ESE:SF/UAR 49
Technical Report 3

PREINVESTMENT SURVEY OF THE NORTHWESTERN COASTAL REGION

UNITED ARAB REPUBLIC

AGRICULTURE

UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

The complete project report consists of:

Technical Report No. 1	Comprehensive Account of the Project
Technical Report No. 2	Physical Conditions and Water Resources
Technical Report No. 3	Agriculture
Technical Report No. 4	Economic Aspects
Technical Report No. 5	Special Studies

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Report prepared for
the Government of the United Arab Republic
by
the Food and Agriculture Organization of the United Nations
acting as executing agency for
the United Nations Development Programme

UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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TABLE OF CONTENTS

LIST OF FIGURES
(in the back pocket)

LIST OF MAPS
(in the back pocket)

Chapter I

ECOLOGY OF THE REGION

1. The Effect of Climate on Crop and Pasture Production

1.1. Rainfall and runoff

With such a low amount of rainfall, it would be a great mistake to over-estimate the agricltural potentiality of the region. From a strictly ecological stand point, the main agricultural resource is the extensive grazing of the natural vegetation. Some crop production, rain-fed or irrigated by wadi floods, is possible here and there, where soil conditions and runoff allow it, but with only 100 to 150 mm per annum of ranfall, some wadis running two or three times a year on rocky, beds, and scarce, more or less salty underground water, crop production possibilities are extremely limited.

Barley is the main crop. Its yield is reduced by half when the annual rainfall is less than about 100 mm, which occurs on the average twice every ten years. The planted area, estimated to vary between 80 000 and 125 000 feddans, is influenced by the amount of early rain falling before December, but no correlation has nevertheless been found between these early rainfalls and the total area planted. Thus in bad years there are low yields and many unharvested fields. This situation is harmful for the range.

Some fast growing leguminosaea as lentils or vetches could thrive in the best soils receiving local runoff. Some pasture of Dactylis glomerata var hispanica: Lolium rigidum, annual medics and vetches could also be established where runoff water accumulates.

Horticulture is confined to some wadi beds and patches of good retentive soil receiving runoff water. Yields are related to the outflow of the wadis, i.e. rainfall amount and intensity. Olive trees are planted on 7 000 feddans. The young trees are irrigated with ground water pumped by windmills. The amounts given per tree (two buckets twice a month from May to September) are just enough to keep them alive. For production, the best favoured orchards receive about 300 mm of water during winter, by spreading of the three or four annual wadi floods. Even if some moderate yields are recorded here and there (along the wadis beds on deep soils, for instance), no fair production can be expected with irrigations restricted to the winter months. From an ecological stand point, it would be more advisable to cultivate early fruit crops which would use soil water reserves during spring and early summer.

The problem for crop production is to transfer, as fast and as soon as possible, the available rainwater, runoff and groundwater into a high value commercial product. Thus vegetables could be the best crop for the region, even though they require more water per unit area.

Range production and dynamics are directly related to rainfall. The variation in rainfall from year to year is not very high for this type of climate. This is an encouraging element for sheep husbandry. However, in the dry year 1967/68, with a drought such as occurs 2 years in 10, the average feed intake from the range was reduced by more than a half, according to estimates (see Chapter III). Further detailed studies must be performed to relate more accurately the relaton between climate and range production and botanical composition.

The first rains of autumn greatly affect the movement of flocks along the coast, according to their distribution. However, the relation between early rainfalls in Matruh and Barrani was found quite close. For 35 years of observation, twice the rainfall was definitely lower at Barrani than at Matruh and twice definitely higher. Thus it seems that only about one year in ten is an eastward or westward flocks' movement justified by a serious lack of early rain. No relation was found between early rainfalls in Sidi Barrani and Sallum.

1.2. Humidity and dew

It is fortunate that the hard conditions imposed on the vegetation by the lack of rain are rather tempered by the high air moisture, but the importance of this fact for agriculture must not be exaggerated. The humidity of the air, even if it is higher along the coast than inland, does not reduce poetential evapotranspiration a great deal: from about 2 000 mm in Cairo to 1 500 mm in Matruh. Saturation deficits are high except in autumn and winter, during which some dew deposits can occur. The benefit to trees and plants of the dew is doubtful. Total dew amount is proportional to the loss of calories by long wave radiation, which is low when air moisture is high. The plant itself plays no part in this process. It is doubtful that dew fall equal to rainfall (150 mm) could be deposited by advective moist air current from the sea, given the high cooling required to condense this amount. Yet some studies should be performed on this subject. Nevertheless, the nearness of the seacertainly lessens the harmful effects of the drought, not to such an extent as to classify the climate of the region as semi-arid, but as arid-maritime.

1.3. Temperature

The temparature of the air is the most favourable element of the reion's climate, for tourism as well as for agricalture. For agriculture the temperature in the winter and spring is as important as it is in the growing seasons. Frosts are not to be feared even at soil level, but night temperature below 10° frequently occur in February. They stop the growth and development of some plants such as string beans and cause abnormalities in tomato flowering. On the other hand the mildness of the winter is unfavourable for some fruit production. An analysis of the number of hours below some given temperatures is still to be made, but it seems that the climate of the region is at the extreme limit, regarding cold requirements, for pistachio cultivation.

1.4. Winds

Wind blows rather heavily along the coast, mostly from the sea, but often (25 percent of the cases) from inland too. These dry and dusty winds are harmful for the vegetation and justify some protection for delicate crops such as vegetables. Plantation of trees and shrubs in the sandy dunes in advisable, as windbreaks against wind erosion

2. The Effect of Soils on Crop and Range Production

2.1. Fruit trees

The establishment of an orchard always involves an outlay of capital and labour and so an incorrect estimation of the soil conditions of the site will lead to a considerable loss. Olive, fig, almond, grape, carob and pistachio trees grow satisfactorily on a wide variety of soil types, from deep fertile soils to moderately deep soils. It is important, however, that fruit trees be planted on deep and well-drained soils free from salinity. For dry-farming cultivation the first condition requires that the soil be deep and able to retain and conserve moisture. Considerable attention must be given to this question. Apricot, mulberry,

peach, almond, fig, olive, pistachio are more or less salt tolerant and can grow on certain slightly saline soils. Soil required for dry culture of the fruit trees must be very permeable to a fairly good depth (50 cm), so that the water is absorbed rapidly, and the water-retention capacity of the surface layers should be low so that the moisture can infiltrate down and ensure the lowest possible evaporation rate. For the tree grower, soil fertility is not the only factor to be considered; the volume of soil available to the roots is also important. This explains why relatively poor soils can give good results with perennials that have large and well-developed root systems.

To ascertain if a saline soil is suitable for the cultivation of grapes, almonds, figs, olives and fodder shrubs, physiological tests should be made with annual plants whose requirements are analogous to those of the olive, such as maize and barley.

2.2. Annual crops

Annual winter crops are less exacting with regard to the depth of the soil, while annual summer crops require medium to deep soils because the shallow soil loses its humidity quickly and the plant is rapidly exposed to dryness. Salty soil should be avoided. However, there are some annual crops which are more or less tolerant to salinity such as barley, broad-beans, etc.

The soils preferred for vegetable production are sandy soils, sandy loams, silt loams, clay loams. Sandy soils are considered of value for very early crops, but the moisture-holding capacity of such soil should be increased by adding organic matter in the form of manure. Sandy-loams are able to retain moisture and nutrients better than sand, and in general are considered better for vegetable growing. The silty loams are valuable for production of most kinds of vegetables, especially where large yields are more important than earliness. Clay loams are not considered so good for early crops. For most vegetable crops good drainage and good preparation of the soil are essential. For planting small seeds it is important to have the surface fairly smooth and free of clods and trash in order to plant at a uniform depth and to have good coverage of seed.

The soil texture also has an important influence upon field crop adaptation. Medium or heavy soils are best for fine-rooted barley, whereas the coarser rooted crops such as maize and sorghum can thrive and are often grown on lighter soils. Water percolates more quickly and also deeper into light soils. Partly for this reason, crops in semi-arid regions are less subject to drought on sandy soils than on heavy soils. On certain soils of this arid region excessive base (saline salts) accumulation is found in different layers. They are unsutable for crop production until the salts are leached by heavy irrigation, combined with drainage. Salt-tolerant crops such as various grasses are more resistant to salt than many legumes.

Forage plants are preferable for salty land because their quality is seldom impaired by the environment. In general, relatively permeable and fertile soils with a good water-holding capacity are most suitable for cultivation in the region.

2.3. Range

The various range types are closely associated with certain soil characteristics on the one hand and with climatic characteristics on the other.

From the coast inland the rapidly declining average annual rainfall, its increasing inter-annual variability and the decreasing air humidity are major factors affecting the composition and density of the range vegetation. These factors, however, interact with the effect of certain soil characteristics which, broadly speaking, also vary in areas parallel to the coast. This interaction of climate and soil causes the

various range types to be located in bands roughly parallel to the coast, especially in the western part of the region. Local variations of this broad pattern are caused by additional factors, such as soil parent material, topography, sand accumulation on the surface, water accumulation and alluvial deposits in closed depressions (often causing salinity), salt spray from the sea along the coast.

As a whole, soils in the region are light, often enabling rapid water penetration and thereby causing the vegetation to consist ofa relatively dense stand of sub-shrubs as compared with other range areas with a similar rainfall pattern but with heavier soils. Nevertheless, within the generally light-textured soils considerable differences are found. The coastal sand dunes have a low fertility, partly due to a very high $CaCo_3$ content; the vegetation cover therefore is poor. On inland dunes and sand accumulations, meanwhile, the relatively loose and deep sandy and loamy sandy soils have a relatively dense stand of sub-shrubs and ephemeroids (e.g. inland sand dunes South of Maktila-Terfaya - Sidi Barrani, area S. of El Dabaa) with a relatively high carrying capacity. On sandy loam and loam, meanwhile, the surface layer of the soil easily loses its structure, becomes compact through animal trampling, and the surface pores seal up rapidly with rainfall, causing a relatively large runoff, even on land which is only slightly sloping.

The result is a relatively low density and less vigorous growth of sub-shrubs. Annuals, meanwhile, have a somewhat longer growth period and are more vigorous on the loamy soils than on sand, due to greater moisture retention in the surface layer of the former. On the other hand, on the loamy soils the density of annuals is to a large extent determined by the micro-topography; relatively dense stands being found in small depressions and around tussock-forming shrubs while few annuals are found on flat land. This could be partly explained by the effect of sheet and wind erosion in carrying off seeds and top soil.

On the rocky slope and edge of the Northern escarpment certain good range species are found which are absent or scarce on deeper soil below or above the escarpment. An outstanding example is Dactylis glomerate var. hispanica. One reason for this phenomenon could be that grazing is less severe due to the relative inaccessibility to sheep (not to goats), another factor is the relatively large moisture accumulation in soil pockets between rocks and stones. The presence of these good species would enable a relatively fast regeneration through protection and management.

3. Animal Ecology

The existing meteorological data on the climate in the project area cannot be used as it stands for the purposes of the animal ecology of the whole range area. The data concerns the climate on the coast only, where the meteorological stations are located, while the ranges spread as far inland as 50 km southwards. Some idea of the climate on the range deeper inland can be obtained from the preliminary study of the surface water expert 1/ concerning the rainfall related to the distance from the coast. The climate rapidly becomes a desert climate with the decrease of rainfall from the coast to the inland range areas.

On the basis of the surface water expert's study, the amount of rainfall for the inland zones of ranges was estimated by modifying the data collected at the coastal meteorological stations. To calculate the average rainfall for the ranges in the grazing districts the numbers of animals (not the surface areas) and the rainfalls estimated as related above were used. The number of animals in each

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1/ Economides, P. : Decrease of the amount of rainfall in the relation to the increasing distance from the sea in the Matruh area, 1968 (Mimeo).

locality was estimated on the basis of the locality's grazing capacity as estimated by the range management expert. Thus the rainfall of each locality should bear the same relationship to the average rainfall of the district as the numbers of livestock in the locality do to the total number of livestock in the district.

The average rainfall on the coast, as compared with the average rainfall calculated by the FAO ecologist 2/ for the corresponding range, is as follows:-

Table 1

COMPARISON OF RAINFALL ON COAST WITH ESTIMATED RAINFALL OF CORRESPONDING RANGE AREAS INLAND

Station:	Average annual rainfall on the coast	Average annual rainfall on the ranges
	mm	mm
Burg El Arab	154.6	79.5
El Hammam	119.9	60.0
El Daba	140.6	82.0
Fuka	108.4	68.7
Mersa Matruh	147.6	81.1
Sidi Barrani	143.4	81.1
Sallum	102.2	55.9
Averages :	134.6	75.5

The average rainfall for the entire project area was calculated according to the numbers of animals grazed in the different districts. As the table shows, the average annual rainfall on the ranges is 75.5 mm, only 56 per cent of the rainfall on the coast.

Temperatures and air humidity were also worked out by using the relation between data from the coastal meteorological stations and data from the station in the Siwa reflecting entirely desert conditions.

Details of the methods of calculation can be found in the special report on the climate on the ranges of the coastal zone which was prepared under the project for the Government 1/. In this report the differences between the grazing districts were also analyzed. Here, however, only the monthly temperature, rainfall and air humidity are used for the construction of the hythergraphs (Fig. 1) representing the climate conditions for vegetations and the climographs (Fig. 2) representing environmental conditions for the animals. The classification of the monthly

1/ Palian, B. : Climate of the ranges on the N.W. Coastal Zone as the factor of animal production, 1968 (Mimeo).

2/ Calembert J. : Final Report, 1968 (Mimeo).

conditions on the hythergraphs is done by using the Martonne indexes: 1 = 20 for desert conditions; 1 = 30 for arid conditions; and 1 = 40 for normal conditions.

From the hythergraphs it is seen that on the coast the average conditions can be qualified as arid only in two months, while characteristic desert conditions prevail for the other months, as they do for the whole year on the ranges. Some significant differences were distinguishable in different sectors of the project area, the climate in the better range areas being less unfavourable. In the most favourable sectors (e.g. Sidi Barrani) the conditions on the ranges are better in so far that in one month (January) the climate can be qualified as arid. This means that the possibilities of improving pastures are very limited except through the use of runoff water, where this is available. It should be also noted that, under conditions which are so marginal for the vegetation, a certain part of the rain water is removed through runoff. The question of how this runoff water is used is therefore of greatest importance for the maintenance of the animal population.

The climograph of the ranges represents a fairly ideal relation of temperatures and relative humidity of air. Perhaps the slightly higher humidity in the summer months on the coast and in the winter on the ranges could be slightly unfavourable, since it could have the effect of aggravating the results of occasional storms. These can be fairly frequent in the winter and spring months and dangerous for the animals. But, with a large number of well distributed shelters built on the ranges, the animals could be efficiently protected.

Thus the unfavourable conditions for the growth of herbage on the range area remain the most important problem of animal production.

Chapter II

PRESENT CROP PRODUCTION

1. Introduction

1.1. Previous investigations

There are six farms in the area which were established for experimentation, propagation and production. Five of them (Burg-el-Arab, Fuka and Matruh farms, and Burg-el-Arab and El Qasr nurseries) belong to the EGDDO and one (Ras-el-Hekma) belongs to the Desert Institue. The Ministry of Agriculture in addition to these two organisations has also carried out work in the area. Many fruit species and cultivars were introduced and tested, especially in the Burg-el-Arab, Fuka, Matruh and Qasr farms. Some varieties of olives, almonds, pistachios, peaches, apricots, figs, grapes, carobs, quince and apples were also introduced. Investigations concerning water relation and the water economy of some fruit trees were carried out and the effect of salinity on the growth and water relations of barley were studied. The results of some of these investigations were published or written, but there appear to be no general documents providing agronomical data for the entire region.

1.2. Work done under the project

The time was relatively short for carrying out a coherent plan of investigation and research. However, the following investigations, studies and experiments were done:-

- Experimental propagation by budding of olive trees, which might be quicker and more economic than propagation by grafting by approach, as at present done in the region.

- introduction of fruit tree species and cultivars to study their adaptation to the ecological conditions of the region. Pistachio and apricot species were introduced from Syria, almonds from U.S.A. and Tunisia. Cultivars of figs for drying from U.S.A. and Italy and 26 cultivars from various countries, of olive trees suitable for oil production and pickling were introduced.

- ecological investigation consisting of comparative studies between the monthly average rainfall and temperature in the main stations of the area and the main stations of cultivation areas in other countries.

- observations on phases of vegetation for the main fruit tree species existing in the region for studying the relationship with climatological factors.

- preliminary investigations of relation between yield and salinity of water and soil for olive trees.

- testing species and cultivars under local conditions and studying the spacing of the trees. (6 000 trees - grapes, almonds, apricots, peaches and olives -

were planted in El Negeila, El Qasr, Mahtalah, Baqqush and Sidi Barrani during 1967-68 and 1968-69).

- survey of olive, almond and grape yields, by weighing yields and relating them to the age of the tree.

- demonstration of various kinds of olive harvesting tools, new to the region.

- comparison under local conditions of Cantanella tomato cultivar from Tunisia with local cultivars (Brichard, Marglobe).

- introduction of 112 barley cultivars of FAO Near East Wheat and Barley programme and 13 Australian cultivars. Tests of these cultivars need to be continued for at least three years.

In addition to this particularised investigatory and experimental work, a land use map showing the distribution of fruit trees vegetables and field crops throughout the region was drawn up. Semi-detailed study of the pilot areas and detailed studies of micro-projects were made. These are described in Volume V. Spreading and terracing projects were carried out in the Fuka area.

2. Types of Crop Production

2.1. Trees crops

2.1.1. Olives

2.1.1.1. Extent of cultivation

Olives are grown throughout the region, sometimes as far as 15 km inland, but mainly near Burg-el-Arab (Bahig and El-Hawarieh), and Mersa-Matruh (El-Qasr and Alam el-Roum), where the oil presses are located. The locations of orchards of the new and old plantations are well selected in wadis and behind dykes and dams where soil moisture is well retained. Usually there are wells in the vicinity of the orchards, or, inland, cisterns providing water for irrigation in the first years. The bedouins have always cultivated olives on a small scale. Farmers prefer olive trees for their ability to resist water shortage and soil salinity, and also because they do not attract animals and are easy to market.

Table 2 shows the area and number of bearing and non-bearing trees grown in different areas of the region, according to the survey carried out under the project.

Table 2

NUMBER OF OLIVE TREES, BY GEOGRAPHICAL AREA, IN THE NORTH WESTERN COASTAL REGION 1/

Geographical Area	Productive trees		Unproductive trees		Total of sectors	
	No. of trees	Area feddans	No. of trees	Area feddans	No. of trees	Area feddans
Burg-el-Arab	34 220	855 00	69 150	1 729.00	103 270	2 584.00
Dabaa	6 430	161.00	40 700	1 017.00	47 130	1 178.00
Mersa-Matruh	49 570	1 239.00	71 400	1 785.00	120 970	3 024.00
Sidi Barrani	6 470	162.00	18 890	472.00	25 360	634.00
Total for the Region	96 680	2 417.00	200 140	5 003.00	296 830	7 420.00

1/ Agric. sample survey, UNSF, Pre-Investment Survey Project of the N.W. Coastal Zone, U.A.R. - May 1968.

2.1.1.2. Production

Production under dry farming conditions is generally poor. Table 3 shows that 94 trees surveyed in 1967 on 7 farms gave an average yield of only 18 kg.

Table 3

OLIVE YIELDS UNDER DRY FARMING CONDITIONS 1/

Location	No. of trees	Age	Average yield
		years	kg/tree
Wadi Maguid	12	8 - 10	8.80
Negeila	15	8 - 10	11.70
Garawla	2	12	7.50
Negeila	11	14	17.60
Garawla	9	14	16.50
Qasr	15	14	14.70
Fuka	9	14	12.40
Garawla	1	16	26.00
Wadi Maguid	2	20	62.50
Garawla	2	20	23.20
Fuka	4	20	34.00
Fuka	12	20	31.00
Average			17.86

1/ Trees were irrigated for 2-3 years after plantation. (150 - 200 litres per tree per year)

The table also shows the great variation in yield, ranging from 5-65 kg per tree, according to the location, the variety and the age of trees.

Production under irrigation is much better, trees producing from 25 to 180 kg of fruit. In 1967, 42 trees were surveyed in 4 farms. The average yield of these trees was 55.57 kg. per tree. (see Table 4)

Table 4

OLIVE YIELDS UNDER IRRIGATION

Location	No. of trees	Age	Average yield
		years	kg/tree
Qasr	1	10	24.00
Qasr	14	12	79.21
Fuka	11	12	46.70
Qasr	9	12	25.40
Qasr	5	14	36.60
Qasr	2	32	137.50
Average			55.57

The figures of Table 4 show the possibilities of increasing production under a limited watering during summer. (200 - 400 m^3/feddan)

The production of olives in general in the region shows the following problems:-

Cultivars: The present main cultivars are Chemlali, Mission, Hamid Wtakin, Manzanillo and Kalamata. Shemlali is the most widely-grown, being used mainly for oil. The number of cultivars tested in the area is relatively limited in comparison with the number of cultivars planted in other countries.

Propagation: This is by grafting by approach which is slow and expensive.

Distance of plantation: The trees are often planted at a distance as close as 5m by 5m or 7m by 7m. Since 1960 the recommended distance of plantation has been 10m by 10m, which is suitable under winter flooding, but insufficient under spreading and very close under dry farming conditions. Generally, farmers erroneously assume that the more trees they plant in an area, the greater yield they will obtain, regardless of other factors.

Pest control: Considerable damage is caused by pests and diseases and farmers do not realise at all the importance of pest and disease control. Growers make the excuse that the poor crops do not pay for expensive sprayings.

Pruning: This is generally not done. There are no skilled pruners or foremen in the area and, when pruning is occasionally done, it is done before the proper time and the trees exposed to sunlight

Irrigation: Though olive trees can withstand dryness, it is better to irrigate them. But sometimes olive trees are not irrigated even when water is available from wells. Sometimes trees are not irrigated at all after plantation (as seen in the Maktala and Sidi Barrani area) and growth consequently starts badly. Light irrigation is normally given in the area, but, being light, a considerable portion of water is exposed to direct evaporation and roots tend to develop near the surface, where they are exposed to drought and destruction by cultivation implements. Moreover, as light watering must be repeated more often, labour costs are increased.

Cleaning and preparation of the site: Often cleaning of the soil for annual and perennial plants is made just before plantation and the ploughing is so shallow that the weeds with deep roots or rhizomes are not destroyed. Subsoiling is not practised, although it would be useful for destroying the lime hardpan which prevents the good penetration of root trees. Little surface work is done on the soil.

Tolerance for salinity: The trees are often grown in soil of higher salinity than they can stand or irrigated with water which is too salty for them.

Olive harvesting: Harvesting is often done before the olives are ripe and this affects the oil quantity and quality. Since some time elapes between harvesting and processing because of the long distance between the farm and the oil press, lack of means of transportation, and the low capacity of the oil presses, the olives start "sweating". This gives rise to deterioration during processing.

Oil processing: The oil presses in the area are old and have low capacity. 2 oil presses belonging to EGDDO, with 2 tons capacity per day, exist in the area, one in Burg-el-Arab and the other in Mersa Matruh. In addition, there are private and primitive oil presses, each having a capacity of about 50 tons per season. The absence of oil presses may limit the extension of olive plantation in other sectors, such as Dabaa and Sidi Barrani.

The oil percentage is very low (14-18 percent) because of the early harvesting

and the deterioration of oil press equipment. The cost of processing is relatively high. The oil press takes 20 percent of the oil or £E 0.03 per kg of olives.

Indebtedness of the producer: Since government or cooperative credit institution exists in the region, producers have dependended on the merchants for their credit needs, and they are now indebted to merchants at the regional markets for their seasonal loans, and to local retailers for their food requirements, and clothes, etc.

2.1.2. Figs

2.1.2.1. Extent of cultivation

Figs are cultivated mainly along the coast in sandy dunes and on sandy or sandy-loam soil. The Sultani and Adsi varieties are the best in such areas. Fig production adjacent to the sea in the east of the project area has had an impact upon the local economy owing to its easy sale for the vacationer in Alexandria during the summer season. The heaviest concentration is from kilometer 34 to kilometer 88 on both sides of the road from Alexandria to Omayed, in particular in the communities Draa-el-Bahri, Burg-el-Arab, Hammam and Omayed. In this area approximately 76 percent of the figs in the region are produced. Fig plantations are also found in Dabaa, Fuka, Baqqush, Mersa Matruh, Negeila and Sidi Barrani.

Table 5 shows the number of fig trees and the areas they occupy in the various geographical areas, according to the survey carried out under the project.

Table 5

NUMBER OF FIG TREES, BY GEOGRAPHICAL AREA, IN THE NORTH WESTERN COASTAL REGION

Geographical Area	Productive trees		Young trees		Total for Sectors	
	No. of trees	Area feddans	No. of trees	Area feddans	No. of trees	Area feddans
Burg-el-Arab	192 410	2 405	146 840	1 836	339 250	4 241
Dabaa	23 920	299	12 030	150	35 950	449
Mersa Matruh	46 240	578	10 400	130	56 640	708
Sidi Barrani	9 930	124	2 420	30	12 350	154
Total for the region	272 500	3 406	171 690	2 146	444 190	5 552

2.1.2.2. Production

The fig tree starts to bear fruit 2-4 years after planting. Once the tree is 7-10 years old, it can be expected to produce about 8-14 kg of fruit a year, provided that it has grown normally and has been cared for properly. Up to the 11th year, average production can reach 15-25 kg, according to the area. Total production in the region for productive trees is about 5 450 tons, with an estimated average per tree of 20 kg, and 515 tons for young trees, with an estimated average of 3 kg per tree.

In some orchards in Draa-el Bahri, production can reach 1-2 kg per day and per tree during the peak period of production.

Table 6 shows the estimated average yield of figs in a winter watered area

similar to Wadi Maguid. (flood-irrigation.)

Table 6

ESTIMATED PRODUCTION OF FIGS UNDER FLOOD-IRRIGATION

Stage of production	Yield		Yield	
	Variability	Average	Variability	Average
years	(- - - - kg/tree - - -)		(- - - - kg/tree - - -)	
From 4th to 6th	1-5	3	80-400	240
From 7th to 10th	6-14	10	480-1 120	800
Up to 11th	12-20	16	960-1 600	1 280

Fluctuations in production are very pronounced and can vary by over 20-30 percent from one year to another, according to rainfall.

The production of figs in general in the region shows the following problems:-

Pruning: Pruning is often not done properly, only unproductive branches or those branches attacked by pests or diseases being removed. The tools used are very primitive - Saw, knife, and hachet.

Cultivars: There are no cultivars for drying. The main cultivar planted is Sultani, (about 95 percent of all figs). The second cultivar in importance is Adsy (A.Abiad and A.Ahmar). Other cultivars like Aboudi, Gharabi, Koumathra, are cultivated but as scattered trees and in very small areas.

Water: For highest yields, figs need watering throughout the summer. This is not often done. Also watering is often not done during the first few years.

Fertilizer and manure: Fertilizers are not used in the area and manure is used only on a small scale. As the sandy dunes are normally poor in nutritive elements, the problem of fertilizing and manuring needs to be tackled.

Pest and disease control: Growers do not realise the importance of treating pests and diseases, confining themselves to cutting back the attacked branches.

Packing and Transport: Figs are often bruised during transport because they are pressed against the sharp sides of the palm leave basket. Transport is very slow and in some cases the fruit reaches consumers spoiled.

Processing: There are no processing facilities. Bedouin families process at home very small quantities of figs into jam which is sold or consumed locally.

Prices: The average auction price received by the producer varies from £E 0.02 to £E 0.04 per kg for Sultani and £E 0.08 to £E 0.12 kg for Buni. The retail price per kg is £E 0.06 to £E 0.12 for Sultani and £E 0.12 to £E 0.18 for Buni. The price for Sultani is relatively low.

Indebtedness of producer: As remarked under "Olives" above, producers are in debt to merchants.

2.1.3. Other tree crops

Other fruit species scattered throughout the region and cultivated on a small scale are almonds, grapes, carobs, pomegranates, pistachio, prickly pears,

peaches, date-palms, apricots, and mulberries.

2.1.3.1. Almonds (Prunus Amygdalus Botsch)

Almonds are cultivated mainly as an intercrop, particularly in the Burg-el-Arab and Mersa Matruh areas. The almond is well suited to the hot interior valleys, where the fruit matures satisfactorily and the trees are less subject to diseases than along the coast. The number of almond trees and the area they occupy is shown in Table 7, together with tree numbers and areas for all the other minor fruit trees. The table is based on the sample survey carried out under the project.

Table 7

NUMBER AND AREA OF FRUIT TREES OTHER THAN OLIVES AND FIGS IN THE NORTH WESTERN COASTAL REGION

Geographical Area	Species	Productive trees		Young trees		Total for areas	
		No. of trees	Area feddans	No. of trees	Area feddans	No. of trees	Area feddans
Burg-el-Arab	Almonds	9 990	125	3 990	50	13 980	175
	Others	3 920	49	-	-	3 920	49
Dabaa	Almonds	1 450	18	850	11	2 300	29
	Others	1 330	17	720	9	2 050	26
Mersa Matruh	Almonds	7 210	90	3 020	38	10 230	128
	Others	3 600	45	4 010	50	7 610	95
Sidi Barrani	Almonds	160	20	50	1	210	3
	Others	7 520	94	1 440	18	8 960	112
Total for the Region	Almonds	18 810	235	7 910	97	26 720	334
	Others	16 370	205	6 170	77	22 540	2 82

Almond production is difficult to estimated. The survey gave the data shown in Table 8.

Table 8

ALMOND YIELD IN BURG-EL-ARAB AREA

Farms	Age	Number of trees	Total yield	Average yield	Remarks
	years		kg	kg/tree	
1st	5	29	26.06	0.93	- Distance between trees 5m by 5m. Dry almond. Irrigated 4 times
2nd	7	26	54.89	2.11	- Distance between trees 7m by tm. Dry almond. Unirrigated.
3rd	3	3	0.70	0.23	- Distance between trees less than 5. Green almond. Unirrigated.
	4-7	10	27.00	0.70	
	9-11	8	83.00	10.37	
	15-21	11	192.00	17.45	
	30	1	60.00	60.00	

The yield in the third farm is relatively good: one tree has given 60 kg of green almonds even without irrigation. This shows that almond production can be improved greatly by selecting strains and cultivars. At present the impediments to production are the following:-

- The bedouins are not inclined to grow almond trees, because all through the growing season fruits must be protected from theft as they are eaten green.

- planting may well take place in soil that is too salty. The almond is probably less tolerant than is generally supposed.

- the choice of cultivars, all of which are foreign, was not considered well. Possibly the most important decision determining the success of commercial almond planting, after the selection of the site, is the choice of cultivars.

- many trees are grown from seed and are bitter. There is no market for bitter almonds in the U.A.R.

- The cultivars of distributed seedlings are usually misnamed.

- trees are planted at 5m by 5m, and some times at 7m by 7m. These distances are relatively close under dry farming condition.

- trees are not trained or pruned before the young trees bear fruit. Pruning for fruit production is not done either. This fact has a big influence on the quality and the quantity of production.

- cultivation has often been neglected or done carelessly, because of the widespread belief that the almond withstands mistreatment and needs little attention. In cases where cultivation is neglected weeds exhaust the soil moisture to the detriment of the trees, especially when irrigation is not practised.

- no control measures are taken over diseases, which are often troublesome in almond orchards.

- almonds are often attacked by nematodes. No tolerant rootstock is known in the U.A.R.

Harvesting:

- as farmers are nearly always short of ready cash, the almonds are often sold green even though it would be more profitable to wait and sell when they are fully mature.

2.1.3.2. Grapes (Vitis vinifera)

Grapes are grown in the region wherever the environment is reasonably favourable, but on a small scale. A small number of vines interplanted between olive or other fruit trees are found in most farms. Some concentrations can be found in Burg-el-Arab, Mersa Matruh, and particularly Sidi Barrani, under dry farming conditions. Some plantations in Burg-el-Arab and Fuka farms are under irrigation. The area of grape trees is estimated not to exceed 20 feddans and the number of trees to be not more than 16 000.

The project survey of 1968 in Sidi Barrani area showed that the average yield per unirrigated plant more than 10 years old is around 8 kg. It is expected that under flood irrigation the yield will be more.

Shortcomings in grape cultivation are as follows:-

- only a small number of cultivars can be found in the area. "Banati" "Roumi Aswad" "Roumi Abiad" "Roumi Ahmar" and "Biz-el-Anzé" are among the most important. Cultivars existing in Sidi Barrani are: "Zaraki" "Hoummeri" and "Bayadi". It is felt that these cultivars are similar to "Roumi Aswad" "Roumi Ahmar" and "Biz-el-Anzé" cultivars, but more adapted to drought conditions.

- sometimes farmers do not irrigate grapes even during the first few years, and the growth of young trees is greatly handicapped by water shortages.

- The space between grape trees in the area is very close, about 1-2 m, the distance used in the Nile Valley under irrigation.

- Grapes are not pruned at all and therefore the production is low in quantity and quality.

- Diseases and pests are often troublesome in grape plantations, but no control measures are taken.

2.1.3.3. Other fruits

Carobs: (Ceratonia siliqua) The carob is of some value. It frequently grows under poor, difficult conditions unsuited to any other form of cropping. There are some plantations at the EGIDDO farm at Burg-el-Arab (272 trees) and at their farm at Mersa Matruh (65 trees). Unfortunately the trees are very neglected and it is very difficult to estimate their production.

Pomegranates: (Punica Granatum L.) A few hundred pomegranate trees are scattered all over the region as interplants. Growth seems to be satisfactory.

Pistachio (Pistacia vera L.) There are nearly 2 feddans in all planted with pistachio trees. The number of trees is 90 at the Burg-el-Arab Farm and 41 at the

Burg-el-Arab Nursery. Seventy seedlings were planted under the project in March 1968 at the Fuka Farm. Propagation, and pollinisation and winter chilling are the major problems for the expansion of this tree.

Prickly pears (Opuntia Ficus-Indica) Prickly pears are found throughout the region, but in few specimens. Some commercial plantations exist between Burg-el-Arab and Alexandria, strictly outside the project area.

Peaches (Prumus persica or Amygdalus persica). Some trees are found as intercrop, especially in Wadi Maguid and Baqqush. There are no commercial plantations in the region.

Date-palms (Phoonix dactylifera L.) The trees found in the region are mainly grown from seeds and produce inedible fruit. They are located in Draa-el- Bahri, between Alexandria and Burg-el-Arab, and in the Qasr area west of Mersa Matruh.

Apricots (Prunus Armeniaca L. or Marmeniaca vulgaris L.) There are two or three trees in the area. Between 1948-1950 some varieties were introduced at the EGDDO Burg-el-Arab farm, but no trace of them remains. The project introduced thirty trees (Hamawi and Baladi cultivars) from Syria at the Fuka farm in March 1968. Their growth is still very good under irrigation. Also 300 trees of local cultivars were planted in the Baqqush, Qasr and Negeila pilot areas.

Mulberries (Morus L.) Very few trees were found in Burg-el-Arab. Growth is good, and production seems to be good too.

Guava (Psidium Guava). There are a few trees in Draa-el-Bahari (Burg-el-Arab) and Baqqush growing under dry-farming or irrigated conditions. The growth is good and production seems to be good also.

Lime (Citrus aurantifolia Swingle). Only very few trees are found. They are located in Draa-el-Bahri and Baqqush and grow under dry-farming and irrigated conditions. Growth and production is not good.

2.2. Vegetables:

2.2.1. Extent of cultivation and types

Some vegetables are grown in the region under irrigation, but most under dry farming, and many farmers grow a few rows or small plots. Onions, broad beans and tomatoes are the main winter vegetables: watermelons and tomatoes are the main summer vegetables. The main plantation under dry farming conditions are: Mersa Matruh((Qasr) and Burg-el-Arab (Draa-el-Bahri.) Some plantations are also found in Hammam, Dabaa, Fuka, Baqqush, Negeila and Sidi Barrani. The main plantations of irrigated vegetables are in the Fuka, Baqqush, and Wadi Enthely (Negeila)areas. The irrigated vegetables are grown where soil moisture is retained through dykes, earth dams, in depressions, and where wells and windmills exist. The area cultivated varies from year to year according to rainfall and is estimated at about 1 500-2 000 feddans, more than half of which are in the Qasr area.

The characteristics of cultivation of the main vegetables are as follows:-

Broad beans (Vicia Faba L.) Broad beans are grown as green beans near Mersa Matruh and as dry beans in isolated areas like Wadi Enthely. They are considered as a winter crop and sown at the same time as barley. They are cultivated on a relatively large scale because of their tolerance to salinity and low moisture levels.

Peas: (Pisum sativum). Peas, which are somewhat less tolerant to salinity and low moisture levels than broad beans, are cultivated on a small scale in the Qasr area in good years. During trials elsewhere in the region in 1967/68 it was found that peas seedlings were badly damaged by birds, whereas broad beans, lentils

and chickpeas were not much affected.

Onion (Allium cepa L.) Onions are cultivated on a large scale because of their tolerance to salinity and dryness. They are planted mainly under dry farming conditions. Sometimes one irrigation is given after manuring and before planting and two or three irrigations later. Mainly the green bunching onion is used, produced from seeds. Onions are largely used as intercrop between fruit trees, especially olives.

Tomatoes (Lycopersicon esculentum.) Tomatoes are a promising crop for the area and are cultivated on a relatively large scale. The area varies from 50 to 100 feddans according to the year. Farmers do not seed directly in the field. The seeds are always planted in a location of warmer temperatures and the plants are transplanted after the danger of cold weather has passed. Under irrigation tomatoes are cultivated either as wintercrop or as a summer crop. As a winter crop, they are cultivated mainly in Draa-el-Bahari, in the Burg-el-Arab sector. Summer tomatoes are mainly cultivated in the western parts, especially near Mersa Matruh. They are planted either under irrigation or under dry farming conditions. Under dry farming conditions, tomatoes are planted where the runoff is sufficient, especially in wadis and on land in depressions. The distance is 2 to 2.5m in the rows and between rows. One irrigation is given, by hand, immediately after planting.

Watermelon: (Citrullus Vulgaris shrad). Watermelons are cultivated on a fairly large scale in the area under dry farming conditions. The area cultivated varies from 350 to 750 feddans according to the year. They are the main summer vegetable crop.

Artichokes (Cynara Scolymus L.) Cultivation was tried under the project and proved successful. This plant has the advantage of being more or less tolerant to salty conditions.

