In spite of this, a Palestinian recently bought oil presses and paid £.L 65 a ton for nuts for oil extraction. However, at the present price for oil it was found to be unprofitable to pay even as much as this for nuts. (On the other hand, it might be possible to extend this area under edible nuts).

On account of the mineral oil boom, it is becoming more difficult to get workers to pick the olive crop and in consequence trees are being pulled up in some cases. Although there are machines which reduce the labour of harvesting, these are not yet very satisfactory.

There have been cases in which soya bean oil has been tinted green so as to look like olive oil and then exported to Malta and Holland. The cost in Libya is 30 piastres/kilogramme for local products, which are preferred for their high acid value, and 25 piastres/kilogramme for imported oil. There is a £.L 10/ton subsidy for oil. The world price is only 17 piastres/kilogramme.

The standards and labelling legislation is very underdeveloped and it is possible to find fish labelled "canned in pure olive oil" which is in fact not packed in olive oil at all.

The castor oil bean, although not actually used for food, could be collected on a large scale from the uncultivated wadi beds and river beds. It is very drought-resistant, but much labour is required, and it is therefore largely neglected at the present time. However, tribal rights would apparently be infringed if outsiders set about organizing its collection.

The needs for olive oil are 14,000 to 15,000 tons a year. It is easily grown, and the structure of the soil is suitable for it. The Italians planted olives along the coast and although this is not a very profitable procedure it is much better than not planting at all. These trees could well be removed now and planted further up the mountain sides, as part of a twenty-year plan. Cuttings could be taken for this propagation from existing trees. Flies and diseases would need to be kept down if the maximum cropping is to be obtained.

Vegetable ghee is imported to the extent of 4,000 tons a year. This could be produced at home by hydrogenating any type of seed oil.

Recommendations

It is doubtful whether an extension of olive cultivation can be recommended in view of labour shortage. It would be better to apply the limited agricultural manpower to activities that can be more easily mechanized. Imports of Tunisian olive oil and of vegetable seed oil either raw, refined or hydrogenated would seem to be the solution to Libya's edible oil requirements.

Cereals

More cereals could perhaps be grown by using machinery (and taking advantage of the 25 per cent subsidy) because the land is flat and there are relatively few stones in the soil. Consumption of flour is now about 120,000 tons/year. Libya has two main flour mills (one in Tripoli and the other in Benghazi) which have an installed capacity of 68,000 tons a year. However, in 1964 production was only 28,000 tons, because the Government as an anti-inflation measure allowed wheat flour

imports which amounted to 110,000 tons in 1964/65, and as a result home mills were working at less than half capacity. German firms were said to be exporting flour very cheaply for the sake of retaining the offals for animal feeding. However, Government policy has now been reversed and mills are working at fuller capacity and the offals are being used in Libya. It is planned to have in reserve one year's flour supply. Tenders have recently been called for four silos of 10,000 tons capacity each to supplement four of 2,500 tons capacity and one of 4,000 tons already in existence.

In addition to soft wheat and durum wheat, millet, rice and barley are also imported.

Pastas

In 1965, 22,114 tons of pastas (including couscous) were produced. Libya is the third largest per capita consumer of macaroni in the world, no doubt due to the former Italian influence. There are 15 establishments, many out-of-date, but also quite a few newly erected with up-to-date and automated equipment.

Biscuits

Biscuits (and also confectionery and chocolate) are made in a modern plant (producing 1,000 tons a year) and are packed in a variety of sizes and wrappings including small lots selling at only 2-3 piastres.

Recommendations

Milling is a basic activity that should be undertaken by any country, in spite of the availability of cheap flour. However, capacity for milling and utilization seem perfectly adequate at the present time, although with increasing affluence resulting from the oil boom it seems probable that more and more wheat flour will be consumed in preference to other cereals, such as couscous and rice.

Sugar

No sugar is produced in Libya and it is prominent amongst agricultural imports, the consumption being 30,000 tons in 1964, all imported in the refined state. However, the Government is being advised on the possibilities of home production by a Dutch sugar engineer. Plans are being considered for replacing 75 per cent of the imports by refining imported "raws". Also trials of sugar beet are under way on an area of 150 hectares. Assuming a return of 25 tons per hectare, and a sugar content of 16 to 16.5 per cent with a yield of 14.5 per cent, it would appear to be practicable to plant 1,000 to 1,500 hectares and extract and refine this as well as refining imported "raws" at other times of the year. In this way it would be possible to produce 30,000 to 35,000 tons of refined sugar per annum for less than the current selling price of sugar in Libya which is £.L 70 per ton.

A factory with a full production sufficient to meet the major part of the present consumption would cost £.L 1.8 million. Four thousand to 5,000 hectares would be required providing an input of 1,000 tons of beet per day for a 90-day season. Water for irrigation would be essential, but this could be made available reasonably easily. Furthermore, harvesting is very susceptible to mechanization. Already beet roots of two to three kilogrammes can be produced. The Government in November 1966 was still making up its mind on the whole proposition.

Raw sugar from Cuba was costing £.L 40 to £.L 45 a ton, but imports of refined sugar from Poland and Yugoslavia recently cost only £.L 20 a ton in sacks. However, these were of very poor quality, with much fibre and dirt, and were only specified to be "at least 97 per cent pure", the rest being ash, compared with 99.9 or 99.95 per cent for the highest quality. As against these considerations, there are not enough fresh vegetables being produced in Libya and these should probably have priority over sugar. Farming is difficult, too, on account of the shortage of farmers, and once beet is pulled it cannot be left lying about in the fields, or it begins to ferment, and loses its sugar.

Starch production from potatoes is also a possibility for Libya, using local potatoes and taking care not to water too much. Ten tons/day for a 90-day season, with a 16 per cent starch content (compared with 12 per cent for the locally grown varieties at present) and a yield of somewhat less than this, could produce 100 tons of starch per season for use in manufactured custard powders, etc., imported. Although "uneconomic" in relation to import prices, such an industry would aid training of local personnel in industrial methods and also help the country to make its full contribution to the world food situation. On the other hand, as regards priorities, it would be nutritionally more desirable to develop sea-fisheries and milk production, for example.

The present price of sugar to consumers is relatively low at 5 piastres/kilogramme and for manufacture it is 4.3 piastres. However, for the pilot-scale date and jam factory (see next section) special permission had to be obtained to import refined sugar from England in paper bags because of the impurity of that imported in sacks.

Recommendations

Although sugar beet could probably be grown and harvested with the high degree of mechanization called for by the present labour shortage, it would seem preferable for Libya to rely on imports, e.g. from the UAR and eventually the Sudan in the middle term, and to concentrate its efforts on producing fresh milk and meat and probably also fresh fish and vegetables for home consumption.

Fruits and vegetables

Apart from cereals and potatoes, agricultural production of Libya is limited chiefly to dates, olives, citrus fruits, tomatoes and grapes.

FAO was largely instrumental in establishing a pilot demonstration plant in Tripoli about 10 years ago for the production of date syrup and similar products and also equipped with a laboratory for the development of other products, such as jam and preserved fruits. This plant has been running smoothly now for a number of years and is about to be expanded into a larger production unit.

Dates

Libya is really a poor country for dates. No one really knows what quantities are available and estimates vary from 30,000 to 70,000 tons a year. Not more than 10 per cent are suitable for table use, so that exports are not feasible, along similar lines to Algeria and Tunisia. Although more suitable varieties for export might be developed, the experimentation needed would take a long time. Fewer dates are now being eaten than formerly in the cities where macaroni is coming to be preferred. FAO's object was to help make better use of the potential supplies and in particular to process the second quality dates, which are clean and therefore quite suitable for school feeding purposes; and also to utilize the third quality dates from the coastal region which are sandy as a result of being sun-dried prior to being foot-pressed. These are already being converted into alcohol for medical purposes, and it is also consumed by the Jewish population but there is an over-capacity of dates for this outlet.

FAO therefore set up a pilot date syrup plant and livestock feeding has also been considered as an outlet.

Table dates come from the desert types only, which ripen on the tree. These are harvested when ripe and are self-preserved by their own sugar. They account for only about 5 per cent to 10 per cent of the total crop.

Coastal dates do not ripen naturally and would consequently rot. Therefore the stones can be removed and the flesh sun-dried to below 20 per cent water content, and then foot-pressed to prevent darkening and reduce insect infestation. The coastal dates are estimated to amount to between 10,000 and 30,000 tons, probably 20,000 being near the mark. These cannot be freed from sand and therefore cannot be used for school feeding. However, the whole situation has altered radically since this project was started. On the account of the oil boom and the consequent drift of labourers to the cities the dates

cannot even be harvested these days as there is no labour available. The price of the product is therefore going up so that there is reduced demand and a further diminution in production. However, the Government considers that much of this raw material is still available, so that a new factory is being planned to supersede the pilot plant and also for the production of date spread for export, as this is a product with a greater resemblance to dates than is the case with date syrup. It is thought that about 1,000 tons might be produced per year. Disposal of such a quantity as this will require a marketing programme.

At present the pilot plant is producing 100 tons of date syrup annually and all this is sold at home. Small quantities (e.g. three tons) go to the USA at a subsidized price calculated to be the break-even price of production in a larger factory. However, it is selling in these quantities and one-and-a-half times the world market price for competitive syrups, such as glucose (c. £.L 50/ton) or molasses (£.L 45/ton in barrels, £.L 68 in 1-kilogramme tins). Date syrups could compete with these at £.L 15-20/ton for the dates. However, at present the price is £.L 33.10 to £.L 35/ton.

Theoretically, there should be 80 per cent yield of syrup, actually 75 per cent is obtained, under good supervision. The raw material price is therefore the price of dates by four-thirds.

It is sold locally at 12 piastres/kilogramme, in half-kilogramme cans equals £.L 120/ton, based on small-scale production.

The syrup sent to the USA sold at £.L 87/ton in gallons (the metal drums being expensive, equivalent to £.L 30/ton). These are plastic-coated inside steel and have to be imported.

It is not yet known whether the new date spread will win acceptance. An earlier project for the production of palm sap, along the same lines as in India, had to be abandoned because it needs people and skill and was impracticable after oil was discovered.

The school-feeding programme takes about 1,000 tons a year of the second quality dates and another 200 tons are produced for the luxury market.

At Kufra and the oasis areas there is also a labour shortage now.

The second method for the extraction of date syrup used in the pilot plant consists of a counter-current process, which is costed by ignoring unnecessary hands that the factory does not really require. The syrup is extracted at 95 degrees centigrade which results in a red colour that is preferred by the consumer to the paler syrup obtained at lower temperatures. It is sold at 70 per cent solids because at 75 per cent, which could easily be obtained, it is considered to be too stiff by the local market. All the sucrose is "inverted" to glucose and fructose easily.

Jams, canned fruits and tomatoes

One hundred and forty-four tons of jams have also been ordered for the school-feeding programme. These will be apricot, and plum and it is not intended to enter the local market with these. They will be packed in glass containers. There will be management problems to overcome in this extension of operations. The FAO adviser's counterpart is at present on a training course in England.

Canned tomatoes, processed and as pastes, will also find an outlet on the home market (partly on account of the Government's prohibition of imported foreign product). The factory will also be making citrus marmalade and squash. Citrus juice in cans is not consumed by Arabs, only by foreigners, for whom imports are allowed.

The present Government represents chiefly the merchant class who tend to favour imports because they entail profits, rather than trying to foster local industries by means of high Customs duties.

An unsuccessful attempt has been made to establish a tomato cannery inland. This was to be in an area where tomatoes will grow in the south-east of the country which formerly used to rely on the

trade resulting from the camel caravans. However, transport is now motorized so that it takes only, say, ten hours to get there and travellers tend to take their own supplies. This has therefore become a depressed area. Gardens have been abandoned and people have drifted to the cities. It was suggested by an FAO expert in 1961 that this would be a good area in which to set up a tomato-processing industry.

There was not much evidence for this and in any case good drainage (and water is liable to be saline), and good management are essential requirements that needed closer preliminary study. In addition, nothing was done to organize the growing of tomatoes to supply the factory. Furthermore, there were only 2,500 inhabitants there and a road also had to be built. Forty tons of juice a day could have been produced by the factory but no tomatoes were available. The project was therefore abandoned suddenly after four years.

Citrus fruits only amount to 20,000 tons a year of which a trifling 500 tons are taken for jam for the Libyan market. Plums and apricots sell mainly as fresh fruits at high prices. Only surplus or second grade is available for jam manufacture, which is a useless basis for any organized processing industry.

Any possibility of improving quantities and standards of quality has disappeared with the oil boom.

However, almost every Libyan food now has tomato in it (although presumably a comparatively recent introduction) by the Italians and in fact there are now about seven commercial factories altogether processing tomatoes, including a fairly large one, all in the Tripoli area. The production of these needs stream-lining. The demand, however, helps to enhance tomato growing but there are year-to-year fluctuations in production. Bulk purée was therefore imported from Bulgaria the previous season to keep production going. Then when the next tomato season came round again the surplus purée had to be used up before fresh supplies could be accepted. This resulted in long queues of lorries with tomatoes waiting to unload and considerable wastage occurred. However, this is fortunately not a chronic feature.

Only purée and sauce are produced. Tomato juice is not a saleable commodity. Other vegetables are mostly available fresh, although canned vegetables are in fact imported.

In 1961 FAO formulated a small project for marmalade from citrus fruit, based on the following calculations:

TABLE L. 12

Two tons input per eight-hour day for 100 days a year

Capital cost of equipment L.L 7,500

A	B
Producing <u>600 kg</u> juice of which:	+ <u>1,350 kg</u> peel of which:
1. 200 kg + 20 kg sugar would give 100 kg of <u>squash</u>	1. 200 kg + 40 kg sugar would give 200 kg of <u>soft drink paste</u> ("comminuted base")
2. 200 kg + 200 kg sugar + 40 kg peel would give 350 kg <u>marmalade</u>	2. 40 kg are used for marmalade (see A)
3. 200 kg would give 20 kg of <u>juice</u> <u>concentrate</u>	3. 5 kg <u>essential oil</u> to add to the marmalade and paste
	4. 1,100 kg of pith goes for <u>cattle</u> <u>fodder</u>
<u>Costing (L.L.):</u>	
2,000 kg at 30 p/kg = 60 per 8-hour shift	
260 kg of sugar at 10 p/kg = 26	
Total expenses: 140	
<u>Income (L.L.):</u>	
200 kg of soft drink paste at 50 p/kg = 100	
pith at 0.2 p/kg 2.2	
100 kg of squash at 10 p/kg 10	
350 kg of marmalade at 10 p/kg 35	
Juice concentrate at 75 p/kg 15	
162	

However, while this was being considered, private enterprise entered the business with a scheme for juice concentrate for export. But the whole proposition was too large because there is only a limited local market for juice and the concentrate had too high a price for export. The equipment was therefore lying idle for some time and ultimately the plant was sold and now operates merely on the basis of repacking imported pulp. Home consumption of squash is increasing but is an operation of bottling rather than processing, using imported concentrates. A much more elaborate and integrated scheme had been proposed to the Government by an FAO expert in 1957, for the establishment of a fruit and vegetable cannery, based chiefly on citrus fruits, tomatoes and grapes. It was considered that the presence of a processing plant would induce growers to undertake on an industrial scale certain crops already cultivated on the family holding, such as apricots, strawberries, peas, beans, cauliflowers and asparagus. Preparation and processing of almonds, peas, beans and lentils was proposed for the slack periods as well as marmalade and lemon and orange squashes. It was figured that for date paste and syrup, 15,000 tons of dates a year would really be necessary for it to be economic. Certain varieties of peanuts were also regarded as suitable for salting and manufacture of peanut butter. However, nothing more has come of this suggestion and in the present circumstances it appears impracticable.

The Government were once interested in a citrus fruit organization AGREXPORT to aid the smaller growers. This was to be a co-operative of growers and merchants, but it did not work out properly, so that the Government took it over. For two seasons there were efforts at standardization of exports in standard cases, etc. But the oranges were crushed in the handling and the merchants claimed that they were damaged so that storage life was reduced. Wooden cases were a difficulty and finally only two merchants were making use of the "co-operative" at the standard fee, so that the small growers were as badly off as ever. The Government then closed it down. Big farm estates then started to do their own packing.

Sea transport to Italy is far too costly to encourage exports, unless the Italian crop is poor. Spain, on the contrary, can just put fruit on the train, with no unloading required. A little is sent to Malta, but the market is small.

The Ministry of Agriculture has a Department of Horticulture where seed varieties are being tested before going to the grower. In the case of tomatoes for processing they supervise production and quality and quantitative yield jointly with the Ministry of Industry. In addition they also encourage the planting of the best varieties of dates and give help in clearing the bushes, etc. All this should have a beneficial effect on the prospects of the processing industries in the long run.

The prices of fresh vegetables are usually relatively high. Outside the main season tomatoes are very dear, 35-50 piastres/kilogramme, whereas in June and July there is over-production. French beans are 20-30 and even 40 piastres/kilogramme; plums 20-70 piastres/kilogramme; and cauliflower 16 piastres/kilogramme complete with leaves. Comparing these prices with wages, a senior civil servant would get L.L 70-75 a month, and a new graduate, say, L.L 50 a month.

Citrus fruits, of which early varieties are obtainable, that could be even earlier still (as with Jaffa), cost as much as 20 piastres/kg at some times, and only 2-3 piastres/kg in the height of the season. Small new potatoes in November are 5 piastres/kg, but can be as cheap as two piastres at times.

Nutritional surveys have shown that the diet of the majority of the population is deficient in vegetables. The seasons should therefore be more spread out to keep prices low and this is a question of "know-how" as well as sheer quantity.

Cold storage

FAO has been advising the Libyan Government on cold storage at Tripoli and Benghazi since 1953 and in 1957 an expert was appointed to draw up the specifications for installations to cope with the requirements

of the slaughterhouses and also of the internal marketing needs. And there was a further expert involved in the later stages. However there has been no development as yet; the Ministry of Planning is holding up construction of the store proposed for Tripoli (perhaps because the new privately owned ones are now considered to be sufficient); the plans are all ready but no machinery is available yet.

There are now, however, two commercial, privately owned cold stores in Tripoli. The newest one, opened on 22 November 1965 (Genefrigo), has five rooms totalling 6,000 square metres for chilling and freezing down to 20 degrees centigrade. It is very modern; it has four Freon compressors and forklift trucks are used to stack goods, but owing to the height of the rooms there is considerable damage inflicted on goods by pressure. Rotation, too is difficult. The Government gives considerable financial assistance for this type of project, providing 51 per cent of the capital and 75 per cent as a loan.

The other store (Ghiacciaie Riunite) is 6,500 square metres altogether, but it is divided up into 20 rooms. This makes loading more costly and the machinery is older, but it is more practical than the other one. The rates charged are 8 millimes/kg/month for medium quantities and 5 millimes for large quantities (over 100 tons). It has continuous air freezers and is fairly well used. Also it uses ammonia, which is more sensible because it is less expensive and one can easily smell leaks. These two stores now take all the required imports, plus 3,000 tons of local perishables. Benghazi has a cold store of 300 cubic metres.

Regarding the use of cold stores, farmers have not yet learnt their value in extending the seasons of goods when prices are high as supplies fall off. One such possibility is for potatoes, which at 3° C can be kept for 3-4 months. Tomatoes, too can only be stored for up to 15 days at ordinary temperature without damage. In the height of the season they can be bought for less than 2 piastres/kg, but later on

(in November) they fetch as much as 34-40 piastres/kg. A good initial quality can be chill stored for 1-2 months. Onions, too, can be stored and also citrus fruits.

Imported Lebanese apples, which go into chill store in Tripoli, sell at L.L 1/kilogramme. The Lebanese would, however, prefer to build their own store, as it would be cheaper to operate, if only they could get a permit.

Recommendations

Further consideration should be given to establishing a large fruit- and vegetable-processing factory after costs and possible markets have been satisfactorily explored.

CHAPTER VI

UNITED ARAB REPUBLIC

Population Estimates

1950	. . .	20,393,000
1962	. . .	27,244,000
1965	. . .	29,730,000
1975	. . .	40,045,000
1985		53,100,000

TABLE U.1
Agricultural Production

E/CN.14/INR/145
Page 183

(1,000 tons)

	1952	1964
Raw cotton	1,296	1,436
Ginned cotton	446	504
Cotton seed	842	939
Rice	517	2,036
Millet	522	740
Maize	1,506	1,934
Sugar cane	3,265	5,150
Peanuts	20	46
Sesame	14	23
Wheat	1,081	1,499
Beans	232	340
Barley	118	141
Fenugreek	34	42
Lentils	32	52
Onions	243	647
Lupins	6	13
Chickpeas	9	10
Vegetables	1,834	4,378
<u>Fruits</u>		
Oranges	257	329
Tangerines	76	55
Lemons	38	85
Sweet lemons	4	3
Grapes	90	91
Figs	9	2
Guavas	38	34
Olives	3	10
Mangoes	55	97
Apricots	7	7
Bananas	47	50
Dates	248	327
Pomegranates	15	9
Others	7	30
Total fruits	894	1,129

TABLE U.2
Main crop areas and yields in UAR
(1963)

	% of crop area	Crop Yield Tons/Feddan		
		World average	UAR average	UAR's position in world order
Cotton	16.0	0.15	0.27	3
Berseem	21.8	-	-	-
Wheat	14.0	0.49	1.02	15
Corn	17.7	0.87	0.91	15
Lentils		2.27	4.34	1
Sesame		1.22	3.72	1
Millet	4.4	0.29	1.22	1
Groundnuts		0.47	0.82	2
Rice	8.0	0.85	2.11	3
Broad beans		0.41	0.63	3
Sugar cane	1.2	-	39.1	4
Onions	1.9	4.96	6.39	5

TABLE U.3
Food consumption (m. tons)

	1952/1953	1963/1964
Wheat	1.7	2.32
Wheat flour	0.17	0.69
Maize	2.04	2.75
Rice	0.33	0.90
Vegetables	1.91	4.3
Fruit	0.89	1.22
Meat	0.17	0.20
Fish	0.085	0.164
Dairy products	0.269	0.328
Vegetable oil	0.078	0.127
Margarine	0.008/1.956	0.029
Sugar	0.287	0.414

TABLE U.4
Food Imports, 1964/65

	L. E. million
Edible oils and fats	9.16
Cattle, fresh meat and chickens	13.31
Frozen meat and fish	1.43
Sugar	6.16
Dairy products	0.49
Vegetables and others, etc.	1.07
Tea and coffee	13.2

TABLE U.5
Production of Processed Foods

	Units	1951/1952	1963/1964
Processed meat	tons	357	673
Frozen prawns	"	-	1,041
Raw sugar	1,000 tons	189	378
Glucose	"	5	31
Molasses (refined)	"	24	31
Cotton seed oil	"	100	124
Margarine and hydrogenated oil	tons	12	46
Chocolate	tons	1,600	2,509
Canned tomato juice	tons	-	605
Pastas	1,000 tons	18	48
Preserved fruits	tons	-	291
Sweetmeats	1,000 tons	56	55
Preserved veg. and beans	tons	600	5,910
Yeast	tons	840	3,179
Carbonated water	million bottles	156	703
Starch	tons	5,300	11,919
Malt	1,000 tons	1	3
Vinegar	"	3	6
Beer	1,000 litres	9,600	16,530
Wine	"	1,619	2,418
Alcoholic drinks	"	1,447	2,087
Alcohol	"	11,125	20,062
Fodder oil cake	1,000 tons	410	654
Molasses	"	100	192
Cottage cheese	tons	109	112
Processed cheese	tons	1,921	3,948
Pasteurized milk	tons	-	15,073
Canned Sardines	tons	-	5,330
Dehydrated fruit	tons	-	291
Ice	1,000 tons	223	342

TABLE U. 6

The value of production in the years 1960-65
compared with the value expected in 1970
(in £)

Food Industry	1960	1965	1970
Sugar	28,660,970	39,292,392	96,346,392
Edible oils	27,679,550	40,047,698	45,911,978
Tobacco	59,137,660	105,754,708	126,567,708
Milk	670,551	2,233,786	4,948,661
Drying and canning	1,594,970	4,226,110	17,689,860
Alcoholic and distilled drinks	2,576,625	3,933,763	7,826,263
Non-alcoholic soft drinks	4,379,615	7,989,710	12,304,710
Starch, biscuits and sweets	6,933,741	10,007,971	18,382,771
Total	131,633,682	213,486,138	329,978,343
Total excluding tobacco	72,496,022	107,732,430	203,410,635
Total excluding drinks and tobacco	65,539,782	95,808,957	183,279,662

N.B. These figures represent the value of products from companies belonging to the Egyptian General Organization for Food Industries only.

TABLE U.7
Investments in food industry

Food Industry	Value of investments completed during the first plan (£)	Value of investments expected to be com- pleted during the second plan (£)
Sugar	31,867,624	106,117,100
Edible oils	2,653,170	7,952,000
Tobacco	2,479,676	4,750,000
Milk products	2,142,032	816,400
Preserved products	520,413	8,090,140
Biscuits and sweets	235,816	1,950,000
Drinks	1,355,973	454,500
Dehydrated products	437,876	2,420,000
Starch and glucose	456,697	1,700,000
Total	42,149,277	134,250,140
		(incl. 56,592,100 for remaining projects of 1st 5-year plan)
Total excluding tobacco	39,669,601	129,500,140
Total excluding drinks and tobacco	38,308,628	129,045,640

TABLE U.8
Food in the First Industrial Programme
(started before June 1960)

	Number of projects	Cost (£. E.m)	%
Food*	24	2,478	3
Total	105	83,465	100

*Including automatic production of biscuits and cakes, canned fruits and vegetables and production of frozen shrimps.

TABLE U.9
Food in the Second Industrial Programme
(1960-1965)
(the First 5-Year Plan)

	Original		Supplementary		Additional		Total		
	No.	£E.m.	No.	£E.m.	No.	£E.m.	No.	£E.m.	%
Food	115	187	126	5.508	37	50.815	339	157.643	15
Total	734	884	662	49	84	99	1,440	1,035	100

Food in the Third Industrial Programme
(1965-1970)
(the Second 5-Year Plan)

	No. of projects	Total cost		Estimated investment	No. of workers to be employed (1,000)
		£E.m.	%	£E.m.	
Food	43	84.3	7	70.0	16.3
Total	-	1,127.6	100	960.0	

Value of production estimated £E.97.8 million, including £E.38 million exported.

TABLE U. 10

FAC world indicative plan gross domestic consumption target (1,000 tons)

	1960-62 average	1975	1985
Cereal products	5,319	8,198	10,512
Wheat flour	2,331	3,643	4,888
Millet, rice	982	1,604	2,246
Coarse grains	2,006	2,951	3,378
Starchy products	292	477	655
Sugar (raw)	384	665	983
Pulses	267	459	690
Nuts (including sesame)	21	40	68
Vegetables	3,121	5,415	8,124
Fruits	1,035	1,950	3,150
Meat and products	255	416	628
Meat	199	328	506
Offals	56	88	122
Eggs	30	51	76
Fish	139 (1961-1963 average)		
Milk	1,142	1,994	2,995
Oils and Fats	154	252	356
of which vegetable oils	149	244	340
Calories/day	2,390	2,520	2,560
Protein - grammes/day	69.7	74.8	75.3
of which animal protein	10.1	11.8	13.2

TABLE U. 11

World indicative plan commodity balance for UAR

		1960-1962 average	1975	1986
Cereals:	Production	6,151	8,610	10,066
	Imports	1,629	1,504	2,504
	Exports	407	996	725
Wheat:	Production	1,554	2,450	2,940
	Imports	1,450	1,447	2,200
	Exports	6	-	-
Rice (paddy):	Production	1,678	2,760	3,120
	Imports	-	-	-
	Exports	398	996	725
Coarse grains:	Production	2,919	3,400	4,000
	Imports	179	52	304
	Exports	3	-	-
Starchy roots:	Production	465	625	808
	Imports	17	-	-
	Exports	90	60	60
Sugar (raw equivalent):	Production	375	1,080	1,404
	Imports	65	-	-
	Exports	52	415	421
Pulses	Production	367	625	850
	Imports	14	-	-
	Exports	24	65	40

TABLE U. 11 (continued)

		1960-1962 average	1975	1986
Vegetables (including melons):				
	Production	3,181	6,300	9,360
	Imports	-	-	-
	Exports	232	260	300
Fruits:				
	Production	1,103	2,210	3,500
	Imports	32	-	-
	Exports	12	40	50
Meat (excluding offals):				
	Production	184	253	349
	Imports	15	75	157
	Exports	-	-	-
Eggs:				
	Production	34	44	58
	Imports	-	12	24
	Exports	-	-	-
Fish and products (fresh equivalent):				
		129.3	190	220
		14	60	136
		4.2	-	-
Milk products (liquid equivalent)				
		1.140	1,454	1,898
		62	640	1,285
		3	-	-
Oilseeds and vegetable oils (oil equivalent)				
		125	258	332
		35	24	68
		5	-	-

General situation

Egypt (United Arab Republic) has nationalized most of its basic food industries which are administered and operated by industrial boards ("companies") under the Egyptian General Organization for Food Industries.

The food industries left behind by Europeans were taken over and run as well as possible and further developed and built up, and new industries have been started, often under difficulties. As in a planned economy, investments in various sectors are formulated in advance, the back-log from the first Five-Year Plan being carried over to the second (1965-70). Foreign exchange is closely controlled and this determines the pattern of trade and where technical equipment may be purchased. A good deal comes from Eastern Europe, and is sometimes paid for in the commodity produced.

The country, which is the most populous in the North African sub-region, is severely limited by being confined in agriculture to the cultivable area close to the Nile and its irrigation system. The total fertile area is about six million feddans (a feddan is about three per cent more than an acre, which is about two-fifths of a hectare). The new Aswan High Dam will ultimately provide over two million additional feddans of irrigated lands, 750,000 of which have already come into use and 340,000 acres are being cultivated since the Dam was closed in May 1964. One-and-a-quarter million acres of land will be reclaimed and it is planned that another one million will be transformed by conversion to perennial irrigation which will increase their productivity. This will result, for example, in an increase in the area under sugar cane, although the surplus planned for export is not as large as envisaged in the FAO World Indicative Food Plan. There are a number of other land reclamation projects underway, one of the most noteworthy being in Tahrir province mid-way in the desert between Cairo and Alexandria, where 122,233 acres so far have been planted with wheat, barley,

vegetables and fruit, including grapes for wine. Present plans also include an expansion in the areas under pulses which, with a very substantial increase in the yield, should meet local demand. Expansion of irrigated land under vegetables indicates that demand will be met, provided that yields can be increased from the present five tons/hectare to 26 in 1985. It is also considered that the present production of dates can be increased through improved management, but it is most unlikely that new plantation of date palms will be established, owing to competition for the available land and the labour requirements. Additional production of milk and meat is also postulated.

Also, the Aswan High Dam, by preventing the periodical Nile inundation, will have other contingent effects on agriculture both positive and negative, the upshot of which has still to be seen in practice.

Planned from 1952 onwards, work on the construction of the Dam was commenced in 1960 with full-scale Russian technical assistance. 36,000 workers are working three shifts continuously. The dam was closed in May 1964, since when the water has risen 26 metres and has a further 60 metres to rise before the new Lake Nasser, extending 150 kilometres into Sudan, is full. The 1964/65 flood was excessive and would have caused much damage but for the dam and this was followed by a drought which would have been equally devastating. It is calculated that the Dam has therefore already saved LE.100 million.

The General Organization for Food Industries is first of all taking active steps to improve the quality of Egyptian processed foods, by paying more attention to the need for standardized, high-quality raw materials such as fruit and vegetables and to processing conditions, so that they can compete with those of the more highly developed countries in the world markets. Secondly, it proposes to set about the problem of improving productive efficiency.

Storage losses due to oxidation, insects and micro-organisms will be controlled by organizing suitable silos and storage facilities. Processing losses will be checked by extension services to ensure that foods are harvested when they are in the optimum condition for processing. Direct processing losses will be reduced by more efficient processing methods (e.g. replacing of existing oil extraction mills based on mechanical pressure by solvent extraction) and the better utilization of by-products (e.g. extraction of oil from rice bran and better use of stalks from sugar cane crushing, formerly used for fuel in the sugar factories, for manufacture of compressed board and, although this lies outside the strict confines of food processing, it contributes to its commercial success).

All these measures will naturally take some time to become effective. Staff have to be trained to control and monitor processes and the necessary facilities have to be provided. The organization of supplies of suitable raw material to keep factories economically occupied is also a problem. In the meantime it is probably correct to process as much food as possible under the prevailing conditions for sale for home consumption as cheaply as possible (provided that the demand exists, or can be developed), whilst improvements in quality and efficiency go hand-in-hand for the future.

However, under three successive Industrial Programmes in which food processing is taking an increasing proportion, new industries have been created, notably canning of sardines, cheese processing, shrimp freezing and extraction of ricebran oil, and existing industries have been expanded, particularly sugar crushing and refining, milk pasteurization, food canning, carbonated beverages, hydrogenation of oils and dehydration of onions. By-product industries, such as particle board from sugar "bagasse", have also been instituted.

In the present third Industrial Programme, originally planned to end in 1970 but now extended until 1972, the targets for expansion in production in some of the chief food industries are summarized as follows:-

TABLE U. 12

(1,000 tons)

	1965	1970	Comments
Sugar	380	950	300,000 tons to be exported
Oils and fats			Consumption is 130,000 tons; solvent extraction will yield 25,000 tons extra (=£ 4 m.); also 1 m. tons oil cake.
Canned food and dried onions			Local consumption 8,000 tons 4,300 tons (=£ 7m.) exported. 12 new projects, costing £ 9m.)
Glucose		80	Including surplus for export of 10,000 tons (=£ 1 m.).
Beverages (m. Hl.)	28.7	57	For local consumption
Beer			
Malt			3,000 tons increased production, including 2,000 tons for export.

It is noteworthy that a general increase in home consumption of home-processed food is anticipated, based no doubt on the assumption that the increasing standard of living, particularly in urban areas will result in an increasing demand for a greater variety in the diet of processed and convenience food, made available at prices which people can afford, and are prepared, to pay.

The planned Ministry of Agriculture investments up to 1962 were L.E 55 million, of which food industrial research was allocated L.E 503,396 and fisheries research L.E 958,378.

In general, there is as yet no standardization in the agricultural production and preparation for marketing is unknown. As a result quality of produce is often very poor. Packaging in flimsy crates is also insufficient to protect fruit, tomatoes, etc. from damage.

Again, mechanization of operations such as drawing water, which only has to be raised a few feet by means of gasoline pumps, would release animals for meat production. Likewise, about a million donkeys are used as beasts of burden. However, they need forage and they eat clover that could be used for stock raising if more mechanical horse-power were available.

Although at the present time, the average Egyptian diet is not grossly deficient in calories or total protein, the consumption of animal protein needs to be increased. It is officially admitted that feeding is a problem in some areas.

There are a number of bilateral arrangements under way. USAID is concerned with developing a high protein beladi bread for school children, made of fortified ground chick-peas and dried yeast and potassium chlorate (to compensate for the poor baking properties of dried yeast). A United States loan, payable over thirty years at 4.3/4 per cent, is aimed at drainage improvements. Pre-investment studies are also underway on the settlement of Bedouins by establishing industries in the western coastal desert, involving figs and dates and the use of fertilizers.

The use of fertilizers in sufficient quantities is particularly vital in an agriculture which provides for such a large population by the intensive cultivation of the limited area of the Nile Valley and delta. Agriculture in Egypt suffered severely during the 1939-45 war because supplies of chemical fertilizer, formerly imported

from Germany and Sweden, were completely cut off. A home industry was established which ensures that the country's agriculture would not be paralyzed in the event of hostilities. UAR now produces in three plants a total of about two million tons of fertilizer a year and the rate of utilization is much higher than in any other country in the North African sub-region. It is estimated that the local needs for fertilizers in 1970 will reach 2.2 million tons, and rise steadily by 220,000 tons a year until 1975. The German-equipped Kima fertilizer plant at Aswan, utilizes the electricity that has been produced at the old Aswan Dam since 1960 to generate the hydrogen required for combination with nitrogen to produce ammonia electrolytically, instead of using water gas from coke ovens. About 100,000 tons atmospheric nitrogen are "fixed" annually as "calcium ammonium nitrate" containing 26 per cent of ammonium nitrate. This electrical process is only used elsewhere in Norway, where cheap surplus hydro-electric power is available. The cost of power at Aswan is 0.1 piastres (i.e. one millieme) /unit compared with three piastres/ unit for the domestic rate. However, the price of the product works out at £.£.38 per ton, compared with a world market price of \$45 (-££ 18)/ton. It is considered that this extra cost is justified by:-

- (1) saving hard currency;
- (2) providing independence of external supplies;
- (3) utilizing local raw materials (air, water and hydro-electric power) with no substantial outside operating costs once the original capital investment in plant has been secured by some bilateral arrangement;
- (4) training workers and managers in modern industrial production (2,400 men employed at the Aswan plant earn about £1/day and benefit from industrial community services, flats at ££ 2/month rent, etc.).

However, the Aswan plant is taking all the electricity that is available at the old dam and will not expand further, future installations being sited elsewhere and not based on electrical power.

Obviously, an expanding fertilizer industry has some bearing on food processing because it guarantees the food production of the future. From the engineering industrial point of view, UAR is making considerable advances compared with other countries of the sub-region, and will be learning a good deal from the construction and operation of the high dam. This might conceivably be turned to good account for the sub-region in the refrigeration industry, which is so important for the proper preservation and distribution of highly perishable food stuffs in a hot climate. An FAO expert on refrigeration in 1965 critically reviewed the cold storage installations of UAR, including new ones at Suez and Port Said which had proved faulty in many respects and for which better use and management all round was called for. It was also suggested that an industry should be set up in UAR for the manufacture of all refrigeration equipment, including that for ice-manufacture, compressors and quick-freezers, with a view to serving all the Arab countries, none of which possesses such an industry.

The detailed proposals were as follows:-

1. The industry should be established on the basis of 50 per cent capital to be provided by the UAR and 50 per cent by some specialized foreign firm.
2. Another company should be established to set up a lighter engineering factory for the production of small, sealed compressors for refrigerators and accessory equipment.
3. Another company should specialize on the purification and dehydration of synthetic ammonia, which is already produced in Egypt for other purposes (e.g. fertilizers). It should also produce Freon 12 (CF_2Cl_2) and Freon 22 (CHF_2Cl) and silica gel, calcium sulphate and other materials for the dehydration of refrigerants.

5. Also technical training would need to be provided for technicians to design and supervise the construction of cold storage facilities.

It is not known what follow-up there has been to these suggestions which certainly seem eminently worth supporting.

As regards research, some centres are very well equipped in apparatus although there is not always enough staff for effective utilization. Also the impression was gained that there may be some overlapping, through lack of co-ordination of effort, although this situation is not uncommon the world over, and can even be defended. For example, there seem to be three different laboratories working on cereal chemistry, including the National Research Centre which has a well-equipped section for food research and the Bahtim plant breeding institute which is concerned with new varieties and carries out baking tests. An autoanalyser is available, amino-acid analyses are carried out, and there is a gas chromatograph. A fourth laboratory recently asked for financial assistance from FAO for research on cereals. On the other hand it seems that there may be little or no research work of a similar character being carried out on oil seeds, although Cairo University has an established school of fat chemistry.

Again, there are often many divergent voices which make it difficult sometimes to come to a clear-cut decision on matters of importance. Such a case seems to be the FAO/UNICEF attempts to generate interest in developing a protein-rich weaning food where a confusion of recipes and policies seem to have so far prevented any progress comparable with that achieved in Algeria, for example, where there is less informed opinion.

The flooding of the Nile Valley in Upper Egypt as part of the Aswan Scheme has made it necessary to transfer many thousands of Nubians to other areas. One such resettlement area is in the neighbourhood of Kom Ombo, south of Aswan. Here a new township has been provided with communal services and plots of new, irrigated land for

subsistence cultivation. Furthermore, sugar cane is also being grown there successfully to provide future raw material for the sugar factory and the people are being drawn thereby more into the agricultural and industrial economy.

Milk

The milking cow component of the national herd is high in UAR owing to the big veal trade. Buffalo milk is of a relatively high standard. More milk could be produced as a result of an increase in numbers and a decrease in calf slaughter. However, Nile Valley dairying developments have been attempted for the past eight years without much advance.

The total output in 1960 was 1,123,800 tons. In rough terms, the present position is one ton of milk/year from each of a million buffaloes and half a ton/year from each of a million cows. The estimated total output by 1970 will be 1,348,500 tons - a production increase in ten years of 224,700 tons from existing cattle as a result of better feeding and a slight increase in numbers, plus 190,000 tons from projects organized by the state meat and milk organization.

The average consumption per head of milk in 1960 was 41.6 kilogrammes, which is planned to increase to 48 kilogrammes by 1970.

Over and above this is another increase due to crossing local cattle with Friesian bulls which will account for a further five kilogrammes per head, bringing the total to 53 kilogrammes.

The dairy factories if working at full capacity would take 10 per cent of total production, but they are unable to get milk for more than about 50 per cent of estimated production, because the animals are not farmed in herds of a reasonable size owing to the ownership being so fragmented. The problem of cooling and collection centres cannot be solved except by initiating larger herds of dairy cattle.

A buffalo gives 1,500 kilogrammes of milk at a lactation with six to seven per cent of fat compared to 3,000 kilogrammes for a Friesian and 2,000 kilogrammes for a cross-bred. 70 per cent of all milk is provided by buffaloes at present. Milk production ought to be increased by selection and good breeding. Doubling the milk production of the buffalo would take perhaps 70 years even if rigid selection were applied. Importing cows is a better means, replacing the indigenous breed by Friesians and crossing local cows with Friesian bulls. In five years this could double milk production. The Egyptian buffalo is a very good milk producer - better than anywhere else in the world, so that no improvement could be effected by importing buffaloes similarly. Veterinary services are regarded as effective in controlling disease in milk and animals. 340 units are scattered over the country. But the vets need proper transport to do their jobs properly, which is not often available, and also the human factor of determination to do one's best is not always present.

The Misr Milk and Food Company was founded in 1954 and began operations in 1959. It has a plant of 100 tons per day capacity in Cairo and 80 tons per day capacity in Alexandria as well as a milk drying plant of 25 tons per day, at Sakha, erected with UNICEF assistance.

Another plant produces 1,500 tons of processed cheese annually and another again is under construction at Damietta with a capacity of 120 tons a day. (=30,000 tons a year). The Elnasr Company operates three dairy plants, one at El Mansura, which sends milk in bottles largely to Cairo. 60 collecting and cooling centres of five to six tons/day capacity each are in the final stages of construction round the dairy plants. A sterilized milk plant is under construction at Kom Ombo. Ten per cent of the raw milk is now utilized. It is the declared intention to establish a central dairy plant in every large town (say in 120 cities), of 5-10 tons per day capacity in the smaller places. Twenty towns of 100,000 population or more should be served

by 1980, say. Milk at the Misr Dairy in Cairo is processed at 85 degrees centigrade for 16 seconds as compared with the usual heat treatment of 73 degrees centigrade for 15 seconds, in order to ensure destruction of rickettsia and viruses. Buffaloes' milk is 50 per cent higher in vitamin C than cow's milk and does not cream, so that the extra heating does not affect its quality significantly, and people are accustomed to a slight, boiled milk flavour.

Female buffaloes are used for drawing water (the males are ferocious and can scarcely be used). If this operation were mechanized, under good management it has been shown on the Alexandria experimental farm that production of a buffalo can easily be doubled, if well fed and not worked.

Replacing native cattle by Friesian and other breeds, can yield three tons per year for perhaps double the feeding compared with half a ton for the local breed now. The two million animals are in 4,000 villages, 80-90 per cent owned by farmers with small herds of one to three cows. Each collecting centre is to serve five villages, each of which has an average of 500 cows or buffaloes. Assuming that the production of 200 animals can be obtained and leaving 300 for the village, this should result in one ton of milk a day from each of the five villages. 20 such centres are in operation and 50 under construction to supply milk for existing dairy plants. Misr sold 6.6 million bottles in 1961 (80 per cent by half a litre and 20 per cent by one-fifth of a litre). In 1966, 26.3 million bottles were sold:

	<u>1961</u>	<u>1966</u>
Total value:- (L.E)	244,000	1,200,000
Milk intake (tons)	3,000	15,000

The initial price was one piastre more than that of the 10,000 pedlars, (seven piastres compared to six piastres) but in 1966 it was one piastre cheaper (eight piastres compared to 9 piastres). If pedlars were given one piastre/kilogramme profit they could handle

pasteurized milk also with suitable controls. 55 tons a day of pasteurized milk is at present sufficient for Cairo out of a total milk supply of 150 tons.

In 1961 the Misr Company lost £ E 15,000; in 1962 there was no loss, and in 1966 there was £E.70,000 profit, a six per cent return on investment. (Three other plants are however not making profits on account of competition with pedlars - legislation being needed to ensure their success). All unsold milk is collected up after one day (numbers being stamped on the cap). About five to ~~six~~ per cent came back in this way at the start but now none is returned.

The minimum guaranteed fat content is 3.0 per cent (actual 3.5) and solids-not-fat content is 8.9 per cent (actual 9.1)

Input is 70 per cent buffalo and 30 per cent cow milk, with not more than five per cent of dried milk. Separated fat chiefly from the buffaloes' milk is used for butter. Producers are paid on fat content on the basis of 9-11 millimes/one per cent of fat in the milk. If six per cent, say, they are paid 54 millimes/kilogramme in winter and 66 millimes in summer.

70 per cent of the selling price goes to the farmers whereas in most countries the proportion is nearer 55-60 per cent.

It would not be more economical to use more powdered milk as not only would it have to be paid for, but also less saleable fat would be separated.

Sakha now has a canning line to avoid packing the dried milk in polythene bags. The capacity is 360 tons of skimmed milk powder per year. Half-cream powder (with 15 per cent fat) goes to needy children. Allowing a 6-10 per cent profit margin, it costs £E 560/ton. Similar plants in Libya and Damascus failed.

A pasteurizing plant costs about LE.500,000 including LE.200,000 for equipment with a capacity of 25 tons per day, half milk and half manufactured products.

In the circumstances there seems no interest in a pasteurized reconstituted imported dried milk, selling at perhaps three to four piastres/kilogramme.

Recommendations

Although pasteurizing plants should be installed in every sizeable centre, more attention needs to be given to ensuring supplies of suitable raw material.

Meat

The numbers of livestock slaughtered in 1964 were no greater than in 1952:-

TABLE U. 13

	1952	1964 (1000 heads)
Oxen	60	57
Cows	40	27
Buffaloes	75	77
Calves	463	449
Sheep	534	486
Goats	17	28
Pigs	22	27
Camel	31	34
Total	1242	1157

It is reported that the increase in emphasis on cotton cultivation has led to a decline in the importance of animal production.

Imports of frozen meat and slaughtered animals have grown in value from LE 4 million in 1954 to LE 12 in 1964. Even so they could easily be doubled to meet the demand if foreign exchange were available.

Live animals and meat imports (1964/65)

25,000	..	..	Camels
100,000	..	..	Cattle
200,000	..	..	Sheep
12,000	tons		frozen beef from America
3,600	tons		frozen beef from Ethiopia
6,000	tons		frozen lamb
4,000	tons		frozen chicken

The state Meat and Milk Organization was set up in October 1964 to remedy the situation.

Under the five-year plan it has been decided to develop animal production and to promote the formation of co-operatives which are planned to increase from 28 to 128 by 1969/70, producing 100,000 calves instead of 20,000 as in 1964/65.

The meat needed for consumption, estimated by various means and the results averaged, is as follows:-

	1964/1965	1965/1966	1966/1967	1967/1968	1968/1969	1969/1970
1000 tons	230	246	260	277	295	316

This rate of increase reflects growth of population and increase in consumption per head.

According to the plan itself, output projects of the Meat and Milk Organization are:-

	1964/1965	1965/1966	1966/1967	1967/1968	1968/1969	1969/1970
Tons	9000	22,540	31,150	40,050	56,175	73,550

The Meat and Milk Organization's activities will make up an increasing proportion of the deficit (consumption minus production) year by year from 29 per cent in 1964/65 to 83 per cent by 1970. The remainder of the deficit can be imported from abroad depending on financial ability.

The total livestock at present (apart from poultry, see later) is, in very round figures:-

Buffaloes	..	..	1½ million
Cattle	..	..	1½ million
Sheep	..	..	1¼ million

The rate of increase in the number of cows is not more than 35,000 a year (or 2½ per cent) and of buffalo cows 50,000 (=3.5 per cent). As a result of the shortage of meat 140,000 females are being slaughtered annually. This is over and above the replacement needed for new herds.

One million buffalo females can produce 360,000 male buffalo calves, which could have a weight of 350-400 kilogrammes at 18 months, if properly fed, etc. Loans are made to farmers and buffalo calves purchased and fed on state farms on green fodder and concentrates.

In addition, calves are being imported for fattening. In 1952, fifty Friesians were imported, in 1964/65 - 9,000. It is planned to import 5,000 pregnant heifers a year for five years, to increase meat and milk production.

The plan for sheep is to import 100,000 head of flesh merinos per year for the next five years. In 1965/66, 40,000 had been imported up to June 1966.

The number of buffalo calves killed in 1961 was 262,000 head, with a total live weight of 10,500 tons (average 40 kilogrammes). If slaughtered at 250 kilogrammes they would have produced 65,500 tons of meat even if the numbers were kept static and the total production static. The local meat output in 1962 was estimated at 186,154 tons and consumption 198,154 tons - a deficiency of 12,000 tons.

Average per capita meat consumption is now:-

	7.5	kilogrammes	from livestock
	2.1	"	from poultry
	<u>4.4</u>	"	from fish
Total ..	14.0	"	

There is a great variation in the consumption of meat. In urban areas it is 16.9 and in the country 6.5 kilogrammes per head per annum (including fish). By 1970 it is planned to increase this average consumption by 10 kilogrammes at least (including poultry and fish). The anticipated deficiency by 1970 is 19,000 tons worth LE 27 million at constant prices.

The solution is to increase the animal carrying capacity of the land and to increase the productivity of the animals.