Other vegetables such as pepper, cucumber, cantaloupe, muskmelon, pumpkin, squash, raddish, lettuce, spearmint, and garden rocket are planted on a very small scale and mainly for local or family consumption.

2.2.2. Production

Production varies greatly from year to year and it is difficult to make meaningful estimates. Production is hindered by the following factors:-

- There are very few species planted in the area because the bedouin population is not familiar with other species. The introduction of new species with a higher value would take a long time, because bedouins are conservative by nature.
- The seeds used by farmers are not selected. They may be mixed and are not free from seed pests.
- shallow working and cultivation are not sufficient to kill weeds.
- there is practically no use of fertilizers and manure is used on a relatively small scale. Green manure is not used at all.
- there is practically no insect or disease control.
- The principles of crop rotation are not known in the area, and often the same species are planted on the same land from year to year.
- extension work is practically non-existent in the area, and farmers need some advice on vegetables grown under dry farming and irrigated conditions.

- The cost of transportation is sometimes as great as the cost of production. This difficulty limits the extension of vegetable plantation and decreases the benefit to the grower.

- The planting time is generally very concentrated, instead of being staggered. Therefore at harvesting the problem of too large a volume for marketing in a short time is encountered, even though the total volume of production is relatively low.

2.3. Field crops

2.3.1. Extent of cultivation

Barley is the most common crop cultivated in the desert of the Mediterranean littoral of Egypt. As its growing season is short, it is suited to areas where moisture is available at root level for only brief periods. Barley is also a salt-tolerant crop. Thus it can be planted in soils with shallow profiles, in those with deep gypsum layers, and in those slightly saline.

In drought years, barley fields in the project area which are expected to be a failure are often grazed at the beginning of heading, when the vegetative parts are still green. Alternatively, the barley may be pulled out before ripening and fed as hay.

While barley is cultivated widely throughout the project area to a depth of 15 - 25 km inland, its cultivation depends greatly on local soil and runoff conditions (see Map 1) and is found mainly in depressions and wadis. It is found inland south of Baqqush and in the Negeila and Burg-el-Arab areas. Many closed depressions in the Dabaa area are cultivated with barley. Closed depressions inland in the Sidi Barrani area are cultivated in good years. In some years a big area is cultivated on the plateau.

The estimated total area cultivated in good years is probably about 135 000 feddans. In poor years, however, the area planted may not exceed 80 000 feddans. Table 9 shows the areas under barley in various zones of the region in 1967/68.

Table 9

AREA UNDER BARLEY IN VARIOUS ZONES OF THE NORTH WESTERN COASTAL REGION

Sectors	Area	Percentage of total area
	feddans	%
Burg-el-Arab	43 800	32
Dabaa	39 400	29
Mersa Matruh	45 500	34
Sidi Barrani	6 200	5
Total	134 900	100

The above table was based on the results of the projects sample survey of April 1968. The figure for Sidi Barrani is probably low on account of certain cultivations there being recorded under other zones, where the cultivator was living. For this reason, the figure for Mersa Matruh is probably too high.

2.3.2. Production

While the yield in a good year is about 400 kg per feddan, with about 800 kg of straw, total barley production in the project area varies greatly from year to year, as the estimates listed in the following table for years of differing climatic conditions (and therefore differing seed availability at planting) show:-

Table 10

ESTIMATED BARLEY PRODUCTION IN THE NORTH WESTERN COASTAL REGION

Rainfall conditions	Seed availability at planting	Area planted	Area harvested	Estimated yield	Estimated production
		feddans	feddans	kg/feddans	tons
Drought year	good	80 000	20 000	200	4 000
Below average year	poor	90 000	70 000	200	14 000
Average year	fair	100 000	73 000	300	22 000
Average year	good	120 000	100 000	300	30 000
Above average year	good	120 000	110 000	400	44 000
Average					23 000

The estimated yields in the table above may be compared with the estimated average yield of 600 kg/feddan for barley grown under irrigated conditions in the Wadi Maguid and similar reclaimed areas, as shown in Table 11

Table 11

ESTIMATED PRODUCTION OF SOME FIELD CROPS UNDER FLOOD-IRRIGATION

Species	Yield	
	Variability	Average
	(- - - - - - - - - - kg/fed - - - - - - - - -)	
Barley	550-650	600
Wheat	500-600	550
Sorghum	350-450	400
Lentil	350-450	400
Maize	350-450	400

Cultivation practices in the project area at present have serious limitations. First, no systematic rotation is followed and the same field is often sown with barley every year, although, as it happens, a form of fallow-barley rotation results from the fact that the total area under barley varies greatly from year to year because of rainfall variation, drought, or lack of seed after a drought year. Also, systematic crop rotation is less necessary on land where runoff brings silt, organic matter

and animal droppings as additional nutrients to the soil. Secondly, barley is cultivated too widely. Proper land use would limit its cultivation to those areas where an average yield can be obtained in all but drought years. Where, as now, land lies fallow for several years because a good barley crop can only be obtained in years of high rainfall, the land is not only wasted, since the natural vegetation has been destroyed by ploughing and therefore is not grazeable, but is also open to wind erosion.

Other features of present cultivation practive are as follows:-

- The barley used is a mixture of the Mariut cultivar with some of the cultivars used in the Nile valley.

- No distribution of certified seeds is made, and there is no treatment of stored seeds, despite the presence of some insects and fungi affecting their quality.

- The soil in general is not ploughed before winter or before sowing to increase the penetration of rainfall.

- The seed is broadcast by hand on non-ploughed soil and then covered by ploughing.

- Ploughing, done with the local wooden plough drawn by a donkey or a camel, covers the seed by creating a small furrow and a small ridge 1/.

- Mechanised cultivation is done by the chiselplough. However, probably only 15 per cent of the ploughing is done mechanically. Whereas most of the mechanical cultivation in the Burg-el-Arab area is done with private tractors from the Nile valley, the tractors available from codperatives in most parts of the project area prove particularly costly to rent because frequent breakdowns increase ploughing time. They are therefore not used as much as they could be were they well and regularly maintained.

- Harvesting is done by the slow and expensive method of pulling plants by hand, for which workers are brought in from outside the project area in years of good harvest.

- Threshing is also slow and expensive, being done by driving an animal-drawn wooden sleigh with cod-wheels over the pile of barley. Winnowing is done by hand, wooden forks being used.

- The chaffed straw is carried by camels or donkeys and piled close the owner's house, where it sometimes remains for years, since no baling is done.

- The barley grains are generally stored in pits in the ground, where they sometimes remain for two years or more and can become infected by insects.

1/ If the land is ploughed across the direction of the runoff, the latter is partly halted and there is more infiltration. Also, the ridges produced by ploughing reduce wind erosion. The local wooden plough and the mechanised chiselplough destroy only part of the perennial shrubs and thus some of the original vegetation remains for grazing in the summer and in drought years.

These pits, which are about 30 cm deep and 1.5 m in diametre, have a layer of chaffed straw on the bottom. The barley is piled in them to a height of 1 m above the ground and then covered with a 20 cm layer of earth and chaffed straw.

- Barley for immediate human consumption is stored in sacks kept in tents.

- There is no barley pest and disease control in the area.

In addition to barley, some wheat, maize, lentils and sorghum are found in the project area in very small quantities.

Chapter III

ANIMAL PRODUCTION AND RANGE MANAGEMENT

1. Introduction

Animal husbandry, one of the main sources of income in the project area, is based on the use of the natural range vegetation for rearing sheep, goats and, to a lesser extent, camels and donkeys. Meat and wool are the products of greatest economic importance, while milk, goat skins, goat and camel hair can be considered as important by-products, mainly for local consumption. The main value of camels and donkeys is for draft and transportation.

Since the frequency and distribution of rainfall are erratic and there are seasonal changes in the palatability of various components of the herbage, a certain amount of flock movement is inevitable. Also, flock movement helps to reduce internal parasite infestations.

This extensive ranging is a form of animal production which has low production costs, and consequently individual flock owners can easily increase the number of their animals. This they tend to do, as animal production provides about 30 percent of the total income of the population and the population is increasing. While in the past this increase was periodically checked by mortality losses and sales during drought years, recently greater availability of concentrate feed at low prices and better veterinary care have resulted in an increase in lambing percentage and reduced drought losses, thereby disturbing the balance between livestock numbers and the natural resources of the range. While temporarily increasing livestock production and the family income the bedouin derives from it, the trend to increase animal numbers is causing steady depletion of the range.

The higher level of animal production desired can only be achieved by proper use of additional feed sources and by better methods of animal husbandry to increase productivity per animal on the one hand and to avoid losses during droughts on the other. The crucial point, therefore, is to know to what level additional feed sources (supplement feed and irrigated land) can be raised to obtain the highest economic return.

1.1. Previous investigations

Much of the considerable amount of scientific and experimental work done in the region, particularly in the fields of phytosociology, ecology, plant introduction, reseeding and various aspects of sheep husbandry (breeding, breed characteristics, animal physiology), was carried out at the Ras el Hekma Station under the auspices of the Desert Institute. Phytosociological studies in various part of the region were also made by scientists of several universities.

The Desert Institute set up the Ras el Hekma Station as an experimental and demonstration station in 1952 for work in the fields of range management and sheep husbandry. Until 1956 the station received expert and material assistance from the United States under the Point Four Programme of bilateral aid. In 1960 it ceased to exist as a range management station, but detailed experiments on sheep breeding and some studies on fodder and range plants are being continued.

FAO rendered assistance in range management and ecology in 1954/55 under its EPTA programme, through the assignment of Mr. G.A. Long, FAO Grassland and

Fodder Crops Expert, Near East Country Group Project.

The EGDDO carried out a comprehensive survey of about 60 000 feddans in the Maktila area in 1965/66 with the aim of establishing a range improvement pilot project.

The previous investigations are summarized hereunder:-

(a) Phytosociological studies

Description and mapping of plant communities were carried out in several areas, notably the salt marshes, the Fuka - Ras El Hekma area, the Maktila - Tarfaya - Abu Nafla area, and Baqqush. The works of Prof. Tadros, Dr. El Sharkawi, Dr. Migahid, Dr. Batanouny and others are of great value for a better understanding of plant - soil - water relationshipsin these various areas and provide much basic information for future detailed work on the use of each area for grazing. The studies of Long and Ayyad in the Ras el Hekma area are of great importance for pasture improvement work there.

(b) Plant introduction, adaption of reseeding studies

Most of the work in this field was carried out at the Ras el Hekma Station and in the neighbouring area of Fuka. From sixteen plots selected for adaptation studies of many exotic and local species, the best results were obtained in valleys at Ras el Hekma which receive runoff from adjacent hills and slopes. A number of perennial and some annual species were found to be suitable for reseeding in such areas, the most promising perennials being: Oryzopsis miliacaea, Phalaris tuberosa, Dactylis glomerata var. hispanica, Agropyron elongatum, Poterium sanguisorba (winter growing species); Panicum antidotale and Atriplex nummularia (summer growers). Acacia saligna and Prosopis juliflora proved to be a tree and woody shrub species of value for fodder. The reseeding studies included work on land preparation and on the establishment of the most promising perennials.

These studies were mostly carried out during the period when Ras el Hekma was a range experiment station under the direction of Dr. Omar Draz, assisted by some Point Four Programme specialists. The work was continued for some years after the departure of the foreign technicians by Mr. Aslan and Dr. Kamal Ibrahim. Now a herbarium is being maintained by the Desert Institute in addition to the herbaria of the unversities and a small collection is kept at Ras el Hekma.

(c) Waterspreading

Since part of the rainfall, especially in sloping areas with a low plant density, runs off into valleys partly draining into the sea or the coastal saltmarshes, its utilization through waterspreading on locations with good soil was felt to be a good means of achieving pasture improvement. Waterspreading systems were laid out in the Fuka area and at the Ras el Hekma station, with the assistance of Point Four Programme specialists, and reseeding with promising perennial species was carried out. In some cases establishment of the reseeded species failed because the year was dry, but, in good rainfall years, there were dense stands of local annuals. These areas were subsequently used by the local population for barley cultivation but the levees are not being maintained and floodwater has broken through some of them.

(d) Sheep breeding and sheep husbandry

Studies on Barqi sheep in the project area were done under the auspices of the Desert Institute by Dr. Y. Ghanem and his associates, and studies on them under Nile Valley conditions were carried out by various Faculties of Agriculture. Much research was undertaken on the productive characteristics of the Barqi sheep

and the possibilities of improving the breed by crossing with imported Hungarian Merino. This work is being continued at the Ras el Hekma station but the carefully collected and abundant data are not representative of sheep production generally in the bedouin flocks. The sheep of the station graze on similar range pastures but the conditions are considerably modified by the extreme concentration of flocks in the relatively densely inhabited area of Ras el Hekma. Consequently the need to supplement the sheep with concentrates and roughages is excessively increased on the overgrazed pastures. Even so, the excessive concentrate and hay do not seem to provide even the level of feed intake existing in the bedouin flocks. This should be taken into consideration when the result of studies carried out at the station are used. In some works the problem of resistance to the different ecological conditions is treated by studying the physiological reactions of animals to stresses; in others, the influence of feed deficiency and of unbalanced rations on breed characteristics is systematically approached.

Thus the research so far carried out on animal production has been too theoretical and is of limited use for practical studies attempting to indicate the future prospects of sheep production by improved feeding and management.

1.2. Work done under the Project

In the field of range management the first task was the preparation of a long-term range-improvement plan which would form the basis for the Government request for continued WFP feed assistance, the Plan of Operation for which the expert and his counterparts subsequently helped the Government to prepare. The principal aim of the continuation of WFP feed assistance is to help the Government initiate a sound policy leading to rational utilization of the range resources. Advisory work on relevant WFP matters was carried out throughout the duration of the project.

Observations were made on the patterns of flock movement, on the grazing behaviour of the different categories of animals and the seasonal utilization of the main perennial species, on animal husbandry practices as related to range utilization, on plant growth in the different seasons under various ecological conditions, and on the period of flowering of the main perennials.

A major item was the estimation of the carrying capacity of the various range types in each grazing district. For this purpose observations were made at various locations in each range type.

To supplement the carrying capacity estimates, clippings of grazeable herbage were made in the summer and autumn of 1967 and in the spring and autumn of 1968. A number of 2 x 5 m fenced enclosures was established for vegetation clippings in different range types of the Maktila area.

Two nurseries of pasture plants suitable for reseeding or for the establishment of pasture reserve plots at farms were established. Seed of various species was obtained through the project from abroad, while small amounts of good local species were collected and likewise planted in the nurseries (at Nubaria and Fuka) a number of pasture demonstration plots with gool local and some introduced species was established at different farms in the autumn and early winter of 1967.

In the field of animal husbandry, preliminary studies showed the possible alternatives for the development of production. These alternatives were studied and a plan of long term development prepared which consisted basically of fairly fast improvement of managemement, during which phase a high level of supplement feeding would continue, followed by gradual application of an improved system whereby full integration of the range with irrigated areas producing fodder would take place.

To provide the elements for planning, a survey of the productive capacities of local breeds was made. Data were gathered in different parts of the region on characteristic types of sheep and goats, such as their physical features, growth rate in the suckling period, growth rate after weaning (with and without fattening), fleece weight, fertility and mortality. Data were also collected on milk production and detailed studies made on the wool properties and parasite infestations, in collaboration with the Desert Institute and the Veterinary Research Laboratory respectively. In addition, a study was made of feeding sheep in a bedouin flock with relatively high rations of concentrates. The experiment, coinciding with the prolonged drought season in that year, provided more information on the efficiency of drought feeding of animals.

Subsequently the animal production expert assisted the Government with experimental and pilot projects in annual production, which were useful in the study of breed capacities in improved environments.

2. Animal Feed and Stockwater

2.1. Range types and range utilization

The range vegetation of the zone can best be described as an open shrub vegetation, characterized by sparse and slightly sparse stands of semi-shrubs with a cover of ephemerals of varying density. Especially on inland dunes and on sites with sand accumulation, the lower strata of the vegetation may contain small perennials (Plantago albicans) in addition to annuals. In certain range types the semi-shrubs have a relatively high density, as in areas with a relatively high soil salinity (the "salt marsh" vegetation and the areas covered with Suaeda pruinosa, where tussock formation is often characteristic), in non-overgrazed areas with Artemisia herba alba as the dominant semi-shrub, and in parts of the inland sand dunes. Generally, the density of semi-shrub decreases rapidly from about 15-20 km from the coast southwards, except in occasional depressions, the Sidi Barrani and Burg el Arab areas, where a relatively dense shrub cover extends further south than elsewhere in the zone, are an exception. The density of ephemerals is highest in sandy areas and in non-saline depressions, but varies greatly from year to year, depending on the amount and distribution of rainfall during the season.

The relationship between climate and soil and range production is discussed in Chapter I. A brief description of the main range types and their use for grazing is given below: for a more detailed description, the reader is referred to Calembert, 1967 1/ and to the range types map (Map 2).

(i) The "Salt marsh" range type

This range type includes different vegetation associations consisting of various halophytes, which occur in coastal valleys and plains. Tussock formation is prevalent. The main species with some value for grazing are found in those dry parts of the coastal depressions where the salinity level is lower as a result of soil formation (mainly wind blown deposits around shrubs on the edges of the depressions) and leaching. The main species with some value for grazing by sheep and goats are Salsola tetranda and Suaeda pruinosa. Apart from grazing by camels, the main grazing period is in the autumn following the first rains. The amount of grazing obtained from this vegetation is very limited, even though the vegetation density is mostly high.

1/ J. Calembert, FAO Agro-Ecologist, Climatologist: Final Report (Part II) Alexandria, June 1967, 29 pp., Pre-investment survey of the N.W. Coastal Region Project of the UAR.

(ii) Gymnocarpus decandrum sub-desert range type

This range type comprises two sub-types. The first is found on rocky, shallow sites with a layer of loamy material on the eroded slopes and crest of the first escarpment, about 5-10 km south of the coast. It includes a number of good perennial species for grazing, e-g- Dactylis glomerata var. hispanica. Ephemerals are not dense, except on colluvium and aeolian accumulations. Because of overgrazing the density of perennials is often low, especially where the escarpment is close to areas with a relatively high population density. The other sub-type is located further inland, mainly in the Sidi Barrani sector, 15-30 km from the coast. It is found on shallow desert soil consisting mainly of aeolian deposits on bedrock. In certain areas where the soil also contains residual alluvial deposits, Artemisia herba - alba is present, while other perennial species which provide grazing include Stipa spp, Pithyranthus tortuosus, Helianthemum ellipticum, Echiochilon fruticosum. Ephemerals are relatively abundant following good winter rains.

Grazing of the first sub-type is mainly in late spring, summer and autumn, while most grazing in the second sub-type takes place in winter, spring and early summer.

(iii) Artemisia herba -.alba

In this range type Artemisia herba - alba is the dominant sub-shrub. It occurs mainly on medium deep calcareous loamy to sandy loam soil in various areas: in the Sidi Barrani area on the first plateau in a belt extending about 10 km from the coast; in the Baqqush and Ras el Hekma areas on the first plateau in a belt extending about 15 km from the coast; in the areas further east in a belt extending about 10 km from the coast east of Fuka, 20 km inland at Dabaa, and 14 km inland at Sidi Abd el Rahman. Some relatively large areas with Artemisia as main palatable semi-shrub are found in the region south of El Omayad, El Hammam and Burg el Arab. Especially when overgrazed, it is accompanied by dense stands of Asphodelus microcarpus a tuberous plant of low grazing value. Annuals are relatively dense in places which receive runoff. Most grazing of Artemisia takes place in summer and autumn.

(iv) Haloxylon articulatum

This range type is found on relatively shallow loam soils. It may be a form of Artemisia herba - alba, degraded by ploughing and overgrazing. Barley cultivation is common when rains are good at the beginning of the season and sufficient seed is available from the previous harvest. Land not receiving much runoff is often ploughed and left uncultivated in subsequent years. Haloxylon articulatum survives cultivation or re-establishes itself relatively soon, while the more palatable species such as Artemisia disappear. Haloxylon is by far the most dominant sub-shrub, especially on the Negeila plateau. Asphodelus microcarpus is frequently found on sites which receive runoff (which are mostly periodically ploughed). Because of its low palatability the main source of herbage for the animals is formed by the annuals, which are usually dense in locations of water accumulation that have not been ploughed. Most grazing therefore is provided in late winter and spring. Barley aftermath with dense stands of dried-up annuals provide some grazing in late spring and early summer. Pythyranthus tortuosus is one of the few palatable species found. When little other vegetation is available Haloxylon articulatum is grazed to some extent in summer and autumn.

This range type is mainly found on the Negeila plateau (mainly north of the highway) and in a belt east of Sidi Barrani up to about 8 km south of the coast.

(v) Plantago albicans on inland semi-stabilized dunes

This range type occurs primarily in the Sidi Barrani area south of the Artemisia zone in a belt 6-12 km wide extending about 80 km from east of Maktila to about

25 km southwest of Buqbuq. Elsewhere, notably on the plateau south of El Omayad, it occurs on less deep aeolian deposits. The main palatable semi-shrubs are Echiochilon fruticosum and Helianthemum lippii. On deep sand Thymelia hirsuta is a very conspicuous component of the vegetation. Since it is practically unpalatable, its presence in a relatively dense stand is considered particularly undesirable in this area. However, as it grows as high as one metre, it provides shelter for sheep during sandstorms and prevents excessive wind erosion. It also provides fuel for the population. Asphodelus microcarpus is also relatively abundant. In view of its low palatability, it is also considered undesirable, but, as it accumulates moisture and nutrients in the tubers, it grows much better in drought years than other species do and the animals thus obtain some grazing from fresh leaves and flowerstalks in winter and from dried-up leaves in spring and early summer.

Mist grazing takes place in late winter, spring and early summer, being provided by Plantago and annuals in late winter and spring and by perennial sub-shrubs and dried-up annuals in early summer. In good years Plantago provides the bulk of grazeable herbage. Since it is short and its growth period is limited mainly to the winter and early spring, it easily gets covered by moving sand during sandstorms. Because of this, and because there is hardly any runoff, herbage availability in this range type varies greatly from year to year.

(vi) Suaeda pruinosa

This range type covers mainly a large belt extending from 5 km southeast of Wadi Halazine (east of Negeila) to 12 km west of Alam Hammam (about 33 km south-southwest of Sidi Barrani). The belt is about 20 km wide south of El Negeila and about 6 km wide near Alam Hammam. Small areas are found elsewhere, for instance southwest of Buqbuq, east of Garawla, and southeast of Baqqush. Suaeda pruinosa occurs on relatively heavy soil (loam) which is slightly saline and forms small tussocks. It is almost the only semi-shrub, except where it is accompanied by other perennials. The density of annuals is fairly good in years of normal or above normal rainfall. Suaeda pruinosa, which has a fairly low palatability, is grazed in autumn, early winter and early summer.

(vii) Anabasis articulata

This range type is the most xerophytic and extends into the desert south of the others and south of the area regularly used for sheep and goat grazing, where rainfall and relative humidity are lower and where the soil is rocky and shallow. Zygophyllum album usually accompanies Anabasis in this type, especially further south. There is usually a fairly wide transition zone with adjacent palatable range types to the north, while eastwards (Burg el Arab area) plants such as Aristida ciliata from the drier sandy desert vegetation to the south are common.

Fairly large depressions occur with relatively dense stands of perennials (such as Thymelia hirsuta, Pythiranthus tortuosus, Atriplex halimus, Helianthemum spp., Salsola tetranda and Artemisia herba alba) on loam or sandy loam, often with sand accumulations on the surface. Annuals are restricted to such depressions, where their density can be high following good winter rains. These areas are the favourite grazing places of gazelles. Camels graze on this range type throughout the year in good years, sheep and goats in winter and spring. The utilization of this type for sheep and goats could be extended to the early summer in good years if more watering points were available.

Summarizing, the Anabasis and Gymnocarpus range types in the south are mainly used in winter and spring; Plantago range type from late winter to early summer, whereas the Haloxylon area provides most grazing in winter and spring. The Artemisia and Suaeda range types are mainly grazed in late summer and autumn, while the Gymnocarpus range type along the northern escarpment is grazed all seasons. No clear-cut distinctions can, however, be made, since the time of use depends mainly

on the density and growth of annuals. In general, the areas to the south are used in winter and spring, when areas closer to the coast are grazed only by the smaller flocks; in summer and autumn the areas closer to the coast are used by large and small flocks alike.

2.2. Estimated carrying capacity

Accurate carrying capacity studies of semi-arid rangeland require detailed experimentation over long periods of time. Experiments using animals to study the effects of different stocking rates in several of the main range types would be the most desirable way of establishing their carrying capacity, but such studies were not possible within the time limit of the project and in the absence of a range experiment station or area.

One of the dominant features of the range in the project area is the great variability from year to year of herbage available for grazing. The variability is directly related to the annual variability of rainfall, and is reflected mainly in the growth of annuals and perennials with a short growing season, such as Plantago albicans, which covers large areas in some parts of the zone. Perennial sub-shrubs are affected to a lesser degree by rainfall variability.

A second important feature is the relative abundance of succulent herbage in late autumn, winter and early spring (provided largely by annuals and Plantago albicans) as compared with summer and autumn. As the climate is relatively mild, annuals begin to grow fairly rapidly after the first rains in early autumn, while their life cycle terminates rather early in spring (about March). In late spring and early summer dried-up annuals still provide a good deal of the animals' intake, although in years with violent storms in spring they may be largely blown away, especially if they are on sandy soil. The difference between succulent herbage available in winter and spring and that available in summer is not as great as in some semi-arid ranges because of the relatively greater density of perennial sub-shrubs which results from the predominance of sand and sandy loam soils and from the effect of relatively high humidity in summer along the coast. The sub-shrubs provide grazing in summer and autumn, but dormancy after flowering and seed formation cause some species to drop their leaves. This usually occurs earlier inland than it does near the coast. Thus, even with a low stocking rate, shortage of highly nutritious herbage justifies a certain amount of supplement feeding in late summer and autumn to ensure a higher animal productivity.

A third feature is the variability of herbage production from area to area in the region because of the erratic distribution of rainfall. Early rains in one area may cause earlier growth of succulent herbage, especially annuals, than elsewhere. As a result short-distance movements of flocks are usual, and long-distance movements essential in drought years. Apart from the years with extreme high or low rainfall, the variation of total annual precipitation from one area of the region to another is not as great as might be expected.

As explained above, the difference between amounts of nutritious herbage in winter/spring and late summer/autumn leads to a certain amount of supplement feeding. A certain amount of drought feeding is also required, since drought years (less than 100 mm total rainfall) occur once every five years on average. Migrations to irrigated areas outside the region may partly replace drought feeding, and this has to be taken into consideration for carrying capacity estimates. Economic factors determine the level of supplement and drought feeding. In this study the carrying capacity was estimated in the field on the basis of year-round grazing without supplement feeding, drought feeding and migrations outside the range. Subsequently the number of animals which it is estimated can be thus maintained on the range was increased in accordance with the amounts of supplement and drought feed considered economic with the present price structure.

The procedure used to arrive at the carrying capacity estimates for each major range type is described in a separate report 1/. The range type map was used and observations were made on main palatable perennials, density of annuals, soil, and range condition in each range type, following mainly north-south transects. At each site the carrying capacity for year-round grazing by sheep was estimated on the basis of the above-mentioned observations and of data and experience from other countries with similar ecological conditions.

Estimations made locally by other research and technical workers were also taken into consideration. An average figure was subsequently arrived at for each range type, part of a range type, or, sometimes, combinations of range types. Each area with a certain carrying capacity was measured on the map and the number of animals (sheep equivalents) calculated. This number was subsequently increased by 35 percent on account of an estimated yearly use of 45 kg of barley and 90 kg straw per sheep equivalent in 4 average years, and 105 kg barley and 210 kg straw in the drought year. This amounts to a 3 months period of supplement feeding in average years and 7 months drought feeding in a drought year. For the Burg el Arab sector the number of sheep equivalents which can be carried by the range without supplement feed was increased by 75 percent on the assumption of the same level of supplement and drought feeding and an annual average migration of 2 months to the crop aftermath of adjacent irrigated areas (Nile Valley) and to range land east of the region. No migrations out of the range were considered for the calculation of the carrying capacity of the other parts of the region. Where the number of goats is 30 percent of the total number of small animals, the carrying capacity and the corresponding number of small animals (sheep and goats) can be increased by 6 percent.

The results are summarized in Table 12. Detailed figures for each proposed range district and for the area east of the districts are given in Appendix I.

1/ Van der Veen, Abu Guendia and Nassef: Estimated carrying capacity, range area of the N. W. Coastal Zone. UNSF Pre-investment Survey of the Northwest Coastal Region Project, Alexandria, June 1968

Table 12

ESTIMATED RANGE CARRYING CAPACITY N.W. COASTAL ZONE (ROUNDED FIGURES)

Area	Range area	Carrying Capacity 1/ without supplement feed	No. of sheep and goats 2/ without supplement feed	Carrying Capacity with supplement feed 3/	No. of sheep and goats 2/ with supplement feed	No. of sheep equivalents adjusted 1967 census 4/
	feddans (1000s)	(feddans per average animal)		(feddans per average animal)		
I. Planned grazing districts:						
Sallum	541	22	24 000	16	33 000	37 000
Sidi Barrani	808	14	56 000	11	75 000	110 000
El Negeila 5/	645	18	35 000	14	47 000	143 000
Mersa Matruh	582	20	29 000	15	39 000	67 000
Fuka (DabaaWest)	346	13	27 000	10	36 000	25 000
TOTAL	2 922	17	171 000	13	230 000	382 000
II Area proposed to be covered by special grazing districts following execution of irrigation project 6/						
Dabaa-East	325	15	22 000	11	30 000	36 000
Burg el Arab Sector	510	17	29 000	10	51 000	98 000
TOTAL	835	16	51 000	10	81 000	134 000
III Grand Total	3 757	17	222 000	12	311 000	516 000

1/ The carrying capacity is expressed as the number of feddans of range land needed for maintenance and production of one small animal (sheep equivalent) in the flock before the end of the summer (before the new lambing season), whereby the long term production potential of the range is sustained. It is based on the flock composition less those lambs and kids (almost yearlings)from the previous lambing season in excess of the number needed for replacement, and less the culls.

Where the goat population amountsto about 30 percent of the total population of sheep and goats, the carrying capacity and the total number of sheep and goats concerned can be increased by 6 percent to account for the smaller feed intake of the goats and the higher percentage of young animals.

2/ Flock at the end of the summer, i.e. without those lambs and kids in excess of the number needed for replacement, and without culls. If goats constitute 30 percent of the total number, the latter can be increased by 6 percent.

3/ Supplement and drought feed consisting of an average of 57 kg barley and 114 kg chaffed straw per animal per year.

An average annual migration of 2 months to areas outside the range is taken into consideration for the calculation of the carrying capacity in the Burg el Arab sector, in addition to the use of the above-mentioned amounts of supplement feed.

4/ The adjustment made was to reduce the number of sheep and goats given in the 1967 census (652 000) by the number of male lambs and culls, thus arriving at the figure of 516 000 for the basis flock prior to lambing.

5/ The Negeila grazing district includes the Shamman cooperative in the West and the Qasr cooperative in the East.

6/ The Dabaa East area includes the 3 eastern cooperatives of the Dabaa sector. At present this area is not included in the planned grazing districts because of the projected irrigation scheme in the Dabaa area, which will require a special form of grazing district. For the same reason the planning of the establishment of a grazing district in the Burg el Arab area was postponed.

As Table 12 shows, it is in the Negeila grazing district that the number of animals most greatly exceeds the number permissible for sustained productivity of the range. Overgrazing in this district is most evident around Negeila village, on the northern part of Negeila plain, and on the foothills bordering the Qasr plain. These are areas of a relatively high density of settled population. Elsewhere, too, overgrazing is most serious in the vicinity of human settlements e.g. near Mersa Matruh, Burg el Arab, Sidi Barrani, Ras el Hekma. Round Negeila, however, overgrazing seems to be a more recent phenomenon, since the remnants of the palatable shrubs are still more in evidence than they are in the vicinity of other population concentrations. There are two reasons for the heavy strain on the vegetation near settlements. First, small flocks owned by the settled population mostly graze within a relatively small distance from the dwelling of the owner. Secondly, the watering points needed in summer and autumn are more numerous in areas nearer the coast. Since the animals are not watered in winter and spring, when sufficient succulent herbage is available, grazing areas at that period are not chosen on account of their watering points. From about April till October, however, there is a tendency to converge on areas closer to the human settlements, where stockwater is more readily available and supplement feeding is easier to organize.

In areas with a higher density of human settlement, the uprooting of shrubs for fuel also contributes to the reduction of carrying capacity. Unpalatable shrubs, especially Thymelia hirsuta, are used first, but when these become scarce as they do near Negeila, palatable shrubs are also used. While mostly fuel oil is now used for cooking and bread-baking in Mersa Matruh, cart loads of shrubs hauled in for fuel are still occasionally seen.

On the Negeila plain and in parts of the Burg el Arab area, excessive ploughing for barley cultivation has led to a decrease of carrying capacity. Now that tractors are available, range land is ploughed which normally receives insufficient runoff to justify its use for barley cultivation.

The number of animals exceeded the permissible number least in the Sallum and Fuka (Dabaa-West) grazing districts and the Dabaa-East area. In the Fuka (Dabaa-West) area the actual number was even less than the potential number based on the carrying capacity estimations. A certain amount of grazing by animals from Dabaa-East presumably takes place in the Dabaa-West area, while, in the drought season 1967/68, a number of flocks from elsewhere (especially from the Mersa Matruh grazing district) grazed here in winter. The density of semi-shrubs (especially Artemisia) is good, and the presence of numerous Artemisia seedlings at places which had received favourable rains in the Dabaa-East and West areas indicates a moderate stocking rate in previous years.

2.3 Feed supplements

As pointed out in the previous section, supplement feed is needed in late summer and autumn for requirements prior to lambing and because nutritious herbage is lacking in that period. The quantities required depend, obviously, upon the rainfall, but, in real drought years, the supplement feeding period would aim mainly at survival rather than at a high productivity and would thus be much extended. As Fig. 3 shows, the supplement feed requirements is the greater in proportion to range herbage use, the greater the animal population. The figure shows the estimated amounts of herbage and feed consumed in 1965/66 and 1966/67, and a provisional estimate for 1967/68, the period from November till November being considered the production year of the range. For comparison, the situation with a proper stocking rate, with 3 months supplement feeding in average years and 7 months feeding in a drought year, is shown, based on the present range productivity. Over the period 1965 - 1968 not more than 50 percent of the animals' consumption requirements were obtained from the range at the proper use rate, even in good rainfall years. This percentage is very low, even when the seasonal nature of the range herbage production is taken into consideration. Economic rather than physical factors, however, determine whether a high intake of purchased feed used on the range, and purchased crop aftermath outside the range, are justified. This is discussed in Vol. IV. It appears that, with present animal productivity and the high inputs of purchased feed (range grazing being comparatively free of charge), the return to capital and labour is very low at official meat prices. However, as high prices were obtained for live animals through smuggling, the high purchased feed inputs were profitable for individual breeders. Large feed supplies were provided by the Government and WFP under the WFP Project UAR 17 in 1965/66 and there was a good barley crop in 1966/67. Feed supplies consumed in those years are given in Table 13. Despite the large amounts of supplement feed consumed, the nutritive requirements of the large animal population were not covered, and the balance of the required feed intake, amounting to nearly 20 percent of the total, was mainly obtained through overuse of the range. In these two years some of the balance was obtained through migrations from Burg el Arab to the Nile valley. Such migrations played a very important role in 1967/68, when the overall productivity of the range was low on account of drought conditions in a large part of the project area. Although the Government supplied considerable amounts of concentrates, less concentrates were available than in the previous years, since the barley harvest was poor. Despite this, some concentrates were used to get the marketable animals ready for marketing, their liveweight being low after poor range grazing. The total feed intake was below requirements, as the lower height of the feed column in Fig. 3 as compared with the column of animal numbers for that year shows. This resulted in increased animal mortality and reduced productivity.

In good years it is customary for producers to keep a part of the barley crop as a reserve for following years, but as the number of animals was high and WFP feed was not available, most of the good barley yield of 1967 had to be used that same year.

There are certain regional differences with respect to reserve stocks. In the Dabaa area, for example, the reserve stocks of barley and straw at the end of the summer of 1967 were larger than elsewhere, while in the Negeila area they were practically non-existent, although barley and straw production that year had been good in both areas. This discrepancy is related to the stocking rate: the number of animals in the Negeila area exceeded the proper stocking rate very much, while in the Dabaa area the livestock population was close to the estimated proper stocking rate and the level of supplement feeding was low (see Table 13).

It should also be noted that at present some of the barley is sold to the Nile valley in good years, especially from the Burg el Arab area.

The estimated supplement feed availability and requirements in the project area with the present range productivity and barley yields are given in Chapter 7, based on the proper stocking rate and moderate supplement feeding. The correct sheep and goats population is calculated to fluctuate between 324 000 (in the four non-drought years) and 280 000 (in one drought year per five years). The feed supplements required are then obtained from the project area, except for about 6 900 tons, on average. In addition, there is annual migration to the Nile valley for an average two months per year from the Burg el Arab area only (fluctuating from an average 1 1/2 months in four non-drought years to 4 months in a drought year).

Table 13

ESTIMATED SUPPLEMENT FEED USED AND FEED INTAKE FROM MIGRATION OUTSIDE THE RANGE, 1965/66 and 1966/67 RANGE PRODUCTION YEARS (Nov. - Nov.)

I. 1965/1966	Production	Use other than feed	Feed Consumption	Feed Units
	(tons)	(tons)	(tons)	(1000s)
Barley				
Human consumption		8 000		
Seed		2 000		
Reserve		3 000		
Total	30 000	13 000	17 000	17 000
Chaffed straw				
Reserve		10 000		
Total	60 000	10 000	50 000	10 000
WFP-supplied feed				13 400
Government-supplied feed				9 500
Total supplement feed available from all sources except migration outside range			a	49 900
Camels & donkeys	Consumption of above supplement feed a = b + c + d		b	2 500
Sheep fattening			c	4 600
Sheep and goats, maintenance and production			d	42 800
Feed intake from migrations outside the range (sheep)			e	3 500
Total supplement feed consumption			f(a+e) f	53 400
Total feed intake for sheep and goats (excluding fattening) other than from the range			f-(b+c)	46 300
Total feed intake for sheep and goats (including fattening) other than from range			f-b	50 900

Table 13 (cont'd)

II. 1966/1967	Production	Use other than feed	Need Consumption	Feed Units
	(tons)	(tons)	(tons)	(1000s)
Barely				
Human consumption		8 000		
Seed		2 000		
Sale to Nile Valley		2 000		
Total	44 000	12 000	32 000	32 000
Chaffed straw	88 000		88 000	17 600
Government-supplied feed				3 400
Privately obtained feed from Nile Valley				1 000
Total supplement feed available from all sources except migration outside range			a	54 000
Camels & donkeys	Consumption of feed a = b + c + d	above supplement	b	2 500
Sheep fattening			c	5 300
Sheep and goats, maintenance and production			d	46 200
Feed intake from migration outside the range			e	5 700
Total supplement feed consumption			f(a+e)	59 700
Total feed intake for sheep and goats (excluding fattening) other than from the range			f-(b+c)	51 900
Total feed intake for sheep and goats (Including fattening) other than from the range			f-b	57 200

2.4. Stockwater facilities

The animals are not watered during winter and spring. From about April to November watering is done every two to three days, depending upon the availability of succulent herbage and on the extent to which supplement feed is given.

Most of the stockwater is obtained from underground cisterns which were constructed in the Roman and Byzantine periods. In the whole zone about 1 200 cisterns were functioning by the end of 1967, while it is believed that several times this number of silted-up, leaking and caved-in cisterns exists. The EGDDO has embarked upon a programme of cistern cleaning, through which about 480 cisterns with a total capacity of about 200 000 m^3 were cleaned and repaired by the end of 1967. An additional 117 cisterns were cleaned and repaired in 1968 (almost all in the Sidi Barrani and Sallum areas). Some stockwater is also obtained from galleries and wells, which are mostly located close to the coast. However, except in some locations, wells and galleries are mainly used for irrigation and domestic consumption. Only in dry years, when the cisterns are poorly filled, and in years with high livestock numbers, is a relatively larger quantity of well water used for animals.

The approximate number and capacity of the cisterns in the region are shown in Table 14.

Table 14

APPROXIMATE NUMBER AND CAPACITY OF CISTERNS IN USE, DEC. 1967

Grazing District (planned or projected)	No. of cisterns	Average capacity	Total capacity	80% of capacity (1967)	75% of capacity (average years)
		m^3	m^3	m^3	m^3
Sallum	63	500	31 500	25 200	23 700
Sidi-Barrani	300	350	105 000	84 000	78 750
El Negeila	270	350	87 000	69 600	65 250
Mersa Matruh	200	350	70 000	56 000	52 500
Fuka	130	350	45 500	36 400	34 125
Dabaa East	80	300	24 000	19 200	18 000
Burg el Arab	125	200	25 000	20 000	18 750
TOTAL:	1 168		388 000	310 400	291 075

Few cisterns are provided with a silt trap. This results in rather large silt deposits which reduce the capacity of the cisterns, especially since most are not regularly cleaned. Even where silt traps do exist they soon become inefficient through lack of regular cleaning.

Only a few cisterns are provided with adequate troughs. There are no hand-pumps and the water is lifted manually with a bucket. There are no screens at the water entrance and thus floating organic material and especially animal droppings from around the cistern and from the catchment area get into the cistern. A study made by the Veterinary Research Laboratory in Cairo shows a high incidence of pathogene micro-organisms in cistern water, which forms a serious health hazard for the human population and the animal population alike. Sometimes the cistern opening is level with the surrounding land surface, and occasionally sheep fall in and drown.

Most cisterns lie within about 25 km from the coast, except in the Sidi Barrani area, where a relatively large number is found up to about 40 km inland (see Map 3). The cisterns in the south are generally bigger.

An effort was made to estimate the distribution per grazing district of stock-water from cisterns and to estimate water consumption at the 1967 animal population level (see Table 15) and at proper stocking rate numbers (Table 16). The estimate is tentative because of insufficient data on cistern capacities and on human and animal consumption from cisterns. The tables show that in 1967 deficits of stock-water existed in the Sallum, Sidi Barrani and El Negeila grazing district areas, whereas at the proper stocking rate a small deficit would occur in average years only in the Sallum area. The 1967 deficit was highest in the Negeila grazing district area, which concurs with the relatively high rate of overstocking which had been taking place there. It is presumed that the deficits are mainly met by the use of well water; to some extent they are met by the renting of cisterns in areas where there is a surplus.

The last columns in Tables 15 and 16 show the estimated numbers of sheep units using cistern water in the summer and indicate the concentration of animals around the cisterns at that season. The tables do not include the Eastern area, where water requirements are influenced by the annual summer migration to the Nile valley. Water availability there will be affected by the new irrigation schemes.

Various tribal sections, or even individuals, claim traditional usufruct rights over the cisterns. This practically amounts to ownership rights, even on cisterns which have been cleaned and repaired by the Government, and leads to a situation whereby, especially in drought years or when animal numbers are high, filled cisterns are rented, at a price varying from £E 50 to £E 100 per dry season. A few "owners" provide the cistern with a lock and reserve it for the use of their own animals or the animals of their kinsmen.

Table 15

ESTIMATED WATER AVAILABILITY AND CONSUMPTION FROM CISTERNS IN 1967.
FIVE GRAZING DISTRICTS

Grazing District	Total water in cisterns - average 4/5 of capacity	Human population using cistern water	Human consumption at 5 litres per person per day	Available for all livestock	Water requirement all livestock (incl. camels & donkeys)	Water requirement sheep and goats 1/	Deficit or surplus all livestock	No. of sheep & goats per cistern 2/
	m^3		m^3	m^3	m^3	m^3	m^3	
Sallum	25 200	3 000	5 400	19 800	23 000	19 000	- 3 200	587
Sidi Barrani	84 000	11 000	19 800	64 200	68 000	58 000	- 3 800	373
El Negeila	69 600	11 500	20 700	48 900	89 000	75 000	-40 100	290
Mersa Matruh	56 000	3 000	5 400	50 600	41 000	35 000	+ 9 600	350
Fuka	36 400	5 000	9 000	27 400	15 000	13 000	+12 400	200
TOTAL:	271 200	33 500	60 300	210 900	236 000	200 000	-25 100	

1/ Based on 450 litres per year per sheep unit and the average number of sheep units from April till October.

2/ Only those sheep and goats whose requirements are met by cisterns.

Table 16

ESTIMATED WATER AVAILABILITY AND CONSUMPTION FROM CISTERNS IN AVERAGE YEARS WITH LIVESTOCK NUMBERS AT PROPER STOCKING RATE. FIVE GRAZING DISTRICTS

Grazing District	Total water in cisterns, average 3/4 of capacity	Human population using cistern water	Human consumption at 5 litres per person per day	Available for all livestock	Water requirement all livestock (incl. camels & donkeys)	Water requirement sheep and goats 1/	Deficit or surplus, all livestock	No. of sheep & goats per cistern 2/
	m^3		m^3	m^3	m^3	m^3	m^3	
Sallum	23 700	3 000	5 400	18 300	21 000	16 000	- 2 700	480
Sidi Barrani	78 750	11 000	19 800	58 950	49 000	37 000	+ 9 950	293
El Negeial	65 250	11 500	20 700	44 550	30 000	23 000	+14 550	188
Mersa Matruh	52 500	3 000	5 400	47 100	25 000	19 000	+22 100	215
Fuka	34 125	5 000	9 000	25 125	24 000	18 000	+ 1 125	300
TOTAL:	254 325	33 500	60 300	194 025	149 000	113 000	+45 025	

1/ Based on 450 litres per year per sheep unit and the average number of sheep units from April till October.

2/ Only those sheep and goats whose requirements are met by cisterns.

3. Animal Resources

Livestock production is the main agricultural pursuit in the project area not so much because conditions are favourable, but rather as an activity which can be pursued in the marginal semidesert environment. It is traditional, seminomadic, and largely confined to sheep and goats. The camel population is some 40 000 head, but projections of future animal production need only be concerned with sheep and goats.

3.1. Livestock numbers

The numbers of animals on the ranges change continuously following a seasonal rhythm of births, mortalities, and cullings, Of the censuses made in 1966 and 1967, the second is more accurate with respect to the total sheep and goat population, but its precision concerning the categories (males, females, adults, offsprings) falls short. At the time the censuses took place, early summer, the numbers were not yet reduced to the reproductive substance of the flocks. The numbers of sheep and goats amounted to 342 457 and 144 514 (total 486 971) respectively in the first census and 418 141 and 233 962 (total 652 103) respectively in the second census. These figures could be used for interpretation of animal production only after analysis and modification.

Generally, the most useful numbers concerning animal production are those which are as close as possible to the reproductive substance and they should be established just at the beginning of the lambing season. Between the time of the census concerned and the lambing season the number of sheep was reduced considerably by culling. To make allowance for this reduction in the absence of data from direct counting, computation was based on subsequent field studies and observations. The first study concerned the age structure of some reproductive flocks and of some groups of animals separated for fattening after the 1967 census.

The results of this study are shown in the following table.

Table 17

STRUCTURE OF SOME FLOCKS AND FATTENING GROUPS ACCORDING TO AGE CATEGORIES IN JULY 1967

Groups of animals:	Males	Female yearlings	Grown females:				
			2 years	3 years	4 years	5 years	Aged group
	(- - -	- - - - - - -	- - -	- % -	- - - -	- - - -	- - -)
Breeding sheep	12.23	17.55	17.02	16.49	13.30	12.23	11.17
Sheep in fattening yars			1	4	9	20	65
Goats (small number)	23	30	8.5	8.5	8.5	8.5	13

According to examination made at the beginning of the lambing season, the reduction affected the sheep 1%, 2%, 22%, and 80% respectively from the two-years old group to the aged group of ewes. The culling rate of ewes results from their reproductive use during 5 breeding seasons. Similar analysis was not practical among the goats because their culling did not occur so explicitly in relation to the lambing season (difficulties concerning the marketing). The reproductive use of does is estimated on 6 breeding seasons. Concerning the presence of the males

in the lambing season, one ram was found for every 20-28 ewes (big flocks) and the attendance of bucks was estimated at one per 10 does.

Taking into consideration the lambing rate, production numbers were deduced from the above-mentioned elements. They are shown in Table 18. As 1955/67 was a better than average year, a distinction was made between it and a normal year.

Table 18

NORMS OF ANIMAL NUMBERS FOR SHEEP AND GOATS

	SHEEP		GOATS	
	In a normal year	1966/67	In a normal year	1966/67
	%	%	%	%
Reproductive females:	70	70	70	60
Fertility rate (weaned offsprings per 100 females):	70	75	130	130
Slaughtered male offsprings:	24.5	26.3	46.0	31
Slaughtered female " :		3.7 (0.0)	4.6	3
Cullings:	14.6	14.6	10.4	8
Production ratio:	39.1	44.6 (40.9) 1/	61.0	42
Increase of numbers:	6.9	5.0 (8.7) 1/	25.0	31
Reproduction ratio:	46.0	49.6 (49.6) 1/	86.0	73
Mortality (adults):	2.7	2.7	5.0	5.0

1/ The figures between brackets indicate the most probable ratios if the WFP feed was available

With the use of these numbers and on the basis of the census data, an evaluation of the actual sheep and goat population immediately before lambing was possible. In Table 19 the change of numbers from the time of census to the beginning of the lambing season in 1967 is shown. The monthly trend of these changes during the production year may be seen from Fig 4. The increase in the number of sheep is only 5 percent, while the corresponding increase of the goat population reaches 31 percent. This phenomenon might be explained to some extent by the tendency of the bedouins to let animal numbers increase excessively, whereupon they would receive more rations of feed from WFP. As the feed was not available on the spot in 1967, they sold the superfluous number of sheep (mainly lambs), but did not sell the goats to the same extent. This abrupt reduction effected the structure of age groups in the sheep population. A rather excessive number of ewes remained in September 1967 (see Table 19) though the yearly increase of number was only 5 percent instead of 8.7 percent, which is what it would have been if the expected feed from the WFP had been distributed. This contradicts the results of the censuses, which indicate a nominal increase of 22 percent. However, such an increase in the sheep population would only be possible with fertility rate above 112 percent or after a complete suppression of any culling of females. It means that the numbers of animals registered under the censuses did not correspond to the same season phase

of the population, though the calendar time of censuses corresponded reasonably closely.

On the graphs of monthly changes, the numbers indicating the corresponding sheep and goat units are given. The value of the offsprings was estimated at 0.6 adult units for sucking lambs and 0.8 units for yearlings. The average size of population during the production year was calculated at 350 000 sheep units and 150 000 goat units. As the animal numbers fluctuate permanently from year to year, long term statistical investigations will be necessary for establishment of the average concerning the size of the animal population. This average will be very near to 300 000 sheep and 150 000 goats.

Table 19

SHEEP AND GOAT POPULATION OF THE NORTH WEST COASTAL REGION

Sector:	SHEEP				GOATS				Total sheep and goats
	Female adults	Female off-springs	Males	Total sheep	Female adults	Female off-springs	Males	Total goats	
	At the time of the census 1967 (June)								
Burg el Arab	41 289	10 319	7 190	58 798	28 957	19 115	14 349	62 421	121 219
El Dabaa	30 418	7 602	5 297	43 317	14 726	9 720	7 297	31 743	75 060
Matruh	116 385	29 088	20 268	165 741	36 985	24 264	18 282	79 531	245 272
Sidi Barrani	105 532	26 375	18 378	150 285	27 958	18 455	13 854	60 267	210 552
Total :	293 624	73 384	51 133	418 141	108 626	71 554	53 782	233 962	652 103
	At the beginning of the lambing season 1967 (September)								
Burg el Arab	34 884	10 007	2 352	47 243	26 917	16 486	4 620	48 023	95 266
El Dabaa	25 699	7 373	1 732	34 804	13 688	8 388	2 346	24 422	59 226
Matruh	98 332	28 209	6 630	133 171	34 296	21 021	5 871	61 188	194 359
Sidi Barrani	89 161	25 578	6 011	120 750	25 988	15 925	4 454	46 367	167 117
Total :	248 076	71 167	16 725	335 968	100 889	61 819	17 292	180 000	515 968

3.2. Breed characteristics and productivity

The sheep and goats in the project area are genetically very mixed, but some characteristics common to all animals give them a mark of distinctive strain or breed, though rather primitive and not formed by organized selection.

Appearance of Sheep and Goats

The Barqi sheep, whose breeding centre is in Cyrenaica, belong to the large group of fat-tailed sheep introduced into the North African countries (Libya, Tunisia, Algeria, and Marocco) by Phoenician colonists very long ago. They are distingushable from other varieties of the same group by a relatively lower accumulation of fat in the tails ("carrot tail"). According to a detailed

survey 1/, the rams of this breed are mainly horned, while 13 percent of the females were found to have strong, and 12 percent rudimental, horns. The colour of the body parts covered with fleece is mainly white, while the uncovered parts of the faces and the legs are pigmented uniformly or in patches, often resulting in large rings round the eyes. The percentage of purely white animals in the flocks is very small (1 percent). The basic colour of the pigmented area is 56 percent black, 33 percent brown, and 10 percent intermediate. This basic pigmentation has some importance in relation to the future breeding programme because it influences the pigmentation of wool (spots in the fleece). According to the survey, 20 percent of the fleeces were gray or spotted through black pigmentation, while only 1-2 percent were gray or spotted by the brown and intermediate basic colour.

The goats 2/ are very small flat-bodied animals with a good developed area of the digestive organs. Their body conformation and fairly long hair indicate probable membership of the widespread community of the Mediterranean derivates of the wild Capra prisca. With long lapped ears, often 50 percent marked with tiny white spots covering even the face, these animals are reminiscent of the Numidian type of goats. The outer appearance is fairly uniform because the black (70 percent) and horned (90 percent) animals are prevalent in the flocks.

Productivity of Sheep

The analyses of body measures (height at withers, length of body, depth and width of chest, circumference of cannon, and liveweight) indicate extensive uniformity of type in the areas west of El Dabaa. No difference in body conformation and size was found there over the different areas and between the big and small flocks, except that the liveweight was 12 percent lower in the small flocks. This, however, was outside the production season, and there is no indication that the lower liveweight in this period has a significant relation to the actual level of production.

In the area east of El Dabaa the 2 percent larger frame measures (height and length) indicate the influence which the larger Nile Valley breeds Rahmani and Ossimi exercise on the population of Barqi sheep. This infiltration of outer genomes is not likely to increase the productivity of animals, which depends mostly upon the availability of range pastures. The environment appears to be the limiting factor to such a degree that the increased frame is not related to other body measurements, some of them being even lower (depth and width) than those in western areas.

The average meat production of Barqi sheep in the project area is shown in Table 20. The listed liveweights concern animals ready for slaughter, i.e. animals previously fed in the usual way before marketing. The fertility rate of 70 lambs per 100 ewes was found to be an average for both good and bad years.

1/ B. Palian, and A. El Say: Barqi sheep in the N. W. Coastal Zone of the UAR, Alexandria, 1968 (in preparation)

2/ B. Palian, and A. El Say: Goats in the N. W. Coastal Zone of the UAR, Alexandria, 1968 (in preparation)

Table 20

MEAT PRODUCTION FROM 1 000 BARQI SHEEP IN THE NORTHWEST COASTAL REGION

	ADULTS			OFFSPRINGS				Total production	
Category	Number of animals	Live weight per animal	Total liveweight	Age	Number of animals	Live weight per animal	Total liveweight	Number of animals	Live weight
		kg	kg			kg	kg		kg
2 years	5	30	150	Up to	5	0	0		
3 "	8	35	280		25	17	425		
4 "	13	41	533	1	93	25	2 325		
5 "	26	41	1 066		73	27	1 971		
Aged	88	40	3 520	year	49	29	1 421		
Rams	6	45	270						
Total	146	Av 40	5 819		245	Av 25	6 142	391	11 961
per head out of 1 000			5.82				6.14		11.96

The average fleece weight was estimated from survey of big flocks in the area of Negeila and Sidi Barrani. Table 21 shows the averages established on the base of 50 percent yield of clean fibres.

Table 21

AVERAGE FLEECE WEIGHT OF SHEEP IN THE NORTHWEST COASTAL REGION

Category	Number	Average fleece weight	Total weight
		kg	kg
Yearlings	250	1.8	450
2 years	170	2.0	340
3 "	160	2.2	352
4 "	130	2.1	273
Aged	240	2.0	480
Males	50	2.7	135
Total	1 000	Av 2.0	2 030

The actual fleece weights are somewhat high because of their sand content. The dirtiness of fleeces is a big problem for the marketing of wool, while the high contamination of burrs, moreover, tends to reduce its physical qualities. Kemp is found in 90 percent of the fleeces, but to a high degree only in 12 percent.

Close collaboration with the Desert Institute, and especially with Dr. Gerges, the wool specialist there, made it possible to establish the qualities of the wool produced in the project area on the basis of laboratory analyses. In the areas east of Dabaa, where wool specimens were not collected, the survey was done by photographing the shorn wool in stores and by classifying these photographs and comparing them with corresponding photographs of the analysed wool specimens from the western areas. The results are shown in Table 22.

Table 22

WOOL QUALITIES OF BARQI SHEEP OF THE NORTHWEST COASTAL REGION

Type of wool	Allotment in % (rounded figures)	Percentage of different groups of fibres						Average diameter in microns
		10-30 micr.	10-40 micr.	30-50 micr.	Over 40 micr.	Over 50 micr.	Over 60 micr.	
Area West of Dabaa (according to the laboratory analyses)								
		%						
Carpet: I grade	18	69		26.5		4.5		27.46
II grade	20	65.5		30		4.5		29.24
III grade	9	54		33		13		33.34
Textile types:								
Medium wool (54'-58')	16	67		32		1		26.93
Close to fine wool	8	86.5		13	3.5	0.5		21.37
Close to medium wool	20	71		26		2.9		27.30
Close to longwool	9		82		18		1	31.02
Total	100	Av 67.5		Av 28		Av 4.5		Av 28.06
Area East of Dabaa (according to the photo-survey)								
		%						
Carpet: I grade	10				up to 5			27-28
II grade	24				" 5			29-30
III grade	18				" 15			33-35
Textile types:								
Medium wool (54'-58')	10	67		32	up to 2			26-28
Close to fine wool	5				" 0.5			21-24
Close to medium wool	23				" 3			27-30
Close to longwool	10				up to 30			31-33
Total	100					5-6		29-31

From these data the following conclusions can be stated:

On average the wool of the Barqi sheep is good carpet wool, relatively coarse in the areas east of Dabaa under the influence of the coarse-wooled Rahmany and, to a lesser degree, of the heterotype-wooled Ossimi sheep.

From the total quantity of wool in the entire breeding area nearly 50 percent could be separated and classified into the different categories of textile wool.

A relatively high frequency of medium type and close to medium type wool indicates the exceptional suitability of the Barqi sheep for a quick transformation into a medium-wool breed.

A few breeders pay rather more attention to wool quality, but, generally, sheep owners do not select their animals for better wool, as shown by the bad quality wool of breeding rams which is very often coarser than the average in the corresponding flocks.

Productivity of Goats

During the preliminary study of the animal population no indication was found of possible distinctions of types of goats in different parts of the project area. The survey of the productive capacities confirmed identity of type, which is a type more suitable for milking than for meat production.

Goats are kept chiefly to provide the bedouins with milk and meat. They are highly fertile and produce considerably larger quantities of meat than would be expected from the liveweight figures. Average fertility is estimated to be about 130 weaned kids from 100 does. While in good years this number could be appreciably higher, and average meat production was calculated on this basis and is shown in Table 23.

Table 23

MEAT PRODUCTION FROM 1 000 GOATS (70% DOES) IN THE NORTHWEST COASTAL REGION

ADULTS				OFFSPRINGS				Total production	
Category	Number of animals	Live weight per animal	Total liveweight	Age	Number of animals	Live weight per animal	Total liveweight	Number of animals	Live weight
		kg	kg			kg	kg		kg
2 years	10	22	220	Up to 1 year	15	0	0		
3 "	14	25	350		51	10	510		
4 "	16	27	432		111	14	1 554		
5 "	20	31	620		177	16	2 832		
Aged	32	30	960						
Bucks	12	36	430						
Total	104	Av 30	3 010		506	Av 15	7 632	610	10 642
Per head			3.0				7.6		10.6

Data on the milking capacity of does are very scanty and extremely difficult to obtain. According to observations during the milking season in 1967/68, a bad year, the quantity of milk suckled by the kids was 90-100 litres and the quantity of milk yielded after weaning was 30 litres for 25 days of milking. In this year the milking failed completely in the most of the flocks, but the Bedouins estimate the milking capacity after weaning at 1 litre a day for five months of milking in a very good year. On this basis the average milk yield would be 100 litres per lactation. However, a truer long term average may be estimated at some 50 litres per lactation.

4. Human Factors

4.1. Nomadism

The physical conditions of the environment make some flock movement necessary: it may be migration outside the region, or long or short distance movement within it.

Migrations to areas outside the region take place on a large scale in drought years, particularly when the drought is preceded by a number of good years during which the livestock population has increased to a level greatly exceeding the average carrying capacity of the range. In the past these migrations took place to Cyrenaica (Libya) and the Nile Valley, and, on a smaller scale, to the Siwa Oasis. Recently, no migrations to Libya have taken place. Migrations to the Nile Valley are also madein non-drought years by flocks from the neighbouring range areas, especially from the Burg el Arab sector.

Long-distance movements inside the region take place when a certain area has a good amount of herbage because of good rains or a relatively low grazing intensity or both. Usually livestock owners wait in their habitual area till late winter or early spring before embarking upon long-distance movement, which has taken place much less of late because cheap supplement feed has been available. In the drought year 1967/68 large movements inside the region occurred prior to migration to the Nile Valley, even to some extent of animals which remained in the zone.

Short-distance movements (up to about 40 km) are a regular and necessary part of range sheep husbandry in the region. They are predominantly in a north-south direction, to make use of winter and spring grazing in the south and to return at the beginning of the summer to the places of settlement nearer to the coast where stockwater is available and supplement feed is provided. Short-distance migrations occur also to some extent in an east-west direction because of the scattered rains in the early part of the season.

It is mainly the larger flocks which are involved in the movements to areas outside the area in drought years and in long-distance movements inside it. The very small flocks usually do not take part even in small-distance movements and are kept in the vicinity of the place of settlement. Medium-size flocks are often combined to form larger flocks, for short-distance movements. Combined flocks, or large flocks owned by one person, are usually taken care of by two shepherds, who take turns in bringing food and water for themselves. Flocks which stay close to the place of settlement are usually tended by one shepherd, while in the case of the very small flocks children usually do the shepherding.

In all three types of movement the general practice is for the flocks to be moved with the shepherds, sometimes accompanied by the owner for certain periods. Contrary to the predominant practice in other arid and semi-arid parts of the Middle East, there is little movement of the whole family or part of the family with its tents and belongings. Some short-distance movement of families with their tents takes place in dry years, mainly to be close to watering points.

4.2. Customary grazing rights

Generally, anybody can graze on land traditionally considered as belonging to the grazing domain of one tribe. However, when herbage is scarce, some tribes will object to the use of their land by members of other tribes not related to them. Occasionally, individual members of a tribe do not allow others to graze on an area surrounding their place of settlement, even if the latter are members of the same tribe. This was found in the area west of Sidi Barrani. However, such individuals are not very popular in their tribes and among their kinsmen. Some individuals try to cooperate with their neighbours and reserve a small area for summer grazing for their own sheep, but this fails when outsiders move in during the night. Because access

by others is easy, it is difficult to convince livestock-owners to plant a forage crop or improved pasture instead of barley. Unless such a planting is fenced, trespassing by other animals is likely to take place, and even a fence is not sufficient guarantee in the case of improved pastures. No claim for compensation can be made in the traditional way, as can be done with damage by animals to barley, vegetables or trees.

It was even reported that, during the drought year 1967/68, some owners of barley fields hesitated to let their animals graze the barley fields before heading, since then other people would consider it a grazing field and would move their flocks in as well.

In short, customary bedouin law considers the grazing areas as collectively held and therefore grazing rights are communal. While there are some exceptions to this general rule, the main problem stems from the fact that the ownership of livestock is individual whereas the land on which livestock grazes is, generally speaking, communal. Thus there is no concern to protect the range by limiting the number of animals turned on to it or to improve sections of it by other means. Recognised grazing rights therefore have no relationship to the carrying capacity of the land. The means proposed for solving this problem are discussed in Chapter 7.

4.3. Livestock ownership

From the sample surveys carried out in the pilot areas it was found that the majority of breeders own rather small numbers of animals. Of all the sheep and goats, 75 percent were owned by breeders having less than 50 animals, and only 13 percent by breeders with more than 100 animals. The average number of animals per owner was 40 (1966). The census figures of 1967 also demonstrated the predominance of small ownership in the Dabaa and Mersa Matruh sectors. For example, 79 percent and 65 percent respectively of the breeders owned up to 50 animals. In this case the figures include part of the male lambs and culls.

Measurements of sheep characteristics in the field indicated that animals in larger flocks have a slightly higher average liveweight and somewhat bigger bodies than animals in small flocks, probably because larger flocks generally move further away from the place of settlement for grazing than small flocks do and thus can make better use of certain range types at the appropriate time. On the other hand, during drought or sand storms, the small flocks, being close to the tent or house of the owner, are given better care (through extra feeding and the provision of storm shelter) than the large flocks are, thereby causing a relativey lower mortality rate in small flocks during such periods.

However, the differences in productivity between large and small flocks is negligible. Apart from the two factors mentioned above, some of the smaller and medium-size flocks are managed jointly during part of the year and thus share the advantages of the larger flocks. It is to be noted that the smaller flocks contain a relatively larger percentage of goats. Owners of small and medium-size flocks often combine their flocks to form larger units, which are sent out to graze with one or two hired shepherds for part of the year (mainly in winter and early spring). This practice enables these flocks to graze further away. The system could be an example for possible future forms of cooperative grazing whereby the shepherd would have certain responsibilities vis à vis the community (grazing district, cooperative) with regard to areas and periods of grazing (see Chapter 7).

4.4. Traditional breeding methods

Because animal production takes place on the extremely scanty ranges, which in normal years offer a relative abundance of feed for animals only during the short season of vegetation, the producers apply a technique of breeding and management aimed at survival in the bad periods and at maximum utilization of even the minimal sources of pasture. This traditional system, completely adapted

to the climatic conditions of the desert, is sometimes surprisingly efficient in extracting some production from such meagre sources. When dealing with this system, this report refers primarily to sheep, which represent the only mass production from the ranges in the project area. Although the goats are simlarly managed, goat production is not so characteristic because its aim is mainly to supply the household needs of the Bedouin families.

The efficiency of production is based on the activity of shepherds devoted to their animals and on purposeful management with limited feed supplements. Economy is even practised in the consumption of water. From the beginning of the grazing season, the shepherds cease to water their animals. In a normal year no watering takes place throughout the lactation period. In this way the body metabolism becomes adapted to the dry feeding regime already in this period. Also, restricted watering means the flocks do not depend on the watering - places during the best grazing season and are always ready for movement to any place where better pastures can be found.

The watering usually starts at the beginning of summer, and its consumption is controlled by offering it every third day or, in very hot periods, every other day. Night grazing of dewy herbage is a measure which has a considerable influence also on the water requirement. The necessity of watering increases with supplement feeding, which starts usually in September during the high pregnancy of animals. But, even in this period, the frequency does not exceed once in two days.

The rations of supplement feeding depend both on necessity and availability. If the animals cannot survive on the pasture, some supplement will be fed even without regard to the season. Full rations, except in extremely bad years or years with extremely high numbers of total animal population, will not be distributed before September and will be continued during the first part of the lambing season till sufficient herbage is available following the autumn rains. Usually 0.5 kg concentrates (barley and cottonseed cakes) and 1 kg straw (or hay if available) are considered as a full daily ration of supplement feed. As a result of WFP assistance, the tendency towards supplement feeding has been increasing recently. This is particularly noticeable in localities with a relatively high density of human population, where people are increasingly engaged in other activities besides animal production (e.g. the area Matruh - El Qasr - El Negeila).

The main lambing season is in November - December, but in some flocks lambing starts in September (especially when range and feeding conditions in the preceding winter and spring have been good), while it extends to April for lambs born very late. This shows a lack of rational control of breeding.

Though undernourishment in the period of breeding has a big influence on the length of the breeding season, it is evident that the practice of separation of rams (in preparation for the breeding season) is not efficient enough.

During the suckling period the lambs are always with their mothers and remain with them until weaning, which is usually done at the age of about 4 months. In bad years weaning is done much earlier to prepare the sheep for migration. At the time of weaning some male lambs are marketed for slaughtering, if good prices are offered. This is especially the case with early - born lambs. Most lambs for slaughtering will be marketed later at higher liveweight. The practice of fattening is becoming more and more popular, partly because of the greater availability of low-cost concentrates (WFP). Some female lambs are also fattened. As a rule the lambs are not fattened immediately after weaning but are kept on range grazing for at least one month. Sites with good range vegetation and green barley fields are often used for this purpose. Grazing usually takes place without watering until the time of fattening.

The fattening period is $1^1/2$ months and starts with a ration of $^1/2$ kg concentrat. daily. This is increased to 1 kg after 15 days and to $1^1/2$ kg after another 15 days.

Roughage, which is offered mainly ad libitum during the whole fattening period, is mainly chaffed straw, but also a certain quantity of hay is imported for this purpose from the Nile Valley. The concentrates used are barley and cottonseed cakes. In this period of fattening watering is done regularly without the mentioned restrictions.

The fattening of adults is also not uncommon. These are the culled old animals, which will only fetch low prices if marketed with the lambs. The fattening time for adults is the summer and sometimes even the autumn, when the prices are usually much higher. The same technique of fattening is applied as for lambs.

As for method of selection, basing the choice of the breeding rams on size and strength, the Bedouin breeders follow the way of natural selection based on resistance against the hard environment. Undoubtedly they have produced results, seen in the appearance of the Barqi sheep, which is highly esteemed for its capacity to adapt to the existing environment. But there are no recognized outstanding breeders nor does any breeding tradition for genetical improvement of local breeds exist.

What helath protection there is, is marked by ignorance and prejudice. Traditional health treatment does not prove efficient in protecting the animals against parasites and infectious diseases. Veterinary protection should therefore have priority as a public measure for the improvement of animal production.

Chapter IV

FORESTRY

1. Introduction

The development of a more complex agricultural system in the region on a dry farming basis requires forests of different sizes, but afforestation at the time the project began consisted only of some scattered withbreaks and clusters of trees at Burg el Arab, Mersa Matruh, Ras-el-Hekma and Fuka.

The importance of forestry work as stated in the Plan of Operation lies first and foremost in the fixation of sand dunes and the establishment of windbreaks and shelterbelts, while there is also a place for the afforestation of appropriate soils to provide animal feed, timber and fuel.

As the soil and climatic conditions are unfavourable to forestry establishment, close study of forest-tree growth and development in relation to environment was necessary. This involved survey of the region's timber trees and interpretation for their requirements of both the data existing and the data collected under the project on climate, soil geology, geomorphology, topography, phytosociology and water resources.

On this basis an attempt was made to evaluate the potentialities of different sites for various forest trees and to estimate growth for future recommended plantations, and some experimental demonstration work was carried out. The final conclusion to which the various studies and the demonstration work carried out led was that woodlands in the North-Western Coastal Region could contribute considerably to crop protection, soil conservation and sand-dune fixation, could improve microclimate and landscape, and could through the application of a special dry farming technique provide fuel, timber and fodder for local consumption despite the low rainfall.

1.1. Previous investigations

No special forestry studies for the region were made prior to the project. Research done by Prof. O. Badran concerned the growth of some species of populus under irrigation conditions, but his very interesting conclusions are not applicable of course to dry farming conditions.

The Egyptian Desert Institute's interesting ecological studies deal with the quantitative value of the main natural features of the region and their relation to natural vegetative associations, but these studies were not directed to forestry. They include intensive ecological research by A. B. Migahid and others for Ras-el-Hekma 1/ and the Sidi Barrani district 2/, and extensive study of the whole area

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1/ A. B. Migahid and M. A. Ayad - "An Ecological study of Ras-el-Hekma District" Bulletin de l'Institut de Desert D'Egypte - Tome IX, No. 2, 1959, p. 120.

2/ A. B. Migahid, D. D. Batanouny, N. M. Sharkawi and A. F. Shalafi - "Phytosociological and ecological study of Maktila sector of Sidi Barrani" Min, 166p + Table, 1963.

by T. M. Tadros 3/.

1.2. Work done under the project

The three main divisions of the work done under the project are :-

(a) study of natural conditions and growth of the timber trees of the region;

(b) experimental demonstration work in the field;

(c) planning for a twenty-year programme in forestry.

Under (a) regular measurement was made in the field of soil moisture and of air and soil temperature in open and covered places, and representative forest sites were selected and classified for their ecological value for forestry. Site by site trees were studied for their height, trunk diameter, volume, form of crown and stem, development of root system and resistance to natural conditions, especially to wind, drought and salts. Timber trees in neighbouring regions were also studied and a report prepared on a study trip to Libya 4/.

To establish the proper types and suitable species of windbreaks, some observations regarding the protective effect of windbreaks on the yield of crops were made. Experimental demonstration pilot areas were set up to determine the proper techniques for sand-dune fixation and afforestation under both dry farming and earlier irrigation, and to estimate the cost of forestry works. This included the establishment of shelter-belts and windbreaks, the afforestation of depressions for timber production purposes, the planting of terraces for soil conservation, and the production of seedlings of nine drought-resistant species in El Qasr nursery. The main work was carried out on the maritime shifting sand dunes in front of El Qasr village and Garawla, and an account of it and the preliminary conclusions reached were given in two special reports 5/.

Details of the proposed twenty-year programme are given in Chapter 7 of the volume.

Great attention was paid throughout to the training of the five counterpart staff and to extension work among the bedouins.

At the request of the Egyptian Agrarian Reform Organization, the forestry expert and the senior Forestry Counterpart studied the problem of sand dune fixation in Senaneya Project-Damietta District, which is outside the project area 6/.

2. Relationship between Main Natural Features and Timber Trees

This section deals with those natural conditions and features of the region which most affect timber tree growth, i.e. rain, dew, evaporation, wind and soil.

3/ Tadros, T. M. -"An Ecological survey of the Semi-Arid Coastal strip of the western part of Egypt" - Bulletin du Désert, Tome VI, No. 2, 1956.

4/ E. Costin-"Forestry study trip in Libya and some conclusions for the North-Western Coastal Region of U.A.R."- March 1968 - Alexandria, U.A.R. pp.26.

5/ E. Costin and Mohamed Ezz - "Forestry Demonstrative Experimental works, made in the winter 1967/68" -March 1968, Alexandria U.A.R.

E. Costin and Abdel Azimo Gamal -"Forestry Demonstrative Experimental works, made in the winter 1968/69"-March 1969, Alexandria, U.A.R.

6/ E. Costin and Mohamed Ezz -"Some proposals for sand dune fixation, improvement of the present drainage system and choice of wood trees for the Senaneya Project Damietta-District." Alexandria, U.A.R. April 1968, pp.11.

2.1. Rain-tree relationship

The total annual rainfall is far from sufficient for normal stand forest growth, it varies from area to area of the region (mean annual rainfall at Sallum is 102.2 m; at Fuka 108.4 mm; at Burg el Arab 150.6 mm), and much is lost by evaporation and infiltration. Moreover, as the dry period lasts practically 7 to 8 months a year, trees are particularly handicapped during their growing season, when they need the biggest quantity of water.

Without supplementary water resources (at present the dew) trees could not grow in the region.

2.2. Dew-tree relationship

Trees in arid areas, especially if the latter are also coastal zones, draw heavily on dew. Messiness 1/ maintains the "Forest stands draw from the atmosphere a quantity of moisture equal to rainfall". The rate of some tree growth observed in the project area, under dry farming conditions, bore out this fact.

For example Casuarina aquisetifolia, which grows at Burg el Arab, achieves an average annual growth of 8 m3 of wood per hectare in one single row of windbreaks with 150 mm yearly rainfall, a rate of growth not normally obtained without at least 300 m rainfall per year. The amount of soil moisture found in summer around the root zone is very small. The only possible explanation for such growth of trees in this region on such dry soil under the prevailing rainfall conditions is the presence of dew (for which the high air humidity, light wind and open sky are particularly favourable) with its direct effect of providing plants and trees with moisture and its indirect effect of reducing transpiration.