The emphasis on growing cotton, rice and maize reduces the potential for meat. However, increasing the areas under reclamation will lead to new stocking. Each additional acre could support one animal. The number of livestock cattle and cows could be increased by 50 per cent if all the new land went to animals.

Quite obviously, in view of the shortage of fresh meat no considerable meat processing can be anticipated. (The hygiene of the handling and distribution of fresh meat could be vastly improved). Already a little meat is canned with vegetables, but people do not eat canned meat very much. Salted cow and buffalo meat is used to make "basterma", and there is also a mortadella type of sausage, only made not from pork but cow meat, on a small-scale. Industrialization of these processes would be possible

By-products are not used at all, neither bones, nor meat meal, tallow, fat stearin or lard, bone oil, blood meal - all are wasted. All this should be an integrated part of a proper slaughter house system. However, not only is there the difficulty of hard currency in importing machinery, but industry also needs to learn to think in this more industrial manner.

Abattoirs are rather primitive. The Meat and Milk Organization would like to see two in Cairo, one in Alexandria and one in Port Said. A mechanical abattoir has already been erected in Suez. Yet another is required in Upper Egypt. The Cairo abattoir would cost LE 300,000. Chilling arrangements and cold storage units are required in the four towns and the capital of each Governorate. Cold storage installations at present are not fully used and they cannot be used for freezing (see "General Situation" for reference to FAO's critique of UAR cold stores). People still prefer fresh meat to frozen. Refrigerated vehicles are at present confined to bringing imported frozen and chilled meat from the ports to the consumption areas.

Meat has gone up in price from 44 piastres to 70-80 piastres per kilogrammes in the past four years. The Government has restricted the sale of meat to only four days a week. There are no pigs, of course, which is unfortunate as the pig is a particularly good converter of grain to fat and protein.

Poultry

This industry is going ahead under the Poultry Organization. Slaughter houses have been ordered from Denmark sufficient for 4,500 birds an hour and 1,500 ducks an hour. At present the supply is 7,000-8,000 a day. The equipment includes some freezing and refrigeration, although the former is not much required on account of the brisk demand. A total of 70 million chicks per year are already hatched by farmers, in primitive houses of mud and bricks, as compared with seven million ducks in the Poultry Organization at present. However the scheme is to hatch 12 million per year by 1970.

Poultry sells at 42 piastres per kilogrammes dressed and 31 piastres per kilogramme live-weight (the price paid to co-operatives) and 37 piastres retail live-weight and 45 piastres dead.

Ducks are 26 piastres per kilogramme live-weight (and are not dressed). Turkeys sell at 42 piastres for hens and 50 piastres for cocks.

Day old chicks are $2\frac{1}{2}$ piastres to 3 piastres. A feeding stuffs mill, nearing completion, will produce 150 tons per day. This will be ready in 4-6 months, the equipment and building being available and about to go up in Cairo. About 40-50 per cent of the cost of the bird is accounted for by the food, as in the case in other countries.

This industry is expected to spread all over the country so that more units are expected before 1970, depending on the availability of finance. Alexandria and Cairo are the chief consumption centres. Aswan, too, could accommodate one.

Recommendation

Industrialised meat and poultry production seems satisfactorily underway but no processing facilities seem to be required.

Fish

The fish catch of UAR has increased from less than 40,000 tons pre-war to 120,000 tons now and there are appreciable imports, including 15,000 tons from Russian sources in 1964/65. Fish is available from the 2500 kilometer long coastlines on the Mediterranean and Red Seas (where there has been Russian assistance in the development), the River Nile and Delta regions and the fresh water lakes (about 600,000 acres), including now Lake Nasser being formed by the Aswan High Dam. About 40 per cent of the catch is lake and river fish and 60 per cent (27,000 tons) Red Sea and Mediterranean fish. In 1958, when the total catch was estimated at 80,000 tons, but was probably one third more than this, 42,000 tons were recorded as coming from the lakes, 6,500 tons from the Nile and 41,500 tons from the sea. Most was consumed fresh, without processing at all

and at that time there was much wastage of fish due to lack of ice, which was manufactured only in four factories in the Suez area, producing about 100 tons per day at a cost of 6.4-7 piastres per 25 kilogrammes block, or c. £5 per ton.

Nevertheless the Fisheries Organization considers that extreme caution is required in appraising the future possibilities because fisheries are now entering into a very critical period as a result of a number of adverse factors which are operating. Firstly, the various projects for land reclamation for cultivation include recovering one million feddans that are at present lakes, which will obviously lead to a fall in the catch of fresh-water fish.

Secondly, the decreased area will result in more fishing on the remaining lakes, which are thus liable to be overfished, so that returns may again be diminished.

Thirdly, various schemes for irrigation are causing difficulties for the inland waters as regards fishing.

Fourthly, insecticides used in intensified agriculture are killing the fresh-water fish.

At present about 10,000 tons of fish come from inland waters of which 6000-7000 tons are from Upper Egypt. There, 300,000 hectares of occasionally covered land, which is a good fish area, are out of action because of the high dam. The dam is also affecting fishing on the Continental Shelf in the Nile Delta region, where lack of the red water from the seasonal flood on which the fisheries depend seems to have resulted in a sudden loss of 20,000 tons a year of sardines, for the canning of which a factory had been placed at Damietta. It is possible, of course, that this disappearance may be no more than the occasional sporadic changes that occur in any pelagic fishery, and nothing to do with the flood control by the Dam. However, it certainly seems a matter demanding urgent attention by fisheries biologists.

To counterbalance this loss of fish, sources of sardines have been found in the Gulf of Suez and the Red Sea also, but not in sufficient quantities as yet to keep the Damietta factory fully employed (see later). In general, however, new fishing vessels for the Red Sea and Mediterranean built over the past few years do not appear to have lived up to expectations in increasing catches markedly, more perhaps because of lack of skill and persistence than from lack of fish, because other nations, including Russia, seem to be able to catch plenty of fish in the area.

As a result of a combination of factors, therefore, a sharp drop in fish catch is anticipated and the Fisheries Organization is developing plans to try and keep it from dropping and if possible to increase it. They are trying at least to keep it at 120,000 tons a year by developing inland and sea fisheries and to protect them by severe laws. More important, they are going into the ocean fisheries of the Indian Ocean and Atlantic. Vessels to prosecute this are now being built in Spain and elsewhere abroad (including USSR) and also in the UAR naval dockyards. These range in size from 34 meters to 80 meters for freezing at sea and some will be of 100 meters length. It is intended that these should fish mainly in tropical waters and are of three main types:-

(1) large (2) medium (3) purse-seiners and/or trawlers. They are hoping to secure tuna and mackerel (Scomber scombrus) for canning. It is realised, therefore, that they cannot hope to cover the supplies required at home from local waters. Deep frozen sardines and mackerel will therefore be brought home and consumed as fresh. Sardines are both canned and salted for home consumption; of the supplies up to a year ago of about 20,000 tons, about 1,000 tons were canned, 3-4,000 tons sold fresh and 15,000 tons salted. Now everything is changing. Local processing plants will be erected in distant areas where transport is too expensive.

In the Atlantic Ocean, operations will be based on a mother ship for sardinops off South West Africa, the ship holding 2,000-2,500 tons at a time. Trawlers will also be available by the end of 1967.

In the Atlantic Ocean it will be mostly ground (demersal) fish that will be caught and in the Indian Ocean the same. It is hoped that the Indian Ocean will furnish tuna and mackerel, the tuna going for canning and the mackerel mainly for the fresh market. Of the sardines, some will be canned and some distributed fresh.

Entire fish with heads and guts intact, are preferred in Egypt, except for the larger groupers and sharks, which are gutted.

Live eels at present are exported to Holland. These could be smoked. At one time, smoked herring used to be imported from Norway and the UK.

Refrigerated vehicles are planned for internal distribution - Bedford lorries imported, fully equipped with refrigerators and Fiats also, as well as locally-built vehicles.

A special company has been set up for the transport of fish. Egyptian people like fish, particularly those who dwell near the coast. Cairo consumers might eat fish, say, once every ten days on the average, (fish observed in the retail market at Cairo had some ice on it and appeared reasonably fresh) whereas in Port Said, it would be perhaps 5 or 6 times a week and in Alexandria twice a week, but inland only, say, once a month. In Fayum fresh water fish is available.

As there is a shortage of fish, there is no object in publicity for it until ocean fish are available, when publicity will be required to encourage greater consumption.

By the end of the seven year plan for fisheries in 1971/72 (the years of which run from July to June) 130,000 tons of fish should be coming from the ocean fisheries in addition to the present resources of 120,000 tons, which may however fall off for the reasons given above.

At present there are imports of canned, frozen and smoked fish totaling about 15,000 tons. It is hoped that these will cease by 1968 and the UAR will be beginning to export. Even now there is some small export of fresh sea-bream to Western Europe by air, and there are also exports to Lebanon and Greece.

Fish is relatively expensive and there is a tendency for prices to rise to limit consumption. With ocean fish it is possible that fish would be 40 per cent cheaper. Processing equipment for the freezing ships is being supplied by Baader Mordischer Maschinenbau of Lübeck and by Atlas of Copenhagen and agreement has been reached on the plans. Refrigeration equipment is coming from J. & E. Hall of Dartford, Kent, and Sabro of Denmark. £ $\frac{1}{2}$ million worth of marine engines are required from England and details of payment facilities are under study.

With regard to the training of engineers for the new ships, this is being done in USSR, Poland and Spain and possibly also in France. Where the ships are being built, technical assistance is given in their operation and maintenance. There is a special school for training of fishermen and other marine schools connected with the Navy for marine engineers. There is also a training plan for all the lines required on the ships, refrigeration, winches, processing, etc.

Each of the factory ships will be working along with four large (600 tons capacity) and 6 medium-sized trawlers and 3 purse-seiners. The larger ships can also deliver fish if necessary (as is normally the case in European freezer-trawlers). It is estimated that the freezer trawlers can fill up with 500-600 tons of fish in 20 days fishing.

They would then have to spend more than 25 days in returning to port. At this rate it would take six to seven years to pay for them instead of two to three years if they were to be fishing all the time. Three transporters are therefore intended to bring back the catch. These will be 110 meters E.P. (i.e. "between perpendiculars") or

118 meters in overall length. However, it seems dubious to expect too much from ocean fisheries until "know-how" and experience have been acquired. It will take some time to reach the level of UK and Japanese techniques and even USA has not gone in seriously for freezing-at-sea ships as yet.

Difficulties have long been encountered in fish farming. An FAO Fisheries Division report on the Nile, Lakes and Pond Farms (1958/59) recommended that Government fish farms should be rehabilitated and operated and that basic deficiencies of administration of inland fisheries research work should be corrected; and also that more training was required, particularly for fish culture. Since 1956 the Nozhahydrodrome, a dis-used sea plane base, has, on FAO recommendation, been used for chemical and biological research work. Biological work always takes a long time to produce results and it is not perhaps obvious to the practical operator what the outcome has been so far. Latterly, the fish have not been large enough when caught. Then the required fertiliser is expensive. In addition, the land planning and reclamation schemes make the future uncertain for such capital investment. In some places, the existence of fish farming is actually preventing land reclamation. They are however trying fish farms at Alexandria and they intend to try more, with small numbers inland where fish are not otherwise available.

Some experiments are underway on the smoking and drying of fish, continuing the work Dr. Hamman formerly carried out under the Ministry of Agriculture Meat Hygiene Research Unit (see "Smoking of Damietta Sardine" - J. Arab Vet. Med. Assn., XXII, No. 1, Jan-Feb-Mar. 1962, pp. 47-51). At one time Egypt imported dried, salted fish from Canada, so that people have come to like it and locally produced commodities could therefore be acceptable. Salted herring are also landed from Russian ships.

Sardine canning at Damietta is based on the four months season in the Mediterranean whilst in the Suez area the fishing season lasts practically the whole year round. Sardine canning was interrupted in 1958 and a new factory was then set up at Damietta with technical assistance and equipment from Japan and inaugurated in 1960. The present industrial plan includes construction of another factory at Hurghada on the Red Sea coast, a factory for canning tuna and sardines at Suez, fishmeal production at Damietta and in the Red Sea area, as well as the establishment of a modern fishing fleet to supply these factories.

Frozen shrimps are produced at six factories, four in Alexandria and two in Port Said, whilst yet another is being added at Alexandria. An input of 10,000 tons of fresh shrimps a year would be necessary to keep these factories busy, producing 4,000 tons of frozen shrimps, mainly for export.

The Damietta factory currently is only running at about half capacity for sardine canning because of lack of supplies. 50,000 cans a day are manufactured from tin plate sheets. This would be equivalent to about 15,000 kilogrammes of fish, or 15 tons a day, corresponding in a 300 day year to 45,000 tons if the factory could be run 12 months at full capacity. 12 million tins could be produced, even 15 million. Actually only six or seven million are produced because of shortage of fish supplies. Thus, three shifts could be worked instead of only two as at present. Import of Moroccan frozen sardines has been considered, but payment could only be offered in canned fruit and vegetables, which was of course, quite unacceptable. Mediterranean sardines have tough scales, which really need removal before canning. Red Sea sardines and sardinelles are also packed in olive and cotton seed oils and tomato paste. And Russian frozen sardines caught in the Red Sea are imported via a store in Alexandria. These fish only contain about six per cent of oil, and at this low level the offal is converted into fish meal without removing oil, in a plant which has a capacity of five tons a day.

Tuna fillets and mackerel are also canned and white crab meat, as well as salted anchovies (which are not heat sterilised). Fish are also salted in barrels for home consumption. 150 grammes of sardines, etc., are packed with 50 grammes of oil. The fish are thawed in running water, heads and tails cut off by hand with scissors and the viscera removed, then washed, brined and three fish packed in a can; the fish are then cooked on trays in a steam cooker and the juice produced, about 20 per cent, tipped out by hand. The cans are then vacuum sealed to give a vacuum of 30 centimeters of mercury and are sterilised at 116°C for about an hour in automatically controlled steam retorts. The Japanese equipment, supplied in 1960, is already only about 50 per cent effective, it was reported. The cans are cooled in water chlorinated notionally at five parts per million and then stored for three weeks to detect swells. Less than one in 1,000 cans are said to be faulty. Four weeks storage is required for maturation. The canned sardines are sold at 11 piastres per 200 grammes net wholesale and at 13-14 piastres retail.

One kilogramme of fish gives 3 to $3\frac{1}{2}$ x 200 grammes cans. This works out at about $3\frac{1}{2}$ piastres per can for the fish content. The labour cost depends on the intensity of work, i.e. on the size of the catches available, and therefore varies from about 2 piastres to 4 piastres per can. The normal price of fish, including the price of the Russian fish is 10 piastres per kilogrammes, but the latter rises to 12 piastres including storage and transport. Frozen shrimps (frozen in "Americo" plate freezers from USA) are sold at LE.600 to 700 per ton, the price paid to the fishermen being LE.300 per ton (30 piastres per kilogramme). A new sorting line has just been installed. It is considered that new vessels and new methods of fishing are required at Suez for fishing at different depths in the Red Sea and Indian Ocean.

Recommendations

It would seem sensible, on a sub-regional basis for Moroccan frozen sardines to be utilised in UAR canneries, except that these would then be largely exported in competition with Moroccan produced.

Freezing at sea will obviously take some years to settle down and become effective technically and economically.

A fish smoking and drying installation seems called for on the Red Sea at Hurghada after pilot-scale trials and acceptability and marketing experiments.

Edible Oils

The chief edible oil in UAR comes from cotton seed, of which it accounts for about half of the total African production. Current production is about 900,000 tons of seed, yielding between 200,000 and 250,000 tons of oil and, allowing for some losses in processing, 620,000 tons of oil cake, which goes for animal feeding. A glandless variety of cotton seed has been developed at the Bahtim Experimental Station which will give a meal free from gossypol that will therefore require less refining.

Some sesame seed also is processed for extraction of oil but there is apparently some difficulty about removing the hulls in large-scale processing, flotation in brine being one possible solution.

All the raw material is used for home consumption and there is no surplus for export. In fact, there are some imports of edible oil, 30,000 tons a year of soya bean oil coming from USA (at a cost of LE 1.20 per gallon)

The home-produced supply is insufficient for needs and 10,000 tons of sesame and raw cotton seed are therefore imported from Sudan. There are about 30 mills processing chiefly seed using either hydraulic or screw presses, only one mill using solvent extraction.

It is planned to convert all extraction to the solvent process. Whereas the expeller leaves a cake containing about 50 per cent water and 4 per cent oil, with solvent extraction less pressure is required, the process is quicker and only 1-2 per cent of oil is left in the cake. Fourteen production units are to be installed, capable of processing more than 840,000 tons of seeds a year. Also a corresponding number of continuous, low-loss refining plants have been ordered and some of these are under construction and some already functioning. One of these new factories now being erected near El Mansura will solvent-extract 200,000 tons of seed a year and other factories will be two or three times as large. A five tons a day of hydrogenation plant is also being installed there for manufacture of compound cooking fat, not margarine.

Hexane is the solvent being used and the equipment for extraction and refinery is supplied by Czechoslovakia. Well ventilated seed storage facilities are also planned. These improvements will increase the annual oil production by about 27,000 tons before 1970.

On the supply side, it is planned to increase the area cultivated by oil-bearing seeds, mainly groundnuts (which are at present grown mainly for edible purposes, not for oil extraction), sesame, soya bean and safflower (although the diseases that affect the soya bean probably need to be more thoroughly understood). Four more solvent plants are being installed for the production of rice bran oil, yielding 6,000-8,000 tons of oil a year. One factory has already been operating this process successfully at Alexandria since 1961. A further solvent plant for groundnuts and soya beans is expected to yield 10,000 tons of these oils a year. Shortenings made from hardened oils or blends of oils which came on the market about ten years ago have practically replaced butter fat for domestic use. The existing hydrogenating plant can be made to double its original capacity and thus meet the increasing needs. In anticipation of further increased need, four new units are being added, including, presumably, the one at El Mansura.

With regard to the possibilities of expanding cotton seed oil production, this depends on the market that can be obtained for the cotton. For comparison, in USA where a total of 48 million acres are available, 12 million are under cotton alone. The yield of seed from the cotton is almost exactly double that of the lint, which works out at an average of 33-34 per cent, and although some **higher figures are** obtained in USA this is not the case with Egyptian cotton.

The average yield of cotton lint is about 6 kantar per feddan (or about one bale of 700 lb. - 658 lb. is the latest figure, a kantar being 50 kilogrammes), so that twice this would be seed, say 1,300 to 1,400 lb. per acre, roughly corresponding with the 1964 crop of nearly $1\frac{1}{2}$ million tons on 2 million acres. The present cultivable acreage of 6 million (which is mostly good land, although with some salt in the soil, in places) is to be increased by 2 million feddan as a result of the High Dam. However, according to a foreign expert, only 600,000 acres of Class II and III land (Class III being barely cultivable) are affected, making possible the perennial irrigation of only relatively small areas. More than two crops a year are possible on some of the land, the average being 1.57 crops per year per unit of land. However, only one cotton crop is taken on about 2 million acres. The Government had to make a decree 2 years ago, determining the area to be planted in cotton in face of the resistance of farmers to cotton, because there is more money to be made out of vegetables and also fruits. 1.3 million lb. of cotton is exported and in fact more than this cannot be sold; if it could, probably more would be grown, and the food acreage would be correspondingly reduced. Thus, the fact that an extra 2 million feddans will be made available by the Aswan High Dam will not necessarily mean that much more cotton can be grown, so resulting in a vast increase in the production of cotton seed. Even the 600,000 of better land will be expensive to drain, although, however, it would probably pay off eventually. In any case the population is growing so fast that even the increased food resources released by the High Dam Scheme, when completed, will scarcely keep pace.

The Dam is now filling up fast and should be filled by 1969, one year ahead of schedule. It will be seen in the next five years therefore what the additional potentialities released by the new lands will be.

The present capacity of cotton seed oil plant is not therefore a limiting factor so much as availability of raw material. Eight (one modern and seven to be modernised) plants have a capacity sufficient for 50-60 per cent of the cotton seed crush. Others are old and used chiefly as a standby. Some of the older plants may be closed, and their technical staff transferred to the new rice bran oil plants being erected. There will, therefore, be no need to plan any expansion of technical staff, although existing staff should receive further training. The solvent extraction plants are more sophisticated and require highly competent staff for completely successful operation. Most of the recommendations in the draft second five year plan relate to raw material and by-products. After conversion of the seven plants, UAR will have more than sufficient plant to meet extraction needs as far as 1970.

Average yields of cotton in 1961 were not much better than 25 years ago. In general, the average level of production is regulated so as to maintain supplies of lint at the level of anticipated take-off. It is estimated that the production of lint in 1970 will remain at about the same level as at present.

As regards the possibility of other sources of edible oil, there could conceivably be an increase of corn production in Egypt by 1980, although maize oil itself is rather expensive.

Recommendation

The shortage of raw material for the edible oil industry, as things stand, renders it unlikely that any processing equipment will be required additional to installations now decided on for completion before 1970. However, if oil continues to be imported in increasing quantities, say

from Sudan, in the form of seed, then extra extraction plants as well as refineries etc., will be required before 1980.

Cereals

In 1965/66 imports amounted to $1\frac{1}{2}$ million tons of wheat, which is milled to 90 per cent extraction for Arab bread, plus $\frac{1}{2}$ million tons of flour of 70 per cent extraction for macaroni, etc. This is a continuing situation, wheat imports from Russia having already been contracted for 1967. Exports in 1964/65 included 527,000 tons of rice (milled equivalent) out of a "paddy" production of 2,300,000 tons (100 tons of "paddy" being equivalent to 65 tons of milled rice). The home production of wheat seems largely irrelevant to the question of milling capacity. However, it is to be noted that the Government, through its control of agriculture, has increased the acreage of corn, so that corn production has increased but wheat has been correspondingly reduced. Cultivation of rice has also been encouraged for the sake of export. One acre of rice produces the same income as six acres of wheat.

White corn can also be grown. If successful, research on varieties would be necessary and also a lot of work on the best methods of culture. The Bahtim Plant Experimental Station is not at present in the best position to carry out such work effectively (although it has recently been successful in producing a glandless cotton). 111 bushels to the acre have been registered by the Ford Foundation, although 80 bushels per acre would perhaps be a safer figure to take as an average for the whole country. The General Organization for Flour Mills, Rice Mills, and Bakeries (Orga Mills) was set up in 1962 to take over the nationalised mills after a period of control of private industry by the Ministry of Supply. This organization is separate and distinct from Bisco Misr which is responsible for the manufacture of biscuits, cakes, confectionery and European-type bread under the General Organization for Food Industries.

In the circumstances, flour mills are fairly fully utilised. Many of the older stone mills are practically worn out.

Rice Mills

When these were taken over from the private sector, there were 78 rice mills, some quite old, some recent. Rice is important because it is one of the main foods and sizeable exports bring in foreign currency. The first short-term objective was to use all idle capacity and to make improvements by providing capital for some new equipment. In this way capacity will be increased from 4,440 tons to 5,300 tons of white rice per day. However, the quality of the milled product has to be considered as well as the quantity. Rice has to be milled to different qualities and equipment has to be capable of producing the higher grades for export.

The next development is that the High Dam will be increasing the amount of water available for growing rice, as a result of which 10-12 up-to-date rice mills will be required, each with a capacity of 155 tons per day. It has been decided that an East German Organization (Unitechna) will be providing these, at a cost of £3 million, during the course of the present plan ending in 1970. The first mill will be established on site in May 1967. It is calculated that these twelve, along with the 78 existing already, after their improvements, will be sufficient for both export and local consumption if they are manufactured according to schedule, but further progress is hoped for in the next fiscal year which will start the next part of the operation. The High Dam is functioning in two periods. In the first, it will be giving some water and in the second this will be assured. Commencing in 1966, the extra rice so produced has been milled to give the best grade for local consumption and exports. Rice now costs 9 piastre per kilogramme, although until recently it was 4 piastres, when it was increased by the Government in order to increase exports.

Flour Mills

When the private sector was taken over by the Government sector, there were about 160 flour mills all over the UAR. Only 26 were of the roller type and 134 of the stone type, most of them over-aged, some 60 years old and out-dated. In preparing short and long term plans the following facts had to be taken into consideration:-

- (a) The condition of the then currently existing flour mills, especially the out-dated and exhausted ones.
- (b) The high rate of increase in population and the continuous need for establishing new units to satisfy the increasing consumption of flour.
- (c) The fluctuation in the local rates of consumption of imported flour which is used as a compensating or subsidizing agent for the locally-milled flour. Irregularity of imported flour shipments puts more stress on the locally milled flour and requires that measures should be taken to establish the appropriate new milling capacities to act as a safety factor in case shipments of imported flour are unintentionally delayed.
- (d) The geographical distribution of the flour mills, in order that all locations would be satisfied and no shortage of flour supply arise due to such factors such as shortage of means of transport in some seasons.
- (e) The long period required for erecting new flour mills which are normally imported from abroad.

A short-term plan was established to increase the milling output of the currently existing stone mills. This consisted of renewing the equipment, and three-shift working at these mills, which started two years ago and will terminate next year. It is planned that after the completion of this programme, the output of these mills will be increased by about 40 per cent.

For increasing the output of the existing roller mills, the required spare parts and additional equipment are already ordered from the respective companies so that the milling capacity of these mills is expected to increase by almost 80 per cent.

A part of the long-term plan includes the importation and establishment of four new compact type Hungarian (2 of 100 tons per day) and ten Czech mills giving a further 8 x 75, 2 x 50, 2 x 25 tons per day - a total of 950 tons per day. The Hungarian mills are under construction, while the Czech ones will be delivered next year. After the establishment of these new flour mills, the flour milling capacity will be increased by 35 per cent.

However, as an FAO expert comments, "this scheme "will only give satisfactory results if there are enough trained people who are capable of running this industry". A Hungarian mill imported a year ago is reported to have broken down after a few days and not to be working again yet. The contracts for the new Hungarian mills are on the basis of bilateral exchange for cotton. An American expert expressed the opinion that mills purchased in this way cost 2 or 3 times more than if obtained from hard currency areas. In old Cairo there were two flour mills. One, still operating, Swiss built, 20-25 years old. The second one was burnt down eighteen months ago and is not believed to be repaired yet. New silos were erected three years ago. It is proving difficult to find enough staff technically qualified to operate machinery on their own and to keep it in good repair. An FAO report emphasises the need for more good middle managerial staff to keep all mills in good condition and operating well. The top managers are usually well-trained but have too many responsibilities and inadequate assistance.

Bakeries

There are in UAR two characteristic types of bread of North Africa and the Near East. (1) "ish-balady" - a round loaf of about 25 centimeters diameter baked for a short time (1-1½ minutes) at 500^o centigrade in a stone oven. The dough puffs and separates into two layers. (2) "Kessra" chiefly in North Africa, where the dough is prepared at home to the families' own recipe and is taken to the baker for cooking, as a flat, but not typically Arab type.

In Libya and Morocco most of the bread in the towns is of the European type. The Arabic type is made almost entirely by hand in small bakeries, mostly poorly equipped and with poor sanitary conditions.

The concerns taken over from the private sector were mostly very primitive. The nationalised bakeries belonging to Orga Mills are all located in Cairo and its adjacent districts. The total number of these bakeries is only 90 out of the total of 900 commercial bakeries in Cairo. These nationalised bakeries produce only 13 per cent of the bread produced in Cairo and its adjacent districts. Although Orga Mills has tried to improve the conditions of these bakeries, the aim was merely to keep these bakeries running until the new improved bakeries come into action.

Factors that hinder the improvement of the currently existing bakeries for continuous commercial production are:-

- (a) The locations of most of these bakeries are not fit for proper production and distribution of bread.
- (b) The low average production capacity of all these bakeries.
- (c) The non-awareness of the workers in these bakeries of the scientific techniques of bread-making.

Thus, it was found impossible to maintain control of production due to the above-mentioned factors, and it was decided to start on a new programme for the economic and scientific production of balady bread by the establishment of a chain of bakeries for the mass produc-

tion of bread. These bakeries will follow in principle the present technique of bread production, only modified to adapt it to large scale production. They will replace most of the older bakeries, only the very best of which will be retained. Such bakeries, which will be able to bake 360 sacks of flour per day, are under construction in Cairo and Alexandria. Measures had been taken in the construction of these bakeries to afford full control of the production both from the technological and economical points of view. Moreover, the dimensions of the production area in these bakeries will allow the new automatic equipment now being evolved by international companies to be substituted for that now in use if the experiments demonstrate that balady bread production can be automated.

Although it was claimed in 1965 that the technical problems had been solved, no test bakeries are yet known to be working. With plenty of labour available, it is perhaps debatable whether more priority should not be given to better designed, traditional bakeries with tiled walls, stone floors and mechanical mixers for making dough, all other operations being carried out by hand. It would be imperative, however, for such remedial measures to be combined with better vocational training of bakers, when it came to making regulations for building and equipping bakeries.

Total consumption of flour in the towns amounts to 2.2 million tons (in sacks of 100 kg.). All this goes to make bread (except for what goes into macaroni, which is, of course, durum, not soft wheat). Each sack yields 1,000 loaves. Imported flour (of 72 per cent extraction) is used for special loaves, and half of this goes into macaroni and sweet pastries.

The price of flour in UAR (in 1965) was 341 piastres per 100 kilogramme or LE 34 per ton. The weight of the loaf is 156 grammes with 40 per cent water maximum. The retail price is 0.8 piastres and there is a subsidy of 0.3 piastres.

Biscuits

The Bisco Misr Company produces about 50 per cent of the total biscuit production of the UAR and operates at full capacity, mostly for home consumption with a small export business.

Its production has grown as follows:-

TABLE U. 14

	<u>Tons of biscuits</u>
1960	11,920
1964	16,500
1970 (anticipated)	25,000

The balance sheet of its operations are as follows:-

	<u>LE.</u>
Flour - 5773 tons (@ about £E 45 per ton)	255,800
Raw materials for the whole company	
including flour	1,383,800
Wrapping material and packing	550,000
Sales value (approx)	3,333,333
Profit perhaps around	500,000

As biscuits are semi-luxury items they are expected to sell at a reasonable profit and are not the first priority in the General Food Organization, so that improvements and fresh investment will only come in the last two years of the five-year plan. Not enough biscuits are being produced to meet demand. There is much hand-packing on the production lines. It is quick but rather rough.

The organization has two factories in Alexandria, one of which is larger than that in Cairo. The Cairo factory has one line for hard biscuits, one for soft biscuits, totalling 16-18 tons of biscuits a day, and one for sliced bread. (30 tons cut and sliced per day). The factory is working 24 hours a day.

Sales were LE 3 million in 1964/65 - say LE 3 1/3 million now from the three factories. The larger Alexandria factory has one line for biscuits of 8 tons per day in 3 shifts. Also, working one shift only:-

1 line for chocolate (Grades A & B - the latter going to country districts)

1 " " chewing gum

1 " " candies and toffees

1 " " mint tablets

Some of these are exported.

The Arabisco factory in Alexandria produces mainly biscuits - about 13 tons a day in three shifts.

The company also makes "halva", a confection consisting of 50 per cent each of sesame oil and sugar, which does not go rancid.

LE 80-100,000 of this are exported at a cost of LE 200 per ton in 1 lb. tins.

Enough money is accumulated by the company to make it self-supporting as regards future capital investments. 20 acres of land is available in Alexandria for future expansion for new factories. But it is difficult to obtain hard currency for new equipment. A new plant is really required so that each product can be made in a separate department. For this LE. 1 1/2 million is required for machinery, or a total of LE. 2 million including building, the plans for which are all ready. An attractive US offer is being considered whereby new equipment would be paid for in 2-3 years by exporting all the production. There is no foreign currency available for further purchases from West Germany which supplied equipment installed in 1963 (this is not robust). UK equipment made by Baker Perkins is preferred because it is very strong, but it is rather expensive. They would prefer to get all the new equipment from one country and if possible from one company.

2,400 employees work in all the factories. This number would be reduced in the new factory. The exports amount to £E 100,000 in value and it would be quite possible to export at least twice as much and to increase total sales by up to 40 per cent if the total production were increased.

It is hoped to be able to start work on the building and ordering the machinery soon and to be in full-scale operation by the end of the present five year plan, as now extended to seven years and ending in 1972.

Bread for school feeding is fortified with seven per cent of milk and eight per cent of fats. It is slightly yellow but tastes good. It is only made in Cairo. There are no signs of any decrease in the production of Arabic bread in favour of the European type.

It is hoped to develop a dietetic bread already produced in the laboratory from gluten and bran. It is rather strong in flavour but has a good consistency. There is also need for plant and "know-how" for the production of breakfast cereals. Kelloggs have been approached without result. It is doubtful whether to include this in the present plan or to wait till after 1972. A total production of say one ton a day with one shift is envisaged at the outset, producing corn flakes, "Quaker-type" oats, shredded wheat and rice crispies. The pilot plant factory required would cost, perhaps, £L 50,000 for equipment and £E 50,000 for extras. Technical advice is required, and technical training. The product would be intended for home consumption, not for export.

The flour used for bread-making is an all-purpose flour and is not uniform enough or "strong" enough to use the Chorley Wood Process. Bisco Misr are members of BBIRA (The British Baking Industries Research Association) but not of BFMIRA (The British Food Manufacturing Industries Research Association) which gives advice on chocolate and sugar confectionery amongst other subjects.

For training, they would like to have about twelve experienced supervisory staff working for a year in a British factory as they have done in West Germany and be paid for an ordinary operative labour (the trade union difficulty could probably be overcome). Baker Perkins run a school in Peterborough, but this costs foreign currency which is not available for the purpose.

Recommendations

Currency difficulties are obstructing technical progress in the Egyptian cereals industries. Milling equipment seems to be likely to be satisfactory for all requirements in the future but constant replacements will be necessary of older equipment. In Arabic bread-baking, improvement in the labour intensive, conventional methods should continue alongside attempts at automation, which is not yet operational. Biscuit manufacturing also find it difficult to obtain the right type of new equipment. In all sector further training of middle-grade staff is all-important.

Sugar

Sugar was first introduced into Egypt by the Arabs in the Seventh Century and primitive sugar production was started in the Ninth and Tenth Century. French factories were installed in the 1860's and 1870's, but before 1952 the newest sugar factory was erected in 1903. Production has increased as follows:

		<u>1,000 tons</u>
1952	..	188
1957	..	299
1962/63	..	358
1963/64	..	382
1964/65	..	420

The present acreage under sugarcane is 115,000 which will be increased as a result of various irrigation schemes and chiefly the Aswan High Dam to 272,000 acres (115,000 ha.) by 1970. It is hoped that about 10 million tons of cane can be produced annually, yielding more than one million tons of sugar a year. The present yield is 40 tons per acre, but attempts are being made to improve this by experimental work. The five existing mills had a crushing capacity in 1964/65 of 4.2 million tons. The crushing season lasts from the end of December to the end of April. The crushing capacity of four of these mills are to be increased, one new mill is under construction at Kons and orders have been placed for two more mills, to be supplied by Czechoslovakia, one at Deshna dealing with 8,000 tons of cane a day to commence in January 1968 and the other at Baliana two years later with 12,000 tons a day. There is also a large sugar refinery with a capacity of 1,200 metric tons a day at Hawamdiah 20 kilometers south of Cairo, which works partly on imported "raws", partly on home produced.

The expansion programme (in 1,000 tons) is as follows:-

TABLE U. 15

<u>Factory</u>	<u>Crushing, 1964/65</u>	<u>Planned capacity 1970/71</u>
Afou Korkas	611	650
Nag Hamadi	1,162	1,500
Achmant	833	1,200
Edfou	434	1,000
Kom Ombo	715	1,500
Kons	-	1,500
Dechneh	-	1,200
Baliana	-	1,500
	<hr/>	<hr/>
Total	3,755	10,050

The total expenditure on sugar projects in the 1965-70 plan exceeds LE 106 million which is 82.5 per cent of the capital expenditure planned for the food industries in this period. In addition various projects for non-food uses of by-products, either completed or under construction for operation before 1970, will cost LE 64.6 million. A new continuous extraction process for sugar-cane is also being experimented with; the German BMA company has bought the licence and is currently selling 100 plants all over the world.

The 1963 consumption of 430,000 tons a year (which is 20,000 tons higher than the figure given by FAO) is about the same as that of Morocco (415,300 tons in 1963) which, however, has only half the population of UAR. Per capita consumption is about 15 kilogrammes per year compared with 9 kilogrammes in 1952. Present production covers 90 per cent of domestic needs but the intention is to become self-sufficient in raw, as well as refined sugar, in order to satisfy UAR's increasing consumption and to export surplus production. It was expected that consumption in 1966 would be 520,000 tons.

The latest plans are to produce 835,000 tons by 1972 and after that to add 150,000 tons a year. However, it is estimated also that consumption by 1980 will be over one million tons a year, so that after 1980 Egypt expects to be a net importer of sugar again, exporting only in the 1970's. This latest official estimate by the chairman of the Food Organisation's Ennasr Sugar Company is in sharp contrast to the figures given in the FAO World Indicative Plan which forecasts a production of 1,080,000 tons of sugar in 1975, with an export of 415,000 tons, rising by 1985 to 1,404,000 tons and 421,000 tons, respectively.

As a result of delays in the execution of new projects the anticipated production in 1978/79 is now 925,000 tons. As against this, expected consumption in 1970 is 565,000 tons; and in 1980, 920,000 tons. Consequently, exports are now expected to be 200,000 tons in 1972, and then to be reduced gradually to nil by 1980.

Cane sugar costs LE 42 a ton to produce in UAR. Beet sugar, by contrast, in Syria costs LE 70 per ton to produce. The investment per ton of sugar for a large sugar mill producing say 150,000 tons per year works out to LE 125 per ton capacity per year (i.e. LE 18.75 million).

A beet sugar mill processing 3,000 tons of sugar beet per day and producing 40,000 tons of sugar a year, which, of course, also refines 40,000 tons of imported "raws" is nevertheless more expensive in capital and incurs the same amount of overheads, management and skilled labour as the larger factory for cane.

From the point of view of the world economy, climatically favoured countries such as Sudan and Southern Iraq, should therefore be growing cane, rather than as the other Arab countries in the region going in for beet. In Sudan for example, where 20 million acres can be planted, five million could probably be given over to cane, thus giving the possibility of producing 20 million tons of sugar a year.

However, such developments take time if only because of the fact that only a three months' season is available in any one year for training workers (for this and other reasons it might be worth giving closer attention to the economics of extending the factory operating season by the cultivation of beet, as in the Morocco plans after 1974).

For the import of machinery for sugar production, "payment facilities" are of course required, but all credits are paid back, i.e. the operations are "auto-financed". Machinery to cover the production of the 830,000 tons planned by 1972 has already been contracted and arrangements made regarding finance.

The cost analysis of the UAR's current sugar operations are as follows:-

TABLE U. 16

	<u>LE. per ton</u>
Value of cane	21.966
Transport of cane	1.400
Wages	5.492
Consumable and packaging material	2.417
Maintenance	2.255
General and administrative expenses (Head Office, etc.)	<u>0.755</u>
Total	34.293
Less value of molasses and bagasses for fibre board	<u>2.611</u>
Net cost ex factory	31.682
Depreciation	<u>5.789</u>
	37.471 (= \$86.18)

This figure can be compared with the cost of production for beet. Egypt's own small-scale experimental operation last year is not comparable perhaps. But in Sweden it is about LE 90. In Syria in 1963, LE 52.7 net (without customs or profit which brings the figure to LE 70 per ton). Furthermore, one acre of beet yields 2.25 tons of sugar in Syria, whereas in Egypt cane yields an average 4.6 tons per acre, assuming 10.3 per cent yield of sugar from cane, which is the figure on which prices are based although actually somewhat more than this is obtained. For all Arab countries in 1962, total sugar consumption was 1,851,200 tons, costing LE 71,085,426 of which 1,425,383 was imported (at a cost of LE 54,734,707). Production was thus only 23 per cent of consumption. By 1970, it is figured that total Arab consumption will rise to 3,127,000 tons (costing LE 146 million) and by 1980 to 6,849,000 (costing LE 315 million).

To satisfy the consumption needs for Arab countries for sugar until 1980 would necessitate capital investments of \$1445 million, which seems a very large sum to expect to raise. This sum is arrived at as follows:-

Taking account of the $2\frac{1}{2}$ per cent annual increase in population and an additional $2\frac{1}{2}$ per cent for increase in consumption per head as incomes rise, it can be calculated that the potential needs will be 4,700,000 tons. In 1963, 425,000 tons was being produced. The difference of 4.3 million x £E 125 per ton capital cost of production in large sugar cane units x 2.8 to the £E gives 1,445 million.

Cuba, Brazil, Venezuela and Mauritius can all produce sugar cheaper than this. If taken on a tax free price (with no customs duty), and based on the average world price of the last 20 years, profits on capital invested in would work out at only 1 to $1\frac{1}{2}$ per cent.

Normally, home produced sugar industries all have to be heavily subsidized by governments. Strategically it is perhaps not unreasonable for a country to become 50 per cent independent of outside sources. In Central Africa, a nine month season of 250 days per year is possible. In Egypt the season lasts only four months, or 125 days, but three or four cuttings are possible before replanting and other crops and cane can be sold at £E 160 per ton, not only to consumers but also to fruit canning organizations who have requested a customs draw-back for produce exported. The retail price is 17 $\frac{1}{2}$ piastres per kilogramme (compared to one-third of this in Beirut), the government tax being high so as to discourage consumption.

Kom Ombo factory, near Aswan, employ 3,900 workers in the crushing season (including labour for transport) and 1,800 in the summer. 180 trainees a year are drawn from local schools and a class of 16 is studying full-time as engineers (receiving £E 5 per month during the first year, £E 7 during the second and £E 13 in the third year).

The crushing capacity at present is 700 tons of cane per day and 50 per cent of the sugar from this is refined. By 1967 it will be possible to refine 80 per cent (to 33.7 per cent polarisation) to produce only 20 per cent of "raws" for refining elsewhere.

By 1970 throughput will be 1,200 tons per day based on the Czech machinery that is coming.

In the engineering workshops attached to the factory, pumps are being made, partly to save hard currency, partly to develop new techniques and technicians. Full-scale trials are under way of the continuous sugar extraction process, developed in UAR research laboratories.

According to a report, the Achmant factory in 1961 was producing 80,000 tons a year and employing 6,000 staff working 24 hours a day. Although extensions were being proposed, it can be deduced from the table at the beginning of this section that these had not been put into effect by 1964/65. Bagasse production was 117,000 tons a year and, although it supplied all the fuel required for the factory, there was a surplus which was baled to avoid spontaneous combustion. Although the ground on the plantations supplying the factory was not levelled and ploughing was not particularly deep, nor selected seed used, nevertheless yields of 40 to 60 tons per acre were being achieved.

A particle board factory adjacent to the Kom Ombo factory now uses 25 per cent of the 100-130 tons a day bagasse produced by the sugar factory, which, however, then has to buy in some fuel oil for the boilers to make up for it. As the bagasse leaves the sugar factory it contains 60 per cent of water and one per cent of sugar. This is first dried out in bales down to about 12 per cent moisture, and then, by means of a dryer, to 6 per cent. Automatic Swedish machinery is used to manufacture the board as follows: It first has the pith removed and is then size classified and separated so that the finer fraction is at the top and bottom of the sheet and the larger particles in the middle half. Seven per cent of ureaformaldehyde resin

is impregnated into the particles, which are pressed in two stages and heated to cause the material to adhere and then the sheets are sawn to size. Various standard thicknesses are produced and furniture is hand-made on a small-scale on the site.

The Société des Sucreries et de Distillerie d'Egypte controls the four older sugar factories and the refinery which were taken over from the former foreign owners in 1956 and these produce about 350,000 tons of sugar a year. The newer Ennasr Company for the Production of Sugar and Paper Pulp is concerned with operating the newer factories which are, however, planned for it by the Société des Sucreries. Its production is about 50,000 tons a year at present.

Starch, Glucose and Yeast

Total annual production is planned to increase from 19,000 to 30,000 tons a year from corn starch in Cairo. Rice starch is made in Alexandria and a new factory is being erected with a capacity of 80 tons a day (24,000 tons per year), which will be completed by 1967 or 1968, compared with the present 10,000 tons of starch and starch products and 5,000 tons of glucose.

Yeast production is at present 12 tons a day, working three shifts a day (4000 tons a year). The factory uses 17 tons of dry molasses a day. Production is to be doubled to 8,000 tons a year to meet the increasing demands of the bread industry. The cost is 14½ piastres per kilogramme and 40 piastres per kilogramme for 500 kilogrammes per day of tray-dried medicinal yeast with six per cent water. Drum dryers are expected to produce 1½ tons per day which might reduce the price to 32 piastres per kilogramme. The yield is 50-55 parts of completely dry material per 100 parts of wet input. Production of fodder yeast, too, will begin next year with a capacity of 5-6 tons per day (2,500 tons a year) at a price of about £E 70 per ton.

These industries seem to be expanding satisfactorily in accordance with needs.

Recommendation

Considerable future expansion of the sugar industry of UAR is planned, on the basis of the additional irrigation anticipated. It seems that the necessary financial arrangements can be made to secure the requisite factories and equipment for further development of the industry as far ahead as 1980.

Fruits and Vegetable Processing

Fruit and vegetables in the UAR are good and they can be grown all the year round, from late winter or early spring there is a whole succession of fruits. There are no apples or pears but tomatoes come in April, then water melons which are succeeded by mangoes (which are sold at 25 piastres per kilogramme) pomegranates and then oranges and white grapes. The climate is favourable for exports early in the season to Europe. But at present a tremendous amount of fresh fruit is wasted. Figs, for example, which grow on the coast near Alexandria, are often split. Packing is bad and this goes for tomatoes too, the crates used being insufficiently strong to prevent damage. Flies and lack of hygiene constitute a perpetual hazard. Water is sometimes even injected in order to increase the weight of fruit, such as oranges (and also of chickens and pigeons, so that it is only safe to buy US frozen chickens).

Typical prices of fresh fruits and vegetables are as follows:-

oranges	..	..	15	piastres per kilogramme
carrots	..	..	10	" " "
new potatoes	..	7	"	" "
apples from Lebanon	£E	1	"	"

These compare with an average wage of about 25-30 piastres per day for unskilled workers, perhaps 60-70 piastres for skilled. (Rents are low and controlled, however).

The production and consumption of canned and preserved foods generally are steadily increasing in the UAR. In the present plan sales are expected to increase by over 300 per cent between 1960. and 1970, and it is intended to establish six new fruit and vegetable canneries in various Governorates. Plans are being laid for increase in the production of frozen vegetables for export and local consumption, with suitable refrigerated transport, storage and distributing centres. The production programme for 1965/66 is over 200 tons.

The export of fresh onions comes next in value after cotton and rice. The export of dehydrated onions, which started with 661 tons in 1950 grew to 7,200 in 1959 after which it fluctuated around 6,000 tons up until 1964. At present there are nine drying factories in UAR, six in Alexandria and one each at Port Said, Maghaga and Suhag. The last named is one of the projects of the first Five Year Industrial Plan. It is sited in the Governorate where 25-33 per cent of the total winter onion crop is produced.

The system of drying fruit and vegetables is very old and is carried out in the home (e.g. for okra and water melons). Sun-dried vegetables are produced in enormous quantities, difficult to estimate. Vegetables dehydrated for export include beans, tomatoes, garlic and celery. Sun-drying of dates is common and modern units for dehydrating and packing are either operating or under construction to replace sun-drying and produce higher standards of quality for home consumption and export. The drying of grapes was established several years ago in the development plan; this will reach 2,500 tons of raisins a year to meet local demand.

There is a United Nations Special Fund project based in Cairo that is entirely devoted to increasing the vegetable production of the UAR. Six experts are involved, concerned with such varied aspects of the problem as seed production, breeding, virology (more than 50 per cent of the tomato and pepper crops are lost through virus infection), soil-water relations, post-harvest physiology, and marketing.

One highly important aspect is seed potato production. These are dear and scarce and there are difficulties over importing. UAR therefore wishes to develop its own seed development programme.

With local counterparts it is hoped to be able to increase the exportable part of the production, particularly in winter-time to Western Europe. It is therefore expected that there will be an important expansion in vegetable production.

Improvement in seed is a longer-term operation. This programme is not directly concerned immediately with processing, but obviously its activities have a bearing on the possibilities of increasing processing in the future.

Egypt has natural potentialities climatically and could increase vegetable production largely by application of established techniques, combined with a spirit of endeavour.

There is a tendency to separate production for export from production for local consumption. This is the wrong approach although of course export usually takes the cream of the crop.

Trained Egyptian scientists are not all sufficiently interested in improving technology. They are liable to be more interested in more complex problems and do not necessarily apply knowledge obtained in overseas training to practical problems met under local conditions.

For example, beans are exported, but harvesting and preparation for the market are poor and result in a loss of 60 per cent of the first quality products. They are not picked at the right time and they are picked in the wrong way, so that they are not good enough for export. But trained scientific workers are more interested in sophisticated research on, say, the plant hormones involved in ripening, or even the addition of artificial colouring, rather than in applying known facts in the field. This attitude ultimately holds back potential production and exports.

Better team work is also required. Two or three laboratories can be found working on the same problem with expensive equipment, but with no apparent co-ordination. (This is by no means only a problem of the UAR, but more developed countries can perhaps better afford the luxuries of duplication of effort and gaps between theory and practice).

A French overseas business group, interested recently in organizing production for export, were not particularly helped in pursuit of their enquiries. Similarly, in vegetable seed production, European and US firms recently invited co-operation. No official help was given as these concerns were regarded rather as competing interests.

Also, in this context, nationalization is always liable, as a result of bureaucracy, to sap initiative and lead to lack of efficiency on the part of people in executive positions, who have no knowledge or technical interest in the matter under their control.

It would be possible, for example, without loss of control of the means of production to invite people from interested countries to organize production and teach local people to a much greater extent than is actually the case at present.

The UNSF project, which lasts for five years, should result in improvements in quality and quantity of vegetable production. There is only limited land available, but the types of crops could change. In the case of cotton, for example, world production is already high and vegetables are more productive and profitable.