Research on dew studies at Ras-el-Hekma in 1959 2/ recorded a total annual dew fall of 11.48 mm, distributed over 102 nights. Research carried out elsewhere 3/ and opinions formed in other areas 4/ reveal that, by present methods of research, the real amount of water obtained by plants is not accurately recorded. Dew is of great importance, especially because it supplies plants during the dry season, and, above all, protects them from drought. In the project area dew can be seen in the early morning dropping on to the sand from the wet leaves of the Tamarix articulata. Also, tree roots develop on the surface of the sand, despite the latter's high temperature.

2.3. Wind-tree relationship

Wind in the project area is a limiting factor that severely hinders the development of vegetation by creating dust, causing the sand to drift, eroding the soil, and causing intensive evaporation and transpiration.

1/ J/Messiness -"Report to the Government of Libya on Forestry"- FAO Report No. 22 - Rome 1952

2/ A. M. Migahid and M. A. Ayyad. - Bulletin de l'Institut du Désert D'Egypte, Tome IX No. 2, 1959.

3/ E. Costin - "Ecological conditions of Forest crops on shore sand from the Danube Delta", Editura Agrisilvica - Bucharest, 1964, p. 155.

4/ R. O. Slatyar and J. C. Mellroy "Practical Micro-climatology, with special reference to water factor in soil plant atmosphere relationships". UNESCO 1961 - AUSTRALIA

The region's prevailing northwest wind has a frequency of 30 to 40 percent. In Mersa Matruh, the dry southwest winds from inland are also important. During winter and early spring winds have an average speed of about 20 to 25 km/h, and the maximum wind velocity of more than 100 km/h occurs 2.2 times in ten years. Wind velocities of more than 80 km/h and 50 km/h occur 17.9 times and 58 times respectively in ten years.

Topographical variations and distance from the sea have a great influence on the wind force in the project area. On the western slopes and on the top of hills, the wind force is stronger than on the eastern slopes. Migahid, (1959) reported that at Ras-el-Hekma, while the wind force was 9 km/h on the western slope and on the hills, it was nil on the eastern slope and depressions.

On the western slopes and the flat plateau, particularly near the sea, wind is the major factor affecting vegetation. The land is particularly exposed, and the windward slopes are more arid and their vegetation poorer than that of the leeward slopes, winds also causing greater evaporation and transpiration. Winds exceeding 50 km/h usually cause severe injuries to plants, breaking the branches, leaves and flowers, deforming the crowns and trunks, drying the tops of crowns on the windward side, and causing the trunks to become oval-shaped and the crowns flag-shaped.

The following observations describe the negative effect of wind on different species in the region and the degree of tolerance that some species show:-

Acacia cyanophylla proved to be very sensitive to the northwest wind. It is stunted, and the crown takes a flag form with the branches lying on the soil on the leeward side. On coastal sand dunes particularly it takes a creeping form and can therefore be planted only under protective cover.

Eucalyptus camaldulensis also suffers from the northwest wind, and there is a very great difference between trees which are exposed directly and which are protected. To windward the leaves are dry and usually become yellow, the branches are smaller and the top of the crown dry. On the sand dunes of Rasheed, Eucalyptus was successful only on slopes and depressions protected from the northwest wind by high dunes. Elsewhere all the trees disappeared.

Casuarina aquisetifolia is much less influenced by wind than Eucalyptus. Nevertheless, its growth is reduced in windward exposures. The height, however, increases in the leeward direction. On the shore at Montazah, Alexandria, for instance, these trees are outstanding for their size.

Cupressus sempervirens is generally a tolerant species towards wind, but with age, under dry soil conditions, and when the height is great and transpiration exceeds the supply of water absorbed by the roots, it produces an unbalanced hydrological state and the top of the crown begins to dry. In the soil with more moisture, however, it can withstand the wind and therefore it can be planted on exposed places, provided the soil is deep and the soil moisture conditions good.

Tamarix articulata is the most wind tolerant species and can resist the strongest northwest wind, even on shallow soil and dry sand dunes, without changing its size. It is therefore an important species for the region for the protection of crops and other timber trees.

2.4. Evaporation-tree relationship

According to Migahid, the annual rate of evaporation in the project area is 1 500 mm, (maximum rate March to October), and the mean monthly rate reached a maximum of 9.1 mm/day in November 1955 at Ras-el-Hekma. With a unit velocity of 19.6 km/h, the evaporation rate rose to 0.8 mm/h on western slopes and hill summits, while, contemporaneously, on eastern slopes, the unit

velocity was 12.4 km/h and the evaporation rate only 0.15 mm/h.

Thus there is a clear need for windbreaks, since the high desert evaporation rate is increased by the velocity of the winds crossing the area. The effect of windbreaks can be judged from the experience of Japanese research workers who found that, on a field sheltered by windbreaks, evaporation from the protected area at a distance from the screen of the screen's height was only 40 percent of the evaporation from unprotected areas. At a distance of 5 screen heights it was 60 percent, at a distance of 10, it was 80 percent.

2.5. Soil-tree relationship

The soils of the region have been closely studied by the Desert Institute, the Faculty of Agriculture of Alexandria University and EGDDO. However, A. M. Balba and M. El Gabaly, in their classification of the soils into 8 land use classes, took into account only the needs of agricultural crops with shallow roots. For forestry purposes, soil depth is of the greatest importance. In the next section, the soils of the representative forest sites and of each forest plantation are classified according to their depth, chemical properties and exposure, the topography and the water regime. This classification enables an ecological valuation from a forestry point of view to be made, the plant-site relationship to be explained, and suitable tree species and afforestation techniques to be recommended. This section deals only with some of the general characteristic of soil formation in the region as a whole and the main physico-chemical characteristics for tree growth.

Because of the aridity of the climate, the effect of vegetation on soil formation is very little and the soil formation set-up is affected chiefly by the physical action of wind and water. The soils have no relationship to the underlying parent rock (subsoil), because they are formed by wind and water transportation from other areas. Timber trees in the form of windbreaks and shelterbelts, as well as timber stand, could have a big influence both in arresting the dust brought from other sites and in setting up a new layer of soil.

The soils are generally fine in texture (being sandy loam or loam sandy): only on the limestone rocks, where the soil is locally formed, does the texture tend to be loam to clay.

The $CaCO_3$ content is generally very high, ranging from 30 to 70 percent, and in many places layers of gypsum are met with. Soluble salts are encountered mainly in lakes and depressions where there is water accumulation and bad drainage conditions.

For timber trees in general, the two main unfavourable soils factors are the limited depth of the soil and its salt content. In the greater part of the area the soils are either very shallow or rocky, hence they tend to hinder root development deep in the earth and, on the other hand, have a bad influence on tree growth where salt content is high. However, many of the trees in the region, such as *Tamarix articulata*, *Pinus halepensis*, *Cupressus sempervirens*. *Casuarina equisetifolia*, *Acacia sp.* etc., are highly tolerant to $CaCO_3$, and some of them, such as *Tamarix*, *Acacia cyanophylla*, *Acacia cyclops*, *Proposis, sp.* etc., are also salt tolerant, to different degrees. In the shallow and medium deep soils, root development is lateral.

3. The Representative Forest Sites for the Region and their Ecological Value

Fourteen representative forest sites were selected on the following basis: a) form of relief, b) exposure of slopes, c) position facing the sea, d) stability of the sand dunes, e) type of soil, especially depth, texture, moisture and soluble salts content . The sites are distributed as follows:-

5 on the Coastal sand dunes; 2 on the plains; 3 on the plateau; 2 on the slopes and 2 on the saline plains. For each group of sites, the limiting factors for development of forest trees were determined, and for each site suitable timber trees were recommended.

a) The coastal sand dunes

The total oolitic sand dunes area in the region is big, reaching about 135 410 feddans. It is distributed as follows: El Alamein - Alexandria 55 990 feddans; Ras-el-Hekma - Dabaa, 47 500 feddans; Mersa Matruh, 11 890 feddans, Sidi Barrani, 14 060 feddans, Sallum 5 970 feddans.

The dunes consist principally of white sand, coarse in texture, made of loose, mobile, oolitic sand grains. The form of relief is undulating, heights ranging between a few centimetres to 32 metres above sea level. In their first stage, these dunes are very loose and mobile, and shifting sands are transported by the violent prevailing northwest wind and by southwestern winds. Research indicates that the calcium carbonate content is high, ranging between 40 and 95 percent where soil reaction is strongly alkaline - pH 8.0 - 8.5. The organic matter content is very low, except in the depressions and on some southern slopes which are covered by a layer of brown reddish soil drifted from continental soils.

Soluble salt content and chlorides percentage are moderate, except for the sand dunes lying immediately near the sea or marshes.

The water holding capacity of the sand is relatively low, and the water is released readily to plants. The soil also has a great capacity for storing large amounts of rain in its large pores. Soil moisture in the summer is low, ranging between 1.9 percent in the first 20 cm to 4 percent at 1.50 m depth.

During the first process of the evolution of moving sand dunes, the pioneer plants are: Amophila arenaria, Agropyron junceum, Silene succulenta, Zygophyllum album. On this seashore there are many sites with different ecological values for forest tree requirements, and also from the stand point of afforestation. The coastal dunes may be classified into the following representative forest sites:-

1.a) Crusted sand dunes and dunes with compact subsoil

These are shallow sands underlying a compact stone subsoil made by solidification of carbonates, calcium sulphates or gypso-limestone. They present the worst soil conditions, and their afforestation is very problematic and practically impossible.

2.a) Moving sand dunes on the windward slopes and hill dunes

These are extremely poor, dry and permanently shifting. The main factors which limit tree establishment are the intensive winds and the scarcity of water supply. In these conditions only Tamarix articulata and Acacia cyclops can be tried.

3.a) Southern side of low sand dunes slopes

These are also very dry sands, but are more favourable than the 2a sites because they are protected against the harmful north wind. They have shifting sands blown from the north and northwestern side.

Among wood trees which can grow here are: Tamarix articulata, Acacia cyanophylla and Prosopis juliflora.

4.a) Sand dunes depressions, low dunes, and the low side of north and northwestern slopes

The more favourable water balance permits the use of some fast growing

species. It is possible to use Tamarix articulata, Acacia cyanophylla, Pinus Halepensis, Prosopis juliflora, and Eucalyptus camaldulensis. in some low depressions.

5.a) Stabilized sand dunes

These dunes represent the last stage in dune development. They are frequent on the leeward side and on a narrow strip in the southern part of the range. Among the natural species which are encountered are the following:-

Ononis vaginalis, Centaurea pumila, Echiopsis spinosus, Cyperus capitatus.

The potentialities of these sites depend on the soluble salt content. In many places located near the marshes, the salt content is high, and hence they are not suitable for forest purposes. When the salt content is low, however, these sand dunes, due to their position and properties, especially from the stand point of ground water table, offer favourable conditions or forest trees, and on them can be established shelterbelts formed of tall and fast growing trees such as:-

Eucalyptus camaldulensis, Casuarina equisetifolia, Tamarix articulata, Cupressus sempervirens, Pinus halepensis.

These shelterbelts have an important role to play in crop protection against wind and drifting sand, in the production of wood, and in improving the landscape..

b) Plains

The plain between the coastal dunes and the escarpment has soil, formed by the action of water and by wind erosion, which is generally deep and fairly good in texture (sandy-loam), and which benefits from the favourable climatic and hydrological conditions.

6.b) Water-borne deep and middle deep soils

These occupy the low part of slopes and the delta of wadis which receive a large supply of runoff water and alluvial particles of soils brought from eroded areas of the plateau and slopes. The soil is in general deep, but in more elevated parts middle or shallow depth is encountered. The texture is often very fine sandy-loam, with about 50 percent $CaCO_3$ content but without accumulation of a carbonate layer. This is a sign that it is undeveloped desert soil. The soil has good water holding capacity (field capacity 19 percent, wilting point 7 percent, and a low content of soluble salt - less than 0.1 percent, for example, at Wadi Maguid)

The natural vegetation is represented by Artemisia association, and on the deep and fertile soils Plantago Echiochilon association is found.

Such locations are very suitable for some horticulture trees and annual crops, especially under irrigation. But because these soils are found very near the sea and are exposed to the strong northwest and southwest winds, which cause intensive evaporation and damage to the field crops, they needs windbreaks. Survey of the scattered windbreaks existing in the region showed that, by using proper fast growing species and an intensive technique of afforestation, it is possible to obtain windbreaks which will produce a great supply of valuable wood, as well as providing the necessary protection.

Among the suitable timber trees are the following: Casuarina equisetifolia. Tamarix articulata, Pinus halepensis, Cupressus sempervirens, var. horizontalis.

7.b) Shallow water-borne soils

This kind of soil is found in more elevated lands or on the sites with a compact of $CaCO_3$ (hard pan) at some depth. The soils are drier in comparison to 6b site soil, and their water retention capacity is low. The barley which is mainly cultivated on these soils uses the winter runoff.

Natural vegetation is represented by Gymnocarpus decandrum - Thymelea hirsuta association.

Windbreaks are also needed on these sites, but the species of trees used should be more xerophytic than those for 6b sites. Tamarix articulata, Acacia cyanophylla, Pinus halepensis are recommended.

c. Plateau

The level plateau stretching westwards from Fuka occupies a large part of the region. In the North, this plateau is bordered by flats and depressions, from which it is separated sometimes by sudden, sometimes by gentle, slopes. Towards the South, however, it extends far into the desert zone.

Because of its elevated position, the plateau is subject to strong winds which, together with runoff, cause intensive erosion. Therefore the soils are in general eroded and very shallow. In the depressions soils are met with which are called by Tadros "original desert soil", a mixture of residual alluvial and aeolion deposits. There are also sandy dunes.

Plateau soils near the sea enjoy a more maritime climate with better rainfall; southward, the climate becomes predesert and then desert climate. The ecological conditions are in general very difficult for forest trees, because of the elevation, the strong winds, the high evaporation and the thin layer of soil. Better conditions are encountered, however, on the inland sandy dunes..

8.c) Inland rocky ridges and shallow soils

The thin layer of existing soil, which has been formed by soils and sands drifted from other areas, is brownish yellow in colour and very dry. It is covered with gravels and boulders.

Natural vegetation is represented by Tymaelaea hirsuta, Gimnocarpus decander association, or Anabasis articulata and Haloxylon articulatum association. These very shallow soils, with low precipitation and intensive evaporation, are of no use for high timber production. Plantings on them are justified only for animal protection, soil conservation and fuel and fodder purposes. The tree Tamarix articulata can be used and the following shrubs species: Prosopis juliflora, Haloxylon persicum, Zizyphus spina-christi, Calligonum comosum.

9.c) Original desert soil, mixture of residual alluvial and aeolion deposits

This soil occurs on the depressions and on protected flats. It is medium-to-shallow deep soil from 30 to 100 cm deep, with sandy loam texture. The calcium carbonate content increases with depth and the pH range varies between 8.0 to 8.5 The soil is in general dry.

Different forms of trees as windbreaks and scattered groups are required for range and animal protection, soil conservation, and also for fuel and fodder production. To the species listed in 8c above, Pinus halepensis may be added.

Because of the adverse climatic conditions and the elevated position far from the sea, it is not economic to grow trees on this soil without irrigation.

10.c) Inland sandy dunes

These sites are found around Sidi Barrani and extend eastward towards Negeila and westwards to Sallum, extending over a narrow strip of land 100 km long and 10-25 km wide. They occur also on the plain near El-Alamein and south of Garawla (near Mersa Matruh). These dunes, which originate from the inland, form a relatively gentle type of sand dunes, with small undulations varying between 0.5 to 1.5 m high, reaching a maximum height of 3-4 m only in some parts.

Their colour is reddish brown to yellowish brown. They have low capillarity and hence less evaporation.

The natural vegetation is Plantago albicans, Echiochilon fruticosum association, and Thymaelia, the latter in abundance.

These inland sandy dunes are the best rangeland in the region and have many palatable plants. Some areas, especially the depressions, can be cultivated with watermelon and fruit trees. It is essential, however, that windbreaks be planted first.

The ecological conditions favour forest trees, and especially those with deep root systems that can exploit a great volume of soil and use the moisture of lower layers. Among these, Tamarix articulata, Pinus halepensis, Acacia cyanophylla and Prosopis juliflora, are highly recommended, as they would give protection, valuable wood and fodder. They would also improve the soil and enrich it with organic matter.

d. Slopes

These sites are more frequently located on the northern part of the plateau, bordering the line between it and the plain. They are also frequently found in the wadis that divide the limestone plateau.

In the case of wadi slopes, exposure may be east or west instead of the usual north. The ecological conditions depend to a great extent on the position of the slopes, their steepness and their exposure.

11.d) Rocky slopes

These usually occupy the upper two thirds of slopes. They are bare of soil and exposed to strong winds. Therefore they are very dry and no afforestation on them is possible.

12.d) Shallow to deep water-borne soils

These lie in the low part of slopes, are usually mixed and covered with gravels and bolders, and are in general poor, dry soils. Their texture on the slopes is sandy-loam with low content of soluble salts (0.80 EC), and moderate pH (7.5).

The natural vegetation is Tymaelaea hirsuta - Gymnocarpus decandrum association with Asphodelus mcrocarpus and Plantago albicans on the deeper soils.

Forest trees are necessary, especially for soil conservation and water control, and can be established in the form of rows or windbreaks on the terraces. Such terraces will improve the water conservation for seedling establishment. Very drought resistant species such as Tamarix articulata, Acacia cyanophylla and Prosopis juliflora are recommended. Pinus halepensis may also be tried.

e. Saline plains

There are many types of saline soils in the region, ranging from soils with low salt content on the elevated sites to very saline soils in the low plains.

For forestry purposes, however, two types are distinguishable: the first with low salt content, where it is possible to carry out some afforestation: the second with high salt content where no afforestation is possible.

13.e) Low salt-content soils

These occur on the flat lands, the lower part of the slopes and the delta of wadis, as well as on the plateau, and are alluvial desert soils.

The salt content ranges from 0.2 to 0.4 percent, with alkaline reaction. The texture is often sandy loam to loam, and the water holding capacity high enough, increasing to 74 percent on salty soil (Migahid, 1963).

The natural vegetation is Salsoletum tetrandra and the dominant species are Salsola Tetrandra, Suaeda pruniosa and Sueda fructicosa.

It is possible that leaching of salts may take place by winter irrigation from runoff.

Some species of timber trees such as Tamarix ar. Haloxylon spp. Prosopis ssp. may help in reducing the salt content, improving the drainage, and covering this soil with a layer of drifted non-saline dust carried by wind. Of these, Tamarix articulata is the best, as it improves the soil very much by absorbing salt through its roots and releasing it to the atmosphere through its leaves.

14.e) Salt marshes and swamps — high salt-content soils:

These sites lie near the coastal sandy dunes and in the lakes and depressions with high level of underground water table or with water drainage. Often these areas are covered in summer with a white layer of salt crust.

The natural vegetation associations are Salicornieto-Limonetum pruniosae on the more elevated parts with less salinity, and Halocenum strobilaceum association on the more saline soils of 4 to 8 percent soluble salts and 2 percent chloride (T.M. Tadros 1956).

Afforestation of these salt marshes with trees is very difficult. A few shrubs, however, may be used for planting, such as Artiplex sp. Haloxylon sp. and Nitraria retusa,. Better situations are met with in Junceto-Schoenetum association and especially in sub-association of Strobolus pungens, which occupy the higher parts of marshes.

Such soils with high salt content are of no importance for forestry work. It may be possible in the future, however, to afforest these soils after they reach a certain stage of reclamation through leaching of the salts by drainage.

4. Present Forestry Activities in the Region

4.1. Kind of plantations and areas covered

Forestry work in the region started about 35 years ago at Burg el Arab and was later extended to Mersa Matruh, Fuka and Ras-el-Hekma.

All afforestations takes the form of windbreaks or roadside plantations, except at Ras-el-Hekma, where it was done under stand form for sand-dune fixation. The windbreaks are very narrow and consist of one row only with the trees spaced 1.0-1.5 m apart. The work was carried out by the Ministry of Agriculture in Burg el Arab

and Mersa Matruh, and by the Desert Institute in Fuka and Ras-el-Hekma.

The effective area occupied by timber trees in the region is about 14 feddans, about 7.5 feddans of which at Burg el Arab, 3.5 feddans at Ras-el-Hekma, 2 feddans at Mersa Matruh and 1 at Fuka.

The windbreaks cover about 10 feddans and sand dune fixation 3.5 feddans. The total length of windbreaks and roadside plantations is about 11 km. There are also some scattered trees such as Tamarix articulata, Acacia cyanophylla and Prosopis juliflora in the area between Alexandria and Mersa Matruh. These become more infrequent as one travels west.

The villages of the region, such as Sallum, Sidi Barrani, Negeila, Sidi Abdel-Rahman, El Alamein and others, have very few trees. What trees there are belong to the following species: Tamarix articulata (7 feddans), Acacia cyanophylla and Acacia cyclops (both 4 feddans) Casuarina equisetifolia (2 feddans) Cupressus sempervirens, var. horizontalis, Eucalyptus camaldulensis, Pinus halepensis, Prosopis juliflora and very few Eucalyptus gomphocephala, Tipuana speciosa, Acacia farnesiana, Ceratonia siliqua and others. While tree ages range between 4 to 35 years, most of the trees are 10 years old.

Most of the plantations are encountered on deep sand loam, or loam sandy soils, if they are in depressions or the deltas of wadis. Other plantations are on shifting maritime sand dunes. There are also some scattered plantations on shallow and medium soil or even on the rocky soils on the slopes and the Libyan plateau.

There is no record of the history of these works or of the afforestation techniques used. According to local information the greater part of the afforestations were irrigated only in the first three years, while those of Fuka were irrigated irregularly for several years but at different intervals and with various quantities of water. Outside the project area, on the El Tahrir project, timber plantations were regularly irrigated at well established periods and with adequate quantities of water. The technical and silvicultural data of these plantations will be dealt with in next section. Unfortunately, the area covered by trees in the region is comparatively small, but the promising results under the project suggest more can be done in the future.

4.2. Nurseries

There are three small nurseries in the project are at El Qasr (2 feddans), Fuka (1 feddan) and Burg el Arab (1.75 feddan).

All three were set up to produce horticulture seedlings, and two of them - Burg el Arab and El Qasr, - started producing small quantities of forest seedlings in 1965. In 1967 Burg el Arab nursery produced 1 420 forest seedlings, El Qasr nursery 565. Both these nurseries have been producing so far the following three species: Acacia cyanophylla, Casuarina equisetifolia and Tamarix articulata.

The seedlings are grown in clay pots, the seeds being sown first in cans and transplanted to the pots after six to eight months.

The soil used in the pots is a mixture of local sandy-loam soil with animal dung in a ration of 3:1.

The nurseries are fenced and covered with reeds.

5. Timber Tree Growth and Development

For both production and protection purposes, the development of timber trees is one of the most essential factors. For production, what counts most is the volume of growth per site, while, for protection, growth in height is more important. Because the growth of trees is closely connected with local ecological factors, and because local species are those adapted to the habitats, attention was directed first to the trees existing in the region, either scattered or as part of windbreaks. Taking into account their structure, which consists largely of pure even-aged stands, growth analysis for average trees was taken as a method of measurement for each stand on each site. The choice of the average tree was made carefully, the height, diameter and form of crown of many trees being measured. This method was applied only to the main species of interest for future afforestation, such as Casuarina equisetifolia, Tamarix articulata, Pinus halepensis, Eucalyptus camaldulensis and Cupressus sempervirens. For other trees, measurement was limited to standing trees without cutting the average tree for analysis. These methods had to be adopted because no normal yield table is available and there are not sufficient trees in the region to set up a local volume table.

Wherever the growth of trees was measured, soil survey was carried out simultaneously. The results of the survey give a preliminary idea of the soil and climate potentiality for tree growth on different sites, and, consequently, the future production and protection effect that may be expected, although, for some trees, where the samples are small, the figures cannot be considered as significant and give only a tentative idea. As there were no trees on some sites or very few species, it is difficult to furnish reliable information, on the basis of existing trees, for all the sites. To estimate the future production of wood of these sites, extrapolation is necessary.

For the European forester, taking into account the scarcity of rains in this region, the reported figures will appear improbably high, but this is due to the long growing season, the high air humidity of the coastal strip and, where stands are concerned, the narrowness of the windbreaks, resulting in wide exploitation by roots on both sides.

5.1. Growth in height and diameter

The protective efficiency of windbreaks depends to a great extent on the distance between them and the height of the trees. Table 24 shows growth information on height and diametre growth for nine species in 28 plots on different types of soils and in various localities of the region. It is evident that, under dry farming or with some few irrigations in the first years (early irrigation) on difficult sites, such as the high parts of sand dunes or on the shallow soils of slopes, maximum heights have been attained after ten years by Tamarix articulata, Prosopis juliflora, and Acacia cyclops trees, measuring respectively 5.3 m, 2.5 m, and 1.8 m. (see Figure 5)

On the medium deep soils which are generally very rich in $CaCO_3$, Tamarix attains a maximum height of 10 m in 12 years.

On the depressions between dunes and lower dunes, though the soil is very poor, some species such as Prosopis juliflora and Tamarix reach a height of 7 and 12 m respectively, because of favourable water conditions.

On the deep soils, sandy loam in texture or loam sandy, the maximum height attained by Casuarina equisetifolia and Eucalyptus camaldulensis, is 13 and 17 m respectively. Cupressus sempervirens and Pinus halepensis reach heights of 7 m and 9 m respectively. (see Figure 6)

Annual growth in height, under dry farming or early irrigation conditions, is faster in the first 7-8 years; after that it gradually decreases (see Table 25). Trees, especially Cupressus sempervirens, on areas where irrigation has been carried out for many years, even under irregular conditons, were higher than on areas where irrigation was done only during the first 3 years. On the former areas height is 9.5 m; on the latter, 7 m.

Under regular irrigation Eucalyptus camaldulensis and Casuarina equisetifolia grow very fast, the first reaching 17.5 m and the second 16.8 m in eight years. (see Figure 7)

A comparison between annual growth in height for Casuarina equisetifolia under early irrigation and regular irrigation for the same ages and the same soil is shown in Figure 8. The height is doubled under regular irrigation.

On the coastal strip the height growth of many species is affected because of the northern winds. Some of them, after a few years of promising growth, start to dry. This is particularly so with Eucalyptus camaldulensis and Cupressus sempervirens, whose tops begins to dry after 7-8 years and 12-13 years respectively. Regarding diameter growth, Tamarix articulata and Acacia cyanophylla are fast growing even under early irrigation conditions. Acacia reaches an average of 25 cm, while Tamarix reaches 28 cm.

Under regular irrigation conditions, Eucalyptus camaldulensis and Casuarina equisetifolia reach the greatest diameter i.e. after eight years the first measures 21.3 cm and the second 16.2 cm. The dynamics of annual growth in diameter are given in Table 25, from which it can be seen that annual ring growth increases continually until 7-8 years, after which it gradually decreases.

Because of the small distance between the trees in windbreaks and the lack of thinning, the section of stem is oval for most of the species, with the diameter perpendicular to the direction of the windbreak longer than the other diameter. For example, the difference between diameters for Casuarina is 14 percent, while for Eucalyptus camaldulensis and Tamarix it is 7 percent.

5.2. Growth of roots and form of crowns

Roots and crowns are two main features of timber trees; the first explains the ability of trees to exploit habitat conditions to obtain the water and food required, whereas the form of crown shows protective capacity for different purposes. Among the species used in the region is Tamarix articulata, which has a well developed root system. From research done on the maritime sand dunes at Ras-el-Hekma, it was seen that ten-year old trees 7 m in height had developed two strong, central, vertical tap roots, of which one penetrated about 9 m deep, touching the underground water table. In its upper part, the diameter of the tap root is 20 cm; at 2 m it is 10 cm; and at 5 m it is 7.5 cm.

The lateral roots extend in all directions for about 17 m but are poor in ramifications. On the shallow and rocky soils, the root of Tamarix penetrates each fissure of the rocks. This kind of root development explains the marked capacity of Tamarix to grow under the very dry conditions.

On the other hand Acacia cyanophylla, studied in the same place, develops another type of root, more shallow than that of the Tamarix. Its tap root does not penetrate more than 1.5 m deep, but has very rich lateral roots which form a dense mat in the first upper horizon of 50-75 cm. It also extends long lateral roots, often of 10-12 meters, the majority of which are in the upper layer of 20 cm. This feature shows the adaptability of the species to dry coastal sands, where it can use the small but frequent quantities of surface water provided by night dew.

The other species used in the region, such as Cupressus sempervirens, Casuarina equisetifolia and particularly Eucalyptus camaldulensis and Prosopis juliflora develop heavy root systems.

These root features are very important for the choice of suitable species for different site conditions, and for the better management of windbreaks, making possible maximum concentration of root development in depth and proper spacing of field crops from the windbreaks.

Most trees in the region have large crowns. From Table 26 it can been seen that, at ten years of age, the vertical projection of crowns ranges from 4 to 10 metres in diameter.

Tamarix has a large crown, rich in main branches and with a diameter varying from 4.5 m on the rocky and shallow soils to 9 m on the deep soil and low sand dunes. Other species with large crowns are Prosopis juliflora, Tipuana speciosa, and Acacia cyclops, all of which can reach 10-12 m in diameter under favourable conditions, especially on depressions with deep soil and in depressions between dunes with accessible groundwater. Because of the crown shape, these species are very good for soil conservation and for shade for animals. Prosopis juliflora also produces very sweet pods which are suitable as animal feed.

The other species, such as Cupressus sempervirens, var. horizontalis, Casuarina equisetifolia and Pinus halepensis, have narrower crowns, with a medium diameter ranging from 4 to 6 m. This shows that they are very suitable for windbreaks.

5.3. Growth in volume

Though the aim of forestry in the region is mainly protective, the production of timber has economic importance.

Table 26 shows the growth in volume for average trees, the volume of one km length of windbreaks, and the volume of one feddan of windbreak, as well as the mean annual growth per km and per feddan of windbreak on different sites. The volume per km length was calculated by taking into consideration the distance between trees, which is about 1.5 m, and the volume of the average tree, while the volume per feddan of windbreak was computed by taking into consideration the mean lateral projection of crowns, the distance between trees and the volume of average trees. All these data refer only to one row windbreaks. Table 27 shows the current annual growth of volume for some of the more important species for future afforestation, under different site conditions, and is based on analysis of growth. Without going into detailed analysis, some comments regarding the volume of the average tree, volume per one km length and of one feddan of windbreak, are given below.

5.3.1. Volume of average trees

On the top and high parts of maritime sand dunes, the volume of the trees is very small. For instance, Prosopis juliflora has 11.0 dm^3, Acacia cyanophylla has 23.0 dm^3 and Acacia cyclops 25.0 dm^3.

On low dunes and depressions between, however, growth becomes better for Tamarix articulata, Acacia cyanophylla and Prosopis juliflora, with a maximum of 192 dm^3 for the first species.

On the shallow and medium deep soils with a layer of $CaCO_3$, Tamarix is the only species with a relative big growth (50 dm^3), the other species, such as Casuarina equisetifolia and Prosopis, having smaller growths.

On the deep soils, under early irrigation, Cupressus sempervirens and Pinus

halepensis produce a small volume of wood (40 and 74 dm^3 respectively) while Casuarina equisetifolia, Tamarix articulata, and Eucalyptus camaldulensis are relatively fast growing in volume.

Under irregular irrigation, it is recorded that Casuarina equisetifolia and Cupressus double their growth, from 46.70 to 90 dm^3 and 40.5 to 123 dm^3 respectively. Under regular irrigagion conditions the growth was three times bigger for Casuarina (46.70 to 124.5 dm^3 in 8 years. - see Figure 9)

5.3.2. Volume of one km length of windbreak

Table 26 indicates the volume of one km length of windbreak only for medium deep soils, low dunes and deep soils - places where windbreaks exist and where new ones will be set up in the future.

On medium deep soils, under early irrigation, growth in volume for one km length is small for Cupressus sempervirens and Pinus halepensis, mean annual growth varying between 1.80 m^3 for the former and 2.59 m^3 for the latter species. Casuarina equisetifolia, Tamarix articulata and Eucalyptus produce considerable quantities of wood under these conditions with a mean annual growth ranging from 3.0 to 7.0 m^3.

Under irregular irrigation, the mean annual growth is about twice for Casuarina (from 3.10 m^3 to 6.10 m^3) and about three times for Cupressus sempervirens.

Under regular irrigation both Casuarina and Eucalyptus produce very big quantities of wood, with a mean annual growth of 10.37 m^3 for the first species and 15.60 m^3 for the second.

5.3.3. Volume for one feddan of windbreak

The volume per feddan of windbreak follows in general the same pattern as the volume per km of windbreak. It should be noted that the volume per feddan of windbreak decreases as the crown increases, since, the wider the crown, the greater the surface of the area occupied effectively by the windbreak and the smaller the number of trees per unit of surface. Therefore the species with large crowns usually have a volume per feddan of windbreak smaller than the volume per km length. For instance, the species with a narrow crown, such as Casuarina, and Cupressus, have under early irrigation about the same volume of feddan and km length of windbreak (1.80 to 1.88 m and 2.59 to 2.48 m^3) while a species such as Tamarix, with large crown, has a volume per km length bigger than the volume per feddan of windbreak (5.10 m^3 for the former and 3.15 m^3 for the latter.)

Under regular irrigation the volume per km length is about double the volume per feddan of windbreak (15.60 m^3 and 8.8 m^3 respectively).

As a general rule the annual growth of trees increases continuously with age. This is particularly so for Tamarix articulata, Cupressus sempervirens, Casuarina equisetifolia, and Eucalyptus. Table 27 shows that the mean annual growth of Casuarina on deep soil under early irrigation is 3.10 m^3 up to 10 years, while it is 6.06 m^3 up to 17 years.

The absence of trees more than 17 years old makes it difficult to estimate the exact rotation of the different species in different sites. However, the data obtained from the existing trees show that these four main species can be economically used in rotation of trees over ten years old.

As stated in the first part of this chapter, all these data deal only with single row windbreaks. The volume of other types of windbreaks will be discussed in Chapter 7.

5.4. Ecological conclusions for some wood trees used in the region and recommendations

On the basis of the fitures given in the previous chapters, the species studied are explained as follows:-

Tamarix articulata grows on a wide variety of sites - shifting maritime sand dunes, shallow and rocky soils, salt soils in the marshes and deep alluvial soils in some valleys.

It is one of the best adapted species for the difficult natural conditions encountered in the region, such as dryness, poor and rocky soils, salinity and $CaCO_3$, strong wind storms, and extremes of temperature.

It has a very powerful root system which permits it to exploit a large volume of soil and rocks for water and food. On the other hand it has a large capacity for using the additional supply of water obtained from dew in the dry season.

Its crown is large and assures good shade for animals and protection for crops.

Tamarix grows fast, especially in diameter and volume, even under difficult conditions such as on the maritime sand dunes.

Information obtained from Sudan 1/ indicates that its wood is hard and durable, useful for rough carpentry work, ploughs, fuel, charcoal and for particle boards, and that regeneration is easily done by cuttings.

Taking into consideration these characteristics, Tamarix is one of the most important species in the initial stages of afforestation on difficult sites in the project area. It is therefore recommended for sand dune fixation, shelterbelts, windbreaks, road side plantations, soil conservation and afforestation as groups of trees which provide shade for animals on dry sites.

Casuarina equisetifolia is another important species for future forest programme in the region. It is a fast growing evergreen species, with a straight stem and flexible branches uniformly spread over the whole trunk from top to bottom.

It is well adapted to a dry climate and poor and saline soils, but it is sensitive to the north winds on the Mediterranean coast, the crown taking a flag form.

The wood is hard and liable to split and crack. It is used for fuel, charcoal posts and poles.

Casuarina equisetifolia is recommended for windbreaks, shelterbelts, road side plantations and green zones on the deep soils under regular irrigation, or under irrigation at least in the first 2-3 years.

Eucalyptus camaldulensis is a very fast growing species under irrigation conditions far from the coast. Under semi-irrigated conditions, especially near the coast, it grows well in the first years, but after that the top starts to be affected by wind and begins to dry, developing a flag crown and yellow leaves.

1/ Republic of the Sudan, Forests Department and U.N.D.P., Forestry Research, Pamphlet No. 33 "Tree species for the Arid Zone of the Sudan", by W.C. Bosshard, 1966.

On the other hand, because of its heavy lateral roots, it can compete against crops growing underneath it.

Thus its use is limited to afforestation, for timber production purposes, for yard plantation, road side plantations and green zones on the deep soils under regular irrigation conditions planted far from the beach or in the protective zones. Cupressus sempervirens, var. horizontalis, under unirrigated conditions or slight irrigation, is slow growing. After 13 to 15 years the top starts to dry. Under semi-irrigated and irrigated conditions it is fast growing. It is well known that its wood, being hard and durable, is well suited for furniture and building puposes. In view of its ecological requirements, the quality of its wood and its shape, Cupressus is recommended for windbreaks, road side plantations, and green zones on the deep soils under regular irrigation or semi-irrigated conditions.

Pinus halepensis, is well adapted to dry conditions on deep soil rich in $CaCO_3$. Its growth is fairly slow, but it has survived 19 years in the region.

The stems are slender and the wood is soft, therefore the trunks of some of the trees are crooked as a result of strong winds.

Pinus halepensis should be extended to many sites as windbreaks, and for the road side, soil conservation, and green zones.

Acacia cyanophylla and Acacia cyclops are two trees well suited to conditions in the region, especially on the shifting poor sand dunes, where very few other species can grow. Each is very drought resistant and quickly improves the soil conditions by its roots and leaves. They are also salt tolerant trees, but they are affected by wind, which pushes down their crowns without drying them. Acacia cyclops is slower to grow than A. cyanophylla, has a smaller volume of wood and prostrate branches, but is more resistant to dryness.

Both species, and especially Acacia cyanophylla, have leaves and young bramches suitable as animal feed.

These two species are recommended for sand dune fixation, Acacia cyclops preferably on the top of dunes and windward sites. Acacia cyanophylla can also be used for road sides, soil conservation plantation, animal feed production, and green zones on the medium deep soils and even on the shallow soils, under dry conditions.

Prosopis juliflora is another very drought-resistant tree, well adapted to the region, with a strong root system and a very large branched crown. Its pods are sweet and liked by animals, its wood is hard, very durable and good for fuel, charcoal and fence posts.

It is one of the species which can be widely extended in the first step of afforestation in various difficult sites for sand dune fixation, especially on the depressions between dunes and the low side of dunes, as hedges outside the windbreak network, and for fodder production and animal shade in dry conditions or wth scanty irrigation.

Elaeagnus angustifolia grows well on the poor low maritime sand dunes. It can be used for sand dune fixation and as a hedge outside the windbreak network.