The High Dam's two million extra acres could, with sun and water and technical skill, be turned into good land for growing vegetables.

Processing industries need to have planned supplies of agricultural produce and cannot just rely on surplus to the fresh market. Although some fruit and vegetable processing factories are producing some good products, such as tomato paste and canned artichokes and fruit, some are of less good quality, on account of irregularity of supplies, lack of the necessary factory facilities, and so on.

UAR makes its own tin-plate (as an off-shoot of the motor car industry) so that it is the only country of the sub-region that is self-sufficient in this respect, which could perhaps provide a basis for co-operation, if prices were competitive with the European and US can manufacturing industries.

For local consumption, however, the prices are high and in some cases, e.g. orange juice, local demand for the canned product may well be limited on account of the availability of the fresh fruit nearly all the year round. Similarly, at the present state of economic development canned fruit and tomatoes seem unlikely to be required on any considerable scale for home consumption. At the high atmospheric temperatures too, vegetable products are very quickly damaged. Peas for example at 30-40° centigrade are above the permissible maximum for good quality. They are often exposed unnecessarily to sun and heat before they are canned.

The practice of processing only selected raw material must be more resolutely developed.

Cold storage facilities are limited. There are a few stores for potatoes, available for four months from June to October for seed. The stores are then practically empty for the rest of the year. They should be used for local production for marketing or export. Chilled storage temperatures should be utilized as much as possible (0° - 3° centigrade for vegetables, 4° centigrade for potatoes). On the other hand the Horticultural Department has acquired a freeze-drier, which although perhaps applicable to drying shrimps, is not really of much use at present for vegetable processing, and in fact is not being used much. Such projects could be chosen more critically (although it is only fair to add that freeze-drying has been over-rated, at least partly as a result of sales pressure by equipment manufacturers).

The important vegetables are potatoes, (of which only a small portion is exported), and tomatoes, which it is hoped to be able to increase. Beans are also important. Paprika has the potentiality

for export to the European market, because it occurs in winter, which is a good season for export to Europe.

But for an export trade, a market and fleet of properly equipped ships are required for the length of the operating season which again requires planning in relation to the succession of crops. Grapes are already cultivated in a minor way, and it is possible that they could be exported early to Europe. A UN Special Fund project is required to study the best ways of handling for the market. University and, even more, technician training, is important. Furthermore, counterparts should be provided at the intermediate level. It is important for the people concerned to concentrate on details, instead of merely thinking in broad terms.

As regards freezing, it is difficult to produce good frozen peas for example because the climate is too hot for the proper sweetness and texture. Once harvested, produce must go to the factory at once otherwise it deteriorates rapidly. Interaction of climate and crop is very important.

Considering now the future possibilities of fruit and vegetable processing, good jam is already produced. The canned mangoes are good and getting more popular in the European market. Other exotics, such as guava, are good and the juice also. Cairo and the surrounding district provide a good area for growing. It was once intended that there should be a development belt of vegetable production round the city which now has five million inhabitants. This plan has subsequently been modified. Giza province has a good programme for vegetable production. Near Alexandria on the West and North West coast there is newly reclaimed land that is available for vegetable production. Fayoum has a good winter climate and soil. In Port Said and the Ismailia areas, however, there are drainage problems on account of proximity to the Suez Canal. The New Valley in the South should have an increased production also.

As regards potential fruit production, 70 kilometers west of Cairo there is the Tahrir Province land reclamation scheme in which 100,000 acres are being planted with grapes, 30,000 for table, 70,000 for wines. 15,000 acres of grape-fruit are also expected in the next five years, and 7,000 acres of date palm. It is planned to export citrus fruit, wine and fresh vegetables. 5 to 10,000 acres of olive trees are also being planted in the north west desert. The crops will be consumed locally on account of the shortage of edible oils, but presses will be needed.

The two General Food Organization groups concerned with fruit and vegetable canning are Kaha and Edfina, the latter being more recent. The Kaha group has two other factories at El Tahrir and Tabia near Alexandria. This group, on a typical day, packs 20,000x 1-lb. cans (about 10 tons) of orange marmalade, made from a mixture of sweet orange and grape-fruit. Bitter oranges are available but in decreasing quantity. Tomatoes are available in January until December, a later season than in Tunisia, for example. Oranges ripen to a colour suitable for packing as juice by December or January.

The output of the three Kaha factories is worth at least LE 2000 per day on average and LE 4000 per day quite often with LE 6000 as the peak. The export is about LE 300,000. A tin of guava juice costs 8½ piastres. A tin of apricot jam holding 680 grammes sells at 20-22 piastres retail. It is planned in 1967 that the outputs will be:-

Tabia	..	LE 6-700,000
Kaha	..	LE 1,725,000
El Tahrir		LE 750,000
Total		3¼ million (approx.)

Peas at LE 25 per ton give a 40 per cent yield.

String beans LE 22 per ton give a somewhat higher yield.

Peaches at 10-12 piastres per kilogramme have a 60-70 per cent yield.

Only 1-2 per cent of the price is labour content, normally at Tabia (at the other factories it is higher), although this can rise to 5 per cent when running below capacity.

70-80 women and 20-25 men are employed, plus for engineers, on only one shift, staggered however. The national minimum wage is 25 piastres per day.

About 40,000 cans a day are made. The price breakdown for marmalade is:-

TABLE U. 17

Cost of production	10.1 piastre per 1 lb. can
(Compare, wholesale price	14 piastres
Retail price	16 piastres)

of which:-

Oranges and grape-fruit	1 piastre
Sugar	3.5 " (at LE 160 per ton)
Can	<u>1.8 "</u>
	6.3

The rest is overheads, administration and profit.

A 211 x 300 can costs	1.5 piastres
301 x 400 (A 1 Tall) " "	2 piastres
211 x 400	1.8 "

Apple confiture costs 3 piastres per kilogramme for the fresh apples. No pectin is required to set. It is sold at 12 piastres per lb.

9 million cans of mangoes were packed in a 45 days season in 1966 in 6 oz. cans and all exported.

Edfina, in Alexandria, is a newer organisation with a more up-to-date factory, which also freezes shrimps, but the total turnover is much less than that of Kaha, although it makes a very similar range of canned products.

Guava juice (said to contain 0.7 per cent ascorbic acid) packed in 6 oz. cans (170 grammes 48 to a case) and 350 grammes (24 cans to a case) costs 30/- for the case of 48.

Canned food is required by the Army and in the desert, and also locally as the standard of living increases. Contracts are made with farmers and merchants to supply certain quantities and specifications at a given price and time. It is hoped in future to issue seeds and to pick and pack under supervision. It is also hoped to obtain a citrus juice extractor and concentrator on a bilateral arrangement, rendering the produce in exchange for the machinery.

All four Edfina factories pack a total of 15 million cans per year (=4000 tons) plus about 500 tons of frozen foods. Three factories carry out shrimp freezing and one the canning of shrimps. There are two other freezing factories in Alexandria, one at Kabari, and one at Fozha. 3 to 4 times the quantity of shrimps could be frozen if the raw material were obtainable. They hope for a 25 per cent annual increase in production for canning. In 1965 it was actually 60 per cent, rising from LE 600.000 to LE1 million sales.

As an overall figure about 25 per cent is raw material cost. Japanese can-making machinery is used for the cans at Edfina in Alexandria which come from the Kaha factory 10 kilometers away. Edfina has US canning machinery. As sugar costs LE 163-168 per ton, compared with about LE 40 without tax, and they use 500 tons a year, they are pressing for a "draw-back" for exports. Up to 30 per cent glucose can be used in jams to replace sugar, according to experimental findings.

Recommendation

The industry is operating at a fairly high level of activity, but products and supervision of processes in general need to be improved for the export market. Supplying the home market with canned foods is rightly regarded as a necessary feature of the rising standard of living brought about by industrialization. It is therefore presumed that canned foods really are selling well in the retail shops, as distinct from deliveries to the Army, etc.

CHAPTER VII

SUDAN

Population estimates

1950	8,615,000
1962	12,470,000
1965	13,540,000
1975	17,335,000
1985	22,005,000

TABLE S. 1

FAO world indicative plan:

Gross domestic consumption targets, Sudan (1,000 tons)

	1961/1963 Average	1975	1985
Cereals	1,583	2,481	3,327
Wheat	126	194	291
Rice (paddy)	9	15	25
Coarse grains	1,448	2,272	3,011
Starchy products	214	326	431
Sugar (raw)	138	205	307
Pulses	198	292	385
Nuts	21	33	46
Vegetables	370	600	916
Fruit	347	583	909
Meat and meat production	313	485	677
Meat	253	397	558
Offals	60	88	119
Eggs	24	36	57
Fish	15.6	24	33
Milk (liquid equivalent)	1,444	2,021	2,764
Oils and Fats	91	146	213
of which veg. oil	64	104	152
Calories/hd./day	2,030	2,160	2,330
Protein,g./hd./day	693	72.3	76.8
of which animal protein	23.9	24.0	26.1

TABLE S. 2

World indicative plan: Commodity balance for Sudan (1,000 t)

		1962	1975	1986
Cereals	P	1,691	2,891	4,125
	I	106	93	131
	E	81	124	179
Wheat	P	29	121	183
	I	100	93	131
	E	-	-	-
Rice (paddy)	P	3	20	42
	I	6	-	-
	E	-	4	14
Coarse grains	P	1,659	2,750	3,900
	I	-	-	-
	E	81	120	165
Starchy roots	P	235	357	460
	I	-	-	-
	E	-	-	-
Sugar (raw equivalent)	P	5	132	198
	I	133	73	109
	E	-	-	-
Pulses	P	210	325	408
	I	-	-	-
	E	12	-	-
Veg.(incl. melons)	P	370	665	1,013
	I	-	-	-
	E	-	-	-
Fruits	P	345	623	1,010
	I	4	-	-
	E	2	-	-

TABLE S. 2 (Cont'd)

World indicative plan: Commodity balance for Sudan (1,000 t)

	1962	1975	1986
Meat (incl. offals)P	275	404	586
I	-	-	-
E	22	7	28
Eggs	28	41	63
I	-	-	-
E	-	-	-
Fish and products (fresh equivalent)	17.4	24	28
	0.6	-	5
	24.4	-	-
Milk products (liquid equivalent)	1,606	2,173	3,197
	-	125	59
	-	-	-
Oilseeds and veg. oil (oil equivalent)	185	330	448
	-	-	-
	107	189	247

P = production, I = Imports, E = exports

TABLE S. 3

Sudan: Food industrial activities, 1965/66

No.	PRODUCT	SECTOR	No. of factories in Production	No. of factories not in Production
1	Sugar	Government	1	1
2	Brewery	Private	1	-
3	Distilleries	Private	2	-
4	Sweets	Private	3	-
5	Biscuits	Private	2	-
6	Vegetable oil	Private	4	-
7	Flour	Private	1	-
8	Macaroni and Vermicelli	Private	7	-
9	Mineral water	Private	3	-

TABLE S. 4

Locations		Estimated Production		Actual Production	
3 Towns	Others	Quantity	Value (£S)	Quantity	Value (£S)
1 NIL	Guneid/Khashm	60,000 x 2 tons	16,000,000	16,592	2,000,000
2 Khartoum North	-	75 million litres	2,000,000	7,080,244	1,832,126
3 " "	-	5 million litres	1,234,632	3 million litres	600,000
4 Khartoum/ Khartoum North	-	5,000 tons	1,250,000	5,000 tons	1,250,000
5 Khartoum	-	-	180,000	-	180,000
6 Khartoum North	-	-	3,000,000	-	3,000,000
7	-	75,000 tons	3,500,000	57,000	2,500,000
8 Khartoum/Omdurman Khartoum North	Many others	-	500,000	1,000 tons	300,000
9 Khartoum/Omdurman	-	-	1,000,000	-	1,000,000

TABLE S. 4 (cont'd)

Imports in value (\$S.)			
	1962	1963	1964
1	2,853,429	7,395,142	8,775,069
2	95,112	63,980	83,255
3	96,675	115,774	137,463
4	-	-	-
5	206,728	292,877	431,975
6	-	-	-
7	-	-	-
8	1,492	3,043	1,996
9	756	1,351	970

TABLE S. 5

Livestock population estimates for North Africa
(million of head)

Country	Year	Cows	Sheep	Goats	Camels	Approximate Total
Morocco	1959/60	2.56	12.9	6.5	0.21	22
Algeria	1965	0.59	6	1.7	0.18	8.5
Tunisia	1959/60	0.62	3.9	0.85	0.17	5.5
Libya	1960/61	0.13	1.0	1.2	0.24	2.5
UAR	1960/61	1.6(1)	1.6	0.8	0.19	4-5
Sudan	1960/61	7 (2)	7.8	6.3	2.0	23-29
Approx. Total		12-18	40	17	3	65-72

(1) Later estimate 2½m. including buffaloes.

(2) Later estimates, 9m. 12m.

General Situation

The Republic of the Sudan has the largest area in the sub-region and the greatest proportion and largest amount of non-arid land. The cattle population is several times greater than the whole of the rest of North Africa put together and it could perhaps become the Argentina (or Brazil) of Africa. It is well watered by the Blue and White Niles and their tributaries. There is a substantial coastline on the Red Sea. There is a great diversity of climate and rainfall, which varies from near nil in the north to 1,500 mm. in the extreme south. Parts are very good for growing fruit and vegetables, although it is so hot that vegetation dries up in the summer. Sugar-cane can grow well under irrigation. Cotton and cotton-seed are exported in large quantities.

However, although potentially perhaps the most fortunately endowed country in the sub-region most of these potentialities are as yet inadequately realized. Such attempts as have been made to develop food processing since independence was achieved have run into difficulties that will be referred to.

Transport is a major problem facing any food industrial development programme. The country is so large that distances are considerable. The main railway line keeps close to the river which winds about. Although the railway system has been extended with the assistance of the World Bank in a westerly direction beyond El Obeid to Nyala, and in the South West as far as Wau, the southern parts are still largely unopened up. Furthermore, there are rather intractable political problems affecting the three non-Arabic speaking provinces in the south. USAID in fact has a transport project.

A Ten-Year Plan of Economic and Social Development was published in March 1962 to cover the period until 1970/71. Although this has subsequently had to be revised and a new Five-Year Plan is now being worked out to supersede it, the information and targets set out for food industrialization are relevant to consideration of future potentialities.

The flooding of the middle Nile Valley due to the Aswan Dam has necessitated the displacement of thousands of villagers whose homes are being submerged. UAR is paying compensation to Sudan for this. Some are being resettled in the vicinity of Kassala and Khashm-El-Ghirba, where some of the new food and sugar factories are located.

FAO is implementing a United Nations Special Fund Project of five years' duration to set up a Food Processing Research Centre at Khartoum. The building is now erected and the technical staff and equipment are being accumulated. This could have an important bearing on the future of food processing in Sudan. However, there are certain factors that could possibly interfere with its function and efficacy. One is that, the Government has already gone ahead rather precipitately to establish its own small-scale production units with bilateral assistance without waiting for the basic information and experience that will stem from the new Research Centre. These facilities will therefore enable research to be conducted by the Government on the application of processing techniques to Sudanese crops as well as serving as demonstration and small-scale production plants. Obviously, this should all be co-ordinated

somehow with the work and programme of the Centre. The second factor is that there is also being established alongside a United Nations Industrial Research Centre administered directly from New York. Obviously, the programme of the latter should not overlap or compete with that of the Food Research Centre, but the two could usefully complement one another's activities. However, their respective scopes need clarification. The Food Centre is to have an Advisory Board, the function of which should be to pull the various strands together in a more integrated pattern.

Furthermore, a project for better utilization of dates with a pilot plant/demonstration factory at Kareima which FAO operated from 1947 to 1964 was rather wasted when it was transferred later from the control of the Ministry of Agriculture to that of the Ministry of Industry, so that all the trained technical staff were lost.

TABLE S. 6

Anticipated increase in crops

	1960/61		1970/71		Extent of Substitu- tion envisaged
	Area (1,000 feddans)	Production (1,000 tons)	Area (1,000 feddans)	Production (1,000 tons)	
Cotton (1000 kantars of lint)	680	2,149	1,004	3,649	
American cotton	180	200	380	536	
Mechanized production of dura	998	400	1,219	668	
Ground-nuts	471	192	845	401	
Sesame	694	127	1,200	275	
Castor	9	4	30	17	
Rice	4	3	19	13	7
Wheat	39	26	69	96	70
Coffee	4	1	19	5	2
Tea	-	-	1	0.3	
Sugar cane	-	-	75	1,500	150 (of sugar)

TABLE S. 7

Sugar Imports (annual average, 1,000 tons)

1947/51	1952/56	1957/61	1970/71 - Planned Production
47.7	98.4	117.4	150 - 200 (£S 3.8 - 5.0 m)

TABLE S. 8

Gross value added by food industries

	1955/56		1959/60	
	£S 1,000	%	£S 1,000	%
Food manufacturing industries	1,473	54	2,512	49
Flour mills	340	12	478	9
Sweet factories	84	3	186	4
Oil mills	1,009	37	1,707	33
Beverages & tobacco	505	18	398	13
Mineral water	347	13	231	8
All manufacture	2,762	100	5,184	100

TABLE S. 9

Import substitution planned by 1970/71

	1,000 tons	£S. 1000
Rice	7	280
Wheat	70	1,750
Sugar	150	5,100
Coffee	0.2	320
Tea	0.33	120
Canned fruit	2.4	200
Milk powder	0.8	300

TABLE S. 10

Output of selected industries (1,000 tons)

	1960/61	1970/71	Basis
Edible oils	46	65	Expansion of cultivation of cotton, ground-nuts and sesame.
Sugar	0	150	1. Guneid factory (open, March 1965) 2. Khashm El Girba.
Canned fruit	0	2.4	1. Kareima (Northern Province) 2. Wau (Bahr-El-Ghazal)
Milk powder	0	0.8	Babanousa
Dehydration	0	5	Kassala

The new industrial establishments (some established with Russian technical assistance), on which some of the above estimates were

based have mostly not worked out as anticipated for various reasons, e.g. no, or not enough, suitable raw material organized, technical teething troubles, or no markets lined up. The two sugar factories, two fruit and vegetable canning plants (not yet in production), the milk and onion dehydration factories (stopped) and a date-processing factory (disorganized) have now all been placed under an Industrial Development Corporation, responsible to the Ministry of Industry. This Corporation (which was set up in 1963 to take over the factories contracted by the former Government, but did not take legal shape till 1965) does not go into fields in which private industry is already operating such as breweries, oil-seed mills and flour mills (although the Industrial Bank did grant a loan to the Blue Nile Mills), but only where private capital is too hesitant to come forward. Although the IDC's first task is to get the factories going properly, it also has to plan for the future, on both short and long term. With regard to potentialities for the future, the Industrial Development Corporation in the face of the difficulties referred to is not unnaturally cautious, and anxious to consider questions of soil etc., before planning expansion. Grapefruit canneries for the foreign market are a possibility. For the Southern Provinces, Kordofan, Darfur, Upper Nile, Equatoria and Bahr-El-Ghazal, information is lacking on the possibilities.

There are 102 small factories in the private sector listed as approved and assisted by the Government but not in production (some even after 10 years) which cover all manner of food processes and products and there are also a number of ice plants and fodder production units in the same category.

The provisional FAO estimate of the average nutritional level for 1961-63 reveals a deficiency in total calories (only 2,034 per hd/day, even after making a 5 per cent adjustment for food gathering and unreported imports) combined with a relative sufficiency of proteins (69.3 grammes/head/day total intake, of which 23.9 grammes is of animal origin (10.4 grammes from meat and 11.5 grammes from milk products). However, it is understood that cattle are kept primarily as a source of wealth and prestige rather than for their local food value and malnutrition can occur in the midst of plenty.

The FAO World Indicative Plan for Sudan as far as 1985 comments that except in the northern areas, ecological conditions are not favourable for wheat, but an expansion of the area of summer coarse grains (sorghum, millet and maize) could be achieved through an expansion of both irrigated and rain-fed land and by growing these crops in rotations. Production could be increased further by double cropping through the use of fertilizers and by the introduction of hybrid strains.

An expansion of the area under cassava, sweet potatoes and yams can take place on rain-fed land in Equatoria. Conditions are favourable for the production of ground-nuts. A substantial increase for export would result from bringing more land under modern irrigation systems. Although cotton will continue to be of major importance as a cash crop, a greater degree of diversification is desirable. There are good possibilities of expanding the area under sugarcane in the central and southern areas, both on irrigated and rain-fed soils. Somewhat paradoxically, perhaps, it is concluded that realization of the 1975 target may be difficult, but that there should be no problem in achieving the 1985 target. One might well have thought that the 1985 target might have been contingent on the 1975 levels being attained first.

Milk

Although cattle are so plentiful, milk processing is poorly developed. FAO has made every attempt to help the dairying industry of Sudan but the confused political situation of the past few years hindered developments.

Belgravia Farm milks 300 cows and produces 2,500 litres per day which is bottled unpasteurized and distributed immediately. It was being retailed in 1965 at 8.5 piastres per litre bottle.

Kuku Farm just outside Khartoum, is a co-operative in which the Government participates. It has been assisted by USAID. It is equipped with small plant for pasteurizing and bottling which is not functioning very well. It is supposed to have capacity of 10,000 litres per 8 hours, although only 5,000 litres are being produced at present. Marketing problems were overlooked when this project was started up and no money was provided for vehicles and cold stores. Sixty per cent of the product is processed,

only 40 per cent being marketed as whole milk. However, a Government hospital contract will now take up 70 per cent of the output, the other 25-30 per cent going to households. The minimum fat content is $4\frac{1}{2}$ per cent but it is often between 4.5 and 5.0 per cent. The milk is not skimmed to reduce the fat content to a standard figure. It is hoped that the place will be running at full capacity shortly and that more co-operative societies will come in.

Four and a half piastres/litre was paid for the milk in 1965 and after pasteurizing it was sold wholesale at 7 piastres per litre and retailed at 8 piastres. At the end of 1966 the milk cost 8 piastres per litre ex-plant in bottles and 9 piastres retail. It is cheaper than it would otherwise be because the Government does not charge for capital invested.

At the same time about 40,000 litres a day is distributed raw by pedlars. FAO has produced detailed plans of a plant for consideration by the Ministry of Animal Resources, but this is supposed to be the scope not of government but of private industry.

There are inadequate supplies of cheese. An integrated dairy husbandry is what is really needed. There is some traditional soft cheese making at cottage level which sells for a few piastres per kilogramme, similar to the Bulgarian type of product. Some of this is exported to Saudi Arabia and the UAR.

In the southern part of the country there is a problem of what to do with the surplus milk produced at the seasonal gathering points for nomads who congregate for two or three months every year. At El Obeid a small milk plant is being built to produce butter and ghee. However, it is difficult to collect milk because the producer normally gets 2 piastres/litre, but the milk plant only offers 0.6 piastres/litre for the value of the cream, the skimmed milk being wasted. For a scheme such as this, mobile collecting centres should always be provided not more than 5 kilometres away from the plant, perhaps located at a water point and accessible by donkey back. If ghee were produced on much larger scale it could be exported to the Middle East. Country-produced ghee at present

sells at only 5 piastres/kilogramme because it is not properly clarified and therefore deteriorates on account of the protein present, as compared with 20 piastres/kilogramme for a high-grade product. The Government is also anxious to manufacture sterilized milk, but this cannot be stored economically round the year because of the millions of bottles required.

The previous Government also negotiated for a Russian milk drying plant at Babanousa, which, however, is not functioning yet. The factory has a capacity of 50 tons of fresh milk a day for drying and is also equipped to manufacture butter and cheese. When milk arrives too acid for drying, it could be used for the manufacture of white cheese. This scheme was originally proposed for social reasons, as an emergency arrangement for the people who, for three months in the year collect milk from an area 70 to 80 miles long by 10 to 15 miles broad, with not less than three-quarters to one million livestock, most of the milk from which is wasted. They later go southwards to the river for summer grazing. It was thought that resettlement might result when it was seen that the cow could be made to produce money and that then pastures could be improved and the period of tarrying would be longer, and so on.

The railway now connects Babanousa, El Obeid and Khartoum, but the first two are still 24 hours apart so that transport of liquid milk is out of the question. It was calculated that 200,000 to 300,000 milking cows giving even three pounds of milk a day would make available about 150,000 pounds of surplus milk daily for drying. This quantity could all be absorbed at home, thus avoiding the necessity for continued imports of milk powder.

The dried milk to be produced, in accordance with FAO standards, will contain 26 per cent of fat, which is a little below that of full cream standard. The milk delivered has a high fat content of about 4 per cent (which usually goes with a poor milk yield) and this will be reduced to 3.2 per cent, and butter made from the cream thus separated. The average milk yield is 8.5 pounds per day during the flush (i.e. the rainy season) which lasts four to five months. For the rest of the year the yield falls

to about five pounds, although it is still intended to dry this, and thus run the plant all the year round, if sufficient supplies are obtainable. As the animals are milked in the vicinity, it has been decided that milk can be sent to the factory direct, in large cans, without going through cooled collecting centres first. Milk powder is used domestically after reconstituting in the home. An additional line for baby milk is also being considered, for which the addition of lactose and vitamins will be required.