6. Protective Effect of Wood Trees

This section deals with the role played by wood trees for crop protection and soil conservation and improvement.

6.1. Protection of crops

The results of field observation showed clearly the strong affect of the north and northwest winds on the growth and yield of horticulture crops, especially olives and almonds. Where olive and almond trees are situated on the windward side in the open places, the stem is crooked towards the south, and they have a flag crown and dry branches on the north side. Such olive trees are particularly noticeable at Mersa Negeila, and affected almond trees are seen ten km from Burg el Arab on the Alexandria road.

In years when strong storms blow during the blossoming period (March-April), entire crops can be lost. The results of some provisional and unpublished investigations done in the region 1/indicate that crops protected by windbreaks yield 30 percent more at least than those in open unprotected places. However, a narrow strip of crops lying along the windbreaks is affected by the latter's root and crowns. The width of this strip depends on the type of tree and its age, the type of soil, and the kind of irrigation. According to observations under the project, it is estimated that at an average age of 10 years, the width of the affected strips is as follows:

Casuarina equisetifolia, 10 m (Wadi Natrun); Tamarix articulata, 7-10 m (Burg el Arab); Pinus halepensis, 5-7 m (Tripoli Libya); and Eucalyptus camaldulensis, 15-20 m (Tripoli Libia). This effect can be reduced by digging ditches on both sides of the windbreaks.

6.2. Soil conservation and improvement of soils

For sand dunes, the best species for soil improvement are Acacia cyanophylla and Acacia cyclops. On the shifting and very poor maritime sand dunes at Ras-el-Hekma, Acacia has set up over the last ten years a 3 cm layer of organic matter, formed of leaves and branches, and underground another layer, 70 cm deep, formed of dense roots full of nodular bacteria. This has fixed the sand, and the evolution of mineral sand to sandy soil has started.

Under the crown of Acacia the temperature is lower in summer. Measurements taken on the sand dunes at Burg-el-Arab, both under the crown of Acacia and in open places, showed a difference in temperature at 1400 hrs of 9.8°C (40.2°C - 30.4°C). Under Tamarix articulata, the sand was covered with a 3-4 cm layer of needles. But the process of humification is very slow and the roots are poor. Though Tamarix has less effect on sand dune improvement it is very good when mixed with Acacia because of its height and wind resistance.

Another very good species for sand dune fixation and soil improvement is Prosopis juliflora.

Though the fig tree (Ficus caryca) is resistant and can grow on low sand dunes, it has no effect on drifting sand. Therefore the farmers are obliged to build hedges of grass or even of stones in between the trees. On shallow soils some shrubs such as Thymelaea hirsuta, Artiplex numularia, Licyum arabicum and Haloxylon articulatum play a big role in soil conservation and add new layers of soil.

This process is even more important on the salt marshes which are developing on the old lagoons. Here Artiplex plants grow near some species of Salsola and Sueda.

The intercepted dust carried by the southern winds from the inner plateau forms a covering layer which in time improves the soil of these salty marshes. This natural proceds should be furthered by the establishment of new trees, as discussed in the second part of the present volume.

1/ Unpublished work done in the Forestry Department of the Faculty of Agriculture, Alexandria University, UAR, 1968.

Table 25

Analysis of Annual Current Growth in Height, for average tree, in some representative windbreaks, in the North-Western Coastal Region of U.A.R.

Species	Casuarina equisetifolia								Tamarix articulata		Cupressus sempervirens		Pinus halepensis	
Locality / Age	Bourg-el-Arab		Mersa-Matruh		Fuka		Tahrir		Bourg-el-Arab		Bourg-el-Arab		Bourg-el-Arab	
growing	H., in cm.	Annual growing	H., in cm.	Annual growing	H., in cm.	Annual growing	H., in cm.	Annual growing	H., in cm.	Annual growing	H., in cm.	Annual growing	H., in cm.	Annual growing
1	1.1	0.9	0.8	0.7	1.3	1.1	2.6	2.3	0.7	0.7	0.6	0.7	0.9	1.3
2	2.0	1.2			2.4	1.4	4.9	3.0						
3	3.2	0.9	2.3	1.1	3.8	1.6	7.9	2.5	2.10	0.9	2.0	0.9	3.6	1.2
4	4.1	1.1			5.4	1.3	10.4	2.5						
5	5.2	0.8	4.6	0.9	6.7	1.0	12.4	2.0	3.90	1.1	3.8	0.7	5.9	0.9
6	6.0	0.9			7.7	0.8	14.0	1.6						
7	6.90	0.6	6.3	1.0	8.5	0.9	15.7	1.3	6.2	0.9	5.2	0.5	6.7	0.4
8	7.5	0.4			9.4	0.1	16.8							
9	7.9	0.3	8.3	0.8	9.5	0.1			7.8	0.5	6.2	0.3	7.4	0.2
			9.1	0.8	9.6									
			9.7	0.4					8.8	0.4	6.8	0.05	7.7	0.9
			10.5						9.5	0.1	6.9	0.05	8.1	0.3
			11.5						9.7	0.1	7.0		8.6	0.2
			12						9.8					

Table 27

Analysis of annual current growing in Volume, for average trees, in some representative windbreaks, in North Western Coastal Region of U.A.R.

Species	Casuarina equisetifolia								Tamarix articulata		Cupressus sempervirens		Pinus halepensis	
Locality	Bourg-el-Arab		Mersa Matruh		Fuka		Tahrir		Bourg-el-Arab		Bourg-el-Arab		Bourg-el-Arab	
Age / Growing	V. dm3	Annual growing	V. dm3	Annual growing	V. dm3	Annual growing	V. dm3	Annual growing	V. dm3	Annual growing	V. dm3	Annual growing	V. dm3	Annual growing
1	0.1	0.5	0.1	0.2	0.1	1.0	2.3	6.7	0.1	0.7	0.1	0.3		
2	0.6	1.5			2.0	3.5	9.0	13.5						
3	2.1	2.7	0.5	1.1	5.5	3.2	23.5	13.7	1.6	2.8	0.7	1.4	2.7	2.9
4	4.8	3.7			8.7	7.2	37.2	17.2						
5	8.5	4.4	2.7	4.4	15.9	8.9	54.4	20.0	7.3	6.4	3.5	3.0	8.6	5.1
6	12.9	6.2			28.8	19.9	74.4	19.5						
7	19.1	7.3	11.5	6.2	48.7	8.7	93.9	12.8/ 17.8	20.1	5.5	9.6	3.3	18.7	6.7
8	26.4	5.3			56.4	8.9	106.7/ 124.5							
9	31.9	5.1/ 9.7	23.9	9.7	65.3	8.5/ 17.7			31.1	6.4	17.1	3.3	32.2	4.7
10	37.0/+ 46.7		33.6	8.5	73.8/ 91.5									
11			42.1	10.8					43.8	3.7	23.7	3.9	42.9	3.3
12														
13			64.9						51.2	6.1	31.5	2.2/ 4.6	49.5	2.4
14				16.7										
15			98.4	12.6/ 30.9					63.4	4.4/ 25.7	35.9/ 40.5		54.2	4.9
16														
17			123.6/ 154.5						72.2/ 88.9				63.1	1.8/ 3.3
18														
19													67.8/ 74.1	

+) Two figures are given for the last year: volume inside bark and volume outside bark.

Chapter V

AGRICULTURAL INSTITUTIONS AND SERVICES

1. Land Tenure and Settlement

1.1. Introduction

The problem of land tenure and settlement constitutes one of the most important issues in the socio-economic development of the region. The modification and modernization of the land tenure system and the creation of settled agricultural communities are among the major means to increase agricultural production and promote better rural living.

The existing land tenure system in the project area is characterized by its tribal and customary features. Customs and traditions have played in the past, and still play, a major role in matters relating to land tenure and settlement. There are of course advantages and disadvantages in the tribal customary land systems which need to be reassessed in the lights of the requirements of agricultural development and settlement.

As to settlement, it may be said that the process of nomads' sedentarization and settlement had been going on spontaneously for quite a long time; though in recent years it has been further induced by the deliberate measures and plans of the Egyptian General Desert Development Organization (EGDDO) in the region. The insecurity and hardship of nomadic life, and the increasing social and cultural changes in the desert as a result of the spread of education and improvement of means of transport and communication, constitute some of the important factors that have forced many nomadic families to settle down and engage in farming and/or other economic activities.

Along with this process of settlement, the need for transforming customary tenures into statutory tenures has become urgent. The defects of the customary system such as the insecurity of tenure associated with it, the lack of incentives, excessive subdivision and dispersion, may indeed hinder further development and settlement.

Hence the traditional system must be changed or modified if it is to be adapted to the requirements of modern economic development.

1.1.1. Previous investigations

Socio-economic problems and particularly the problems of land tenure and settlement in the North Western Desert have not adequately been investigated or studied. The EGDDO and the Desert Institute have concentrated their studies on the physical and agricultural aspects; whereas the social, economic and institional problems have been tackled to a much less extent and studied far less systematically or scientifically.

In the field of land tenure and settlement the only available study is that of Dr. Christodoulou, FAO Land Tenure and Settlement Expert. He visited this country during 1964 on the request of the UAR Government to FAO for assistance and

advice on problems relating to land tenure and settlement facing EGDDO and to suggest solutions.

The report which he wrote at the end of his three weeks' assignment can be regarded as a preliminary investigation confirming the existence of institutional problems of an acute nature, which will be of overwhelming importance in the future and which are initially in need of solution. 1/ Dr. Christodoulou stated, however, that his report could not be a substitute for systematic investigations of the problems involved, which should be carried out by a team of experts able to stay long enough in the field to plan and carry out the studies in an adequate manner.

The investigation and study of other socio-rural problems has recently been initiated by the Social Research Centre of the American University at Cairo, under a programme of anthropological researches. These researches cover many aspects of bedouin social life. So far only one report, by Dr. A.S. Bujra, has been issued - in April 1967 under the title "A Preliminary Analysis of the Bedouin Community in Mersa Matruh Town." Dr. Ahmed Abu Zeid, Professor of Anthropology at the University of Alexandria, has also carried out some studies in the region for the above-mentioned Social Research Centre, but the results of his study are not yet available. Dr. Abu Zeid has, however, previously published some articles on the nomads of the region, notable among them being his paper entitled "The Nomadic and Semi-Nomadic Tribal Population of the Egyptian Western Desert and Syrian Desert". 2/

Beside these few systematic studies, there exist some booklets and books written in Arabic or in English on the bedouin life and their tribal organization. But these books are more or less of the type of tourist guides and cannot be considered as reference books. However, one important book by G. W. Murray entitled, Sons of Ishmael : A Study of the Egyptian Bedouin (1935) constitutes an important reference material on many aspects of bedouin life.

1.1.2. Work done under the project

In the field of land tenure and settlement the main objective of the Project is to bring about sedentarization of the tribal people and to create settled agricultural communications through changes in the traditional tribal land tenure system and the tribal social organization. These changes and modifications are to be based on a thorough study of all the problems concerning the situation of the land and the people as well as the possibilities and conditions of settling nomadic tribes and scope for formulation of settlement or resettlement schemes as an important part of an integrated agricultural development plan for the region.

More specifically, the tasks of the FAO land tenure and settlement expert were:

1. To study the situation and/or the traditional land tenure system in the Project area as a whole and in each of the specific pilot areas.

2. To study in close cooperation with the rural sociologist, the distribution of the population over several sectors of activity, particularly between agriculturists and pastoralists, settled farmers and nomads, and to examine to what

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1/ Report to the Government of the UAR on Land Settlement and related Rural Institutional Problems of the General Desert Development Organization, FAO, Rome, 1964.

2/ Published in the Bulletin of the Faculty of Arts, Vol. XVIII, 1963 - Alexandria University.

extent their customs and ways of life affect land tenure and farming operations and hinder or promote agricultural development.

3. To study the type and extent of land occupation by several human groups, the man-land ratio, and to determine the absorbing capacity of the area for settlement purposes according to the potentialities as determined by the agronomist and economist of the Project.

4. To make recommendations concerning the eventual modification needed in the land tenure system, as well as in legislation, in order to facilitate the settlement of nomadic populations.

5. To make recommendations concerning a settlement scheme specifying:

   (a) the number of families which could be settled;
   (b) the system of settlement;
   (c) thecriteria for the selection of settlers;
   (d) the layout of the settlement (in collaboration with the other experts and specially the economist and the agronimist);
   (e) the tenure rights of the settlers.

6. To train national personnel in land tenure and settlement aspects of the Project.

The Land Tenure and Settlement Expert, who joined the project in April 1966, was appointed Project Manager in March 1968. His successor as Land Tenure and Settlement Expert joined the project at the end of September 1968 for a period of 7 months i.e. till the end of April 1969. The two experts worked in consultation to continue and complete the following surveys and investigations:

1. Survey of the tribes and their traditional and customary system of land tenure and water rights and their suitability to settlement.

2. Study of existing legal system, legislation and policies affecting land tenure and settlement in desert areas.

3. Systematic field investigation of land tenure and settlement and related problems in five pilot areas, namely: El Qasr, Negeila, Baqqush, Fuka and Dabaa.

4. Development of land tenure and settlement plan for Wadi Maguid experimental project.

5. Study of grazing rights of pastoralists in relation to settlement.

6. Formulation of Settlement schemes as part of the integrated agricultural development plan for the Region.

Based on these surveys and investigations, the following reports were prepared during the course of the project:

1. "Report on the Impact of World Food Programme Aid on the Settlement of the Nomads in the North Western Coastal Region of the UAR", June 1966.

2. "A Preliminary Report on Land Tenure and Settlement Planning for Wadi Maguid Project", April 1967.

3. "Determination of Farm Sizes and Number of Families to be settled in Wadi Maguid", August 1967.

4. "Proposed Land Tenure and Settlement Plan with Supporting Institutional Measures", November 1967.

5. "Socio-economic Issues of Nomads Settlement in the Western Desert of UAR", pp. 14, January 1968.

6. "A field study of Land Tenure and Settlement Problems in El-Qasr Pilot Area - Matruh", May 1968.

7. "A consolidated Report on the Land Tenure Situation in the Five Pilot Areas, El Qasr, Fuka, Negeila, Baqqush and Dabaa", March 1969.

The sections of the Final Report on the project which deal with Land Tenure and Settlement questions contain:

(1) An analysis of the existing situation.
(2) A discussion of the scope for improvement and development
(3) Proposed changes and modifications of a legal and socio-economic nature necessary to achieve the sedentarization of the tribal people and the agricultural development of the region.

(4) detailed studies of Land Tenure and Settlement and Cooperative in each of the five pilot area.

The studies referred to under (4) show the tribal structure, composition and distribution, land tenural position (particularly distribution and size of tribal holdings), degree of land fragmentation and sub-division, water resources and water rights, land utilization patterns, livestock position, patterns of settlement, degree of sedentarization and types of dwellings, annual family living expenses and the functioning and growth of cooperative movement, etc.

1.2. The tribal system in the region and its historical background

The most important tribes inhabiting the Western Desert of Egypt and in particular the North Western Coastal Zone from Sallum to Alexandria are the "Awlad Ali" of the Sa'ade tribes. The term "Awlad Ali" applies to the descendents of Ali's three sons: Ali Abyad, Ali Ahmar and Sinena. These constitute the three major clans of the Awlad Ali tribes. Among them lived another category of tribes which belong to what is commonly known as the Morabiteen (bound or attached) tribes, such as the tribes of Jemieat, Qita'an, Awlad Suleiman, Hawara, Habbun and Samalous, who were until recently considered as vassals to the Awlad Ali tribes, paying tributes to the latter. To distinguish themselves from their vassals, the "Awlad Ali" called themselves "hurr" (free) tribes, The Morabiteen tribes, however, were divided into various grades, according to whether they paid tribute to the free tribes or not.

1.2.1. Historical background of the tribes and their possession of the area

The aboriginal population of North Africa consists of Berbers, a Libyan branch of the Hamitic race, mixed with some Semitic people to the east and with negro elements to the south. Following the early Arab conquest of North Africa in 640 AD, the Berber nomads remained in undisturbed possession of the countryside, since the Arabs established themselves in towns to safeguard their rule, and were no longer tent-dwellers.

In the 11th Century (1049) an Arab penetration of far more ethnic significance than the first conquest took place. The Fatimid Caliph, el-Mustansir, decided to send two warlike tribes, the Beni Hilal and Beni Suleim, which were then residing in Upper Egypt, to re-conquer the Berber in North Africa whose Sultan, Mu'iz bin Badis, had rebelled against the Fatimid of Egypt and announced allegiance to the Abbaside Caliph of Baghdad. Fierce fighting took place and the two tribes succeeded in subduing the Berbers and their Sultan and were given the right to rule the conquered territories.

The Beni Hilad tribe continued its penetration further west to Tripolitania and Tunisia, but the Beni Suleim settled in Cyrenaica, from whence some of their descendents have drifted back to the North Coastal Region of Egypt and to the Nile Delta ever since. Those who settled in the Delta and Nile Valley fast lost their nomadic character and became settled cultivators; those who remained in the North Western Coastal Region remained semi-nomads leading a pastoral life.

It is worth mentioning here that while the original Arab Moslem conquerors of North Africa during the 7th Century mostly settled in towns and left the open country to the Berbers without much influence on the nomadic population, the subsequent conquerors of the 11th Century (i.e., the tribes of Beni Hilal and Beni Suleim) continued their nomadic existence and their penetration and possession of the country, and hence were one of the decisive factors in moulding the character of the present-day population. Many Arab tribesmen have become inextricably mixed with Berber tribesmen as both races spent their lives in the desert herding their flocks, and both were warlike. Also intermarriage and intermingling of a few generations should have led to some kind of integration so that now almost all of them claim an Arab origin.

1.2.2. The Sa'adi tribes

The Segments of Beni Suleim that settled in Cyrenaica (Libya) and in the North Coast of Egypt constituted the well-known Sa'adi tribes of Cyrenaica to which the Awlad Ali tribes of Egypt belong. All of them claim one original ancestor called "Dhib" known also as "Abu el-Lail" of Suleim descendent. Sheikh Dhib was a great contemporary of Ibn Khaldun (1332 - 1406).

The title of "Sa'adi is said to be derived from their ancestress "Sa'adi", the wife of Dhib.

The pedigree of Saadi tribes shows that they fall into three main groups: The Baraquith, the Aqaqra and the Salalma. Each of these is in turn sub-divided into sections and sub-sections as shown in the Fig. 10.

The Saadi tribes of Cyrenaica, the Jibarna and Harabi, divided the country between them; the Jibarna tribes occupied Western Cyrenaica and the Harabi got hold of the eastern part, from east of Benghazi, covering the whole of the Green Mountain (Jebel El Akhdar), up to the Egyptian border.

The Awlad Ali tribes also lived for a long time in the Green Mountain of Cyrenaica, until they were dispossessed and driven out of Cyrenaica in the 18th Century by their cousins the Abaida tribe, and they were forced to drift eastward to the Egyptian border.

During this very period, the Hanadi tribe in the North Coast of Egypt also dispossessed and drove away many other tribes from this region and held the Egyptian North Coast for nearly a century for themselves. One of the tribes which was defeated and driven away by the "Hanadi" was the "Beni Auna", who sought refuge in other settled parts of the country and left their vassals, the tribe of "Jemeiat", at the mercy of the Hanadi. The Jemeiat tribe continued their struggle under the leadership of their ritual chief called "Baqqush" and sought the assistance of the "Awlad Ali" tribe who had been driven away from Cyrenaica by the Abaidat tribe. Vigorous warfare which lasted till the time of Mohamad Ali Pasha, broke out between the two tribes, resulting in the ultimate defeat of the "Hanadi", who then offered 100 000 tallaris to Mohamed Ali Pasha for assistance for the restoration of their territories. However, the Awlad Ali defeated the combined forces of Mohamed Ali Pasha and the Hanadi in a battle of Hosh'Isa. Mohamed Ali Pasha pacified and compensated the defeated tribe by granting them land in the Wadi Tumilat.

The conquered territory of the North Coast was then divided between the conquerors, the Awlad Ali and the Jemeiat. The latter received a third, and were no longer

considered Morabiteen, and thus released themselves from the payments of tributes. They now live intermingled with the free sections of Awlad Ali, all along the North Western Coast, and particularly in the Dabaa sector, and also in Beheira.

1.2.3. The Morabiteen tribes

The Morabiteen tribes, as stated above, were vassals of the Sa'adi tribes. A kind of feudal system prevailed both in the Western Desert of Egypt and in Cyrenaica by which groups of Morabit or client families, not whole tribes, were attached to different clans of the Sa'ad tribes. Thus the Qata'an tribe is divided one part client to the Awlad Ali Ahmar Clan, another to Sinaqra Clan, and a third to Sinena. There existed a tribute called "alms", which by hereditary obligation each Morabit family had to pay the Sa'adi clan to which it was attached and on whose lands it dwelt. (see Table 28)

There are various legends about the origin and the status of the Morabiteen tribes. Prominent among them are the following:

a) It is claimed that the Morabiteen were the original inhabitants of Cyrenaica and the North Coast of Egypt before the invasion of the Beni Hilal and Beni Suleim and that after the invasion they came under the control of the latter.

b) It is reported that El Sayed Idris, the Senussi leader, gave it as his opinion that the Morabiteen are descended from tribes mainly Yemenite in origin, who colonized North Africa after the first Moslem conquest and that the Saadi tribes are the Beni Suleim nomads of the eleventh century who never settled on the land and continued to live as bedouins exercising a blackmail known as "Sadaqa" or "Alms" on the peaceful and religious Morabiteen.

c) Others claim that the Morabiteen were segments of Arab tribes who came with Beni Hilal and Beni Suleim and were given the task of guarding the sea-shore and to be tied (attached) to it. Not being as strong and warlike as the Sa'adis, each group of them attached itself for protection to one of the Saadi sub-tribes in its districts.

d) A fourth story relates the Morabiteen to the famous Almoravides, who ruled Spain in the twelfth century and who were split up into families dwelling among the Saadi tribes and paying tributes to them.

Investigations suggest that the Senussi story about the origin of the Morabiteen is the most acceptable, as most of the Morabiteen tribes claim to be the pious descendants of the first Moslem Arab conquerors of the 7th century, and some of them are said to be Ashraf, claiming consanguinity with the Prophet. For this reason the Sa'adi tribes, though despising the Morabiteen as clients, respect them for their piety and resort to them for the writing of charms and for the settlement of their disputes and feuds.

As the Saadi tribes possess the whole of Cyrenaica and the Egyptian North Coast by right of conquest, the Morabiteen tribes use the land and water bil-ihsan, i.e., by grace of the free tribes. As mentioned above, some of the Morabiteen used to pay a tribute called Sadaqa (alms) to the free tribes for protection and for the privilege of using the land and water. Some of them also were forced to perform services for the Saadi tribes among which they dwelled. Some Morabiteen tribes, however, though attached to Saadi tribes, live independently, paying no tribute and pefforming no service for them, notably, the Jemeiat tribe who used to be attached to Beni Auna and later to Awlad Ali, but are not required to pay any fee or service. Other Morabiteens such as the Jawabis and Awamma were in an intermediate stage between the Sa'adi and the Morabiteen. Still others, such as the Awlad Abdul Salam, the Samaloas Al-Diminat, and perhaps the Fawakhir, call themselves "Morabiteen bil Baraka", a priestly cast which in Tripoli used to receive special privileges from the Turkish government.

Table 28

THE MORABITEEN TRIBES AND THE SA'ADI (AWLAD ALI) TRIBES TO WHICH THEY ARE ATTACHED

Names of Morabiteen tribes and sub-tribes	Names of the Awlad Ali Clans to which they are attached
Jemei'at	
Ishtour) El Mousa) El Qawasim)	Independent
Quta'an	
El Ma'abda) El Rukhamat)	Asheibat-Ali Ahmar
El Fazzar) El Shararma)	Sanagra-Ali Abyad
Habboun	Awalad Kharouf-Ali Abyad
Minefa	Qatifa-Sinena and Ali Abyand
Serehma	Senaqra-Ali Abyad
Hawara	Arawa-Sinena
Awamma	Awalad Kharouf-Ali Abyad
Mawalik	Arawa and Qatifa-Sinena
Shawa'ir	Awlad Kharouf-Ali Abyad
Howaitat	Awlad Kharouf-Ali Abyad
Zigheirat	Ali Abyad
Jibeihat	Ali Abyad
Jawabis	Independent
Sarahna	Ali Abyad
Fawakhir	Awaqir
Sheibat	Arawa, Sinena
Qreidhat	Sanagra
Seaitat	Sanagra
Awlad El Sheikh	—

The differences in social status between the Sa'adi tribes and Morabiteen tribes lessened greatly after the Italian Rule in Cyrenaica and since the early part of this century in the North Coast of Egypt. Today there is not a single Morabiteen tribe that pays fees or performs services for the Sa'adi tribes. Nevertheless, aspects of past relationships still survive and affect the behaviour of many tribesmen on both sides. Moreover, many of the Morabiteen tribes are still, by tradition, without land of their own. They have lived, grazed their flocks, and cultivated barley on the Sa'adi tribal territories for many generations, but they have not been allowed to plant trees or make any permanent improvement in the land

unless they purchase it from the Sa'adi tribesmen.

Although the Sa'adi tribal possession of land is not based on statutory law, i.e. from the legal point of view they are no more than people in actual physical occupancy of lands belonging to the State, yet no Morabit or any outsider would dare to purchase land from the Government and utilize it without the consent of the tribal possessor, who would be compensafed. Thus, when the Government under the 1958 law gave tribesmen the opportunity to buy desert lands being developed by tree planting or permanent improvements, some Morabiteen tribesmen and others applied for pieces of lands for development, but, before concluding their contracts with the Government Agency (EGDDO), they had to arrive at peaceful settlementin terms of money with the customary tribal possessor.

It should not be understood, however, that no Morabiteen tribes have lands of their own. The Jemei'at and Quta'an and some other big tribes do have their own lands whose rights are recognized by the Sa'adi tribes. These rights were obtained by participating in war on the side of the Awlad Ali tribes against other tribes.

1.2.4. Distribution of the tribes

Table 29 below and Map 4 show the distribution of the major tribes in the four main sectors of the North Western Coastal Region.

Table 29

DISTRIBUTION OF TRIBES IN THE FOUR SECTORS OF THE N. W. COASTAL REGION

Name of tribes	Burg el Arab sector		Dabaa sector		Matruh sector		Barrani sector		Total	
	No. of families	%	No. of families	%	No. of families	%	No. of families	%	No. of families	%
Awlad Ali tribes:										
Ali Abyad	1 694	44	306	19	896	26	209	13	3 105	27
Ali Ahmar	216	5	64	5	1 296	29	173	7	1 749	15
Senena	128	4	53	4	255	5	243	13	679	6
		53		28		50		33		48
Morabiteen tribes:										
Jemeiat	672	18	605	41	444	13	-	-	1 721	14
Quta'an	137	4	5	-	202	2	751	36	1 095	9
Other Mor. tribes	1 125	25	509	31	1 068	25	563	31	3 265	29
		47		72		50		67		52
Total	3 972	100	1 542	100	4 161	100	1 939	100	11 614	100

As the table shows, the tribe of Ali Abyad is predominant in Burg el Arab, the tribes of Ali Ahmar in the Matruh sector, the Jemeiat tribe in Dabaa sector and the Qu'taan tribe in the Barrani sector. A further perusal of the table also reveals that Morabiteen tribes outnumber overwhelmingly the Saadi tribes in the Dabaa and Barrani sectors, while they are almost in equal proportion in Matruh sector.

1.2.5. Tribal organization

The Awlad Ali tribal group is divided into three major divisions, or Qabila, the Qabila of Ali Ahmar, the Qabila of Ali Abyad and the Qabila of Sinena. Each division is in turn divided into sub-tribes, which ought to be designated clans, since each of them pretends that the society comprised under its title had a common ancestor. For instance, the Awlad Ali Abyad tribe is divided into two sub-tribes or clans: the Awlad Kharouf and the Samaqra. The clans are composed of more primitive associations of families, i.e., sub-clans or sections which are called "Ailat". The Ailat, in turn, is divided into beyout (singular, bait). The Ailat is the most important unit in the tribal system as far as collective responsibility and the obligations of members toward a common cause are concerned. The members of the Ailat feel closer together since their common ancestor is less remote than the common ancestor of their clan.

However, a much stronger feeling or kinship and mutual loyalty is found in the bait, which is the smallest unit in the tribal organization, containing from 10-20 families descending from an ancestor only three or four generations back. Almost every bait has a leader, an elderly influential man, called "Aqilah" (Wiseman), who is responsible for the welfare of all members of the bait and for the settlement of their disputes and conflicts within the bait or with outsiders. There may be four or five beyout and therefore as many "Awaqil" in the Ailat.

Each Ailat has a petty Sheikh. These petty Sheikhs, together with the "Aqilah, usually participate in the election of the two officially recognized leaders of the clan, the "Umda" and the "Sheikh". The "Umda" is the supreme Sheikh and the most authoritarian of all the chiefs of the clan. Some clans, however, have only Sheikhs and no Umda; others may have more than one Umda, each serving a different locality. It is through the Umda or the Sheikh that the orders and decrees of the Government are transmitted to the tribesmen. Both the Umda and the Sheikh are officially appointed by a Committee called "the Committee for the election of Umdas and Sheikhs". The committee is formed under the chairmanship of the Police Director and the members are the Aqilah and representatives from the Departments of Justice and of Security and from the Governorate. The Umda is elected directly by his tribesmen under the supervision of the Committee; the Sheikh is elected by the Committee itself. A nominal monthly stipend (£E 6 to the "Umda" and £E 4 to the "Sheikh") is paid by the Government. This remuneration is to cover the expenses they incur in transmitting the orders of the Government to their tribesmen and in representing their tribes in all disputes and transactions with other tribes or with the Government.

1.3. The customary system of land tenure and water rights in the region

1.3.1. Bedouin customary laws

Before the advent of 20th century there was no strong National government to dominate and control the tribes and enforce law and order properly. Being nomadic or semi-nomadic, they were inaccessible in the wide desert, living freely and recognizing no authority but that of the family or the clan. They developed their own rudimentary judicial and administrative system and their own customary laws by which they administered justice and maintained order.

The customary laws are simple, unrecorded codes, which are easily applied. They are transmitted orally by each tribal judge to his successor. These codes take account of families and groups rather than of individuals. Responsibility is conceived of as corporate; and hence punishment retaliation and compensation are not imposed on the wrong-doer individually, but on all the men in his family or clan. As the family never ceases to exist, responsibility for a debt or injury involving compensation is passed on from one generation to another.

Although customary laws are, generally speaking, unwritten codes which vary

from tribe to tribe; yet the Awlad Ali of the Sa'adi tribes had in the past developed a comprehensive unified code based of the Moslem Sharà. This code was written down and sealed by the convening sheikhs. This happened when all the leaders of the Sa'adi tribes met together about 300 years ago (in the year 1064 AH) in a place called "Haqfa" near Derna in Cyrenaica (Libya) to work out a comprehensive customary law. The Code was formulated and sealed by the twenty two convening sheikhs who testified to its accuracy and proclaimed its promulgation. The Code dealt with various matters such as the payment and distribution of diya (Blood money), the difference between intentional and unintentional killing, taking refuge (Nazala), outlawry, oath to be taken when evidence is lacking, killing of adulterer, killing of a thief, slaying by contrivance, instigation of murder, slaying of a relative, death in prison, death from fright, causing miscarriage, overlaying, neglect of a guest, responsibility of a host, rape, assessment of wounds, false evidence, stealing, civil claims and land possession etc. Land possession and civil claims are dealt with in some detail in the following sub-sections.

1.3.1.1. Land possession

As far as land possession is concerned, the customary law states that "the clans of Awlad are divided, in Mariout and elsewhere, among sections or plots or territories. Each clan has its own territory which it occupies to the exclusion of encroachment or invasion by others. Should any one encroach or trespass on the territory of another, the case shall be heard by a special tribal court convened for this purpose, where evidence shall be produced by both parties, and also from the owners of the territories adjacent to the one in dispute, and in the end the court shall decide the case by means of oaths."

In the settlement of disputes, oath is considered the most reliable means because the bedouins of the Western Desert have great faith in it. They believe that an oath brings forth truth and exposes falsehood.

The customary law reveals the customs of Awlad Ali tribes in the settlement of disputes over land as follows:

1. If a person claims ownership of a piece of land, he shall be called to produce evidence, and if he fails to do so, the defendant will be put on oath. This is in accordance with "Hadeeth Sharif" that "the claimant shall give evidence and the party denying shall take oath". Oath shall be taken without witness if the disputed land does not take more than one Ardeb of sowing seeds. If it takes two Ardebs, there shall be one witness at the time of taking the oath. But if the disputed piece of land takes more than two Ardebs, the number of witnesses shall be as many as the Ardebs of sowing seed required.

2. If a person claims ownership of a Roman cistern or a well or a real estate which is under the possession of another tribesman, the claimant shall be called to give evidence, and if he fails to do so, the defendent shall be put on oath with twenty four witnesses of his kinship, and once oath has been taken, he shall be the righful proprietor of the cistern, well or real estate for which oath has been taken.

3. If a person claims ownership of a land or real estate and the like on which another neighbouring person has laid his hand for a long period of time and he has been disposing of it by demolishing or building or by other means for 15 years, and the claimant knew all about that but kept silent, he shall have no more right. However, if he claims that he has disposed of his land by lease for a certain period, free of charge, he shall in this case be called to produce evidence, otherwise his claim shall be dismissed.

4. If a person claims ownership of a land over which dispute has arisen between two parties concerning its possession, and the claimant knows all about that

dispute and the oaths but keeps silent, he shall have no right whatsoever and his case shall be dismissed.

5. If two persons dispute over a free land, which no hand has ever been laid upon, and each alleges that he was the first to lay his hand, or his father or grandfather had long time ago done so, each shall be walled upon to produce evidence in support of his prior holding or of his father's or grandfather's having done so and also the year in which it was so done. If the disputedland is on the sea-shore, the year 1299 (Hegria), known as the year of Oraby, shall be taken into consideration in settling the dispute. Anyone who gives evidence of his holding the land prior to that date, he shall be the righful proprietor of the land. In case of land far from the sea-shore, the priority shall be given to the party who first ploughed the land since the year 1313 (Hegria), known as the year of El-beyoudh (the year of rats).

These are some of the important rules extracted from the tribal customary laws of the inhabitants of the region. Although the tribal possession of the land is not based on statutory law; that is, from the legal point of view they are no more than persons in actual physical occupancy of lands which belong to the State, yet no outsider could purchase the land and utilize it without the consent of and without payment of compensation to the tribal possessor. Even the tribal possessor himself is not completely free to dispose of his land; he has to follow certain traditional rules. In selling his share in tribal property, he has to give priority to the members of his clan; and the price of land should be reduced if one of his relatives wishes to purchase the land.

If should be noted that the prevailing tribal system of land tenure stems from the past social history of the tribes in the Region and is governed by their traditions and social institutions and ideas. Among the important features of this system is the fact that boundaries of the territories of the clans and of individual plots within them, though the people themselves have very clear idea about them, are seldom recorded in any form of land register or set-out clearly in a cadastral map.

Another important feature is the prevalence of individualization of tenure especially in cultivated desert areas. The tribal territory is no longer commonly or collectively utilized by members of the same tribe to which the land belongs; rather it has been allocated individually among the tribesmen in such a way that each tribal holder knows quite well the shape and boundaries of his share in the tribal area. The investigation in El Qasr Pilot area revealed that out of the 158 holdings investigated, there were only 9 tribal communal possessions and all the rest were individualized holdings.

1.3.1.2. Civil claims

Civil claims are equivalent to debts among the tribes of Awlad Ali. If a creditor makes a claim upon a debtor who is in possession of property, the debtor should settle the debt, and if he refuses, complaint is made to his relatives. If his relatives find no way to make him settle it, then the creditor is free to plunder anything that the debtor may possess. It should be noted, however, that this custom is not followed nowadays, as such matters are now usually referred to the Government for settlement.

Debts are usually settled in three recognized seasons, which are: the

"Hassida" or the time of barley harvest; the "Rabia" or the lambing season; and the "Simman" or quail season, when the quail (migratory bird) fly in the region in thousands coming from Europe.

Debts incurred in the form of borrowing barley in kind for seed purposes are settled in two ways: Either the borrower may return double the quantity that was borrowed originally, after harvest, or he may share the produce with the lender according to a fore-agreed proposition.

The main drawback of the first type of arrangement is that in the case of complete failure of a crop (which happens once or twice in every five years), the payment of the loan in kind is deferred to the next crop season with the stipulation that the quantity to be returned would then be four times the original weight. According to the custom, debt multiplies geometrically.

In the case of the second system, risk of crop failure is jointly shared by the lender and the borrower.

Keeping in view the uncertainlty and the meagreness of rainfall in desert areas, and a high degree of risks involved, the second type of arrangement appears to be more suitable for the bedouins. 1/

Cases relating to inheritance, will, gifts, marriages, divorce or other family connections etc. used to be referred to special tribal courts, but since the establishment of sharâ courts in the desert, the bedouins began to resort the them and accept their decisions. However, according to customary law, inheritance of landed property is confined to male decendents only; and in such cases, therefore, the relevant rule in the Islamic Sharâ is not followed,

1.3.2. The legal position of the tribal customary laws

The application of the tribal customary laws in the Western Desert continued even after the Government had taken more interest in this Region at the turn of this century. First of all, the Government established the Coast Guard Administration to prevent smuggling and provide some security. Then in 1917 the Frontier District Administration (F.D.A.) was created as a special agency to govern the people of the Western Desert, taking into consideration their customs and traditions, and to provide the bedouins with a sort of unified services, combining police, justice, public health, collection of taxes and the prevention of smuggling. 2/

The F.D.A. founded what was called "The Movable Tradition Courts". These Courts were called "Movable" because they used to move to the place of the offence or where the crime took place; and they were labelled "Tradition" because their functioning was according to the tribal traditions and customs. In doing so, the

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1/ See Radames S. Lackany, The Egyptian Riviera, Sallum 1962.

2/ The F.D.A. was a military administration responsible for the Provinces of the Western Desert, Sinai, the Red Sea Coast, In each of these provinces there is a Governor and several district officers responsible to F.D.A. which was in turn attached to the Ministry of War. However, in 1960 a system of local Government has been established giving the authority of administering these territories to a Governor representing the President of the Republic and responsible to the Minister of Local Government.

F.D.A. had virtually recognised and approved the application of the Customary Law in the Western Desert. This recognition is still valid, and the concerned administrative authorities are still leaving the job of settling disputes to the tribal chiefs and traditional arbitrators under the auspices and supervision of the local administration. Simple affairs are usually dealt with by a court of "Aqilah" (elders). In serious cases, however, the police may be asked to interfere, but even in those cases the official law complements the customary law by asking the advice of the tribal chiefs in the settlement of disputes.

Thus the legal position is complicated by the fact that both modern law and customary law are regarded as valid, and the existence of both legal and traditional procedures is recognised. It has been alleged by one writer 1/ that, "in many cases it was found desirable, if not absolutely necessary, to follow tribal customary laws even at the risk of deviating from regular modern rules and procedures". It is to be noted that the settlement of disputes in accordance with customs and traditions is much less costly and less time consuming than the settlement according to modern laws and procedures. Mr. Jawhary, a former Government Judge in the Desert writes in his book that "experiences have proved the unsuitability of modern laws in the settlement of disputes among the bedouins."1/ This fact, he claims, compelled the Government in many cases to resort to customary laws in settling tribal feuds and disputes".

Notwithstanding the fact that the Customary Law is still resorted to in the settlement of all types of disputes in the desert, yet it is not recognized as far as land tenure is concerned. The 1958 and the 1964 laws governing land possession in desert lands did not recognize customary rights exercised collectively or individually over lands. However, lands which had been planted with trees or lands over which buildings had been constructed could be alienated to individuals against payment of its estimated value in instalments. Hence tribesmen who had customary rights over pieces of land could enjoy no legal right if they do not apply for the purchase of these rights or their conversion into statutory rights in accordance with rules laid down in the provision of the above-mentioned Laws. These points will further be elaborated in the following section.

As regard the grazing areas, these are, legally speaking, also State lands, but are, customarily speaking, held collectively by the tribesmen and therefore grazing rights are communal. As has already been mentioned in this report, the main problem in communal grazing rights is the absence of any balance in the tribal customary law between grazing rights and the carrying capacity of the land. The common feature of customary grazing is that the possession of the grazing land is "communal", whereas the ownership of the flock is "individual". Therefore, because the land is free to all, no one has the incentive to limit the number of animals grazing on it, or otherwise protect or maintain the land. This is why most of the grazing areas in the Region are becoming degraded, owing to overgrazing and lack of grazing management and improvement.

1/ See Rifaat El Jawhary, "Secrets from The Western Desert," the National House for printing and Publication, Cairo U.A.R. (n.d.) P. 92.

1.4. Government Policy in Land Tenure and Settlement with reference to the Region.

1.4.1. Reclamation and Settlement of Desert Areas

The agricultural policy of the UAR is incorporated in, and is an integral part of the country's overall development policy which aims at tackling the problem of overpopulation through greater industrialization, more rigorous agrarian reform measures and by accelerating land reclamation and resettlement through water resource development and horizontal expansion in the desert areas with the maximum use of the water supply after the completion of the High Dam in 1970.

The cultivated area of Egypt is very limited, constituting only 3 per cent of the total area of the country; the rest of the country's area (97%) is desert land, with untapped resources. It is only very recently that Egyptians began to consider the utilization of the deserts areas.

As the cultivated area is already intensively cultivated and not much increase in agricultural output is expected by more vertical expansion to cope with the rapid growth of population, it was decided to consider the utilization of desert area, thus increasing the cultivated area by horizontal expansion. This expansion will be limited by the availability of water. It is estimated that the High Dam will make water available for 1.3 million feddans of new lands for agricultural production, and will also provide enough water to convert nearly 730 000 feddans of basinly irrigated land to more intensive cultivation through controlled perennial irrigation.

Horizontal expansion through land reclamation was a very slow process during the first half of this century despite the fact that conditions for expanding agricultural area were much favorable. There was a surplus of storage water and plenty of accessible land in the Northern Delta where drainage facilities existed. It may be said, therefore, that before the Revolution of 1952, reclamation workwas limited and confined to small areas already reclaimed by the State Domains Administration and by some big landowners such as the

Gianaclis Vineyards in Mariut. Indeed, the success of the Gianaclis Vineyards in Mariut and of the Italian farms in Cyrenaica drew attention to Egypt's Mediterranean Coastal region which in Greco-Roman times was famous for its grain and wines. (1)

The total area reclaimed during the twenty years period preceding the Revolution of 1952 was no more than 237 000 feddans; that is, at an average of 12 000 feddans per annum. (2)

It is worthwhile mentioning that while the population of Egypt during the period 1895 - 1952 rose by almost 13% (from 9.3 to 21.5 millions), the cultivated area rose by only 14.5% (from 4.9 to 5.6 million feddans). (3) This rapid and high increase in population which was accompanied by a very small increase in the cultivated area resulted in a big downward trend in the area of land cultivated per head. The per capita ownership of land dropped from 0.5 acres in 1907 to 0.2 acres in 1967. This wide gap between the growth in population and the growth in cultivated area and agricultural production, awakened the Government to the necessity of enhancing the process of horizontal and vertical expansion to bridge the gap and to reduce the import of grain. Wheat imports amounted in 1952 to about 50 per cent of the needs for local consumption. (3)

The first bold attempt to remedy the situation was made in 1953 when the Government drew up a rapid programme for horizontal expansion, initiating it with the well-known Liberation Province (Tahrir) reclamation project extending in the desert area along the western edge of the Delta from Cairo to Alexandria and based on underground water. About 140 artesian wells were dug and pumping stations were installed. Total area reclaimed in this pioneering project amounted by the end of 1962 to about 60 000 feddans in both the Northern and Southern sectors of the Tahrir Province.

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(1) Charles Issawi, Egypt in Revolution, An Economic Analysis, Oxford University Press, London 1965, p. 132

(2) Sayed Marei, "Land Reclamation Policy and War Economy", in Al-Ahram Economist, No. 296, 15 December 1967.

(3) Ibid.

A new organization called "The Permanent Authority for Land Reclamation" was established in 1954, and was first attached to the National Council for Production Development, but later on it was attached to the Council of Ministers. The Authority was entrusted with two main functions; namely:

(1) surveying and delimiting all reclaimable lands and drawing general plans for their reclamation and development;

(2) reclaiming and developing any other land entrusted to the Authority by other agencies.

In 1955, the National Production Development Council drew a general plan for reclamation based on comprehensive reconnaissance surveys of lands capable of reclamation. The plan aimed at achieving the following objectives :

1. Reclamation of 325 000 feddans of fallow land in the Nile Valley, and another area of 21 000 feddans in the oasis.

2. Reclamation and development of 50 000 feddans in the zone east of Suez Canal for the Palestinian refugees.

3. Implementation of a programme for reclaiming and developing the areas which lie within the orbit of horizontal expansion in the Governorates of Behaira and Fayoum, and the improvement of the socio-economic conditions of the people in these areas.

4. Investigating the possibilities of agricultural expansion and range development in desert areas.

5. Utilizing the land of Wadi Natroun.

6. Selling fallow lands belonging to the State to individuals and companies capable of reclaiming and developing them.

The Land Reclamation Authority was entrusted with the above mentioned functions. However, despite all the efforts exerted in this respect, total area reclaimed between 1952-1960 did not exceed 78 800 feddans (see table 5.1/3), that is, at an average of about 10 000 feddans per year.

A much more rigorous programme of reclamation was included in the first five-year plan of development (1960 - 1965), for which about L.E. 111 million were allocated for reclaiming 520 000 feddans inside the Nile Valley and 83,000 feddans outside it (in the desert area). This 5-year plan of reclamation was part of a long term plan for reclamation utilizing the High Dam Waters. The Government, with the aid of a FAO/SF Soil Survey Team, and further survey work done by its own specialists, has explored a large area to select areas which can be developed for irrigation farming. Consequently, a long-term plan for the reclamation and development of a total area of 1 275 000 feddans of land was drawn up. It is expected that 1 052 000 feddans of this will be the net farming area. In addition, the High Dam waters, will also be utilized for converting 700 000 feddans from basin irrigation to perennial irrigation.

For the implementation of these programmes, the whole-set-up of land reclamation was reorganized and the following organizations were established subsequently.

1. The Egyptian General Desert Development Organization (EGDDO)

The organization is responsible for the preparation and implementation of reclamation and development projects in the desert areas (the New Valley, the Western Coastal Zone of Matrouh and the Eastern Coastal Zone of Sinai, Wadi Natroun and the desert areas adjacent to the Nile Valley such as Mariut project and Eastern Suez Canal and El-Menia).

2. The Egyptian Organization for the Utilization and Development of Reclaimed Lands (EOUDRL)

This organization is responsible for the full development and cultivation of the reclaimed lands and for preparing it for distribution to beneficiaries. It aims at settling immigrant farmers from over-populated provinces to the new land and endeavours the development of new communities both socially and economically.

3. The Egyptian General Organization for Land Reclamation (EGORL)

The organization is established to serve the two above-mentioned organizations in the physical implementation of all land reclamation and development works. Five State Companies specialized in the various stages of land reclamation and fully equipped with heavy machinery were established for this purpose to work under the direction and supervision of this Organization.

1.4.1.1. Reclamation and Settlement activities of EGDDO in the North Western Coastal Zone.

The reclamation and settlement activities of the EGDDO in the Western Desert (the North-Western Coastal Zone) may be summarized as follows :

(1) In the eastern part of the Zone, which lies between the borders of the Nile Delta and El Dabaa, and where the necessary water requirements for agriculture can be obtained from the Nile Water mixed with drains water, there exist two main irrigation projects : the Mariut (50-000 feddans), and its extension (18 000 feddans), and the El-Dabaa Project which is under study. In the latter project, Nile water will be utilized as a source of supplemental, i.e., irrigation besides rainfall, over an area of about 50 000 feddans.

(2) In the western part of the Zone, which is located between El Dabaa and Salloum, development projects in this area depend mainly on rainfall, runoff, and the utilization of the shallow underground fresh water layer floating over the water seeping from the Sea. The EGDDO reclamation activities in this part have been centered on rendering assistance to the bedouins in developing their lands and planting them with trees by using windmills, aqeducts and dykes. It is reported that about 14 500 feddans have been reclaimed in this way. Moreover, a pilot project for range-improvement in an area of 60 000 feddans was planned.

Furthermore, about 340 old Roman cisterns (storage wells) have been cleaned and reconstructed to provide drinking water for sheep and goats in the area. This is in addition to the construction of earth dams to provide irrigation for 1 200 feddans.

These achievements together with the establishment of a network of cooperative societies all over the coastal zone were among the satisfactory results accomplished with the assistance of the World Food Program Project on Nomads Settlement and livestock improvement which was concluded in July 1963. The purpose of the project was to reduce nomadism by encouraging settlement based on mixed and settled farming, through reclamation of desert areas and the improvement of animal husbandry practices including grassland management.

1.4.1.2. Reclamation and Settlement Activities of EAUDRL

The activities in the field of land reclamation and settlement were carried out by the Egyptian General Desert Development Organization (EGDDO), the Egyptian General Organization for Land Reclamation (EGORL) and the Ministry of Agriculture. However, in April 1966 a new authority was established, the Egyptian Authority for the Utilization and Development of Reclaimed Land (EAUDRL) to unite efforts of the various activities concerned with land reclamation and development based on Nile water irrigation, while the EGDDO continued to be responsible for land reclamation and settlement in desert areas based on rainfall and underground waters.

The EAUDRL started its activities on 200 000 feddans already reclaimed and put under cultivation by the EGDDO and the Ministry of Agriculture. In 1967 and 1968, 300 000 feddans were added, but in 1969 owing to financial difficulties, only 50 000 feddans can be reclaimed.

Table 30 shows the progress of reclamation activities since 1952. Total area reclaimed since 1952 and until 1959 amounted to 78 000 feddans. The process of reclamation was much enhanced and accelerated during the first Development Plan. The total area reclaimed as shown in the Table during the first 5 year Plan (1960 - 1965) was 536 000 feddans. In the second plan period (1965/66-1971/72) it was planned to reclaim an area of 658 000 feddans, of which 116 000 feddans were to be desert areas. (4)

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(4) The reclamation programme of the second plan includes a number of large and important projects which all aim at the creation of new integrated communities in different regions. Notable among these projects are the following:
(1) A project for reclaiming 312 000 feddans in the region which is located between Salhiya and South Port Said. This project will accommodate a large number of families and will require the establishment of a new Governorate containing 30 towns and 120 villages. This project will require a total investment of about L.E. 107 millions.
(2) A project for reclaiming and developing an area of 56 000 feddans located in the Governorates of Sharkiya and Kafr El Sheikh.
(3) The Russian Project. Two agreements were concluded with the Soviet Union the first concerning the reclamation of an area of 200 000 feddans west of Nubarya Canal; and the second provides for the establishment of a pilot farm equipped with all type of machinery and implements as well as irrigation facilities on an area of 10 000 feddans located East of the Desert Road and west of the area to be reclaimed in accordance with the first agreement.

TABLE 30 : Progress of Land Reclamation Activities 1952-1972

Year	Nile Valley and desert adjoining delta	Barren region inside valley	Desert region inside valley	Total feddans
	(feddans			)
1952-1959	74.500	—	4.300	78.800
First Plan 1960-1965	391 100	61 800	83.500	536 400
1965-1966	49 700	1 500	54.900	119 600
Total area reclaimed till end 1966	515 300	76 800	142.700	734.800
Second plan 1965-1966/ 1971-1972	527 000	1 500	116 000	658.000
Total area to be reclaimed by 1972	992.600	76.800	203.400	1272 800

Source: Agrarian Reform Authority, "Agrarian Reform and Land Reclamation", August 1966.

Total amount of investment needed to execute this second plan was estimated at L.E. 347 million. However, this Plan has not been implemented to the full extent as originally anticipated due to various circumstances such as the availability of funds and the increase in defence expenditures as a result of the hostile situation of the North-Western boarders.

Therefore, the target date of reclaiming 1 275 000 feddans by 1972 would not be achieved and the date may have to be shifted for at least two more years later (i.e. 1974) if the requested United Nations (WFP) assistance is approved; as this assistance will make it possible for the EAUDRL to continue reclaiming 150 000 feddans per year as planned. Table 31 below shows the total areas reclaimed and settled per year from 1966 up to 1974.

Table 31 Programme of Land Reclamation, Cultivation and Settlement (1966 - 1974)

Year	Area Reclaimed per year (1)	Total Area Reclaimed (2)	Area of Settlement per year (3)	Total Area Settled (4)	Total Area under Final Reclamation or cultivation (5)
	(		feddans		)
1966	176	176	-	-	176
1967	132	308	24 000	24 000	284
1968	132	440	30 000	54 000	386
1969	44	486	30 000	84 000	402
1970 1/	132	618	80 000	164 000	454
1971 1/	132	750	50 000	214 000	536
1972 1/	132	882	45 000	259 000	623
1973 1/	132	1 014	50 000	309 000	705
1974 1/	132	1 144	45 000	354 000	790
		(1 275 gross)		(402 000 gross)	(898 000 gross)

1/ Period of WFP Assistance as requested.

Source: EAUDRL, Ministry of Land Reclamation, Cairo, February 1969.

As mentioned above, the initial phases of reclamation is carried out by the EGORL. The EAUDRL takes over the reclaimed land from the EGOIR and carry out the following additional types of work:

1. Finalizing the reclamation of the land mainly by levelling the land and perfectioning the on farm irrigation system.

2. Improving the physical and chemical characteristics of the soil through specific methods according to the type of soil (such as adding gypsum to the heavy clay saline soils, adding Nile mud to sandy soils and continuous leaching of saline soils etc..)

3. Cultivating the land with suitable crops which under the prevailing soil conditions tend to further improve the quality of the soil and give eventually the maximum returns.

It is planned that lands will be fully reclaimed and planted for a number of years by the migratory, labourers under the direct supervision of the EAUDRL before they are offered to the cultivators for settlement. In most reclamation projects, and particularly in the Mariut project detailed plans and specification for the construction of housing, roads, community facilities have been implemented in the reclaimed areas for the settlers.

When the land reaches the level of economic return, which takes a period from 3 - 6 years, the migratory labourers and other prospective beneficiaries are surveyed for selecting the settlers. The settlers are considered as renters during the first three years. After the three year period of rent, the settlers have the choice to remain as renters or to become owners of the land. In the latter case, landowners have to pay approximately L.E. 1 600 over 40 years without interest which covers the cost of land reclamation and the price of the house and other facilities. The owner will also pay L.E. 2 - 4 per acre per year for irrigation water depending on the circumstances.

Settlement by farmers on five feddans areas is planned, and farmers are settled in vollages formed of 200 families (1 000 feddans). Drinking water and electricity are available in most villages, and each settler is provided with a cow, the value of which is to be paid over 5 years and is encouraged to raise some poultry.

The process of cultivating and settling the reclaimed land has lagged much behind the process of reclamation. Further perusal of Table 5.1/4 reveals that by the end of 1974 total area reclaimed would amount to 1,275,000 feddans while total area under cultivation would be 898,000 feddans and total area settled would not exceed 402 000feddans. Settlement is slow because it requires the establishment of many physical and social infrastructures and this in turn depends upon the availability of finance and the professional, technical and administrative resources to undertake successfully the settlement programme at the planned rate.

1.4.1.3. Conclusion

In conclusion it may said that the UAR plan for reclamation and settlement calls for an overall increase of about 1.3 million feddans or about 20% of the cultivated area in the country. It is expected that 1 052 000 feddans of this will be the net farming area. Settlement by farmers on five feddan areas is planned when farming development has proceeded to a certain point from which farmers, in some cases with assistance in the early stages, can achieve a substantial margin of return over costs. It is estimated that over 200,000 families comprising over 1 million citizens will be benefited from the distribution of the reclaimed and developed lands.

A recent economic appraisal of the Land Reclamation Utilization and Settlement Programme of the UAR carried out by the WFP Mission reveals that "the project as a whole is assessed to be technically and economically feasible". The internal rate of return for all three soil groups of the Project (i.e. sandy, clay and calcareous soils) is calculated to be around 14.1 percent. This measures up very well to the requirements of loaning agencies with funds available for the purpose of aiding developing countries. From the point of view of Egypt, the devleopment of whatever land can be brought under irrigation farming reasonably economically is necessary to meet the requirements of the expanding population. It is also necessary for the purpose of increasing export earnings and to reduce import requirements.(5)

(5) Economic Appraisal of Land Reclamation, Utilization, Development and Settlement Plan of the UAR Government, UNDP Cairo, March 1969, a draft report prepared by a member of the WFP Mission.

1.4.2. Land Tenure Legislation for Desert Areas

The increased activities of the UAR Government in reclaiming and developing fallow lands in the Nile Valley and desert lands outside the Valley, necessitated amendment of the existing legislation or enactment of new ones to deal with the tenure and settlement problems of new lands.

Prior to 1958, there was actually no legislation dealing explicitly with land tenure and land use in desert areas. However, during the last century, some Decrees (SUPREME ORDERS) concerning desert lands were issued during the reign of the Khedewys who were then ruling over the Country. Some of these Decrees provided for granting Bedouins (Arabs of the Desert) the right to exploit desert lands through cultivation and grazing. Amongst various Supreme Orders concerning land property, the two most important ones were the Supreme Order of 21st May 1867 and that of 9th September 1884. According to these two Supreme Orders, the ownership of State fallow lands was subject to prior permission and approval of the Government through a prescribed procedure.

Even the Egyptian Civil Law did not deal explicitly with ownership rights in desert areas. Under the old Egyptian Civil Law, the interpretation in Jurisprudence and court judgments had been directed to consider desert lands situated outside the Zimam (cultivated districts of the Delta and the Nile Valley) as Matrouka (abandoned) lands, ownership rights on which could be acquired through cultivation, plantation or construction of a building. This interpretation was based on Article 57 of the Ahli (National) Egyptian Civil Law, which provided that "as regards the uncultivated land lawfully owned by the Miri (Government), nobody shall lay his hand thereupon (hold) except by Government permission ... But any person who had cultivated any of the said lands, or planted or put up a building thereon, becomes the owner of that land in absolute property; but he shall forfeit his right if he does not use the land for a period of five years during the fifteen years following the date on which he has laid his hand upon (held) that land.

Such had been the case until the year 1940 when the Military Order No. 62 of 1940 was issued to deal with land possession and ownership in Frontier Districts.

However, when the Martial Law, under which such Order was issued was abrogated, the same provision was enforced by Order in Council (Décret - Loi) No. 111 of 1945. Under this Decree, however, foreigners were prohibited from possessing, except by inheritance, lands in the Frontier Districts, or from acquiring any real estates rights thereon. It also stipulated that Egyptians must obtain in advance a permission from the Government with regard to the lands they possess by any means, other that inheritance, and to the real estate rights they have. It was also stipulated that "any property transfer and any establishment of any real estate rights contrary to the provision of the Military Order shall be nul and void", and that "the status quo remain unchanged for proprietors....."

In 1948, the new Egyptian Civil Law was issued. Article 874 of the said Law provides that "Uncultivated lands with no owners shall be the property of the State, and no person can possess these lands or lay his hand thereon (hold) except by permission from the State according to the regulations in force; but if an Egyptian citizen cultivates these lands, plants trees or builds thereon, he shall immediately possess the cultivated, planted or built part even without permission from the State; but, he shall lose the property if he does not use the land for five consecutive years during the fifteen years following the date of possession.

To accelerate the development of desert areas and the settlement of Bedouins thereon, the need for a special legislation was felt. This was done in 1958 when a special Law governing possession and ownership of desert lands was issued (Law No. 124 of 1958). In its Explanatory Note, reference was made to the "argument which has been raised regarding Article 874 of the Civil Law of 1948 which provides for land ownership by free acquisition.... Heated debates followed specially as to whether this article abolished the Order in Council (Décret - Loi) No. 111 of 1945 or not. There were two contradictory views; one saying that article 874 of the New Civil Law 1948 has in fact abolished the Décret - Loi of 1945 for the main reason that this article followed the issuance of the said Décret - Loi; whereas the other view holds to the contrary that the said Décret - Loi concerns the desert land property while the new Civil Law deals with land property in general and, therefore, the Decret - Loi remains in force as a special legislation.

The Explanatory Note of the 1958 Law adopted the view contained in the Décret - Loi of 1945, and accordingly it has disregarded the rights supported by Article 874 of the Civil Law of 1948. Thus the 1958 Law denied the real estate properties rights established in desert lands even if these rights were established prior to the enforcement date of Law No. 124 of 1958.

1.4.2.1. Property rights under Law 124 of 1958

The recognition of property rights previous to the enforcement date of the 1958 Lawwas according to Article 5, restricted to the cases where the property rights were supported by registered deeds and/or final judgements established prior to the enforcement date of the Law, or by certificates issued by the Government and had not yet been registered ...

The application of the said Law has, unveiled certain deficiency and created feelings of insecurity and anxiety in the minds of the inhabitants of desert areas regarding non-recognition of their land properties which had been supported by Article 874 of the New National Civil Law, which had been in force since 1883. The 1958 Law and Article 57 of the Old Civil Law provided for the alienation and lease of desert lands to any tribesmen who had occupied a piece of land by orchard or building before August 1957 against payment of one-tenth of the value of land at delivery and the rest to be paid in instalments over a period of 30 years. Occupants of desert lands adjacent to cities applied for purchase of lands in accordance with the provisions of this Law. But the bedouins, who are the traditional occupants of these desert lands were reluctant to apply as they resented the idea of applying for the purchase of land which they believed to possess and utilized for many generations. However, upon the initiative and the efforts of the E.G.D.D.O. and through its technical and material assistance to the bedouins for cultivating their lands and establishing fruit tree and olive orchards, some bedouins were induced to apply for the alienation of pieces of lands which they had developed, or were developing them into orchards. They thus were able to obtain some assistance from E.G.D.D.O. in the form of windmills to be installed on their wells and to get seedlings of olives and other trees to be planted in their orchards. This is besides the technical assistance extended to them and the

establishment of cooperative societies for the distribution of WFP aids in food and fodder to serve their living and production requisites. In spite of all these inducements, few bedouin families applied for the alienation of their lands or purchase of land in accordance with the provisions of the 1958 Law.

At present, however, it is difficult to assess the progress of registration of titles made under the 1958 Law; the number of cases registered till to date and the area affected is indicated in the following table.

Table 32 showing the number of bedouin families in the Western Desert to whom land was alienated in accordance with the provisions of the 1958 Law.

Type of Tenure	Number of Beneficiaries	Area
		feddans
Lands sold and alienated to customary holders (1960 - 1961)	549	2251
Lands sold and alienated to lessees	324	2433
Alienated reclaimed lands with windmills	558	4715
T o t a l	1431	9399

In fact, many difficulties and obstacles have been encountered in the application of the 1958 Law mainly because the provisions of the said Law were not based on thorough understanding of the socio-economic conditions affecting the life of the inhabitants of desert areas. It has already been mentioned that the

application of this Law in some desert areas has caused many worries and much anxiety to the tribesmen in these regions. There were some provisions in the Law which proved to be difficult to apply without major revision and amendments. The Government, therefore, had come to the conclusion that Law No. 124 of 1958 should be amended to ensure due support to the legitimate rights of tribesmen and to ensure the recognition of their property rights which had been established before the enforcement date of this Law (1).

1.4.2.2. Law No. 100 of 1964

Accordingly, a new Law (Law No. 100 of 1964) was promulgated to regulate the land tenure arrangements in all State-owned lands including desert lands.

Land categories and difinitions : Law No. 100 of 1964 deals with three categories of lands belonging to the State. These are : (i) agricultural lands, (ii) fallow lands and (iii) desert lands. Article 2 of this Law contains the legal definitions of these land categories : It defines "Agricultural Lands" as including the lands inside the Zimam (districts of cultivated lands) as well as the adjoining lands extending outside the Zimam to a distance of 2 kilometers, because these lands are considered the natural extension of the lands inside the Zimam and are in fact being cultivated.

Concerning "Fallow Lands", their definition specifies that they mean uncultivated lands within the agricultural lands in the Zimam as well as adjoining uncultivated lands outside the Zimam; and all these lands are by their situation and nature considered as zones for immediate horizontal expansion and development.

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(1) One more consideration that necessitated the amendment of Law No. 124 of 1958 was the fact that during the promulgation of the said Law, the Egyptian General Desert Development Organization (EGDDO) was affiliated to the Ministry of War, and the Minister of War had been in charge of enforcing the said Law and supervising its application. However, by virtue of two Presidential Decrees No. 1899 of 1961 creating the Supreme Council of the General Organizations, and No. 3317 of 1962 regarding the Egyptian General Desert Development Organizations, the latter Organization (EGDDO) has become affiliated to the Ministry of Agrarian Reform and Land Reclamation, and in consequence of this change the competence of carrying into force the 1958 Law and supervising its application had to be transferred from the Minister of War to the Minister of Agrarian Reform and Land Reclamation, leaving the exceptional powers provided for in this Law to the Minister of War in connection with the strategic and military considerations on the one hand and for the sake of public safety and State security on the other hand.

As to the "Desert Lands", these have been legally defined as including all cultivated and uncultivated lands located within the zones considered as being outside the Zimam (after the distance of 2 kilometers outside the Zimam).

The phrase "Lands inside the Zimam" as stated in this article, means lands which have been surveyed in detail and recorded in the Register of the Survey Department as well as in the Mukallafa registers (records of land property) at the Land Taxation Department, and which are in this case subject to real estate tax on lands.

As regards to the phrase "Lands outside the Zimam", this include desert lands and all other lands which have not been surveyed in detail and have not been recorded either in the register of the Survey Department or in the Mukallafa registers at the Land Taxation Department, and which are not as such subject to real estate tax on lands.

As mentioned above, the Law No. 100 of 1964 deals with all types of State owned land including desert and fallow lands which are dealt with in Part III of the said Law (Articles 22 to 42). This part contains three principal sections. Section I deals with the disposal and alienation of desert and fallow lands for reclamation and development purposes. Section II deals with the granting of desert lands on lease basis. Section III deals with distribution of reclaimed desert lands. These three sections will be discussed subsequently.

1.4.2.3. Disposal of desert and fallow lands for reclamation purposes

Article 22 of the first section empowers the Minister of Agrarian Reform and Land Reclamation (i) to fix, by an ad hoc decree, the districts in which fallow and desert lands may be sold for development purposes, after ascertaining that these lands may benefit by irrigation from artisian water or any other water source, and (ii) to dispose of fallow and uncultivated desert lands by mutual agreement sales to would-be buyers for development purposes within the limit of

twenty feddans of fallow lands and fifty feddans of desert land for each buyer. Article 23 of the 1964 Law stipulates that the buyer must be of the United Arab Republic nationality, major, of good reputation, and has not been sentenced to any penalty or imprisonment in a dishonouring offence. The same Article stipulates that the buyer shall undertake to develop the land sold to him and to cultivate it within seven years in case of fallow lands and ten years in case of desert lands beginning from the date of land delivery. This Article provides that the Executive Regulations shall lay down the rules for the sale by mutual agreement, the assessment of price, the conditions of payment, the period, the interest and other such conditions.

Article 24 specifies that if the buyer fails to meet his obligations in developing the land sold to him, neglects its cultivation, does not carry out development within the prescribed time limit and consequently disregards the agreement by which he is bound, the resolutory condition which is contained in the sale contract shall then be enforced, rendering the contract of sale null and void since the original date of the contract; and the buyer shall consequently return the land and pay the proper rent from the date of delivery to the date of return, following the enforcement date of the resolutory condition; and that any immovable assets built up by the buyer on the land shall be transmitted to the Government free of charge as compensation to the State for the failure of the buyer to meet his obligations and thus causing harm to the public interest.

Article 25 stipulates that buyers shall only be allowed to dispose of the land sold to them if full payment of the price has been made; and that such disposal shall be to small cultivators who fulfil certain conditions so as to avoid concentration of large areas of developed land in a few hands and to give chance to bigger number of small cultivators to own the land.

Article 26: to safeguard the public interest and to encourage the development of fallow and desert land, Article 26 empowers the Minister of Agrarian Reform and Reclamation to authorize the selling of fallow and desert lands to companies

(public and/or private corporate bodies) in areas larger than the 20 and 50 feddans limits set for individual buyers, provided these corporate bodies carry out the development and the cultivation of the lands they buy within 10 years from the date of land delivery to them; otherwise the provision of Article 24 regarding the dissolution of the sale contract, the returning of the sold land, the payment of rent and the transmission of immovable assets on the land to Government free of charge, shall be applied.

1.4.2.4. Granting desert lands on lease

Article 27 provides that desert lands shall be given on lease to small cultivators within the limit of ten feddans for each. It is to be noted here that lease is a preliminary stage prior to distribution and disposal of land, and that in this case the exploitation of such land shall be granted to citizens of good conduct, who deserve more care and whose occupation is cultivation of land as their principal source of living; and in addition, they, together with their families do not own more than two feddans of agricultural lands (the minimum prescribed by the Law of the Agrarian Reform for small agricultural holdings) or ten feddans of fallow and desert lands per citizen and family.

Article 27 provides also that lease priority shall be given to those who have fulfilled the aforesaid conditions and to those who hold the leased land and cultivate it in fact. If the cultivator is not among those who are entitled to lease, social considerations shall be taken into account, such as the larger size of the family, the income level etc., giving preference to the inhabitants of the nearest zones to the leased land.

The above mentioned small cultivators shall, according to this article, be exempted from payment of any deposit in cash or in kind, as in the case of agricultural lands lease.

Since the rules of real estates taxes on agricultural lands inside the Zimam have not yet been applied to desert lands outside the Zimam, it is not possible to estimate the rental value of these lands on the basis of real estate tax rates. Article 28 of the Law has, therefore, referred the matter to the Executive Regulations with a view to laying down the rules which will be followed in assessing the rental value of desert lands.

1.4.2.5. Distribution and disposal of developed desert lands

Desert lands which have been reclaimed, developed and cultivated by the State shall be distributed to small cultivators and graduates of Agricultural Institutes, so that each shall have a small holding of not less than 4.5 feddans and not more than 7.5 feddans depending on the fertility of the land and the social conditions of the beneficiary (Article 30).

The same article stipulates that those to whom reclaimed land shall be distributed must have the prescribed qualifications, viz, they must be of the UAR nationality, major, of good reputation, that they have not been sentenced to any penalty and/or imprisonment in a dishonouring offence; that their occupation is land cultivation, shepherding and/or hunting as their principal source of living; and that the property of each, together with his wife and his minor children's property are altogether less than two feddans of agricultural land or ten feddans of fallow and desert lands.

Article 31 specifies the order of priority in distributing reclaimed and developed desert lands as follows: (1) first priority for those who have previously occupied and utilized the reclaimed area. It is obvious that the development and reclamation works cause harm to the inhabitants of the developed area and deprive them from their principal source of living whether in animal grazing or in seasonal cultivation which they customarily carry out. Therefore, these citizens deserve the first priority in land distribution in compensation for the unintentional harm they have undergone as a result of the desert land development projects which are drawn up in the general interest of the community.

Second priority is to distribute equally the remaining surplus (after the distribution to those living in the reclaimed zone) as follows : (a) to the inhabitants of the overpopulated zones in the various governorates of the Republic, and (b) to the inhabitants of the desert zone in which the developed land under distribution is situated, including the inhabitants of the other not so thickly populated zones of the Republic.

The order of priority for distributing the first half of the remaining developed desert land which is reserved to the inhabitants of overpopulated zones is as follows : (1) to Agricultural Institutes graduates as well as the Tarahil labourers (hired workers transported from one place to another to work in the fields) who have continuously worked in developing, constructing and cultivating the land under distribution; (ii) to demobilized Armed Forces soldiers; and (iii) to the inhabitants of the overpopulated zones who accept to emigrate to the reclaimed area.

As to the distribution of the second half which is reserved to the inhabitants of the reclaimed zone, the order of priority is as follows : (i) Agricultural Institutes graduates and agricultural labourers who have continuously worked in developing and cultivating the land in appreciation of their efforts in developing these lands, (ii) to demobilize Armed Forces soldiers, and (iii) to the inhabitants of the Zone in which the developed land is situated as well as to the inhabitants of the neighbouring zones.

1.4.2.6. Organization of Cooperative Societies

Articles 64 to 68 have dealt with the organization of agricultural cooperative societies which the Ministry of Agrarian Reform and Land Reclamation is keen to propagate among the small owners and lessees of agricultural and desert lands. Article 64 provides that the lessees of agricultural and/or desert land under this Law, and the persons to whom the ownership of these lands will devolve

shall be ipso jure members of the cooperative society which the Ministry will create or establish.

Article 65 gives details of the services which these cooperatives will render in achieving the objectives of their establishment. These services include providing the farmer with production requisites and credit, organizing his crop rotation and land utilization, marketing his produce of major crops and providing him with other necessary agricultural, social and economic services.

Further details concerning the cooperative societies and their development in the North Western Coastal Zone are found in a subsequent section.

1.4.2.7. Transitory Provisions

Article 75 of this Law contained transitory provisions purporting the recognition of property rights previous to the enforcement date of Law No. 124 of 1958. This article recognizes the tribesman's ownership right to that part of his holding which he had planted it with trees or actually cultivated it since at least one year preceding the date of enforcement of the 1958 Law; provided that total area possessed will not exceed the ceiling limit set for land ownership. Right of ownership to parcels of land depending on rainfall and only seasonally cultivated are not recognized according to this article. Article 76 stipulates that ownership rights will not be granted if the holder fails to notify the Governorate or the E.G.D.D.O. of all particulars regarding his holdings and this should be done within one year from the enforcement date of the 1964 Law (1)

Article 80 specifies that occupants of desert lands by putting up buildings or growing trees, who are not considered as proprietors by virtue of this law may request to buy such land or take them on lease for a period of not more than nine years. However, if they had not submitted this purchase request within one year of the enforcement of the Law, (this was amended to make it within a delay up to end December 1969) or if they had in fact submitted but it was dismissed, the Egyptian General Desert Organization would have the right to demolish the construction and pull up the plants or keep the buildings and the plants considering them as being the property of the State.

(1) This was amended and the delay was extended until end December 1969

1.4.2.8. General Concluding Remarks

Although the old and new Egyptian Civil Law relating to Landed property did not deal explicitly with ownership rights in desert areas, yet these two laws contained important provisions under which any Egyptian citizen could acquire property rights on desert lands through cultivation or plantation of trees or by putting up a building, even without prior permission from the Government. However, this right was subject to forfeiture if the land was not used for a period of five years during the period of fifteen year following the date of the acquisition of the proprietory rights.

These legal provisions relating to acquisition of ownership rights in desert lands encouraged tribesmen to reclaim and develop these lands and expand cultivated areas and facilitated their settlement in line with the National development Policy.

The Law No. 124 of 1958 governing possession and ownership of desert lands was especially enacted with the objective of developing such lands by requiring tribesmen to acquire and establish their tenural rights in a legal prescribed manner. As this Law did not take into account the customary and legitimate ownership rights of tribesmen acquired and established prior to this Act, it gave rise to suspicions and worries amongst tribesmen and discouraged them to register their tenure rights under this law.

An effort was made to rectify the situation by replacing Law No. 124 of 1958 with new Law No. 100 of 1964. However this New Law has some shortcomings which also impede and discourage the legal establishment of rights and the rectification of the agrarian pattern in the desert areas. A reference to the shortcomings in the Law 100 of 1964 and suggestions for modifications and improvements will be made in the subsequent sections dealing with the Scope for Development in order to facilitate the process of settling tribesmen and to create progressive and viable desert development schemes.

2. Agricultural Cooperatives and Credit

2.1. Introduction

The E.G.D.D.O., set up by the UAR Government for the development of desert areas, started operations in the N.W. Coastal Region during the year 1961 with the major objectives of improving substantially the economic and living conditions of tribesmen. It initiated important programmes and activities to change the face of the arid and wild desert through development of agriculture, horticulture, animal husbandry, soil and water resources, transport and communications, etc. and by providing improved and modern facilities and amenities of life and living.

One important vehicle for executing the development activities and programmes was the involvement of the tribal people through a network of cooperative societies. Cooperatives were considered the most effective local organisations for involvement and participation of tribal people for the implementation of various development programmes, and an effective tool towards the sedentarization of the tribesmen and the development of new communities.

2.2. Organisational structure

Before the start of the EGDDO, the responsibility for spreading and organising cooperative movement in the Region rested with the Ministry of Social Affairs, but, with the establishment of EGDDO, this responsibility for the cooperative movement in its all aspects was transferred to this organisation. It became an essential part of its official policy and great efforts were made to bring maximum numbers of tribesmen in the cooperative fold.

For the purpose of organizing, guiding and supervising the cooperative movement, EGDDO has established a Cooperative Division which consists of One Cooperative Director, who is assisted by Cooperative Officers at H/Q and Cooperative Inspectors at Sector Level. All these are employees of the EGDDO and generally have an agricultural education background.