An enormous area across North Africa, extending from Sudan into the Central African Republic, is practically virgin pasture. There are enormous potentialities here for dairying which would need a thorough survey by a team of, say, six people, provided with a helicopter. Although such a project would be rather difficult to manage, FAO tried some time ago to evaluate it concisely for a United Nations Special Fund project, and estimated that the cost of a pre-investment survey would cost US\$200,000. Then the Minister changed and no further consideration has been given to such a scheme on an international basis. The south of Sudan, too, is in rather a restive state, so that such a proposition would be unworkable for the present. However, another province is under consideration for a similar type of scheme, although presumably not so all embracing.

In all such dairy husbandry projects, a dairy technology expert is required to attend to problems of utilization in view of the extreme perishability of milk.

Any large scheme for the collection of milk must also face the fact that between July and October many of the roads are impassable (even those in the vicinity of Khartoum during the months of July and August). In addition, the railways meander, going perhaps 600 miles for 200 miles direct in order to follow the course of the river in preference to taking short cuts through the desert.

Recommendations

More of the milk for the Khartoum area should be pasteurized, backed with the force of the necessary legislation and the attention to animal husbandry, feeding and milk collection and cooling centres that all this will involve.

The El Obeid and Babanousa schemes should be got going properly in spite of all the difficulties.

The dairying potentialities of the south-west should be explored jointly with the Central African Republic by a United Nations Special Fund Project, administered by FAO.

Meat

Various estimates indicate that there are between nine and twelve million head of cattle in Sudan. There is no doubt that this industry could be developed more. In 1960-61, when Argentina and USA were limiting exports and Australia and New Zealand had droughts, USAID reported that Sudan could be made a great livestock centre. Investment in the infrastructure would have been essential, particularly roads (the railway being suitable). The veterinary services are efficient but need important expansions to meet future requirements. In 1956 the University produced 6-7 vets every two years. Now, 30-40 are being turned out every year.

Traditional dried products are produced on a domestic scale. Fifteen to twenty years ago, a large-scale meat drying establishment was set up by the Government for export of meat to the tse-tse areas. This is no longer a problem as live animals can now be taken there in trucks on a large scale. Another method of preservation involving pickling of slices of meat with salt and spices is a special delicacy and there is some possibility of commercial production of this type of product for export for example to Syria.

Some years ago Liebig's had a factory at Kosti which was closed down because of disagreements between the Government and the factory over getting supplies of cattle. The situation was well-chosen, being where the railway crosses the White Nile. But cattle had to be marched considerable distances to the slaughter for the manufacture of corned beef and meat extract, and a number died on the way and the rest arrived very emaciated (and with very acidic flesh which caused corrosion inside the cans). There were also management problems. Then there was some trouble over Israel operations of Liebig's and the factory was evacuated and some

of the equipment taken to their other factories. Accommodation was sold locally and it is considered impracticable to try to resuscitate the factory.

Now USAID has produced a scheme (prepared by Thomas H. Minor and Associates of USA) which is summarized in the following table, for production of canned meat in El Obeid and frozen meat in Kassala.

TABLE S. 11

Summary of capital investment and return for development of
livestock in Sudan

	Nyala	El Obeid (Plan A)	Kassala (Plan B)	Kassala	Total/Annum
Through- put per day	8,000 Cattle (holding area)	<u>Packing Plant</u> Cattle 300 Custom 100 Sheep Custom 300	<u>Packing Plant</u> Cattle 150 Custom 100 Sheep Custom 300	Feed lots 4,000	Cattle 195,000 Sheep 100,000
Output		Canning max. 300,000 cases/ year boned beef 600 short tons offals	Freezing Boned beef 900 short tons Boned quarters & cuts 3,600 short tons offals		
Invest- ment	\$640,000	\$1,323,509	\$1,022,244	\$538,000	\$3,523,753
Income before taxes	\$90,000	\$384,945	\$550,528	\$151,098	\$1,173,371

A 33 per cent return on capital was indicated, whereas 12 per cent was acceptable

Although Kassala is not a cattle area in itself, it is not unsuitable for meat processing, because there are other industries such as sugar in the neighbourhood, and cattle could be fed in the holding areas. Frozen meat could then be shipped from Port Sudan. This trade is impossible at present on account of the International Veterinary Organization (OIE) ban because of risk of contagious diseases such as rinderpest and foot-and-mouth disease in Sudanese cattle. It is also suspected that there are economic motives behind maintaining these tight regulations. Nevertheless, there are exports to Saudi Arabia, Egypt, Malta and Libya at present. Fresh meat used to be transported from Nyala by plane to Libya until the trade was stopped recently on the grounds of the animal health hazards. It is hoped to get international recognition of "disease-free zones", in which there is full disease control and regulation of the movement of animals. The size of the area so required is uncertain but it is hoped that it can stretch from Kassala to Port Sudan so that exporting will be possible. This was to be discussed at a conference of the OEI to be held at Dakar.

EEC has taken steps in West Africa from Guinea to Chad to eradicate disease but this stops short at Western Chad because there is interchange between Eastern Chad and Sudan. Unless this area is extended into Sudan it cannot be sealed off. But Sudan cannot participate in the Common Market which is open to ex-French colonies only. With FAO participation this arrangement should be carried through Sudan and to parts of Ethiopia to ensure safety.

A technical delegation is at present in Libya negotiating a resumption of the trade in fresh meat. BOAC used to send a VC 10 every Tuesday to Khartoum at 11 a.m. so that meat killed on Monday evenings and put in chill reached Tripoli and was on sale the same afternoon.

However, it is doubtful whether the quality of Sudan beef at present really justifies air freight charges. Tripoli in Lebanon has established a quarantine area in which meat can be processed, but political relations between Sudan and Syria are not encouraging trade at present.

A Swiss firm which has put up a large scheme for export of cattle, involving refrigeration and slaughter houses, is awaiting the decisions of the Ministries of Finance and Foreign Affairs who are studying this proposal.

There are enough stocks and a surplus of sheep for export to the Middle East, Saudi Arabia, etc.

The price of meat officially is 24 piastres/kilogramme retail for mutton and 14 piastres for beef irrespective of grade, but 30 piastres and 20 piastres respectively are paid for the best qualities of mutton and beef unofficially. These are the Khartoum prices, but less than 200 miles away they are very much lower which would make such meat suitable for processing. Transport and movement to connect production and consumption is a big problem. There is also a complete lack of any form of marketing organization, meat being in the hands of small individual enterprises with very little investments.

At Khartoum Abattoir, actual slaughter is carried out by market staff but flaying is done by workers paid by the butchers but approved by the slaughter house authority, a bonus being obtained for good flaying. However, it is realized that this is not a satisfactory method and the Ministry of Finance has been asked for authority to employ flayers.

As 30 piastres a day is the average wage of a manual worker, fresh meat is obviously beyond the means of the average urban dweller. However, unless raw material prices in the outlying regions are very much lower than in Khartoum it is doubtful whether corned beef could be much cheaper than the fresh meat on sale.

Recommendation

Sudan seems such a favourable place for the canning, freezing and processing of meat that more should be done to capitalize on this advantage. Eradication of disease is the stumbling block in the way of fresh and frozen meat trade and quality would need to be improved before it could penetrate European markets. Nevertheless, there seems no reason basically why this should not be done eventually.

Fish

Sudan has a fishery amounting to some 20,000 tons a year. Most of this is freshwater fish, coming from the numerous rivers and lakes. There is a long coastline with the Red Sea which hitherto has not been very productive. One reason for this is the traditional prejudice in Sudan against eating fish. There is also the problems of preventing spoilage of fish in such a hot climate. This must often render fish consumed inland practically inedible, and probably accounts for the prejudice against it.

However, with modern knowledge, and methods of preservation, and an improved transport system, this is likely to change. Russian experts have prepared a plan for the future exploitation of Sudan's fisheries which is under study by the Government. The chief resources are the rivers, the dams created by the various barrage schemes, notably Lake Nasser/Nubia formed as a result of the Aswan High Dam, and lastly the marine fisheries of the Red Sea coast.

The River Nile as far as Juba has 1,000 miles of fishable water. Nile fish used to be processed by sun and salt and sent to the Congo, but this trade has been stopped for the past three years. Ceylon now wishes to buy such salted sun-dried Nile fish and prices are being calculated. The fish is apparently liked and is called "Sudan mullet." The quantities envisaged are to the value of about £S half a million. There is not much local consumption of fish in the area of the river because there is plenty of local fresh meat and people have no taste for fish; it is sometimes even regarded as unnatural to eat fish. The Russian survey shows that the Nile system is extremely rich in fish and that at present there is no really effective utilization because the methods of exploitation are so extremely primitive. In the White Nile, productivity increases the further south one goes. The river has been surveyed in three sections, from Jebel Auliya as far as Kosti; from Kosti to Renk and from Renk to Juba, in the last section of which the yield is 105-110 kilogrammes/hectare/year.

The Jebel Auliya Dam, 30 miles south of Khartoum, is a large source of fish. Its area is 120,000 hectares and it is fished only by traditional boats which have been unchanged for hundreds of years. **This dam at present** supplies Khartoum with all its requirements of fish.

It is planned also to utilize the waters of the Aswan High Dam, of which there are 173 square kilometres in Sudanese territory. It is understood that the Egyptians are doing well with fisheries in their part. However, the Sudanese are getting no information back, although the United Nations and Ford Foundation who are both helping, operate on an international basis. On the other hand, perhaps Sudan has no counterparts with whom Egyptians could usefully exchange information. However, wild life knows no boundaries, and in addition there is the difficulty of policing the border against possible inroads by Egyptian fishermen which, it is felt, could best be prevented by Sudanese fishing vessels themselves constituting the boundary. A United Nations Special Fund application is under consideration with a view to exploiting these new resources. A survey is first required, leading up to modern fishing vessels, catching equipment, buildings, etc. and processing facilities including ice factories.

Another new dam at Khashm El Girba is the site of resettlement of people displaced by the flooding of the Nile Valley due to the High Dam (and incidentally is also the site of the new sugar factory). Also the Roseires Dam on the Blue Nile could be a further source of fish. The Nile drainage valley itself embraces 39 million acres (out of about 600 million acres for the entire land area) and there are many small rivers abounding with fish. Of the 200 species of freshwater fish found in the region, 40 are available in marketable quantities. In addition, there is Alestes, which is fermented as "fessiql" for export to Egypt, until this trade ceased about three years ago. Great quantities of this species are available, constituting a great reserve for possible fish canning or other processing. Some thought has even been given to the possibilities of fish flour.

There is not much fish available, apparently, in Red Sea waters, at least the territorial waters, the Russian survey confirming earlier

FAO reports - this applies both to surface and bottom fish. The results are certainly not encouraging for the prospects of utilization on a large-scale commercial basis. On account of coral reefs, nets cannot be used, and with only lines and hooks the return would not be good enough to justify much effort. It is doubtful whether more fish would be obtained than could be used in catering for local consumption along the Red Sea Coast.

The Red Sea shell fishery for mother-of-pearl and trochus is a more successful project, although nothing to do with food. The possibilities were first surveyed fifty years ago by a British biologist, Dr. Crossland, who made experiments in 1905 on the possibilities of shell culture in the Red Sea. The achievements were quite promising, although his report was not apparently implemented until a project was started up in 1957, and continued until 1960 with good results. The first production was in 1961-62 and the results are described in the report of the marine fisheries officer, Mr. William Reed, who left in 1964 and is now replaced by a Sudanese fisheries officer.

In considering the Red Sea fisheries, it must not of course be overlooked that other nations seem to find a remunerative occupation in fishing outside territorial waters, including particularly the Russians and Japanese who operate factory freezing ships for tuna and other pelagic (i.e. surface swimming) species such as sardinelles and sardinops.

All fish supplies are envisaged from the point of view of export, even salted, and fresh fish, e.g. by aeroplane to Lebanon, Saudi Arabia and Kuwait. The same outlook, of course, applies to the prospects of canned fish and fish flour. Exploitation, however, demands trucks and motor roads, or new railways.

If plenty of fish results naturally in Lake Nasser, this will be exploited. If not, it is proposed to introduce Tilapia nilotica.

To exploit all these fisheries effectively a number of specialist technologists are required. Firstly, a boat technologist is required to improve on the traditional vessels. As the reports show that the

waters are so rich in fish, it is therefore a question of how to catch it. This involves boat building. A fisheries technologist is also required so as to exploit the resources both horizontally (by setting up as many fishing camps as possible on the river bank) and vertically to increase the intensity of fishing, for which research will be required. Then it is necessary to store and distribute the catch. At present methods chiefly rely on sun-drying and salting. It is necessary to diversify the product to meet the segmentation of the market, for fresh, dehydrated perhaps and smoked products. For this reason, a fish processing technologist is also required. Cold storage would be needed for exports to, say, UAR, Tunisia, Lebanon, Jordan and Middle East countries. Even London is already receiving tilapia from Uganda by air and in Italy, it is believed fresh fish is preferred to frozen, etc. Finally, for marketing all this fish once produced, a marketing officer is required. Presumably FAO could help in these matters.

A freshwater fish canning factory has been planned by Russian experts. This will be situated about 40 kilometres south of Khartoum. If established, it would cost about £S 550,000, including all materials and construction. In the first year of full-scale operation, it is calculated that revenue would be about £S 311,000 for the sale of the canned goods. The average cost of a can of product would be around eight piastres. Against this, imports of canned fish are said only to amount to £S 30,000 a year, this certainly being of types such as sardines, salmon and tuna that are quite different from the products that would result from the canning of Nile fish. Even so, there would be difficulty in disposing of the other 90 per cent of the production, either locally or abroad. The scheme proposes that two kinds of fish should be canned in tomato sauce and two kinds of oil. Although there are reports that a Russian fish canning factory has already been installed, it is understood that money for this is still being held in reserve for the time being. Fisheries department staff are against the proposal on the grounds that no markets can be foreseen.

Preliminary thinking in the fisheries department envisages two large fishing vessels of 1,000 tons capacity each, provided with a freezing

system of 250 tons capacity, with a speed of nine knots and equipped with echo-sounders, wireless, etc. It is envisaged that the cost might be about £S 800,000 for both. This is surely an under-estimate and the difficulties of building such vessels on the edge of the Lake would be formidable. Obviously the use of ice and a shore station to process the catch is the proper alternative. In addition, the need is seen for 50 small boats of 11 metres length made either of Sudanese mahogany, or possibly plastic, and two outboard engines each (one as a standby) costing about £S 500 each plus £S 1,000 for engines, with fishing equipment extra. It is thought that a small by-products plant, costing £S 30,000, and also a factory for fish flour could be provided all at a total cost of \$ 1.6 million, say, £S half a million. Accommodation would have to be provided and the final expenditure considered is £S 2,340,000. As against this, the revenue anticipated in the first year's operation is £S $2\frac{3}{4}$ million. The net profit on the first year's operations would be expected to be £S 190,000. After £S 50,000 deduction for tax, this still leaves £S 140,000 as what is regarded as the "absolute minimum".

A commentary on the low level of fishing technique and application in Sudanese waters is instanced by the fact that Egyptian fishermen recently were conducting such successful fishing operations on the Nile near Khartoum that the local fishermen complained and the Egyptians had to leave. Again, in any industrialized fishery, fishermen would need to stay out for three to five days on the Lake, say, without danger in areas infested with insects, including mosquitoes, and in very hot and humid weather. Again, some of the richer fishing grounds are inaccessible owing to floating islands of weed which would need to be cut by suitably equipped ships. Nevertheless, at Jebel Auliya, the present yield is 3-5 kilogrammes/hectare average, and with modern fishing vessels and techniques it is estimated that this could be increased 30 kilogrammes/hectare. If caught in greater quantities, the costs of fish could drop by 50 per cent, and this would have an encouraging effect on home marketing.

To conclude, of the various factors involved in successful exploitation, namely raw material, labour, capital, organization, and marketing, only the first exists and all the others would have to be created.

At present, river fish cost about 35 piastres/kilogramme in the market. Port Sudan fish costs £S 1/kilogramme, owing to the inefficient methods of catching. Lobsters sent by air in ice from Port Sudan fetch about £S 2/lobster.

Recommendations

Although there are possibilities of increasing Sudan's fish production, particularly from fresh waters, the emphasis is almost exclusively on export rather than home consumption. Efforts should be made to increase the latter and export markets lined up for the remainder of the supplies anticipated whilst plans are being laid to increase exploitation of the waters.

Edible oil

The cotton crop yields 200,000-300,000 tons of cotton-seed which is the primary vegetable oil-seed product of Sudan. It also produces half the sesame seed of Africa (200,000 tons). Ground-nut is increasing (30,000 tons). Castor, although not a food product is also quite important industrially (6,000 tons). Ground-nuts and sesame are crushed traditionally for local use in often very primitive, small-scale mills. Sesame oil is preferred for home consumption, and exports of ground-nuts are rising.

Cotton-seed is crushed in eight industrial mills (five in Khartoum, two in Port Sudan and one in Raback) which have a capacity to crush a total of 257,000 tons/year. Two in Khartoum and one in Port Sudan can each handle 40,000-45,000 tons/year.

There is an export to Greece and Germany, sometimes, but not to other North African countries apart from the UAR at times.

There is some hardening of cotton-seed oil for margarine and ghee manufacture in Khartoum.

The larger mills employ 300-400 people. Extraction rates are about 19 per cent of oil and 79.5 per cent of cake. Processing costs are about £S 5/ton for crude oil produced and £S 7/ton for refined oil. Unskilled labourers receive £S 12/month and skilled workers £S 30 to £S 40 for a top mechanic. At Port Sudan again, the large factory employs 300 workers, one-half of whom are contract labour engaged for the delivery of seed to the factory premises. Wages are slightly lower than in Khartoum.

Capacity could be doubled by installation of additional expellers without much expenditure on additional equipment or buildings.

Some seeds are exported but most of the oil produced is used for home consumption. Exports of oil-cake are however substantial because there is less local demand for it as animal feeding stuffs.

As regards the future, 25-50 per cent more cotton could be grown by more irrigation. Similarly an increase in ground-nuts production would be possible in the central rain-fed belt where precipitation is 500-800 millimetres/year.

Between 1957 and 1965, the seven-year average for cotton-seed was 248,392 metric tons. There is a slight upward trend discernible in spite of season-to-season variation.

TABLE S. 12
Areas and yields of seed oil crops
(1964-1965)

	<u>Acres</u>	<u>Approx. yield/acre</u>	<u>Comments</u>
Sesame	1,116,116	400 lb.	Reasonably static at present but could be doubled in ten years and increase 50% again in the next ten years.
Ground-nuts	778,861	$\frac{3}{4}$ - 1 ton experimentally 2 tons after	Increased three times in last ten years and could, say double in the next ten years.

Recommendations

It can be envisaged that Sudan's oil-seed production will increase several fold by 1980 and that processing equipment corresponding will be called for. It could then supply much of the North African countries' import requirements.

Cereals

Durum wheat is a staple crop, most people depending on it for their starch requirement, many small mills are scattered throughout the land, where it is milled for family consumption. It is doughed and baked into "Kinsa", a sort of bread. The extreme northern regions traditionally cultivate wheat and also consume it (15,000 tons/year). People in the south depend on cassava. In the west "dukham" is also used. Most people, particularly in the towns, also use bread made from wheat flour.

The per capita consumption in 1949 was only one kilogramme/year but it had risen to nine kilogrammes by 1963 and is still rising.

About 110,000 tons of wheat and 90,000 tons of flour were imported in 1964-65.

In 1957 a privately owned mill was decided on, which came into operation in 1961 (the North Khartoum Mill). The capacity is 240 tons of wheat per day and it is fully or nearly fully utilized. However, there are problems connected with the selling prices set by the Government and in adapting the machinery to suitable types of wheat, soft and hard. The throughput is only 200 tons/24 hours with soft French wheat and also with hard Sudanese wheat which requires a longer time for predamping and tempering before milling. Also the training of personnel is a difficulty which is being met.

The total cost of building and equipment was $1\frac{1}{2}$ million (or \$6,300/ton/day capacity) and running costs have worked out at \$10.3/ton milled.

A new mill for 300 tons/day in the Blue Nile province has been under consideration since 1964 when it was anticipated that it might cost £S 750,000.

Final estimates are now finished and the Industrial Bank has been asked to make loan.

Another small mill is being organized at Gezira as a result of co-operation by tenants growing wheat. This is now under construction and should be ready soon, before the Blue Nile mill, the capacity, however, being only 20,000 tons/year.

Recommendations

With flour imports so high, there seems room for at least one more mill after the ones under way.

Sugar

Sudan is potentially a good country for growing sugar-cane and technically an enormous area could be made available. Three or four "ratoons" (i.e. recuttings before replanting) are possible compared with only two to three in the UAR and Morocco (and up to six or even nine in Cuba). Nevertheless the present object in regard to sugar is only to make supplies sufficient for the local market. It is not regarded as a favourable field to put much real effort into for export.

Sugar manufacture in Sudan commenced in 1963 with a cane factory at Guneid which was due to produce 60,000 metric tons of refined sugar a year. This compares with present consumption of about 150,000 tons a year. However, for various reasons the factory has not yet got going properly, producing in 1963 only 14,400 tons, in 1964, 21,700 tons and in 1965, 26,000 tons. Now a new Russian factory has just been opened at Khashm El Girba but it is also equally important to overcome the conspicuous lack of success of the Guneid factory to date and to remedy the faults and build production up to the scheduled level. These two factories should then make it possible to substitute a great majority of the imports, although two other factories of half the size each namely 30,000 tons, are now being considered. These would make Sudan independent of refined sugar imports.

The equipment for Guneid was supplied by Buckau and Wolf and also BMA (Braunschweigische Maschinenbau Anstalt).

A distinguished and experienced foreign expert was engaged by the Sudan Government to advise on the whole sugar project. He stayed in the country between 1960 and 1964. At the outset three places were considered for establishing the factory and plantations, firstly on the Blue Nile at Abu Na'ama (the site favoured by the expert); secondly at Singa, also on the Blue Nile, and thirdly at Guneid. The last named was the place finally selected by the previous Government for political reasons. Guneid had originally been intended for cotton cultivation, and therefore some irrigation pumps and roads were already available. However, the expert's objections to Guneid were that it was on the wrong side of the river, that it was watered by pumps and not by gravity, and that as it was intended for the cultivation of cotton, the co-operation of the villagers might be difficult to secure. Tests of seeds, some obtained by air, were carried out on ten-acre plots and trials showed that a yield of 40 tons/acre was possible. In the event, on the 7,500-acre plantations allocated, the yield fell to 10-15, and sometimes as much as 20 tons/acre. The reasons for this were that the tenants were not accustomed to cultivating sugar-cane, that fertilizers were lacking, or were applied too late or not properly, and the whole operation was not properly understood. The canals and roads had to be widened to carry heavy machinery. The factory was not in the centre of the estate but at the extremity, so that collection was difficult, but the shape of tenants' plots dictated this arrangement. (For the new factory at Khashm El Girba that was already being planned, the expert insisted on making contract-buying a condition of his continuing as their expert and ultimately the Government agreed). Fertilizer was only applied at the outside of the plots at times, so that crops looked better than they were. Mechanical cutting of cane was decided on, which is a skilled operation. United States engineers were prepared to send instructors and to pay all costs in the first place, but the Government refused this offer. As a result, the machinery was damaged hopelessly, and cane was wasted by being cut too far from the ground, and in the end the army officer who was ultimately put in charge of the factory decreed that cane should be cut by hand. After

cutting and burning off the leaves of the cane, they must be collected at once for extraction, but sometimes the labour did not materialize so that a day's cutting of 360 tons might be wasted. Again, the expert recommended a small factory in the first place but the German engineers said that replacement of boilers would be more expensive if capacity were subsequently to be doubled. So the Government decided on 60,000 tons capacity. A bigger scheme, and quicker results by utilizing an existing estate instead of having to clear one from the very beginning, held obvious advantages. The position of the factory in relation to the plantation involved unnecessary 30 kilometre treks with the cane. A lateral arrangement would have meant clearing one area at a time. Whereas for hand-picked cotton all that is required for transport is a donkey, which can easily get round corners, it was difficult for the heavier transport necessary for cane to manoeuvre in the radii encountered. Dura was also grown on the same site which harbours the stem-borer pest, which got into the cane and killed it, so that the tenants had to be prevented from planting dura. This again led to trouble and bad relations.

Four thousand tons of cane, yielding 400 tons of refined sugar, were planned to be processed every 24 hours in three shifts for a five-months' season with a break for cleaning every two to three weeks. The cost of enlargement of the pumps to permit the proper watering of cane on the plantation when converted from a cotton scheme was about £S 18 million. The total cost of the factory was £S 4,795,650 for capital including interest, plus £S 1 million for machinery and about £S 690,000 for building, a total of about £S 7 million. The bagasse or spent sugar cane stalks was used as fuel, and was sufficient to provide the steam and power requirements of the whole factory in the working season.

The first season failed altogether because the electricity board had promised electricity by November in time to test the equipment and start crushing in January. In the event they did not connect up until 15 May when it is so hot that the syrup ferments within hours. Nevertheless, 20-day trials were carried out to test the machinery and the rest of the planted cane was lost that year (1963). Then one of the pumps broke, and

when cane is not watered properly little juice is obtained. The material from the trial acres was also used for testing the size of trailers required to carry a load of 20 tons. However, less weight is carried if the cane is dry so that the calculations were in error. Various causes of failure may therefore be summarized as follows:

Firstly as regards the plantation:

- (i) the planting was wrong;
- (ii) the tenants were of the wrong type;
- (iii) watering by pumps instead of gravity feed;
- (iv) transport difficulty;
- (v) dependence on ferry boat to carry the fuel oil across the river;
- (vi) the non-availability of plantation labour when required;
- (vii) the failure of the tenants to do the weeding and "hilling" in time;
- (viii) the lack of proper co-operation between management and farmers on the plantation;
- (ix) the type of cane planted was poor at the beginning until seed was imported;
- (x) the poor method of distribution of fertilizer in the plots.

On the factory side the reasons for failure were:

- (i) lack of technicians, especially labour;
- (ii) lack of by-product factories near the sugar factory for the manufacture of alcohol and fibre board for example;
- (iii) the lack of technicians at headquarters to check on work in the field which led to losses being unnoticed, etc.;
- (iv) the lack of competent mechanical engineers to maintain the heavy machinery of the factory;
- (v) the lack of co-operation between plantation and factory.

This analysis of failures leads to the following proposals for improvements for the future.

- (i) Close the factory for one year.
- (ii) Remove all the present cane and replace by good varieties.

- (iii) Make suitable arrangements with farmers so as to be able to widen canals, etc. and divide the plantation up rationally into three pieces in order to facilitate transport for the convenience of the factory.
- (iv) Appoint a proper plantation manager who knows about cane.
- (v) Set up a school for training people in the problems of cane.
- (vi) Make sure that the "hilling" and weeding and application of fertilizers are done properly and at the right times.
- (vii) See that the machines for harvesting, loading and cutting are always properly maintained and kept in order by competent people.

And in the factory:

- (i) Appoint a production manager who knows about the sugar industry.
- (ii) Employ trained sugar chemists.
- (iii) Appoint electrical, mechanical and production engineers and a chemical engineer.
- (iv) Build a molasses factory and one for the use of excess bagasse (in the Sudan cane there was an excess of fibre which was not needed for fuel, but this may have been because of the poor variety chosen).
- (v) Keep the factory machinery in good order.
- (vi) Organize proper reporting on forms so that production can be monitored.

These teething troubles can and should be overcome so that the factory can work properly.

It is essential that people in the factory should work as one team along with those on the plantation. Recreations and staff amenities are necessary (including a mosque, football facilities, etc.).

A bridge should be built across the Nile to transport the sugar to the railway and the oil to the factory.

For the new Russian-equipped sugar factory at Khashm-El-Girba, as in the case of the other Russian food-processing factories in Sudan, the capacity is greater than the actual production. The Russian terms, however, involve low interest rates of 2 per cent, repayable over 40 years and provide for training of technicians to operate the plant as a part of the contract. In general, there is a great need for mechanics and for people with experience in management. The rated capacity of this factory is 4,000 tons/day for crushing. Refined sugar only is imported, "raws" not being imported for refining at present.

Considering now the potentialities of the future, the southern part of Sudan is climatically the most suitable for growing sugar but there are severe transport problems. For easier transportation, factories could be envisaged at (i) Singa, (ii) Roseires, and (iii) Abou Na'ama on the Blue Nile which was where the expert first recommended that the factory should be established. The labour in these places is apparently of average quality, although not particularly dependable. Other suitable sites would be at Atbara, where there would be cheap transportation, and Gezira where there is a canalization scheme already available for cotton cultivation. Finally, when the railway gets as far south as Juba (which has been planned, although temporarily "shelved"), the south of Sudan might well establish itself as the Cuba of Africa. Rail transport is really essential both to get the machinery to the factory and the sugar away. A lorry would be satisfactory for the latter, but water transport is useless. At the same time labour is weak in the south largely due to malnutrition. Also the situation of the world sugar market at the present time is not such as to encourage such developments.

The prices of sugar in the shops is 7 piastres a pound, corresponding to £S 150/ton, there having been an increase recently from 6 piastres. As sugar is imported at about £S 50/ton, the rest is taken by the excise authorities. No cost figures have been issued for the Guneid sugar factory operations to date. Consumption of sugar in Sudan is increasing by 10 per cent/annum.

Recommendations

Sudan seems specially favoured climatically for sugar production and in spite of the world market vagaries, exportable surpluses could well be made available to meet future needs. However, the lessons of teething troubles encountered so far will need to be learnt and applied in future industrial enterprises.

Fruit and vegetable processing

There is not much fruit and vegetable processing in Sudan and this is all of very recent date. Vegetables are sun-dried quite widely, but as all fruit can be sold fresh at high prices there is no incentive to process. There is a shortage of vegetables however, and a low per capita consumption. Some very good varieties are available but these are not known to farmers. There are also social reasons why vegetables are not eaten very much. Educational campaigns are required to teach people their value and use. Also growing needs to be integrated with marketing. It is difficult to regain the confidence of farmers once they have been disappointed over growing perishable crops (as compared with grains which are more sure and also store well).

For commercial growing, different types of crops would need to be selected, suitable for various seasons. In any case it is difficult to compete in the world market from so far south in Africa, with Suez Canal dues to pay and so forth. It will take perhaps 15 years to compete on equal terms with Europe. In the interim the industry can only be built up on home consumption.

The tomato purée produced at present is particularly good and so are peaches, with six to seven years' experience already. However, the tins are allowed to get rusty sometimes. In western Sudan a Special Fund project has the objective of improving the varieties and prospects for horticulture, particularly as regards the quantities available, the soil and climate being suitable.

In the south, in Equatoria Province, there is a good potential for fruit, the high temperature favouring tropical fruit such as pineapple

and papaya. Much of the natural production of fruit there just falls to the ground. Trees such as mangoes would need to be improved by grafting to produce first-class products. There is a considerable possibility here although it would be difficult to accomplish. Production of pineapples (like that of tea and coffee) has stopped at present because of the political instability. Information is still required on the areas and volume of production. Development is ten to fifteen years off.

Citrus fruit, etc., occur in the Northern Province, Kassala, Khartoum and Blue Nile in respectable quantities.

In the Northern Province, dates are first in importance, and next come all citrus fruits, which are grown on 1,500 acres. There are one-and-a half million to 1.7 million trees, although earlier there were 2 million. Next come mangoes, of which there are 850 acres of different varieties. Fourthly are vegetables, of which tomatoes, onions, okra and other local species account for 3,000 acres. This area could be increased because it is all in the region of the rise and fall of the Nile, if prices provided any incentive. In Kassala province there are 1,200 acres of potatoes, mixed vegetables, 6,000 acres of fruit, mangoes, citrus and bananas, but no dates. Now with the resettlement of the people from Wadi Halfa in the next five years, 20,000 acres may be put under fruit and vegetables.

Supply of water is the crucial issue for long-term increases in production. In Blue Nile province, water supplies could lead to increased production of cotton. But a policy of diversification is being mounted to get away from monoculture and the 4,500 acres of vegetables grown now could perhaps be increased to 30,000 acres in five to seven years.

Khartoum province is the smallest but constitutes the main market of the above. However, some limited extension is possible. At present, 3,500 acres are given over to vegetables and 2,000 acres for fruit.

The Russian-equipped fruit and vegetable canning factory at Kareima has a well-equipped tomato line with an output of 6,000 to 7,000 cans

per shift (the rated three-shift capacity is given as three million continental cans of 354 cubic centimetres volume per year or season) but it is working much below this for reasons concerned with planning. There are three other lines, one of which is for citrus juice, the machines for which are fixed up to operate at 2,000 cans a day at the best but the seaming and retorting facilities are inadequate for this. The precisely similarly equipped factory at Wau, which was not intended, however, to duplicate the production of Kareima, has not yet operated and is unlikely to do so whilst conditions in the south are so unstable. It is stated at the Ministry of Industry that it was sited where it is, in order to induce people to go in for agriculture, but it has not yet had the desired effect. The plant for the dehydration of onions at Kassala (capacity 50 tons per 24 hours) is not equipped with a blancher, so that it cannot be used to dehydrate other vegetables. Furthermore, only the pink and purple onions are grown in the area and these are not the right type for export as dried which requires white onions. The equipment, consisting of truck-and-tray tunnel driers and oil-fired steam boilers, again is of excellent quality but is not planned to give economic production, although possibly this was not intended and these plants must be looked on in the light of pilot/demonstration/training plants, with some production. Furthermore, these plants belong to the Ministry of Industry and Mining and are operated by the Industrial Development Corporation and there appears to be need for co-ordination with the Ministry of Agriculture in arranging supplies of suitable raw material for processing. Thus, no tomatoes are available locally to supply the factory and there are no plantations being made. In any case special varieties are needed for tomato paste. On the other hand, there is a considerable home demand for processed tomato products. Sun-dried products are made and consumed, and improved sun-drying techniques could be devised if better equipment could be provided. Similarly, there is a good home market in the south for dehydrated onion. But there is not enough water in the region of Kassala to grow more onions in that area, so that water either will have to be brought there or else the onions will have to be grown elsewhere, where irrigation is available

50 miles away, and then transported to the factory. However, the factories are all sited on railways, near towns and have good road connexions. The main problem of planning overlooked by the former Government was the provision of raw material. The new FAO/UN Special Fund Food Processing Research Centre will be looking into the reasons why the factories are not in production and what changes would be necessary for other types of product. The canning factories have their own generating plant and workshops and cold stores (running down to 30 degrees to 40 degrees F). A stand-by boiler is provided and a can-making plant using rather thick Russian tin plate and appropriate machinery (which might have been modelled on UK machines) and the cans are cut according to Russian sizes. The capacity of the can-making equipment is about ten times that sufficient to supply the peak demand of the factory, so that cans are to be sent to the fish canning factory, etc.

Temperature is a serious problem for supplies of raw material for processing factories. For this reason vegetables are only possible in the winter. The crops are in the ground well before the end of November and tomatoes will become available by late December or the beginning of January. Potatoes come a little later and later still greens and there seems nearly always to be produce of some type available up till the end of April. In May and June it becomes too hot for vegetables but fruits are becoming available then.

Dates need processing before they can fetch a good price. For many of the important varieties the fruit dries as it matures on the tree. The traditional trade was in dry dates in sacks.

There is a small factory (really a pilot scale/demonstration/training unit) at Kareima for date packing set up under an FAO expert, which has worked since 1951 for washing, fumigating (with methyl bromide) and converting to paste, sweets, spreads, syrup, recovery of alcohol and vinegar generation. However, this factory passed in 1963/64 from the Ministry of Agriculture to the Ministry of Industry, with the result that all the trained workers stayed with the Ministry of Agriculture

to do other work and there is therefore now no one to run the plant. This plant was in any case an example of a pilot plant trying to operate as an industrial unit.

The Special Fund project will also be looking at the possibilities of dried bananas (with which there are difficulties) and tomatoes, both paste and slices. A natural draught, black box windmill might be a possibility, as there is almost perpetual wind, for an improvement on sun-drying. This is carried out widely on a village basis in west and central Sudan in a very primitive way, particularly for tomatoes and bamia (= okra, or ladies fingers, Hibiscus esculentus).

The main problem in the case of all the new food-processing factories is that of supplies of raw material. The farmers work on their own account and it is necessary to convince them to extend the areas cultivated and improve production per acre. There is also a need to contact the local authority to get more land under cultivation and more local agricultural activity. In the northern provinces the coming three years should see the problem overcome. In the south it may take longer, not for political reasons, so much as because there is not the traditional interest in agriculture. In addition to training farmers to go in for large-scale production to supply a big, steady market it is also necessary to train mechanics and technicians so as to be able to operate factories.

It may be concluded that the potentialities for fruit and vegetable processing in Sudan are very good. Tropical fruits which introduce an exotic touch, could well be developed to produce attractive and nutritious drinks that might prove a rival to the commercial colas that at present consume so much money in transport of water and bottles as a result of expert marketing. For a sophisticated market, blends of tropical fruit flavours should be possible given a suitable flavour chemist to investigate the chemicals involved and their concentration and adding back.

Recommendations

The successful marketing of Sudanese fruit and vegetable products depends chiefly on organizing suitable supplies for processing which will take a decade or more. In the meantime, the best possible use should be made for purposes of experience and training of the existing small demonstration installations.

ANNEX I

THE PRINCIPAL FOOD PROCESSING METHODS AND TERMS USED

Milk

Milk consists essentially of a suspension of a fat and protein, a sugar (lactose) and vitamins (particularly vitamin C) and minerals (especially calcium), along with around 85 per cent of water.

Raw Milk is milk that has not been heat treated. It can therefore contain disease bacteria (in particular those responsible for tuberculosis and contagious abortion in cattle - brucella) and other types of microbe (such as rickettsia) derived from the animal, as well as carrying human-borne infections conveyed by unhygienic handling and distribution (such as salmonella, including the typhoid and paratyphoid germs). All these organisms multiply rapidly at tropical temperatures - hence the importance of refrigerated collecting centres for milk awaiting transport to a processing plant. Non-dangerous bacteria are also present which produce acid and thus turn the milk sour - the usual measure of acidity being pH value. The presence of coliform organisms is usually an indication of contamination of faecal origin.

Pasteurization is a carefully controlled but relatively mild heat treatment ("high temperature, short time - HTST) that is sufficient to destroy the harmful organisms and render milk safe to consume without appreciably altering its flavour or nutritive value. The non-harmful bacteria, which are not all destroyed, can multiply so that pasteurized milk goes sour sooner or later, depending on the temperature at which it is kept.

Sterilized milk is heat treated sufficiently to kill all bacteria, so that it keep indefinitely provided that it is sealed to prevent contamination by stray bacteria. (The same applies to the newest ultra-high temperature -UHT- treatment, without the disadvantage of the "cooked" flavour of sterilized milk, but this is still expensive).

Evaporated milk and condensed milk are concentrated and then sterilized in cans.

Dried milk has the water removed, leaving a dry milk powder in which bacteria cannot multiply. However, the cream can easily oxidize in the presence of oxygen to produce an unpleasant, rancid flavour. Dried skimmed milk can therefore be kept more easily than dried whole milk. It can be reconstituted with water and either mixed with whole milk, or butter fat and then pasteurized in the usual way to produce "toned" milk.

Butter (which contains about 16 per cent of water) can be made by churning the cream, although this is wasteful unless the protein of the skimmed milk is used. The butter-milk that separates can also be used. Ghee is dried butter-fat.

Cheese is produced by controlled clotting of milk followed by "ripening" of the curd, numerous different types being produced by variants of the process. The whey that exudes can be utilized.

Yoghourt is produced by adding certain bacteria to milk so that it turns somewhat acid and sets.

The principal requirements for a successful milk processing industry are:-

- (a) Properly bred, fed and managed herds (or flocks);
- (b) Veterinary service to keep them healthy;
- (c) Hygienic arrangements for milking in suitably designed buildings supplied with water and electricity;
- (d) Refrigerated centres to hold milk awaiting collection;
- (e) Transport (e.g. in hygienic tanker vehicles) to the processing plant;
- (f) Skilled operation and management of the processing plant;
- (g) Expeditious distribution to consumers in closed containers.

Meat

Flesh foods are a source not only of proteins for body-building but also usually of fats and vitamins. Animals need proper hygienic slaughtering arrangements in suitably designed abattoirs, under veterinary inspection or control. Refrigeration (i.e. "chilling" without actually freezing) after slaughter delays decomposition so that meat remains edible for some weeks at around 0°C.

Freezing and cold storage at well below 0°C enables meat to be kept for several months, the longer the lower the temperature within limits. Frozen cuts or blocks are preferable to whole carcasses or quarters. Neither chilling nor freezing renders meat safe that has been infected with bacteria and other micro-organisms whilst alive or after slaughter.

Drying, as to produce biltong, preserves satisfactorily, but is scarcely adaptable to mass production and distribution. The same is true of salting in containers with brine. However, curing in salt brine containing also saltpetre (or the nitrite produced therefrom by bacteria) is used for manufacture of bacon from pig meat and similar products from beef, etc.) which are often also smoked to aid preservation and improve flavour.

Heat sterilization in sealed cans or glass jars, with suitable precautions and controls kills all spoilage bacteria and renders meat completely safe.

Corned beef is the most important canned meat product, with meat extract as a by-product.

Manufactured meat products, such as sausages and pies, are themselves subject to rapid spoilage at high temperatures. Successful meat processing has certain requirements, similar to those for milk production:-

- (a) Suitable raw material in properly bred, fed, housed and handled herds (or flocks), satisfactorily transported to the factory;
- (b) Properly appointed and hygienic factory conditions for housing and slaughter;
- (c) Proper control of all stages of processing, particularly for canning, with adequate supplies of clean chlorinated water;
- (d) For other than canned meat, suitable cold storage plants and refrigerated transport arrangements.

Poultry, likewise, need proper breeding, feeding and management and veterinary inspection, hygienic slaughtering, cleaning and packing lines and either chilling or freezing for distribution. [Antibiotics (of the penicillin type) can be used under strict control to increase "shelf-life" during distribution].

Eggs are usually distributed without processing, except perhaps for chilled storage.

Fish

Raw material located and caught by suitable fishing methods, usually from fishing vessels, has first to be preserved by packing in crushed ice. Fresh unprocessed fish can be distributed in this chilled state, (usually in ice) either whole or after removal of inedible head and bones, ("fillets") for up to about two weeks after catching if kept at 0°C., preferably in insulated and refrigerated containers and vehicles. (Antibiotics, incorporated in the ice, can increase shelf-life, at increased cost. So also can irradiation by means of an artificial radio active source, but the equipment is complicated and the process quite expensive).

Fish frozen on vessels immediately after catching or at land installations can be kept in excellent condition for up to 12 months at temperatures as low as -30°C. (Liquefied or solid carbon dioxide, and even liquid nitrogen have been used in some circumstances instead of mechanical compressors using ammonia or "froons" for the refrigeration of insulated transport vehicles and buffer, holding stores).

Fish sticks (or "fish fingers") are sophisticated products sawn in regular strips from blocks of frozen fillets and then fried in fat and usually refrozen for distribution and sale.

Fish are mostly free from diseases harmful to man, but infection can occur as a result of human handling, particularly where no further heating is applied before eating. However, particular care is needed for crustaceans and molluscs to avoid various sorts of food poisoning.

Canned fish and shell fish with various forms of sauce or oil require the usual care to ensure sterility and exclude recontamination once sealed in the can.

Traditional processes of salting, drying, and smoking are still useful, and mild smoking can in fact be combined with other forms of preservation, e.g. chilling and freezing.

Fish meal, prepared by heating and pressing fish offal, and sometimes whole, fatty fishes, and then drying, provides a valuable, protein-rich, animal feed, and any oil also produced can be processed into edible fats. This is, however, a wasteful procedure for fish which can be eaten directly by man.

"Fish protein concentrate" - FPC - is a superior type of fish flour produced by solvent extraction of fish meal made under specially hygienic conditions to yield an almost flavourless and colourless powder for use in human nutrition.

In tropical conditions, all dried products need protective measures against insect pests (including fumigants such as methyl bromide).

Vegetable oils

Edible fats are high in dietary calories which provide the body with energy and also contribute some essential nutritional constituents. Oil is extracted from oil seeds by pressing, cold for olive oil, but more often after heating. Further extraction with chemical solvents, such as hexane, removes most of the residual oil from the press-cake which can be used for animal feeding. Crude oil usually has to be purified in a refinery by treatment first with alkali to neutralize the free fatty acid, then with water to remove the soap produced and finally dried before it is consumed.

Chemical hardening by hydrogenation produces margarine and compound cooking fats.

Oils once exposed to the atmosphere tend to oxidize and become rancid. Proper storage facilities are necessary and certain chemical anti-oxidants may be used to minimise this effect.

Cereals

Cereals are the most important component in any diet. Although consisting principally of carbohydrate, which is a source of calories, cereals also contribute significant quantities of vegetable protein, although in general this is less balanced nutritionally than animal protein. Furthermore, cereals are relatively rich in vitamins, which are often

concentrated in the darker outside layer. Grains as delivered by the farmer are already dehydrated, but proper storage in silos is nevertheless necessary and chemical or heat treatment to destroy insects. Various milling treatment are required before consumption. Rice is milled to remove the husk and bran (or outer layer, which also contains a useful quantity of oil). Wheat is ground to a flour which is whiter the lower the percentage that is extracted (the degree of extraction) the remaining offals being valuable for animal feeding.

Milling methods range from sheer hand-pounding at one extreme, through primitive, animal-driven mills and stone mills to highly mechanized steel roller mills at the other extreme.

So-called durum wheat (which is not the same as the "hard" wheat of North America) is used exclusively for the manufacture of alimentary pastes (pastas) such as macaroni and spaghetti, and for couscous which is a staple article of rural diet in North Africa. (But dura in Sudan means grains such as as millet and sorghum).

Baking of "soft" wheat flour to produce bread requires yeast and ovens, the process being amenable to varying degrees of labour-saving and automation.

Biscuits are usually baked in specially designed continuous ovens also incorporating mechanical mixing and shaping etc.

The starch extracted from maize and similar cereals can be treated so as to produce glucose syrup as a sweetener, dextrine and other by-products.

Beer is a special cereal product utilizing barley which is suitably heated to produce malt, the sugar of which (maltose) is extracted and allowed to ferment with yeast to produce a liquor containing about 4 per cent of alcohol.

Sugar

Purified sugar, being 100 per cent carbohydrate, is a source only of calories and contains no accessory food materials. Sugar (sucrose) is first extracted from sugar-cane or sugar-beet and the liquor then

evaporated so as to crystallize as impure "raw" sugar. After carefully controlled recrystallization in refining, this gives white sugar (granulated, cubes or crystallized as sugar loaves).

Molasses is a by-product from which yeast can be produced and also industrial alcohol. The fibre remaining after extraction of sugar-cane can be made into compressed board.

The season during which either cane or beet can be extracted is of limited duration. The organization of supplies of raw material for the factory is of prime importance. This requires planting the right varieties in the first place, disciplined labour for properly cultivating, fertilizing and watering at the right times and then for correctly harvesting and transporting to the factory when required.

Fruits and vegetables

Starchy vegetables are important sources of calories and pulses of vegetables protein. Fruits also provide a certain amount of sugar, furnishing some calories. Both are rich in vitamins (particularly vitamin C) and some in minerals, although these can be lost in careless cooking or processing procedures.

Fresh distribution necessitates careful attention to grading and packing. However, a processing industry cannot really be based on supplies of material rejected or surplus to the fresh marketing.

Fruits and vegetables can be dried either in the sun (or dehydrated in artificial driers, "accelerated freeze-drying" - AFD - giving the most nearly perfect product, but at high cost). In many cases (although not with onions) "blanching" is necessary before drying in order to inactivate the enzymes that cause deterioration on storage.

Quick freezing of vegetables and some fruits properly carried out produces excellent results but of course requires continuous refrigeration for marketing at home or abroad.

Canning requires all the usual factory control for safety of product. Concentrated fruit juices (especially citrus and tomato) and tomato paste are specialized products with standards and requirements of their own.

Both freezing and canning require strict standards of selection and quality of raw material, especially as regards suitability of particular botanical varieties for processing and the proper condition of ripeness.

Fruit can be canned in sugar syrup and jam (and marmalade from citrus fruits) made by boiling fruits with sugar.

Salting is a well-tried method of preservation for vegetables to be used for pickles and some fruits, such as mangoes, are also kept in salt prior to manufacture into chutney.

Vinegar ("vin aigre", literally "sharp wine") consists of dilute acetic acid which can be produced by the oxidation of the alcohol formed for the fermentation of sugar from grapes, malt, dates, molasses, etc., it is also employed as a preservative in pickle manufacture. Fresh fruits and vegetables can be stored at chill temperatures, and in certain cases in controlled atmospheres with carbon dioxide in order to lengthen processing seasons and facilitate distribution.

Wine is a special fruit product resulting from the fermentation of the sugar of grapes to yield a beverage containing about 12 per cent of alcohol. Apart from its stimulating properties, alcohol contributes only calories.

ANNEX II
PERSONS CONSULTED

Food and Agriculture Organization (FAO, Rome)

Dr. B. Nicol, Nutrition Division
Dr. G.D. Kapsiotis, Nutrition Division
Mr. R. Harrison, Fisheries Department
Dr. H. H. Brown, Fisheries Department
Mr. da Costa, Fisheries Department
Mr. A.D. Faunce, Agricultural Engineering Branch (Land and water Division)
Mr. H. Pederson, Animal Production and Health Division
Mr. C. Renaud, Animal Production and Health Division
Mr. Aten, T.E. Division
Mr. A.A. Kerr, Commodity Division
Dr. P. Binder, Commodity Division
Dr. F.P. Pansiot, Horticulture Branch
Mr. N. O. Gotzsche, Animal Hygiene Section

MOROCCO

Rabat

Mr. H. de Mell, Acting FAO Country Representative
Dr. Tallier, FAO Nutritionist
Mr. F.A. Rohn, FAO Sugar Technologist
Mr. Beguin, FAO Economist (Sebou Project)
Mr. Landa, Ministry of Agriculture and Agrarian Reform
Mr. Serpethe, Ministry of Agriculture and Agrarian Reform
Mr. W. Kluft, Ministère de développement
Mr. Lami, Ministry of Industry
Mr. Houel, Ministry of Industry
Mr. A. T. K. Kebbaj, Director General, Office cherifien interprofessionnel
des céréales.
Mr. Chadmi, Inspector General, Office cherifien interprofessionnel des
céréales.