Further, at the regional level, there are two super co-operative organisations, namely, the General Cooperative Society and the Regional Co-operative Union. The former is responsible for cooperative economic activities, while the latter union handles non-economic functions. Local cooperative Societies are supposed to be the members of both these two super cooperative organisations.

The Cooperative Division of the EGDDO supervises and directs the Operations and functioning of all the local cooperative societies as well as the two regional cooperative Organisations.

According to the direction of the Cooperative Division of EGDDO, each Cooperative society should have a managing staff consisting of:

One Manager	-	(Graduate from the Faculty of Agriculture)
Clerk	-	" " Intermediate Agricultural School
Storekeeper	-	" " " " " and

a guard.

Each local society is a multipurpose body and has a store of 200 ton capacity. Further, there are five stores with a capacity of 1000 tons each in the four Sectors of Burg-El-Arab, Dabaa, Matrouh and Sidi Barrani. The construction of all these stores was financed by the EGDDO.

As all these cooperative societies are dependent upon EGDDO for financial and material support, therefore, tribesmen consider cooperatives as branches of EGDDO and an instrument of distribution of Governmental Aid. The participation of Members in the management of affairs of Cooperative Societies is very limited and most of their decisions are made by the cooperative staff.

2.3. Growth of the Cooperative Movevement in the Region

The spread of the Cooperative movement in the Region is of recent origin and started after the Revolution. Till 1960, when the responsibility for cooperative affairs was with the Ministry of Social Affairs, only about 6 cooperative societies were organised in the Region.

With the establishment of EGDDO and the transfer of responsibility for Co-operative work to this Organisation, the number of cooperative societies began to increase rapidly due to the very keen interest taken by the organisation. The movement received rapid acceleration with the start of the WFP Project in 1963. A beneficiary of the WFP must be member of a Cooperative Society. The tribesmen, in order to receive maximum WFP Aid, tried to enlist as many family members, friends or relatives as possible as members of cooperative societies. The tribal leaders considered it a matter of prestige for them to increase the membership of their tribe or sub-tribe as the case may be. Therefore, the existing cooperative membership position does not present a true situation regarding actual membership, capital and assets etc..

The following table shows the growth of the cooperative movement in the Region before and after the EGDDO.

Table .33 Growth of Cooperative Membership in the Region

Year of Registration	Number of: Cooperative Societies		Total membership		Share Capital		Average per Society	
	Yearly	Cumulative Total	Yearly	Cumulative Total	Yearly	Cumulative Total	Membership	Capital
A) Before EGDDO (1960)	4	4	5595	5595	£E 12713.50	£E 12713.50	1399	£E 3178
b) Since EGDDO								
1961	2	6	995	6590	882.50	13596.00	498	441
1962	20	26	7323	13913	5117.50	18713.50	366	256
1963	6	32	1995	15908	1171.00	19884.50	333	195
1964	3	35	907	16815	504.50	20389.00	302	168
1965	2	37	41	16856	40.00	20429.00	20	20
1966	3	40	168	17024	98.00	20527.00	56	33
	40		17024		20527.0		425	514

A perusal of the above table shows the slow progress of the movement before functioning of EGDDO in the Region. There was a phenomenal increase in number of cooperative societies and in membership during 1962 as compared to any other period. This was due to the start of the WFP Project in 1963, preparations of which were started in 1962 by way of bringing tribesmen in the cooperative fold to be eligible for getting subsidized food and feeds under the Project.

The average number of members per society is 425 with an average share capital of L.E.514. The number of members per Society is thus too large for sound management purposes.

2.4. Important types, functions and achievements of Cooperatives in the Region.

In this Region, there are only multipurpose cooperative societies which are supposed to perform the following functions:

1) Supply of agricultural production requisites like seeds, seedlings, fertilizers, pesticides, agricultural implements and tools.
2) Organizing a system and arrangements for the supply and use of modern agricultural machinery like tractors, harvestor combines etc..
3) Helping tribesmen in improved plant production and plant protection..
4) Organising and making available veterinary services.
5) Organising marketing.
6) Supply of consumers goods.
7) Any other related functions.

In actual practice, the cooperative societies are functioning as the distributing channel for the EGDDO.
Prior to WFP Project, the main activity of cooperative societies was to obtain permits for fodders and seedlings. The costs of transport, payment and distribution etc... involved in this activity were borne by the local leaders outside the cooperative society.
With the start of the WFP Project in 1963, the cooperative societies have been the chief vehicle for the distribution of animals feeds under this Programme. The cost of WFP feed is £.16.00 per ton against the market price of about £.45.- per ton. That is why the tribesmen have swelled the cooperative membership. Their other important achievements are:

1) EGDDO has provided financial aid and technical assistance for the installation of 1000 windmills for the cooperators.
2) Over 300 cisterns have been repaired and cleaned for improving drinking water supply.

3) 52 tractors bought by the EGDDO from the WFP Sale proceeds have been supplied to societies for ploughing purposes. The tractor charges are seventy piasters per hour and are substantially subdized.
4) About 44000 olive seedlings and about 23000 fig, almond and peach seedlings have been sold to members at the subsidized rate of 2-4 piasters per plant against the actual cost of 11 piasters per seedling.
5) The Central Cooperative Society started marketing activities through the purchase of wool and barley, but it has not achieved any success in this activity.
6) Some societies have been given labour contracts for execution of some works but these societies consign these contracts to private contractors at a 5% profit margin and the original purpose has been defeated.

2.5. Important problems and difficulties.

1- The tribal system of social organisation is a great impediment to the growth of a healthy cooperative movement. The tribal organisation is based on custom and tradition and it is dominated by tribal leaders who are the decision makers. Therefore, the cooperative principle of equality of right and voting does not find any place in this structure. A tribal chief is afraid that a cooperative society may erode his power and influence and may replace him ultimately and, therefore, he is not well disposed of towards it. In actual practice, the Cooperative Societies have sometimes become tools in their hands to exploit the local people and use the cooperative for their own selfish ends.

2- A very high rate of illiteracy amongst the population along with a very rigid and conservative outlook of life do not encourage the spread of the cooperative movement. They cannot undertake and participate in management and financial affairs of the Societies.

3- Usually, the membership of a cooperative society is confined to members of a particular sub-tribe or clan with the result that the area of operation of a cooperative society becomes very large and extensive and sometimes overlapping. It therefore becomes difficult to manage and supervise a cooperative society and ensure its proper functioning.

4- Due to the periodical movement of the tribesmen, there is no permanency and consistency of membership. It is a big problem to maintain efficient contact with members and to effect recovery of dues and outstandings.

5- There is no effective coordination between the national cooperative movement and the cooperativesin the region which is the sole concern of the EGDDO.

6- Due to arid and harsh climatic conditions and lack of social amenities, the administrative staff are not much enthusiastic about cooperation and are not interested in the country side.

7- There is no proper system of maintenance of accounts and account books, inspection, audit and supervision, guidance and training.

8- Due to closeness of the region to Libya, and the prevelance of the same tribal system accross the border with close kinship ties, many influential tribesmen are involved in extensive smuggling operations accross the borders and are not interested in cooperation.

9- Lack of appreciation on the part of the tribesmen of the role of cooperativesin the improvement of their economic condition and complaints of discrimination in distribution of EGDDO aids and subsidies are other important factors hampering the spread of the movement.

3. Agricultural Extension and Veterinary Services

Actually, at present there is no exclusive Agricultural Extension agency as such operating in the region for the development of Agriculture on scientific and improved lines. Before 1962, the Ministry of Agriculture was responsible for carrying out agricultural extension activities and for supplies of services to farmers in the region. With the start of the activities of the EGDDO in the region, the role of the Ministry of Agriculture was limited to making available only veterinary services to farmers while all other Agricultural Extension and development activities were entrusted to EGDDO who have one Agricultural Division with the following staff in the region at :

A - At Head Quarter (Marsa Matruh)

Chief of the Agricultural Division assisted by :	one
Farm Machinery Specialist	one
Plant Protection "	one
Crop Production "	one
Horticultural "	one
Range Management "	one
Animal Husbandry "	one

B - At Sector Level, the Agricultural Division have the following Staff :

i - Farm Machinery Assistant	one
ii - Plant Protection cum Horticultural Assistant	one

Further, there is one Range Management Assistant at Solloum and one more is proposed to be appointed at Sidi Barani in the near future.

The Ministry of Agriculture have the following staff in the Region :

One Veterinary Assistant at Solloum (for quarantine purposes)
One Veterinary Assistant at Sidi Barani
and One Veterinary Assistant at Fuka

They have one Veterinary Centre at Marsa Matruh which is supervised by one Veterinary Specialist of the Ministry.
The main purpose of this Centre is to attend to animal breeding, animal health and poultry production.

The most important achievement in the field of Veterinary work has been the successful demonstration of the treatment against, high infestation with internal parasites in animals. This treatment has now been accepted by breeders and is an indispensible measure of the animal health protection. Successful dipping demonstrations against external parasites were carried out by the Project.

One poultry station has also been established at Marsa Matruh by the EGDDO in cooperation and with the assistance of the Ministry of Agriculture, with the aim of improvement of poultry production in the region mainly for home consumption. This station is manned by one veterinarian and one technician.

Further, the EGDDO have the following research & extension farms in the region :

i - One Agricultural Experimental Farm and Nursery at El Qasr
ii - One Nursery and Experimental Station at Fuka (30 Feddans)
iii - One Nursery in Burg El Arab (30 Feddans)

These farms and nurseries are being managed and supervised by the staff of the Agricultural Division of the EGDDO at Sector level.

There is at present no Agricultural Extension Institute in the region for imparting extension education and training in extension methods.

The Agricultural Extension activities in the region generally relate to distribution of some seeds of barley and vegetables, plants of olives, figs, almonds and other fruit species, supply of fertilizers, renting of tractors and other farm machinery, facilities for maintenance of windmills and some plant protection services and the distribution of feeds under the WFP Project.

At field level, all those activities are actually carried on by the staff of the Cooperative Division of EGDDO through multi-purpose Cooperative Societies which number about 40 in the whole region.

The present state of affairs in the field of Agricultural Extension is not of the desired extent or level and needs many modifications and changes for improvement of agriculture, of breeding and management of livestock especially sheep and goat production, range management and forrestry, and soil and water conservation.

4. - Agricultural Institutions and Services

4.1. Rural Sociological Issues

No detailed survey or study relating to rural sociological aspects of the population of the region was undertaken by the FAO team directly. Assistance was sought from the Faculty of Agriculture of the Alexandria University for studying the rural sociological aspects. They made available the services of Dr. Hussein El-Kholy, as consultant for this job.

In this region, the prevelent system of social organisation is tribal in character in which custom and tradition play an important role, in regulating social and economic behaviour relations and ties between individuals and groups of people in the Society. The important rural Sociological aspects of the tribal people are described below :

(i) Familism - An extended type of family or a joint family system is the prevelent form of family organisation. The average family size is between 7-8 persons. The family is valued above the individual and individualism is, by and large considered as selfishness. The family tie is highly respected and a man is quite important if he has powerful family members and relations because of a sense of security which he feels as a result of close association. Due to this close attachment to familism and tradition, they are likely to be resistant to channels of communication, originating outside the community because outside information is apt to disrupt tradition and family cohesion. Being emotionally attached to the family, a tribesman's loyalty is more to his family members and it is a difficult task to persuade him to move to better opportunities of living and earning outside his family in other parts of the country.

(ii) Traditionalism and Conservatism

Customs and traditions are by and large, basically religious. In almost every action and behaviour, the tribesman seeks to conform to custom, tradition and religion. Novelty and changes do not have much appeal; rather new ideas or things are generally viewed with skepticism. Conservatism appears to be culturally sanctioned. Old folks are respected since they embody the folk wisdom of their group.

(iii) Reverence to age

Old folks and their opinions are highly respected, loved and valued. Sons, even when grown up and married, manifest profound respect for their parents. Obedience to parents is considered a sacred duty and dis-obedience to them is considered a religious sin. The locus of authority and traditional decision making processes are manifest in family structure as noticed from family head status-rate. Elders rather than youngsters are always sought for advice. Consulting sons or daughters for their marriage is usually not practised.

(iv) Group Solidarity

An important feature of the tribal society is their ideal of behaviour towards fellow tribesmen. This ideal is reflected in a strong sense of mutual obligation within the framework of family and friendship, a general preference for small-group identification and a willingness to criticize anyone who deviates greatly from these customary norms. This concept pattern tends to be incompatible with the trend toward individualization that characterizes urbanized and industrialized communities.

(v) Paternalism

The tribesmen regard the state as being responsible for their welfare. They rely heavily on the government for all kind of services that would improve their social and economic conditions.

(vi) Factionalism

The tribesmen are frequently plagued by greater-than-normal amounts of factionalism. If the members of one faction show interest in a new programme, it is quite usual that the members of another faction may immediately offer opposition just for the sake of opposition to this programme without any logic and without attempting to understand its merits.

(vii) Fatalism

The tribesmen are great believers in fate. Any failure, mistakes or mishappenings or illness etc., are attributed to fate. A fatalistic outlook with a firm belief that whatever happens is the will of 'God', is the best adjustment that a tribesman can make to an apparently hopeless situation in hard, harsh and desertic conditions of great scarcity.

(viii) Folk lore and superstition

Tribesmen greatly believe in 'evel eye'. In suspected cases, charms are sought to be worn by the afflicted persons, or verses are recited from 'Quran' as a remedy to ward off the evel effect. Illness is considered as God's test of the patience, faith and endurance of the faithful.

(ix) Pride and Dignity

The tribesman is proud and highly values his self respect. He can forego many pleasures if their satisfaction were to hurt his pride or dignity. Fear of loss of face can threaten and handicap sometimes development programmes such as child and health welfare.

(x) Socio-Cultural Isolation

The degree of socio-cultural isolation of the tribesman can roughly be judged by knowing their accessability to main services, which, in turn, serve as channels for communicating new ideas and practices.

It was found that only about 48% of the houses have access to railway stations, while the rest of 52% of the houses are far away from the railway stations. 27% of the houses are located on paved roads; 9% on gravel roads and the rest of 64% are located on dirt roads and foot trails.

Besides the above, socio-characteristics of the tribesmen, some other important psychological obstacles are as follows :-

1 - Submission: The tribesmen often develops submission to the forces of his environment and holds to the idea that no amount of manipulation will change things as nature meant them to be.

2 - Contentment: The tribesman feels that everybody should be satisfied with his lot in life and praise God for what he has got. An attitude of contentment with what one possesses as predestined by God, is the keynote of his happiness. Love of too much and greed are condemned. This is discernable in some of their proverbs such as 'a little, which will endure rather than the plenty which will be cut off', or 'contentment is an inexhaustible treasure and so on.

3 - Pessimism: The tribesman believes that human happiness and achievement are behind and not ahead of him. Consequently, he should seek guidance from the past rather than look to the future for the sake of knowledge, justice, and value. He also believes that every deed of forefathers was good and many actions of those who followed are bad. This pessimistic outlook on the present and about the future affects his attitude twords change. As it is believed that change produces regress rather than progress, little motivation is left for the individual to seek it.

4 - Feelings toward Government : Tribesmen consider both government and government officials to be agencies of imposition and control, and hence to be feared. To keep away from governmental institutions was always the safest policy. Because of this suspicious nature of the tribesmen; some government officials doubt whether it is possible to bring about important changes in tribesmen's ways of life and living.

Chapter VI

MARKETING

1. Livestock and Meat Marketing

1.1. Introduction

Although the Government operates a maximum meat price the animal produoer in U.A.R. enjoys a high degree of freedom as to the quantity and quality of his output. The returns of the producer being largely determined through the marketing mechanism, every effort should be made to create an efficient marketing system. Such a system can also play an important role in maintaining stock numbers at a level which is in keeping with the carrying capacity of the region. Furthermore a well developed marketing system may serve as a source of information on the quality and quantity of production and price levels, so important for the formulation of policy measures.

1.1.1. Previous investigations

When the expert started work on the project no large-scale investigations had been carried out in the field of livestock marketing in the North Western Coastal Region. In April 1968 Mr. Faruk el Kashef published his work: "Project for Cooperative Marketing of Sheep and Goats in the North Western Coastal Region (64 pages).

1.2. The supply and demand for livestock and meat

The high proportion of self-suppliers and the lack of adequate organized marketing institutions in the past time are the reasons why the supply of livestock can only be estimated. The estimations are based on the livestock censuses, the last of which has been made in 1967. The movement of flocks greatly influences the situation of supply. Flocks and therefore supply can increase or decrease considerably within a certain period in certain districts of the zone. The habit of movement, which in former times did not stop at the Libyan border, is one of the backgrounds of the present smuggling too.

Meat is not imported into the region. As far as marketing facilities are concerned there is generally a big elasticity in the turnover of quantities. This is especially true for the simple and cheap livestock markets and slaughterhouses. Therefore their economy would not be affected much, if livestock population and supply would drop half or increase by 50 percent or even more. The 1967 census of the region includes just sheep and goats, no camels, donkeys or other livestock. Therefore these relatively small groups have to be neglected.

To estimate the supply of livestock the following calculations are made, based on a situation whereby no increase or decrease occurs in the flocks: A mixed flock of 100 sheep - the mixture of the age groups is comparable with those in the average livestock census - deliver yearly 40 animals to the market. The present off-take rate of 100 goats is estimated at 60 per year.

The average age of marketed animals is lower than that of the total flock. The same is true with the average weight, which is estimated at 30 kg per sheep and

20 kg per goat.

To get the supply of livestock which can be sold outside the zone the gross supply has to be reduced by the amount consumed by the population of the region. (see Table 34)

Egypt as a whole had on the last available statistics (1962) an import of 15 000 tons (i.e. 6.3 percent of the production of 240 000 tons). A few cattle from the Nile valley are sold in Matruh but the region as a whole is a surplus area.

This surplus is at the moment smuggled or sold to Libya in spite of a lack of meat within the country. The reason is the better price that Libya is ready to pay for the sheep of the zone. While the price of sheep in the Nile valley is about £E 0.18 per kg liveweight, official exports receive £E 0.265 and smugglers are reported to get between £E 0.300 and £E 0.400 per kg.

For Libya, this price may even lie above the world market price. But Libyan buyers are used to that type of meat and can afford to pay this price. Reportedly the retail price of Barqi sheep meat in Cyrenaica is in the order of 0.75 Libyan pounds per kg. Recently, there were exports of meat to the Lebanon by air. Statistical data on these exports are, however, not yet available.

The export capacity of the zone ranges from about 1 to 2 million £E per year at current export prices. It would therefore be well worthwhile studying the Libyan market carefully.

On the other hand, it is profitable for Egypt to export sheep above the price of the world market and import, at the same time, other meat at world market prices. In that way it can either earn foreign currency or have more meat for consumption.

1.3. Present marketing channels and infrastructure

Practically all the sheep which are not consumed in the region are smuggled to Libya. The main marketing channels are:

1.	Breeder	-			Dealer	-	Libyan dealer or butcher	-	Consumer
2.	Breeder	-					Butcher	-	Consumer
3.	Breeder	-	Market	-	Dealer	-	Libyan dealer or butcher	-	Consumer
4.	Breeder	-	Market	-		-	Butcher	-	Consumer
5.	Breeder							-	Consumer

Transport is carried out, with very few exceptions, on the hoof. Up to now there have been no market reports in the region or in other parts of the country. Bargaining is done per head without scaling the animals.

There are three livestock markets in the region. The biggest one is Matruh, which functions on Sundays and Mondays. The two others are in Hammam and Sidi Barrani, the former functioning on Fridays and the latter on Saturdays and Sundays

The markets are organized by the municipalities. The organization however is very simple and should be improved. The municipalities made a wall around the market place, stationed police officials at that place and charge 2 piastres per head of sheep or goat, and 10 piastres per head of camel or other big animal leaving

Table 34

SUPPLY AND SURPLUS CAPACITY OF THE SECTORS OF THE REGION BASED ON THE 1967 CENSUS (SHEEP AND GOAT)

Sector	Sheep population	Annual Turnoff	Average liveweight per animal	Supply of meat	Goat population	Annual Turnoff	Average liveweight per animal	Supply of meat
	(1000s)	(1000s)	kg	tons	(1000s)	(1000s)	kg	tons
Burg el Arab	59	23.6	30	708	62	37.2	20	744
Dabaa	43	17.2	30	516	32	19.2	20	384
Matruh	166	66.4	30	1 992	80	48.0	20	960
Barrani	150	60.0	30	1 800	60	36.0	20	720
Total	418	167.2	30	5 016	234	140.4	20	2 808

Sector	Supply of sheep and goat meat	Population in the region	Meat consuption per head	Meat consumption in the region	Surplus capacity for export out of the region	Average liveweight (sheep + goats)	Surplus capacity of small animals for export
	tons	(1000s)	kg	tons	tons	kg	(1000s)
Burg el Arab	1 452	16	12	192	1 068	23.9	44.3
Dabaa	900	13	12	156	744	24.6	30.2
Matruh	2 952	33	12	396	2 556	25.8	99.1
Barrani	2 520	19	12	228	2 292	26.2	87.5
Total	7 824	81	12	972	6 852	25.5	269.5

the compound. That is about 0.3 percent of the value of the animals. Municipalities do not allow marketing outside the market place. Market days and times are fixed. Up to now no information on the market has been collected or published, not even the number of livestock marketed. The only slaughterhouse is in Matruh and it is not first rate but, compared with other slaughter facilities in the country, it is fairly good. It suffices for the present demand of the Matruh municipality.

1.4. Prices and price policies

The U.A.R. Government generally makes a low price policy for agricultural products. With regard to mutton, the Government fixed a maximum price of £E 0.550 per kg retail price. In most parts of the country, especially in the smaller villages, the average meat price is, however, under the maximum price. The price limit therefore has no influence on the real price.

In the project region the situation is different. Here the mutton prices exceed the official price limit.

To be able to compare the situation in the U.A.R. in the field of prices, costs, and margins, with those in some other countries, the expert chose the OEEC-form of calculating these figures. The sheep and mutton prices for Matruh and its distribution margins have already been stated.

The fees for meat inspection are very high compared with the costs of this state service. Such overdrawn prices for sanitary measures discourage butchers declaring their meat for sanitary inspection. It would be wiser if state taxes were collected in other ways.

2. Wool Marketing

2.1. Cooperative system in relation to wool marketing

In 1961 under the direction and guidance of the Egyptian General Development Organization (EGDDO) a network of multi-purpose cooperative societies was developed within the project area; this cooperative system was divided into four major sectors within the project zone, namely Burg el Arab, El Dabaa, Mersa Matruh and Sidi Barrani.

Within each sector there are various numbers of cooperative centres, the number of cooperative buildings and administrators within each sector is governed by certain factors in relation to population, amount of agriculture and animal population. The purpose of the cooperative system was established as a means to encourage the Bedouin Society of the project area to develop the zone, and to help administrate and encourage many other functions such as agricultural services, transport, loans, veterinary services and marketing.

2.1.1. Wool marketing through the cooperative system

Prior to 1966 no effort had been made to market wool through the cooperative system, but in 1966 in the sector of Mersa Matruh, the EGDDO office planned and initiated the marketing of the wool clip in that sector, with the purpose in mind to encourage a greater link and understanding between the Bedouins and the cooperative system and also to improve and stabilise a system whereby the Bedouins would gain a higher price for their wool by eliminating the middle man or merchant. The principle of this plan did not fully materialise, as certain middle men and merchants, who are basically Bedouins themselves, began purchasing wool from other smaller breeders or Bedouins, paying a lower price to them than what they themselves were receiving through the cooperative system.

In 1967, to implement a more stabilised marketing system, an order from the Governor was issued that in the sector of Mersa Matruh, the central cooperative society was to be the sole buyer of the wool in that sector, guaranteeing a fixed time for final payment after an advance payment was made on receipt of Bedouins delivering their wool to the cooperative centres or collection points.

In principle and on paper this method appeared to have merits and feasability until a complete break down in the cooperatives administration occured in relation to the payments of the wool to the Bedouins, forcing the cooperative to make several changes in times fixed for the final payment of the wool, and it was found that the balance of the selling price for the year 1966 was not settled until 12 to 14 months later.

It is to be mentioned at this point that the handling and marketing arrangements of the wool by the cooperative was done by men within the administration of the cooperative who lacked any knowledge of wool or its potentials in respect to manufacturing.

Resulting from the poor administration and inability of the cooperative to control and handle the marketing of the 1966 wool clip in the sector of Mersa Matruh, braught about a lack of interest and confidence by the Bedouins throughout the project area in the cooperative system, resulting in only a small percentage of the Bedouins in that sector being prepared to sell their 1967 clip through the cooperative.

The Bedouins being quite dissatisfied with the method imployed by the cooperative regarding the selling of the 1966 and 1967 wool clip, their complaints being many but their main was the length of time taken in securing their money, decided to revert to their old methods again in 1968 and sell directly to the merchant, who took full advantage of the situation and commenced his old practice of only paying a low price, but paying cash on the spot, which has been his main basis of securing wool from the Bedouins for years, as he realises the economical and financial position of the Bedouins is such that he is prepaired to take a low price for his wool on receipt of immediate payment.

Despite this negative experience of attempting to improve the wool marketing situation, there is no doubt that with technically trained personnel in wool grading and marketing, present cooperative system

as set out by the EGDDO office within the project area, could be made use of to develop a sound and economical wool grading and marketing scheme.

2.1.2. Wool prices obtained through the Cooperative system of marketing for the years 1966 and 1967.

1966 prices

Resulting from discussions held with members of the Bedouins society and administrators of the Cooperative Centre in the sector of Mersa Matruh and from what accounts were available.

The Consultant was able to ascertain that under the Wool Marketing scheme applied through the cooperative system by the EGDDO office in 1966 in the sector of Mersa Matruh, the Bedouins mostly all of whom were merchants or middle men, received the advanced payment of 18 P per kg. for his wool with the understanding that he could receive more at a later date.

These prices were set by the cooperative after having discussions with the manufacturers on what prices they would be prepared to pay.

The first price was set by the cooperative with an understanding that any wool yielding better than 30% clean scoured, the manufacturer would pay more on a yield percentage basis for all wools yielding better than the flat 30%.

From figures given to the cooperative by the manufacturer for wool bought by them in the 1966 season, which was approximately 300 tons, the average overall yield was only 29% clean.

It is to be understood that this wool was bought by the manufacturers in a very mixed state, the fleeces were rolled into balls, each containing large pieces of stains and dung, beside black pieces and other form of inferior types that could be added. No method of grading or classification had been carried out prior to selling.

It was quite evident that in some cases quite a large quantity of sand had been added to the wool prior to selling by some of the Bedouins, or merchants, which encouraged the low yield percentage of the consignment, thus making the honest Bedouins dissatisfied with their yield when informed by the cooperative. This in turn made a large percentage of the Bedouins most dissatisfied with the first cooperative marketing system.

1967 prices

In the season of 1967 due to the lack of faith and interest in the cooperative method of marketing, only a small percentage of the Bedouins in the Mersa Matruh sector sold their wool through the cooperative system, the prices to be paid involved the same type of discussions in relation to price fixation between cooperative and the manufacturer.

The advanced or first price payment being set at a rate of 17P per kg.

The drop in price was a means by the manufacturer to stabilise a wool price for local wools and to show their disapproval of the larger percentage of sand that was found in the 1966 clip.

The Bedouins who continued their selling through the cooperative in the 1967 season were forced by the cooperative to "hand shake" their wool to eliminate as much of the added and natural sand as possible.

On a hand shaking test taken on 70 tons of wool by the cooperative it was found that 8% of the weight in sand was removed.

At the completion of the Consultant's appointment in October 1968, no final payment had been made by the manufacturer to the cooperative of the wool purchased by them through the cooperative system in the Mersa Matruh sector in 1967.

2.1.3. The merchants prices 1966-67-68 seasons.

After many discussions with various members of the Bedouins society throughout the project area, it was found that prices paid by the merchant varied from sector to sector and were subject to variations within each sector.

The merchant varied his prices subject to condition of wool, in relation to length, sand content, burr content, percentages of black wool to white wool, the amount of debt the Bedouin owed the merchant and the capability of the Bedouin to argue for a better wool price.

The analysis showed that the prices paid by the merchant irrespective of the sector or the year very seldom varied between 11 P to 14 P per kg, but his main basis of business was immediate payment on receipt of the wool.

The Merchant

Being basicly a business man the merchant soon learned the needs and requirements of the manufacturer regarding wool quantities and the condition it was to be in before a reasonable price would be paid. It was found that the larger merchants were doing a preliminary type of grading to the wool prior to selling it to the manufacturer, this grading was in the form of removing stain, dung, and keeping the white and black wools separate.

On delivery of these types of wool to the manufacturer, the merchant was receiving a considerable increase in the price of his wool compared to what he had paid the Bedouins.

2.2. The Wool manufacturing industry of Egypt.

This industry appears to be a well established organization throughout the country, in comparison to other countries of the World, their wool consumption and numbers are comparable.

Of the 30 Wool manufacturing industries listed in the "Bulletin of Industrial Egypt" eight to ten of these companies would be regarded as being large manufacturers, having the machinery and equipment to handle their own scouring, carding, combing, spinning and some too finishing.

Several of the larger mills are commissioned combers and sell their tops or if required the yarn to the smaller companies who are mainly carpet and woollen mills.

The quantity of local wools used by the larger mills is small, as they concentrate mainly on imported wools either from United Kingdom, New Zealand, Australia and Iraq and the condition in which they buy local wools is so low and badly mixed in comparison to imported wools, that the large mills are reluctant to purchase unless forced to by the Government.

The general feeling of the manufacturers towards the local wool is that having to buy it in such an ungraded and mixed state, makes it uneconomical for them to regard it as anything other than a carpet wool, which is allowing the carpet manufacturers to purchase the local wools with very little competition.

Several of the larger mills have within the last few years been receiving army contracts, to supply army drill, coats and blankets.

These companies have been using local wools with some degree of success, but again their problem is the mixed state in which they are forced to buy the wool, lacking themselves the necessary trained staff to do any grading before manufacturing.

The feeling at present with most manufacturers is against local wool, with preference given to imported Iraqi wools, which they have been allowed to import in recent years.

They are buying this wool in an ungraded state regarding quality, but black wools and stain have been removed and the wool has been semi-scoured to a yield of 70%, making it more economical for them to import this wool in preference to using local wools.

The main advantage to the manufacturer in buying Iraqi wool is their repayments are helped, covered by being allowed to export a percent ge of the finished products to Iraq.

2.3. Exhibition of recommended graded and classified types of wool.

An exhibition was held for two days showing the results of the grading and classifying of 1 ton of wool representing a cross section of the wool from the project area.

The grading and classifying of this wool was done by the consultant, who's aim was to grade and classify the wool into recommended types most suitable for various manufacturing purposes (see Table 35 and 36).

Letters of invitation were posted to all members of the Wool Manufacturing Industry of Egypt and to members of the EGDDO office and Agricultural Institute.

The purpose of this exhibition was to show the manufacturers the potentials available in the utilization of the local wool, once graded and classified, the response by the manufacturer to the exhibition was well above expectations, and discussions held during the exhibition with members of the EGDDO office and the manufacturing members showed the necessity for the grading and classifying of the wool from the project area before marketing.

The utilization into the various manufacturing fields of the recommended graded and classified types, after discussions with the manufacturer and consultant, were based on percentages as follows :

Approximate percentages %	Proposed manufacturing usages
3	Finer fabric or choice woollen
13	Fine drill or woollen
27	Army surge or drill and/or blankets
28	Blankets or fine carpets
29	Carpets

The proposed manufacturing usages of the local wools can be visualised on a higher percentage basis following the recommended wool improvement through the intensive form of integration of animal production based on a long range programmed as follows :

Approximate percentages %	Proposed manufacturing usages
14	Finer fabric or choice woollen
26	Fine drill or woollen
25	Army surge or drill and/or blankets
27	Blanket or fine carpet
8	Carpet

All members of the manufacturing industry accepted the recommended graded types, with the expression that given the opportunity to purchase the local wools graded to these types, an automatic upgrading of the utilisation of the local wool could be visualised.

2.4. Sheep breeds of the project area.

The present sheep population of the project area is approximately 300 000 with the possibility of a further increase of 160 000 under a suggested programme of range control with the use of irrigated lands.

The main breed within the project area is commonly known as the Barqi Breed, with a slight infusion in the eastern sector of the area of a breed called the Rahmany.

The Barqi Breed is a long legged animal, with flat sided ribs, showing characteristics towards the fat tailed breed, having an average size body, with a live weight of an average of 40 kg.

This breed would be commonly known as a dual purpose breed of sheep where as the Rahmany having basicly similar body conformations as the Barqi, but predominately of the fat tailed breed is mainly bred for its mutton purpose.

These breeds are shorn anually in the months of April and May with the fleece of the Barqi breed being shorter and of a finer spinning quality, having an average fleece weight of 2 to 2½ kg., where as sheep showing the infusion of the Rahmany breed being of a longer staple and stronger type of wool have an average fleece weight of 3 to 4 kg. However, the percentage of the Rahmany breed and its infusion within the project area is very small.

2.5. Training school.

To illustrate by a practical demonstration the necessity of grading and classifying wool before marketing and to teach and train as many Bedouins as possible, the preliminary after shearing method of handling their wool.

Namely the art of skirting a fleece, the consultant held a school for one month in the district of Borg El Arab.

The purpose of this training to the Bedouins, was to encourage them and show them a method by which they temselves could present their wool in a reasonable condition in preparation for marketing.

It was proved by example that the preliminary art of skirting a fleece increased at least 60% of the fleece by 15% to 20% in yield, which alone would help increase the selling price of their wool.

It was felt that if no immediate implementation of the future proposal for technical training and grading and marketing was commenced the training to the Bedouins regarding the skirting of the fleece in preparation for selling, would be of some justification for an increase in the price.

The Bedouins were instructed and shown how to skirt the fleece and were advised to make the following lines :

- skirted white fleece
- white pieces
- skirted black fleece
- black pieces
- stain

The time element only allowed for the training to be given in one of the smaller sheep populated sectors of the region with instructions that further training in the art of skirting the fleece would be given to Bedouins and Breeders, throughout the project area by the two counterparts who remained with the consultant throughout the course.

2.6. The Wool of the Project Area. 1/

The wool within the project area shorn from the Barqi breed of sheep, is of an inferior type in comparison to the main wool growing countries of the world, yet in comparison to wool of the middle eastern countries, and semi-desert to desert area, this wool is of an average to good standard.

As the sheep of the area had only 4 months growth of wool at the time of the Consultant's appointment, all analysis and percentages were taken from tests taken on 1 ton of wool which was bought for the Consultant's use. This ton of wool was regarded as an average type and quality in relation to the wool within the project area, being one of the exceptionally dry years, this wool was not carrying any burr or seed content. It was found to be of an average to good length for its particular spinning quality, being heavy in condition, having a heavy suint and/or wax content, which inturn encouraged a heavy sand and dirt percentage.

The Consultant estimated that fleeces in their unskirted and ungraded stage, being the general condition in which they have been sold to the manufacturer would yield approximately 35% to 40% clean.

Being shorn once a year, encouraged a better length, but it also allowed for a greater penetration of the sand and dirt, which is found adhering to the skin and lower portion of the wool fibre, this sand and dirt penetration is a common fault in all semi-desert to desert areas.

1/ Visual spinning quality of the wool and the approximate yield or clean wool content were determined by the consultant's experience in this field. It was not possible during the period to which this section in wool marketing relates for the consultant to have micron tests of the fibre or to have wool tested for its correct clean wool content.

With analysis taken on the visual spinning quality of the wool it was found to be in the average percentages of quality types as follows :

Visual spinning quality	Approximate percentage of wool within the project area
56^s and better	44½
$50^s/46^s$	33
$44^s/40^s$	16
$36^s/30^s$	6½

The wool falling into the category of 56^s and better were subdivided into types 58^s/UP and $56^s/54^s$, these two types were of an average to good length for their particular spinning quality being 3" to 3½" for the 58^s/UP and 4" to 5" for the $56^s/54^s$.

These wools showed a tendency to being thinly grown, showing evidence of hungry finness, webbyness in respects of weak growth with little or no regular crimp formation.

Once graded and classified it was found that the percentage of sound wools to tender wools were equal, with a viusal kemp content not exceeding approximately ½%, with a clean yield content of approximately 45% for the 58^s/UP and 50% for the $56^s/54^s$.

The $50^s/46^s$ were wools of surprisingly good length and style for this type of country, their average staple length being between 5" to 7 inches, showing a fair crimp formation, but lacking density and body.

Fleeces of this particular type showed a large thinning and weakness in the fibre area along the back of the fleece, which after grading showed a good 30% of this wool to be tender.

The estimated yield of this wool after grading was approximately 50% with an estimated kemp content of up to 1%.

Wools coming under the spinning quality of the $44^s/40^s$ type were harsh wools, lacking in crimp formation showing little character to what the type or quality should process and being of an average length of 4" to 6 inches, basicly sound.

Having an approximate yield of 50% with a high kemp content of approximately 2% to 3%.

The wools of the $36^s/30^s$ type are a hairy coarse, heterotypic type of wool, irregular in length and very brittle, its approximate yield being 45% with an estimated kemp content of 4% and over.

Black marking on the fleece are very predominent within this breed, it was found that an average of 17% of the sheep population had black spots or markings on one or two sections of the fleece, the percentage of all black and brownish black fleeces of the wool worked was 4½%, where black pieces resulting from black markings were 6½% of the pieces weight.

The percentage of outsorts namely pieces and stains were within the average allowance of 40% of the total weight, but it was found that the percentage of urine stain and dung stain wool was high being 22% of the 40% allowance, this being caused mainly by the fact that no form of crutching or shearing around the tail area has ever been done or introduced.

2.7. Programme for sheep washing before shearing.

It is to be mentioned at this stage of the report the necessity for an intensive programme at some future date being initiated in relation to encouraging the Bedouins to wash their sheep before shearing.

There are many problems in respect to a washing programme being introduced and the most immediate one is the shortage of water throughout the project area and the facilities required to carry out this

programme, but under the animal husbandry and veterinary service programme, a series of sheep dips have been recommended along the project area, as illustrated on map 1 of the project area, and the consultant has recommended the utilization of these dipping structures for the purpose of washing the sheep.

As an incentive to the Bedouins the consultant has included a suggestion for an extra encouragement in his future proposal, which is attached to this report, that at the time of purchasing the wool from the Bedouins, a higher price be paid per kg. to anyone showing that his sheep were washed before shearing.