Mr. Burchardi, Banque nationale pour le développement économique
Mr. Skiretch, Bureau d'études et de participations industrielles (BEPI)
Mr. Haderen, Bureau d'études et de participations industrielles (BEPI)
Dr. Choumara, World Health Organization
Dr. Raoult, World Health Organization
Dr. Buffa, World Health Organization
Dr. Ganamian, World Health Organization
Mr. Holliday, U.K. Embassy

Casablanca

Mr. Mekouar, Office de commercialisation et d'exportation
Mr. Ribierre, Office de commercialisation et d'exportation
Mr. Couve, Office de commercialisation et d'exportation
Mr. G. Roebben, FAO/BEPI consultant
Mr. L. Setout, les Grandes Marques
Mr. J.R. Toledano, Coopérative marocaine de la conserve

ALGERIA

Algiers

Mr. Harrati, Ministry of Agriculture and Agrarian Reform
Mr. Meddahi, Ministry of Agriculture and Agrarian Reform
Mr. M. Boudries, Ministry of Industry
Dr. Ben Kourdel, chef de direction d'élevage
Mr. Deraichi, Huileries modernes d'Algérie
Mr. Afritz Belcour, Fabrique de pâte de la S.A. Sempac
Mr. Ait Youres, Planning Department
Mr. Koudani, Office national des pêches
Mr. Ilief, UN Special Fund
Mr. Z. Sniadecki, FAO Expert (Agricultural Education)
Mr. F. Maignan, FAO Expert (Pasture)
Mr. Alix, French Bilateral Expert (Dairying)
Prof. C.H. Doss, FAO Expert (Agricultural Statistics)
Mr. H. Steffen, ILO
Mr. B.J. Hayden, U.K. Commercial Officer, c/o. Swill Embassy.

TUNISIA

Tunis

Mr. Ben Slimane, Delegate of Morocco and Vice-Chairman, Maghreb Permanent Consultative Committee

Mr. Thani, Delegate of Tunisia, Maghreb Permanent Consultative Committee

Mr. Ayub, Delegate of Libya, Maghreb Permanent Consultative Committee

 Delegate of Algeria, Maghreb Permanent Consultative Committee

Mr. T. Haouat, Chief of Service of Agricultural Production, Ministry
 of Agriculture

Mr. van der Hell, Sugar Technologist

Dr. Edler, Oil Technologist

UNIT D ARAB REPUBLIC

Prof. Aref, Chairman, The Egyptian General Organization for Food
 Industries

Dr. H. Ashmawi, General Director, The Egyptian General Organization for
 Food Industries

Dr. A.S. Halfawi, The Egyptian General Organization for Food Industries

Dr. H. Aboul Ela, Public Affairs Officer, Egyptian General Organization
 for Food Industries

Dr. S. Naguib, Technical Adviser, Egyptian General Organization for
 Food Industries

Dr. M. S. K. El Rafei, Director, Misr Dairy Plant, Cairo

Dr. A.A. El Rahin, Chairman, E. D. Fina Company

Mr. A.M. Moussa, Director, E. D. Fina Company Alexandria

Dr. M.M. Hassouna, Chairman, Biscomisr, Cairo

Dr. A.T. Habib, Consultant, Biscomisr, (Cairo University)

Mr. S.M. El Batal, Manager Biscomisr

Dr. T. Rasheed, Director, Kaha Company, Tabia, Nr. Alexandria

Dr. Morad, Director, The Egyptian Starch products and Yeast Company,
 Alexandria

Dr. H. Kemal, Director, Ennasr Sugar and Pulp Company, Cairo

Mr. H.B. Baghdadi, Société de distillerie d'Egypte, Kom Ombo (Deputy
 Factory Manager)

Mr. Mistikawy, Director General, Egyptian Organization for Aquatic Resources, Heliopolis.

Dr. M.A. Haman, Technologist

Dr. A. Farag, Director, Rice Mills, Flour Milling and Baking General Organization, Cairo

Dr. F. Ragab, Director, Meat and Milk Organization, Cairo

Dr. M.A. Kheir Eldin, Director, Poultry Organization, Cairo

Prof. M.H.H. Ragab, Food Technology Department, College of Agriculture, Alexandria

Dr. H. Osman, Department, College of Agriculture, Alexandria

Dr. A. R. Sidky, FAO Assistant Director General, Near East Regional Office, Cairo

Mr. J. H. Hammad, FAO Deputy Director General, Near East Regional Office, Cairo

Dr. J.B. Poliakoff, FAO Regional Food Technologist, Cairo

Dr. T. J. Job, FAO Regional Fisheries Officer, Cairo

Dr. B.F. Johnson, Manager, FAO Cotton Research Laboratory project, Cairo

Mr. H.J. Louwes, FAO Regional Marketing Adviser

Dr. S.H. Lok, FAO Regional Agricultural Economist

Dr. Y. Salah, FAO Regional Horticulturist

Mr. A.R. Persson, FAO Expert, UN Special Fund Project on Vegetable Improvement and Seed Production, Research Centre

Mr. N. Fourati, Chief of Division of Industrial Production (Fishery Department) Ministry of Industry

Mr. Ben Ammaz, Chief of Industrial Development Plan

Mr. Ben Yedder, Banque nationale agricole

Mr. Rekik, Office de l'huile

Mr. El Ghoul, Office national des pêches

Mr. A. Hadad, Director, Office des céréales

Mr. Hadj, Ministry of Agriculture (Fishery Department)

Mr. Burki, Société tunisienne des industries laitières (STIL)

Mateur

Mr. Vial, Director, Société tunisienne de la laiterie et du fromage.
(SOTVLAI FROM)

Béja

Mr. Bellagha, Director, Société Izdihar

Soliman

Mr. A. Feriani, Director FACNA
Mr. C. Keller, FOA Expert (UN Special Fund Project)
Mr. Van Melle, FAO Expert (UN Special Fund Project)
Dr. Le Bideau, FAO Expert (Nutrition)
Mr. Phelps, UN Special Fund Mission
Mr. Stooler, UN Special Fund Mission

LIBYA

Mr. Omish, Ministry of Economy
Mr. S. Ghanem, Directorate of Foreign Trade
Mr. I. Belkheir, Directorate of Technical Co-operation
Mr. M. Bakoush, Research Department, Ministry of Industry
Mr. M. Dajani, UN Technologist, Ministry of Industry
Mr. M. Sharif, Ministry of Industry
Dr. Assughier, Ministry of Agriculture
Dr. D. Ahmad, FAO Country Representative
Mr. W.H. Barreveld, FAO Expert (Processing)
Mr. Boothby, FAO Expert (Animal Husbandry)
Mr. Rifai, Arab countries bilateral expert
Mr. Gilles, FAO Expert (olive oil)

SUDAN

Khartoum

Mr. Y. H. Abu Samra, Acting Director, Ministry of Agriculture
Dr. Gaheen, Ministry of Agriculture
Mr. M. Khogali, Under Secretary, Ministry of Industry and Mining
Mr. A.B. Wisa, Acting Managing Director, Industrial Development Corporation
Mr. M.M. Medani, Director, Game and Fisheries Department
Mr. Y. Babikr, Game and Fisheries Department
Mr. M.A. Nur, Manager, Packaging House, Khartoum
Dr. Hussein, FAO, Agricultural Planning Adviser
Mr. G.W. Hope, FAO Project Manager, UN Special Fund Food Processing Project

ANNEX III

LITERATURE AND REPORTS CONSULTED

General - food

The State of Food and Agriculture 1964. Chapter III, Protein Nutrition Needs and Prospects, pp. 98-132.

World Grain Trade Statistics 1964/65. Exports by source and destination. (FAO, 1965).

A world survey of the production, trade prices and consumption of Durum Wheat. Secretariat Paper No. 3. International Wheat Council, London, (November 1963).

Durum Wheat in 1964/65 and 1965/66. FAO group on grains. Tenth Session. (March 1966).

Economic survey on modern flour mills in developing countries and some policy considerations. FAO group on grains. Tenth Session. (January 1966).

Consultative Sub-committee on the Economic aspects of rice, Ninth Session.

Economic aspects of Rice processing industries. (19 January 1965).

Rice Bran : utilization and trade, in Monthly Bulletin of Agricultural Economics and Statistics, 13 January 1964.

Economic aspects of the location of oil-seed crushing (12 August 1966) paper for study group on oil-seeds, oils and fats (September 1966).

A working draft paper on food and agro-allied industries in East Africa P. Nand, J. Leclercq, J.B. Poliakoff and Th. Zwankhuizen. (WS/40586, FAO, Rome, 1965).

Establishment of Food Processing Industries in West Africa, J.E. Heesterman and Thio Goan Loo (M66-1316 and M66-1364, ECA, Addis Ababa, September, 1966).

FAO's activities in the field of industrial development (MR/42396, FAO, Rome, 1966).

General - North Africa

Protocol of the agreement between the Kingdom of Libya, the Tunisian Republic, the Peoples Democratic Republic of Algeria, the Kingdom of Morocco (27 November 1964).

Report of the ECA Industrial Co-ordination Mission to Algeria, Libya, Morocco and Tunisia, E/CN.14/248, ECA Sixth Session, Addis Ababa, 5 February 1964).

Report of the North African Industrial Co-ordination Mission to Algeria, Libya, Morocco and Tunisia, Addendum (E/CN.14/248/Add.1, 24 April 1964).

Main Problems of Economic Development and Co-operation in North Africa (E/CN.14/NA/ECOP.4, ECA Sub-regional Meeting on Economic Co-operation in North Africa, Tangier, 20-27 June, 1966).

Report of the Industrial Mission to Algeria, Libya, Morocco and Tunisia, January-March 1966, (T66-43, ECA, Tangier, May 1966).

Economic Survey of North Africa Part I, North Africa in the early 1960's (draft S. Fikowski, July 1965).

Part II Economic Growth in North Africa during the 1950-62 period (December 1965).

General - food - North Africa

African Agricultural Development. R. Dumont (FAO/UN, New York, 1966).

FAO Africa Survey (FAO, Rome, 1962).

Comparative Economic Study of the Industrial Crops in the Maghreb countries S.E. Shehata. (M66-782. ECA/FAO Joint Agricultural Division, Addis Ababa, April 1966).

A comparative Study of Food Production and Trends and Projections of food demand and outlook in total and each of the Maghreb countries in 1970 and 1975. A.Z. Sheira. (M66-729, ECA/FAO Joint Agriculture Division, Addis Ababa, May 1966).

Some observations on the problems involved in the marketing of citrus fruit, wine, olive oil and esparto grass in the countries of the greater Maghreb (Rabat, January 1966).

Conference on Industrial Development in the Arab countries, Kuwait, March 1966

Food and Food Industries (WM/33871)

Fisheries Industries (WM/33379)

Economic significance and accelerated development of industries based on renewable natural resources (WS/33723)

Rapport sur les industries de transformation des produits agricoles en Afrique du nord (Algérie, Libye, Maroc, Tunisie). H. Montagnac (FAO, Rome, January 1964).

Report of the FAO Conference on Cereal and Bread Technology for the Near East Region, Cairo, February 1966. (Rome 1966).

Special Programme of Agricultural Education and Training in Africa. Food Technology Education and Training in Africa. F.H. Reuter and R. Stefanovic (FAO, Rome, October 1964).

MOROCCO

General

Plan triennal 1965-67 (Royaume du Maroc, Cabinet royal)

Délégation générale à la Promotion nationale et au Plan.

Division du Plan :

Laits et produits laitiers (jan. 1965)

Viande (jan. 1965)

Produits de la basse-cour, volailles, oeufs (jan. 1965)

Olives (jan. 1965)

Annexe - essai pour l'étude mathématique de la consommation d'huile de graines au Maroc (jan. 1965)

Céréales (jan. 1965)

Annexes-céréales (jan. 1965)

Fruits (jan. 1965)

Produits maraîchers (jan. 1965)

Note de synthèse relative aux études de produits agricoles (jan. 1966)

L'industrie et les mines en 1964 (Comptes d'exploitation, effectifs employés, investissements réalisés).

(Ministère du développement et du Plan - Division du Plan, mai 1966).

Statistiques fondées sur le fichier général des établissements économiques. (Ministère du développement et du Plan, août 1966).

Situation actuelle et prévisions d'évolution pour 1970 des industries de transformation (fascicule). Industries alimentaires.

(Ministère de l'industrie et des mines, août 1966).

Répertoire des établissements industriels (1962)

Ministère du commerce, de l'industrie, etc. (also revised in manuscript to October 1966).

The Economic Development of Morocco (The International Bank of Reconstruction and Development, December 1965).

Projet Sebou : Aménagement hydro-agricole de la plaine du Rharb - Projet d'aménagement d'une première zone de développement, annexe 5. Le plan d'aménagement agricole.

Royaume du Maroc. Office de commercialisation et d'exportation. Bulletin mensuel d'information, juin 1960 (No. 214).

(Casablanca).

World Food Program News (sept. 1966).

Fish

FAO/ETAP Rapport No. 888. Rapport au Gouvernement du Maroc sur les pêches dans les eaux intérieures. (Rome, mai 1958) W.A. Dill et M.J. Girard. Promotion of the consumption of fish and fish products in Morocco (FAO, Rome, 1960). Rapport général de la Direction de la marine marchande au Conseil central des pêches du 13.4.65.

"The Moroccan Fishing Industry" (Fishing News International, Vol. 6, No. 1, January 1966, p. 66).

Société nationale de farine alimentaire de poisson "SONAFAP" (Bureau d'études et de participation industrielle, Rabat, (juillet 1966).

La fabrication des conserves de sardines au Maroc.

Rapport sur une mission au Maroc, 21 sept. - 5 oct. 1966. E. Sidaway (OMS)

Edible Oils

Rapport sur les huiles alimentaires et tout particulièrement l'huile d'olive. M. Torelli (FAO, Rome, 1965).

Les légumineuses, les graines oléagineuses, condimentaires et diverses, au Maroc. Abd El Khalek Kebbaj (Rabat, 1965).

Céréales

L'économie céréalière au Maroc, 1937-62 (jan. 1963) - Abd El Khalek Kebbaj.

Enquête de la FAO sur la meunerie dans les pays en voie de développement.

Rapport présenté par le Maroc (1 juillet 1965).

Fruit and vegetables

L'avenir industriel des agrumes en Afrique du nord. Y. Vincent (1961).

Etude d'un compte d'exploitation en vue de l'implantation au Maroc d'une usine de jus de fruits. Bureau d'études et de participation industrielles. G. Roebben (jan. 1964).

Possibilités de développement des industries de transformation des fruits et légumes dans le Bassin du Sebou, en regard des industries similaires dans les autres régions du Maroc (FAO, Rome, 1965). J. P. Allchin.

Supplementary report on the processing of edible fish flour from sardines at the Azote Union Plant in Safi, Morocco. G.D. Kapsiotis - FAO, Rome, (september 1961).

Possibilities for development of protein rich food mixtures for infants and children in Morocco. G.D. Kapsiotis. (FAO, Rome, March 1965).

ALGERIA

General

L'Algérie agricole (numéro spécial). La statistique agricole (Ministère de l'agriculture et de la réforme agraire, 1966).

Bulletin des industries agricoles et alimentaires Nos. 1-9 (mars-nov. 1966). Ministère de l'agriculture et de la réforme agraire, 1966.

Analyse des activités économiques du secteur autogéré, années 1963-1967, (mai 1965). Ministère de l'agriculture et de la réforme agraire, 1966.

La situation économique de l'Algérie au 1er janvier 1965. (Direction générale du Plan et des études économiques). Industries alimentaires (transformation).

Institut pour l'étude et le développement de l'industrie en Algérie, M. Bousser (3 volumes, septembre-octobre 1959).

Société d'études et de réalisations minières et industrielles (Paris, nov. 1964).

1. Stations de conditionnement (4 rapports)
2. Huileries (8 rapports)
3. Savonnerie (4 rapports)
4. Stéarinerie (1 rapport)
5. Meunerie - Semoulerie (5 rapports)
6. Pâtes alimentaires - couscous (4 rapports)
7. Traitement du riz (3 rapports)
8. Biscuiterie (6 rapports)
9. Sucrierie (2 rapports)
10. Levure (1 rapport)
11. Brasserie (2 rapports)
12. Distillerie (4 rapports)
13. Boissons alcooliques (1 rapport)
14. Boissons non alcooliques (4 rapports)
15. Laiterie (4 rapports)
16. Conserves des fruits et des légumes (4 rapports)
17. Conserves des sardines (4 rapports)
18. Confiserie (4 rapports)

19. Chocolaterie (3 rapports)
20. Conserves d'olives (4 rapports)
21. Vinaigrerie - câpres et piments (3 rapports)
22. Traitement du café (2 rapports)
23. Alimentation animale (2 rapports)
24. Entrepôts frigorifiques (4 rapports)
25. Rapport de synthèse (2 rapports)

Miscellaneous

Possibilities for development of protein-rich food mixtures for infants and children in Algeria. Report on field trip to North Africa, March 1965.

G.D. Kapsiotis (FAO, Rome, 1965).

Development of the Algerian weaning food mixture. G.D. Kapsiotis (FAO, Rome, February 1966).

TUNISIA

General

Plan décennal, 1962-1971.

Plan triennal, 1962-1964.

Plan quadriennal, 1965-1968 (1965).

Les industries alimentaires en Tunisie. Document presented by the Government of Tunisia at Colloque sur le développement industriel en Afrique, Cairo, 27 January-10 February 1966.

Répertoire des industries tunisiennes (November 1965)

Economist Intelligence Unit. Economic Review, 1966.

Annual Supplement, Algeria, Morocco, Tunisia.

Economist Intelligence Unit. The Economic Development of Algeria, Morocco and Tunisia. July 31, 1966.

La Recherche scientifique en Tunisie, 1960-1961

Fish

FAO/ETAP Report No. 864, Rapport au Gouvernement de la Tunisie sur la situation de la Flotte chalutière tunisienne. P. Gurtner (FAO, Rome 1958).

FAO/ETAP Report No. 1283, Rapport au Gouvernement de la Tunisie sur la pêche en Tunisie. M.F. Bourgois (FAO, Rome 1960).

FAO/ETAP Report No. 1336, Rapport au Gouvernement de la Tunisie sur la préparation de produits à base de sardinelle. Robr. Vesterhus (FAO, Rome 1960).

FAO/ETAP Report No. 1410, Rapport au Gouvernement de la Tunisie. Essais de chalutage au large des côtes tunisiennes (F. Bourgois and L. Fasina) (FAO, Rome, August 1961).

FAO/ETAP Report No. 1036. Rapport au Gouvernement de la Tunisie. La prospection systématique des fonds de pêches au large des côtes tunisiennes. V. Fodera. (FAO, Rome 1964).

FAO/ETAP, Report No. 2029. Rapport au gouvernement de la Tunisie. Programme de recherches sur les ressources de la pêche maritime et l'évaluation des stocks. J.P. Wise (FAO, Rome 1965).

Resumé of the situation as at 9 November 1960 with regard to the sardine and sardinelle canning industry and the introduction of sardinelles canned in brine into the tunisian Government's school feeding programme.

M. H. Routh (Draft FAO/ETAP Report, Rome 1961).

La pêche maritime. Banque centrale de Tunisie. Bulletin No. 22. September 1964, p. 5.

Pêche. Comité sectoriel de l'agriculture et de la pêche (1966).

Olive oil

Regard sur l'économie oléicole tunisienne (Office de l'huile d'olive de Tunisie)

Banque centrale de Tunisie. Bulletin, 18 July 1963.

Cereals

Rapport sommaire sur la meunerie et la fabrication du pain dans les pays du Proche-Orient et d'Afrique du nord. E. Dijkstra (FAO, Rome, 1965).

Bulletin mensuel économique et statistique agricole (FAO, June 1966, Vol. 15, p. 5).

Miscellaneous

Possibilities for development of protein-rich food mixtures for infants and children in Tunisia. G.D. Kapsiotis (FAO, Rome, March 1965).

Hygiène du milieu en Tunisie. R. Mandello (WHO, June 1958)

LIBYA

General

The Economic Development of Libya. International Bank of Reconstruction and Development (John Hopkins Press, Baltimore, 1960).

Report of Industrial Census, 1964. (Tripoli, 1965).

Bank of Libya. Monthly Intelligence Bulletin, Vol. VI, No. 3-4 (March-April 1966), p. 33.

Report to the Government of the United Kingdom of Libya and Food and Nutrition Policy. Y. H. Yang (FAO, Rome, 1963).

Milk and Meat

FAO/ETAP Report No 487. Report to the Government of Libya on the development and organization of a dairy industry. F. Vieira de Sa (April 1956).

Draft Report on visit to Tripoli, 30.9.62-7.10.62. R. Tentoni. (FAO, Rome).

Animal husbandry, production and health. Country study 1966. Working document for Indicative World Plan for Agricultural Development (FAO, Rome, August 1966).

FAO/ETAP Report No. 1938. Report to the Government of Libya on Animal Feeds. E.I. Robertson (FAO, Rome, 1965).

Fish

FAO/ETAP Report No. 18. Report to the Government of Libya on the Fisheries of Libya. C.D. Serbetis (FAO, Rome, 1952).

FAO/ETAP Report No. 817. Report to the Government of Libya on the present situation of the Libyan fisheries, February-August 1956, F. Bourgois, FAO, Rome, 1958.

FAO/ETAP Report No. 1289. Report to the Government of Libya on Fishing Policy and Administration by J.L. Dibbs (FAO, Rome, 1960).

Report on Fishing in Libya. A.A. Azzaby (August 1960).

FAO/ETAP Report No. 1858. Fishery Administration and Planning. J.S. Asciak (FAO, Rome, 1964).

Fruit and Vegetables

FAO/ETAP Report No. 491. Report to the Government of Libya on Date Processing and Packing. V.H.W. Dowson. (August 1956).

FAO/ETAP Report No. 613. Report to the Government of Libya on the establishment of a fruit and vegetable cannery. G. Roebben (1957).

Project for a citrus-processing plant. W.H. Barreveld and S.L. Galpin (Tripoli, June 1961).

Miscellaneous

Environmental sanitation in Libya. C.A. Morse. Report Series No. 13 (2 December, 1952).

Report to the Government of Libya on Tripoli and Benghazi cold storages. R. Sbordoni. (FAO, Rome, 1958). (Report No. 799).

UNITED ARAB REPUBLIC

General

General Frame of the Five-Year Plan (1960)

The Yearbook 1965 UAR.

Statistical Handbook, 1952-64.

Provisional Indicative World Plan for Agricultural Development 1965-1985 Near East. (FAO, Rome, 1966).

Food Processing Industries in UAR. J. Ashmawi (The Egyptian General Organization for Food Industries).

Fish

FAO/ETAP Report No. 543. Report to the Government of Egypt on the Fishery Investigations on the Nozha Hydrodrome (1956). K.W. Jenser.

FAO/ETAP Report No. 911. A Second Report to the Government of Egypt on the Fishery Investigations in the Nozha Hydrodrome, The Delta Lakes of Egypt and on the work in other inland waters. H.S. Elster (May 1958).

FAO/ETAP - Report No. 1243. Report to the Government of the UAR (Egyptian Region) on the Fishery Investigations of the Nile River, the Lakes and the pond farms in Egypt, 1958-59. (Dr. W.F.J. Wunder).

Travel Report on Field Trip to Egypt (UAR) 1959. R. Kreuzer (FAO, Rome, 1960).

FAO/ETAP 1640 (1963). Second Report to the Government of UAR.

Second Report on Fishery Investigations on the Nile River, the Lakes and the pond farms in Egypt, 1961 and 1962. (1963, W.F.J. Wunder). FAO/EPTA report No.1640.

Smoking of Damietta sardine. M.H. Youssef et al.

J. Arab Veterinary Medical Association. Vol. XXII, No. 1, p.47 (1962).

Edible Oils

Bahtim 110. New Egyptian cotton free of gossypol induced by radiation. A. Afifi et al. Bahtim Experimental Station. (Egyptian Agricultural Organization) Technical Bulletin 80 (May 1965).

Sugar

The Sugar Industry of the United Arab Republic (Cairo)

Fruit and Vegetables

FAO/ETAP Report No. 1513 marketing fruit and vegetables for export. W.L. Lumholtz (FAO, Rome, 1962).

Miscellaneous

FAO/ETAP Report No. 2018. Refrigerated Storage and transportation of perishable food-stuffs. V. Sellerio (FAO, Rome, 1965).

Food Hygiene and Food control in Egypt, 1953. A. Jepsen (World Health Organization, August, 1954).

SUDAN

General

The Ten-Year Plan of Economic and Social Development (1961/62-70/71). (The Economic Planning Secretariat, Ministry of Finance and Economics, March 1962).

Provisional Indicative World Food Plan for Agricultural Development 1965-1985 for the Near East, (FAO, Rome, 1966).

Milk

Preliminary Draft for the Establishment of a Milk Plant at Khartoum. J. Holloway (FAO, Rome, August 1965).