Unless the practice of washing the sheep before shearing is not fully implemented, the possibility of a mechanical method of shearing could never be introduced into the projects plan as the quantity of sand adhering to the skin of the sheep is so great, making it almost impossible to shear with any mechanical shearing machine.

2.8. Grading and classifying.

It has been proved throughout the wool growing countries of the World that to fully justify the full market value of wool, it has to be graded and classified to the various manufacturing usages that the wool may contain.

With this being the main object in mind and taking the 1 ton of wool used during the training course, the consultant graded and classified the wool for the purpose of determining its potentials in relation to its manufacturing usages.

Before grading and classifying certain factors had to be considered in respect to the number of types that could be recommended. These factors being :

- sheep numbers of the area
- wool quantities
- seasonal conditions
- trade requirements

- burr content
- condition of wool prior to grading
- market value.

Lists of proposed graded and classified types for the wools of the North Western Coastal Region.

With the factors mentioned in mind and considering that the wool of the 1968 shearing was completely free of Burr and /or grass seed, and recommending that in future seasons the possibility and necessity of making further recommended lines in relation to burr content and length, could be visualised the Consultant formulated the proposed types as shown in Tables35 and 36.

Excepting the 1 ton of wool as an average cross section of the wool within the project area, the figures shown in Table 37 give the percentage relationship between fleece wool black and white, and pieces black and white of the wool within the project area.

Tables 38 and 39 show an approximate estimation of the percentages of the graded and classified types in relation to the wool quantities of the area.

Table 35 List of proposed graded types and description for fleece wool

Type	Visual spinning quality	Tensile strength	Description	Approximate yield percentages	Approximate kemp fibre percentages
Extra fine	$58^S/60^S$	sound	Average to good length 3' to 3½' heavy condition	45	Nil
Fine	$56^S/54^S$	sound	Average to good length 3' to 5' heavy condition	48	up to ½
Medium	$50^S/46^S$	sound	Good length 5' to 7' heavy condition	50	1
Strong	$44^S/40^S$	sound	Average to good length 6' to 7' heavy condition	50	1 to 2
Extra strong	$36^S/30^S$	sound	Average length 5' to 6' heavy condition	45	4 and over
Fine backs	56^S/UP	tender	Thinly grown Webby wool	55	Up to 2
Strong backs	50^S/DOWN	tender	Thinly grown Webby wool	55	2 and over
Fine black	56^S/UP	sound	Average length Heavy condition	48	1
Strong black	50/DOWN	sound	Average length Heavy condition	50	2 and over
Cotted	mixed	tender	Inferior type Heavy condition	40	mixed

TABLE 36

List of proposed graded types and descriptions for lower types

Type	Visual spinning quality	Description	Approximate yield percentages	Approximate kemp fibre percentages
Fine white pieces	50^{s}/UP	Average to good length heavy condition	30	1 to 2
Strong white pieces	46^{s}/DOWN	Average to good length heavy condition	33	2 to 4
Fine black pieces	50^{s}/UP	Average to good length heavy condition	30	1 to 2
Strong black pieces	46^{s}/down	Average to good length heavy condition	33	2 to 4
Lambs	mixed	Average length and style heavy condition	55	mixed
Stains	mixed	low type	20-25	—

Table 37

Approximate percentages of fleece and pieces within project area.

Type	Description	Approximate percentages
White	fleece	54
Black	fleece	4½
White	pieces	12½
Black	pieces	6
Stain	Black and white	22
Sand		1

Table 38 Estimated percentages of graded fleece wool

Type	Visual spinning quality	Percentage	Approximate estimation of wool in project area	
			Bales	Tons
Extra fine	$58^s/60^s$	$2\frac{1}{2}$	175	$17\frac{1}{2}$
Fine	$56^s/54^s$	13	620	62
Medium	$50^s/46^s$	27	1190	119
Strong	$44^s/40^s$	9	430	43
Extra strong	$36^s/30^s$	3	140	14
Fine backs	56^s/UP	28	1320	132
Sure backs	50^s/DOWN	9	420	42
Fine black	56^s/UP	4	185	$18\frac{1}{2}$
Strong black	50^s/DOWN	$3\frac{1}{2}$	160	16
Cotted	mixed quality	1	40	4

Table 39 Estimated percentages of graded pieces

Type	Visual spinning quality	Percentage	Approximate estimation of wool in project area	
			Bales	Tons
Fine white pieces	50^{s}/UP	38	560	56
Strong white pieces	46^{s}/DOWN	32	475	47½
Fine black pieces	50^{s}/UP	25	370	37
Strong black pieces	46^{s}/DOWN	5	75	7½
Stain	mixed	22	1760	176
Sand	—	1		8

Chapter VII

THE SCOPE FOR AGRICULTURAL DEVELOPMENT AND NECESSARY MEASURES

1. Introduction

Two lines of agricultural development are potentially possible for agricultural development in the project area; horizontal expansion and vertical expansion. The former depends on the availability of cultivable soil and water resources which have so far been used only partially or not at all. Surveys indicated that, as a whole, the scope for horizontal expansion is limited. Vertical expansion would consist of a better use of the soil and water resources and the favourable climatic conditions on the existing area used for agriculture, and the main development possibilities appear to fall in this category. While a certain amount of investment would be required, the main emphasis should be put on better applied technology in farming and animal husbandry. A more judicious use of both the local financial resources and those provided for development purposes is especially necessary. A better balanced and coordinated use should be made of all available manpower resources in order to reduce especially seasonal unemployment, and to increase labour productivity. To achieve these goals, the present social, institutional and organizational framework needs considerable improvement, which will take time.

1.1. The agricultural potential

Most of the soil with qualities adequate for cultivation which receives enough runoff to provide at least minimal moisture conditions for crop growth in average years, is already being cultivated, mainly with barley. On much of this land cultivation is intermittent; i.e. in years of poor rainfall in the early part of the season, or when seed is scarce, the area cropped is considerably smaller than in years with good early rains and ample seed supplies. On land which receives large amounts of run-off and where water resources exist for irrigation, fruit trees and other horticultural crops are grown. In those areas where the runoff and flash floods of the winter season can be diverted to, or retained on, suitable soil, cultivation can be intensified, in the ways listed below:-

a) More regular cultivation of barley, giving a higher average yield.
b) The cultivation of fodder species in short term or long term rotations with barley, or the cultivation of perennial fodder plants (grasses and shrubs) for special purposes such as dairy goat production or lamb fattening.
c) The cultivation of barley in rotation with pulses for human consumption.
d) Vegetable cultivation.
e) Viticulture.
f) Arboriculture (fruit and fodder trees).
g) The establishment of shelterbelts, wind-breaks, timber.

The choice between these forms of intensification or their possible combinations depends upon technical, economic and social considerations. Soil depth and texture, water hodling capacity, infiltration rate, the occurrence of stones in the profile, degree of soil salinity, slope, average amounts of runoff which can be collected, exposure to prevailing wind and to salty sea spray are among the technical factors to be considered, and soil depth, the degree of soil salinity, and the amount of

runoff the chief of them. In so far as the choice between field and fodder crops, perennial grasses and fodder shrubs, vegetables and tree crops is concerned, trees and, to a lesser extent, shrubs as compared with grasses and annual crops, have the advantage of a deeper root system for reaching moisture at depth. Furthermore, tree crop yields would be less affected by the variation from year to year in rainfall and runoff. Most tree crops, on the other hand, have their productive growth period during or even after the summer, thus causing much of the moisture to be lost by evaporation, while annual winter crops and, to a lesser extent, perennial grasses have their productive period when there is most moisture, i.e. winter and spirng. Since the mild winter does not handicap the growth of the latter crops, their cultivation makes better use of the water available at a time when evaporation is low.

These considerations lead to the general conclusion that, both for deep and light soils where the runoff from flash floods in the winter rapidly penetrates to a great depth, tree crops are more suitable, whereas on the heavier and shallower soils, animal crops are more suitable. Grapes, fodder shrubs and perennial grasses hold an intermediate position. Among the tree crops, those which have early-maturing fruits, among others carobs, almonds and those whose fruit development can benefit from the early autumn rains (such as olives), are to be preferred from the point of view of water utilization.

Economic and social considerations are of importance in making the choice between the production of barley, fodder crops, perennial grasses and fodder shrubs. The available production data are insufficient for judging which of these is most economical. It is felt that where rainfall and runoff moisture are insufficient to ensure a reasonable yield of barley at least 6 out of 10 years, the land should be under natural or improved pasture, an average of 200 mm from rain and runoff being considered the minimum for economic barley cultivation. This means that some land at present under intermittent barley cultivation should be converted to grazing land. Above this minimum moisture level, barley cultivation is more feasible under the present land tenure and social conditions. A change to rotation systems with barley and forage crops or even to perennial pasture or fodder shrubs could be achieved first for special intensified forms of animal production, such as lamb fattening or dairy goat production. The balance might also be tipped in favour of crops for grazing should rising labour costs render barley production uneconomic, seeing that barley harvesting is labour intensive. While threshing operations could ultimately be mechanical (e.g. on a cooperative or contract basis), the mechanization of harvesting is not generally feasible in view of the scattered nature of land pockets, the short stems, the presence of rocks on the surface, and the occurrence of shrubs in the field.

As for the choice of fruit trees, while almond trees could be economically cultivated on a wider scale, olives are preferred by the farmers because of the great losses of almonds they suffer through unauthorized picking in the green stage. Large-scale grape cultivation in distant locations is eliminated on account of marketing limitations. For perishable vegetables this problem does not arise to the same extent, since their cultivation potential is mainly limited to land with a permanent source of irrigation, and such land is mostly located close to the coastal population concentrations.

Windbreaks and shelterbelts have the important function in the intensification of agriculture of reducing the adverse affects of wind storms. Furthermore, they are important for reducing wind erosion and thereby helping to retain the soil resources. Other erosion control works would be required to retain the long-term potential of the area for agriculture, but such measures cannot be easily assessed in economic terms. An improvement of the vegetative cover, especially of sloping areas close to population concentrations, where the vegetation has been severely depleted as a result of overgrazing, would not only be beneficial for animal production but also greatly reduce erosion. Sand-dune fixation would reduce sand drifts to neighbouring cultivations and human settlements, provide timber and

improve the attractiveness of the area for tourism. Fodder tree plantations would greatly benefit animal production by providing both feed in the drought season and shade.

The improvement of animal production requires above all better utilization of the range resources. This entails control of animal numbers in accordance with the carrying capacity. Technical range improvement work includes mainly proper grazing systems, periodic resting and reseeding on selected sites. The inland sand dunes near Maktila offer possibilities for fodder shrub, fodder trees and perennial grass establishment. Veterinary control would increase animal productivity, while selection and breeding could increase wool quality. Proper supplement fedding at certain periods would also enhance animal productivity, but it should be at an economic level. Animal productivity would be greatly increased by linking sheep production during part of the year on land irrigated with Nile water with sheep production on the range.

Sheep fattening and poultry production are other fields through which an intensification of agriculture can be achieved, but they would depend partly on feed sources from outside the project area.

A gradual reduction of the number of goats and their simultaneous conversion to a high milk-yielding breed through selection and crossbreeding would, under proper management and feeding, be a means of intensifying this segment of animal production in selected parts of the area. Complementary processing of milk into cheese would promote better use of manpower and reduce seasonal unemployment.

2.- Crop production.

2.1. The scope for increasing the cropped areas.

Increases in agricultural production in this developing Zone have hitherto come mainly from extension of the cultivated area. The remaining untilled land is either of poor quality or can be brought into production only after a relatively large investment. Temperature and sunshine are very favourable for plant growth. Especially the moderate winter temperatures are a factor which should be made use in order to produce out of season vegetables. Wind, however, is a negative factor during some parts of the year, causing the necessity of the establishment of windbreaks for orchards and annual crops close to the coast. The extent to which a horizontal development is possible depends on the availability of cultivable soil and water resources.

2.1.1. - Soils.

The coastal Zone contains a number of major soil units, the main characteristics of which have been chiefly defined in general terms (see Volume II). It is estimated that the gross area is of about 3.8 million feddans. More than two thirds of this area is affected by extremely unfavourable conditions from the point of view of any potential development. Sites lending themselves to agricultural use will therefore have to be selected in the remaining third. About 250 000 feddans (6.5%) have soils suitable for field crops and/or horticulture. The remaining 3.55 million feddans have often a vegetation cover which is used for grazing (range). The proposed agricultural recommendations in this section solely concern the first area, which actually scattered all along the whole length of the coastal zone.

A - Soil for fruit trees.

The establishment of an orchard always involves an outlay of capital and labour and so an incorrect estimation of the soil conditions of the site will lead to a considerable loss. For dry-farming cultivation the first condition requires that the soil be deep, is able to retain moisture and consequently considerable attention must be given to this question. Apricot, mulbery, peach, almond, fig, olive, pistachio are more or less salt tolerant and can grow on certain slightly saline soils.

B - Soil for annual crops.

The annual winter crops are less exacting with regard to the depth of the soil while summer annual crops require medium to deep soil because the shallow soil loses its humidity quickly and the plant is rapidly exposed to dryness. Saline soils should be avoided. However, there are some annual crops which are more or less tolerant to salinity such as barley, broad-beans, etc... Sandy soils are considered of value for very early vegetable crops. Sandy-loams are retain moisture and nutrients more than sands, and in general are considered better for vegetable growing. Forage plants are preferable for alkali land because their quality is seldom impaired by the environment. In general, relatively permeable and fertile soils with a good water-holding capacity are most suitable for cultivation in the Zone.

2.1.2. Water.

Plant life in the desert primarily means struggle for water. Wherever water exists the desert disappears. The shortage of water is likely to be a severe restricting factor for potential agricultural development. Partial or complete irrigation is one of the most important factors in the desert. Apart from Nile water for irrigation, the water sources for agriculture can be classified in the following categories: water from direct precipitation, torrential runoff water from wadi's sheet runoff from rain (surface runoff) and underground water (including gallery water). The average rainfall is about 150 mm. along the coast and decreases rapidly inland. Since for a barley crop 200 mm of direct precipitation is considered a minimum for a reasonable yield, rainfall by itself would be insufficient for this most drought-tolerant crop. Only about twice per ten years this minimum is reached on the coast. It is clear that this is an important factor in any attempts to increase agricultural production in the zone. Some methods can thereby be distinguished. The first is to utilize runoff water from catchment areas through wadis (valleys) draining to coastal plains, valleys or into the sea, by its diversion and equal distribution on suitable soil of such plains. The second is to collect local runoff from relatively small areas in order to store it in cisterns or to concentrate it on a restricte surface, where it will provide increased infiltration, enabling the cultivation of field crops

(mainly barley) or fodder plants on the shallow soil types, and fruit trees (olives) fodder trees (carob) and shade trees on deeper soils. This system is sometimes referred to as "water harvesting". The third is to use groundwater from wells and galleries.

2.1.2.1. Utilization of runoff for agriculture.

The utilization of runoff for agriculture can be by winter watering which is undoubtedly the most economical way of runoff utilization. It is applied by flooding, terracing or spreading of stream flow during flash floods on large gently-sloping areas of deep soils. Plants with deep root systems, such as olive trees, grapes etc, can take the most advantage of the stored water since their root system exploits a thicker layer of soil. Selected possibilities have been studied u the project and five detailed agricultural development plans have been prepared.

A - Winter watering by flooding.

This method is suggested on gently sloping areas which are free from gullies or depressions and when the runoff of wadi is relatively important. Winter watering by flooding can be applied on the plains of El Qasr, Suineyat (Abu-laho), Baqqush, Garawla and several other smaller plains between El Negeila and Mersa-el-Asi. Examples of such agricultural development plans of winter flood watering are the Wadi Magid and Wadi Enthely projects. The gross area of the potential application of such schemes in the Zone is 7000 feddans gross area and 5000 feddans net area. The average annual runoff is 1000 m^3 per feddan, while the total moisture available is about 388 mm (150 mm rainfall and 238 mm runoff). In such projects it should be possible to select some fruit trees, some vegetables and some field and fodder crops, which under such conditions give the projected yields. Different patterns can be suggested. The patterns laying emphasis on the horticultural aspects can often be the best. Based on preliminary studies it is possible to cultivate the following major crops.

Fruit trees. Olive, grapes, figs and almonds.

Vegetables. Watermelon and other cucurbitaceas, broad-beans, onions, peas and tomatoes.

Field crops. Barley, wheat, lentils and some other legumes, sesame, sorghum and maize.

Forage crops. Alfalfa, sainfoin and Phalaris Tuberosa with the highest moisture levels, spineless cactus, vetches and other legumes with less moisture.

Through extrapolation of the crop acreages suggested for Wadi Magid and Wadi Enthely to the total winter watering by flooding area, the area to be covered by each crop is arrived at, as shown in Table 40 . The cropped area can be increased by the cultivation of interplants and intercrops between the principal fruit tree species. The area of intercrops and interplants can reach 1500 feddans during the first 3-5 years and 500 feddans till the 8-12 years, from the date of planting. Insofar as ground water is available for irrigation in the first few years arboriculture (olives, grapes, almonds and some other stone fruits) is recommended on the deep soils, while vegetables and field and fodder crops are suggested for the shallower or slightly saline soils.

B - Winter watering by spreading

This method is suggested on the more sloping areas and when the runoff of the wadi is not sufficient to submerge the whole beneficiary area. The areas suitable for such projects are on the northern slope of the escarpment in Ghot Rabah, Garawla, Abu-laho, El Negeila, East of Negeila, the area between Baqqush and Ras-el-Hekma and the Western part of Fuka. The gross potential area is 8000 feddans, with a net area of 3000 feddans and an annual runoff of 500 m^3/feddan. Total moisture available is 259 mm (140 mm of rainfall and 119 runoff). Examples of such agricultural development plans of winter-watering by spreading are the Wadi Wakal project in Negeila and the Fuka spreading projects. In such projects, it can be possible to cultivate the following crops in the first strips immediately upstream the dykes: Olives, almonds, carob, watermelons, broad-beans, onions, barley, lentils and fodder crops.

Table 40. Estimated present and future areas for agriculture.

Species	Project areas +				Other areas	Total area	
	Flooding	Spreading	Terracing	Water conservation		Present	Future
	(- - - -	- - - - -	- - - - -	-feddans- -	- - - - -	- - - - -	- - - -)
Figs	-	-	-	-	7000	5552	7000
Olives	1860	480	770	6200	4000	7420	13310
Grapes	1080	-	-	-	200	-	1280
Almonds	1020	-	-	130	200	340	1350
Carob	-	780	150	6200	200	-	7330
Pistachio	-	-	80	1240	-	-	1320
Other fruit trees	-	-	-	90	100	282	190
Vegetables	1440	-	-	390	1000	1800	2830
Field and fodder crops	600	1740	-	40270	60000	110000	102610
Grazing	-	-	-	7480	-	-	7480
T O T A L	6000	3000	1000	62000	72700	125394	144700

+ Supplemental irrigation during the establishment phase of orchards and vineyards in flooding areas will be mainly from wells and in the other areas mainly from cisterns. Well irrigation will continue in the flooding areas while no supplemental irrigation is expected to be given in the other areas after the establishment phase of the orchards and vineyards.

In the second strip, barley or reseeding pasture are the only crops which can be cultivated. The pattern lays emphasis mainly on the horticultural aspect in the first strip and on field crops in the second strip. Through extrapolation of the crop acreages suggested for Wadi Wakal and Fuka spreading projects to the total spreading area, the area to be covered by each crop is arrived at, as shown in table 40 . The area can be increased by the cultivation of interplants and intercrops between principal fruit tree species in the first strip. The area of intercrops and interplants can reach 600 feddans during 8-12 years. Perennial plants and annual crops can be taken in consideration.

C - Winter watering by terracing.

In case of wide wadis, with even land slopes and when there is no land suitable for cultivation downstream the wadi it is possible to apply winter watering by terracing. The whole area between Sidi Barrani and Mersa-el-Asi contains such wadis. Terracing can also be applied on the slopping areas of deep soils, at the outfalls of wadis (Example the Fuka terracing projects). The gross area is estimated at 1500 feddans with a net area of 1000 feddans and an average runoff of 2000 m^3 per feddan. The total available moisture is 616 mm, of which 476 mm from runoff, 140 mm from rainfall. Examples of agricultural plans for winter-watering by terracing are the wadi Abou-Moubarak project in Negeila and the Fuka terracing projects. It can be possible to select some fruit tree species, which under such condition give the projected yields. The pattern lays emphasis on the fruit trees aspect. Among others, the following species can be envisaged: olive, carob and pistachio. Through extrapolation of the crop acreages for Wadi Abou-Moubarak in the Negeila and Fuka terracing projects to the total winter watering by terracing project areas, the area to be covered by each crop is arrived at, as shown in Table 40. The cropped area can be increased by the cultivation of interplants and intercrops between fruit tree species. The area of intercrops and interplants can reach 500 feddans during 8-12 years. Perennial and annual crops can be taken in consideration.

2.1.2.2: Utilization of sheet runoff for agriculture.

The sheet runoff is the surface runoff that flows over the land. There are two ways of sheet runoff utilization: The construction of water conservation works by which the sheet runoff is accumulated in restricted areas where it could be used mainly for annual crops and secondly its storage in cisterns.

A - Sheet runoff utilization.

Water conservation works for better use of rainfall and sheet runoff can be applied on a very large scale in the N.W. Coastal Region where there is no possibility of application of other more efficient methods of water improvement (winter watering, terracing, etc..). Besides the improvement of the water conditions of the land, an effective erosion control can be obtained by the suggested water conservation works. The surface water development project of Micro-Fuka and most of the Fuka water development plan are based on this principle. Including the direct rainfall the application of this system of surface water utilization would provide moisture equivalent to an average of about 250 mm per year. The total area having proper topographic and soil qualities for its application amounts to about 62000 feddans of net area. It is recommended to be used mainly for annual crops, such as barley or broad-beans and some other crops such as fodder crops. Where this system would ensure more than the above expected average amounts of moisture, the cultivation of widely spaced olive, carob and some other drought tolerant fruit trees could be considered along the upper side of the small contour dykes used for this system, provided cistern water is available for watering of trees during the dry period in the first few years. Examples of this agricultural plans of winter watering by water conservation are Zagharat project in Negeila, and Micro-Fuka in Fuka pilot area.

Through extrapolation of the crop acreages suggested for Wadi Zagharat and Micro-Fuka to the total water conservation project area, the area to be covered by each crop is arrived at, as shown in Table 40.

The estimated development of fruit trees under water conservation depends on the confirmation of the present calculation of moisture availability through field experimentation, secondly on the possibility of effective protection of

the scattered rows of trees from damage by animals and thirdly on the closeness of cisterns for supplemental irrigation during the establishment phase. The area can be increased by the cultivation of interplants and intercrops between fruit tree species. The area of intercrops and interplants can reach 3 500 feddans during 8-12 years. Perennial and annual crops can be taken in consideration.

B - Cistern water utilization.

This stored water can be used for domestic purposes and livestock watering, and in some cases for the establishment of tree plantations by giving the young trees small amounts of water during the dry season. There are about 2 500 cisterns in the N.W. Coastal Region. The amount of water that can be assured yearly after cleaning and repair of all the existing cisterns is estimated at 1 000 000 m^3. It is estimated that 300 000 m^3 could be available for agriculture. Assuming that every tree needs 1 m^3/year it would be possible to water 300 000 trees per year or 15 000 feddans (20 trees in average per feddan). The practice in the area is to irrigate fruit trees during the first three years. If sufficient water is available, irrigation can be continued during the first 5-6 years but if the water is scarce or far from the orchard, irrigations are applied during the first 2-3 years. The trees would be irrigated once or twice a month during the summer at a rate of 20-40 liters per irrigation.

2.1.2.3- Utilization of ground-water for agriculture.

The total amount of the third water source, ground-water from wells and coastal sand dunes galleries, which can be obtained for agriculture without the risk of an increase of water salinity, at the present is estimated at about 750 000 m^3 per year, excluding the windmills in Mariut Extension Project, and without considering potential additional water development from maritime sand dune galleries and from bores in the Fuka basin. Its economic use is limited to supplemental irrigation of orchards and winter vegetables and full irrigation of summer vegetables. An estimated 2 000 - 10 000 feddans of orchards can receive supplemental irrigation from this source over and above the water obtained from winter irrigation and rain, depending on the intensity of supplement irrigation.

The availability of water from this source is mainly limited to the coastal strip. Very few farms apply continuous irrigation because water in the zone is very scarce; in such farms 3-5 irrigations per year are given to fruit trees during May, June, July, August and September. One windmill is only sufficient for watering 2-3 feddans of fruit trees (80-120 trees) with a relatively high irrigation rate (300 m^3/fed/year) or 8-10 fed (320-400 trees) with a low irrigation rate of about 75 m^3/fed/year. But the high cost of under-ground water, is one of the serious obstacles for the proper utilization of the area.

According to preliminary studies, a considerably larger quantity of water is available from galleries in the maritime dunes. However, it is felt that these studies should be confirmed through further field measurements. Furthermore, a considerable extension of the gallery system has been suggested.

In case these large amounts of water from galleries are available, irrigation of the cultivable area of certain plains near the dunes, such as the El Qasr plain, would be possible at a considerably lower cost than is calculated for ground-water utilization with windmills. In addition, there seems to be a good scope for under-ground water from bores in the Fuka synclinal.

If these preliminary estimations are confirmed through further investigations, a considerable scope for irrigated farming exists in the Fuka basin. If such considerable amounts of under-ground water are available from galleries for the plains near the maritime dunes and from bores for the Fuka basin, the planned development of those areas through surface water utilization could be amended to include irrigation development from galleries resp. bores.

2.1.3. Agricultural expansion.

From the above it can be noted that from the physical point of view, there is a relatively large possibility for an increased cultivation of some fruit trees, vegetables and some annual winter and summer crops. A part of this development would take place on land presently used for barley cultivation.

2.1.3.1. Expansion of fruit production.

The increase of the area under fruit trees depends on the availability of water, When there is no irrigation the main sources of water for plants are precipitation in the form of rain and dew, flood runoff and sheet runoff. Fruit trees can be placed in the following order according to their water requirements: peach, apricot, grape, mulbery, almond, olive, carob and pistachio. The last six species are highly water economic. These species are the most suitable for the application of small quantities of irrigation water given at the right moment, especially olives. Water requirements for different varieties of the same species vary within wide limits. Drought tolerance means the ability of plants to withstand droughts, i.e. to revert easily to their normal condition after prolonged wilting with a minimum damage both to the plant and to its crop. Other factors such as: production costs, labour requirements, input, yield and price can influence the expansion and the choice of fruit tree species. The increasing mechanization in agriculture has not reduced perceptibly the manpower needed for the cultivation of fruit trees in general and olives in particular. Pruning and harvesting, the most important operations, are done almost exclusively by hand.

A - Expansion of olive production.

The study reveals that olive is a highly water economic plant. The difference between table olives and those for oil must be borne in mind, because the first needs more water than the second to produce fairly large fruits.

The excess of rain water from adjacent slopes and catchment areas can advantageously be run into the olive orchards in order to provide the soil with a water reserve.

Runoff water, finds an excellent use on olive groves especially planted on the down flow side. Dry farming is the usual method of special olive culture for olive oil production. The area of olive trees can be increased mainly under winter watering by flooding and water conservation area (see Table 40 Oil presses and a workshop for olive pickling of sufficient capacity should be established gradually in promising areas in order to facilitate the expansion of the area under cultivation.

B - Expansion of fig production.

The desirability to expand fig production in the North-Western Coastal Zone deserves consideration. The fresh figs have still a ready market and the dry figs have a big ready market. The expansion of fig plantation for fresh consumption can be initiated mainly along the coast, in sandy dunes especially between Hammam and El Alamein. The expansion of figs in more distant areas can be envisaged if cultivars for drying can be introduced. The cultivated area could then be increased by more than 25% (see Table 40).

C - Expansion of other fruit tree species.

Some other fruit tree species can be planted and their cultivated area can be expanded.

- Almonds can be cultivated especially as interplanting. The area can be increased all over the zone. The area in Table 40 does not include the interplants.
- The area of grapes can be increased as interplanting. It is possible to increase the area cultivated as principal crop mainly in the Sidi Barrani sector where raisin cultivars can be planted. The area in Table 40 does not include the interplants.
- Pistachio trees can succeed and are suggested to be cultivated especially inland where the winter is less mild. It is necessary to take into consideration the problem of pollinisation. The area South of the asphalt road (Alexandria - Mersa Matruh - Sallum) is more suitable for this species (see Table 40).
- The success of the carob tree in the area is assured. Deep and suitable land in the grazing area can be planted by this interesting fodder tree, provided moisture conditions are favourable. The Sidi Barrani sector and the water conservation projects are the most promising area for its cultivation (see Table 40). In addition to its use for feed, the carob also is a potential crop for export purposes (industrial use of the seeds) and for human consumption.
- Pomegranate and prickly-pears are two other potential very useful species in the North-Western coastal zone.

The major problem for the orchards in the area is the animals. Sheep and goats cause some damage to fruit trees and gardens. The lack of barbed wire to protect orchards is one of the obstacles for the expansion of fruit trees in some areas. In some cases the wire fence can be substituted by the plantation of prickly-pears, pomegranate, Prosopis juliflora, Lycium europaeum and Acacia karoo, as fence around orchards, but the wire fence is still necessary during some years after the plantation of these thorny species. Pomegranate can be used as interplants also because of its tolerance to dryness and salinity.

2.1.3.2. Expansion of vegetables.

It is possible to expand the area cultivated by vegetables in the project areas of winter watering or improved infiltration or recharge of ground-water. The cultivation of vegetables can be expanded especially near the consumption centres such as Alexandria and Mersa Matruh. In more isolated areas the less perishable vegetables can be cultivated such as broad-beans, onions, etc...

The area of El Qasr and Draa-el-Bahri are promising for such cultivation but the real expansion is by increasing the productivity. The proposed acreage is shown in table 7.21/1.

2.1.3.3. Expansion of field crop.

The customary practice of increasing the area under barley in rainy years, where by grazing land is ploughed and left fallow in other years, should be discouraged if not completely prohibited. As a general rule, land which receives less than 200 mm as rainfall and runoff should not be cultivated and left for grazing. Around 40 000 feddans can be cultivated in the water conservation area while 60 000 feddans should be continued to be cultivated in other areas (see Table 40). The average expected total production can reach over 26000 tons, despite a proposed reduction of the area.

2.2. The scope for increasing productivities

2.2.1. The improvement of agricultural-horticultural operations and practices.

2.2.1.1. Introduction.

The horizontal expansion is relatively limited. It is felt that the main development possibilities fall in the improvement of production methods and technology applied in farming. There is a need for a "package" of improved practices, including improved seeds and seedlings, better water use, crop protection measures, chemical fertilizers modern equipment and generally higher standards of farming, if production is to be increased sufficiently rapidly. The improvement of technology will not only increase yields but will also decrease unit costs and thereby increase profits.

Some of the main ways in which modern technology can contribute to raising agricultural productivity are discussed in following paras. Although each is dealt with separately, yet, it should be borne in mind as emphasized above, that their full impact is obtained only when they are combined in a suitable "package".

2.2.1.1. Improving fruit tree plantations.

The improvement of cultivation techniques should be considered separately for existing plantations and for new orchards.

A - Improving existing plantations.

a - Orchards on unsuitable sites.

For orchards on an unfavourable sites, it is obviously much better to uproot the trees and replace them with a more suitable crop. Sites subject to strong winds are particularly damaging to fruit trees, especially for fruit of which the appearance is important. Strong excessively hot winds, such the sirocco (locally called "Khamsin") make the cultivation of some fruit tree species impossible in exposed positions.

b - Orchards on suitable sites.

The following measures are suggested to improve existing orchards located on suitable sites:

1 - Soil and water conservation measures.

- Undertaking anti-erosion measures when the orchards are on slopes; this will also help to ensure good use of the rainfall.
- Helping the penetration and storage of irrigation water or rain by frequent harrowings. Further studies are required to determine the economically optimum number of cultivations.

2 - Orchards cultivation.

The orchard cultivation and shallow working of the soil mentioned above have the additional advantage of destrowing weeds, facilitation irrigation and harvesting, incorporating cover crops, adding manure and fertilizers in the soil, controlling certain pests, preventing evaporation and aerating the soil.

3 - Manuring and fertilization.

Manuring is very important under dry farming conditions and fertilizing and manuring are also very important under irrigated conditions. Further studies are required to determine the response to fertilizer and manure, and to determine the economies of fertilizer application.

4 - Irrigation.

It would be much better to assure the summer irrigation during at least the most critical period for the physiology of the crop. A few deep irrigations are better than many light and shallow irrigations.

5 - Control of pests and diseases.

Cultivation practices do not give complete control of pests and diseases in all seasons. Supplemental chemical control is necessary for some insects in certain years and for more serious insects in all years.

6 - Pruning.

In such arid zones, pruning is done late. If the rainfall is low, it is essential to prune drastically. The best advice is to prune more often but less severely. The training of skilled pruners and foremen is necessary.

7 - Harvesting.

For pickling olives, it is advisable to delay harvesting as long as possible to allow the fruit to reach its maximum size. For oil cultivars a complete ripenning of the olive is required. Certain harvesting equipment has been tried in the Zone and the preliminary results are relatively satisfactory. No problems exist for the harvesting of other fruit trees.

B - Establishment of new orchards.

For the establishment of a new orchard, the following main points should be taken into consideration.

1 - Choice and preparation of sites.

Priority should be given to sites, where, continuous watering can be done, secondly, to soils receiving winter irrigation, and finally to land, where water conservation work can be done in order to improve infiltration of rainfall and of runoff from adjacent land.

2 - Planting density and distances.

The planting density for fruit trees should be relatively too great. More will be lost by too close planting than by too wide planting.

3 - Pollination.

The problem of pollination should be taken into consideration for some fruit trees species mainly almond, pistachio and carob.

4 - Planting.

All precautions must be taken in order to prevent the seedlings from drying. When trees with bare roots are being planted, the formation of air pockets around the roots must be avoided.

5 - Care after planting.

It is necessary to protect the trunks of seedlings against sunburn. If damage from animals is feared a wire net cage or thorny branches should be put around the trunk. Cultivation with light implements should take place as soon as the soil forms a crust or grass starts to appear.

6 - Pruning.

A low form should be given to most species of fruit trees. Concerning pruning for fruit production, the amount of annual rainfall, runoff and irrigation possibilities should be borne in mind; more severe pruning being required at lower moisture levels.

7 - Water requirements and irrigation.

It would be much better not to extend fruit trees in general and olive trees in particular without the assurance of summer irrigation during at least the first few years after plantation. Some heavy and deep irrigations are better than many light and shallow irrigations. Irrigation enhances the benefits of modern inputs; makes better crop rotation, diversification and mixed farming possibly reduces instability in output, and increases agricultural employment. There is no dependable irrigation in the area and rainfall is scanty and precarious, therefore the main effort should be on contour bunding and contour cropping, and dry farming practices, so as to maximize returns per unit of water.

8 - Other care.

See precedent paragraph (A).

2.2.1.3. Improving vegetables.

Vegetables need more care and more intensive agricultural techniques than field crops. The following care and operations are suggested.

1 - Soil erosion by water and by wind is a serious matter in some production regions. Soil erosion by water can be controlled through terracing, contour tillage and planting, and by strip cropping. Soil erosion by wind can be controlled by the use of windbreaks, by keeping the soil well supplied with humus, and by growing cover crops or fodder crops when the land is not occupied by other crops.

2 - Soil preparation. Soil preparation is very important. Soils for vegetables should be fairly deep. Fall plowing is desirable for early planting in the spring.

3 - Manuring and fertilization. Manuring in dry-farming areas and fertilizing and manuring on irrigated land should be applied on a large scale. The concentration of sheep flocks in sheep pens at night is recommended to enable manure collection. The level of fertilizer use per feddan of arable land is closely linked to the level of crop production per feddan. Studies elsewhere have show that small scale farmers using their traditional methods could raise their yields by an average of over 50% through the use of relatively low rates of fertilizer. The average economic return thereby amounted to over four times the cost of the fertilizer applied (1). The use of fertilizer should be combined with the use of better seed and pesticides and other improved practices such as better tillage and sowing methods and higher plant population. Fertilizer subsidies should be used in the Zone.

4 - Crop rotation. The principles of crop rotation should be applied (see sect. 2.2.2.)

5 - Seedling and transplanting. Vegetables should be sown in succession in order not to have a surplus production at one particular time. Special outdoor areas which give the plant some protection or make them easier to take care of, a cold frame and plant protectors can be used in order to have earlier seedlings and longer period of production.
In future a hotbed and greenhouse can be found economical to be used in the field of early vegetable production.

6 - Irrigation. Irrigation is essential to the success of many species in such a semi-arid region. It is necessary to benefit from the available water as much as possible.

7 - Weeding. Most weeds are removed by the use of mechanical equipment. In some cases elsewhere selective herbicides have greatly reduced weeding costs, but it is too early to determine the feasibility and economics of their use here.

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1) The State of Food and Agriculture 1960
Food and Agriculture Organization of the United Nations.

8 - Control of pests and diseases. Without suitable crop protection measures the increased yields obtained through the use of improved varieties, fertilizers and irrigation are in danger of being wiped out by pests and diseases. Most growers do not realize the importance of controlling pests and diseases in order to obtain maximum yields. The economics of crop protection require further study especially in the conditions prevailing in the Zone.

9 - Agricultural extension. Farmers need more advice on vegetable growing under dry farming and irrigated conditions.

10- Marketing. Marketing through cooperatives should be organized in order to decrease the cost and to have a more remunerative price.

2.2.1.4. Improving field crops.

If suitable agrotechniques are adopted, it will be possible to increase the production to a great extend.

1 - Soil preparation. The soil should be properly ploughed in the autumn to increase the penetration of rain water. However, the soil should not be turned over but rather opened up as done at present, but to a deeper level.

2 - Sowing. Barley seeds should be either drilled by sod-seeder or regular drill or sown at a suitable depth. (2-3 inches) in lines and not by broadcasting method.

3 - Harvesting. At present the barley is harvested by pulling the whole plant from the soil. The use of combine harvesters seems to be difficult. The way of harvesting can be improved to be more economical and more rapid by using scythe (seef) or even sickle.
An advantage of using the sickle (or possibly the scythe) would be that the roots and short stubble stays in and on the land, thereby giving some protection against wind erosion in summer, providing more litter on the soil to enhance water penetration in the next rainy season, and to improve the physical structure of the soil. It is suggested to use the local threshing sleigh (Norag) but with the use of seedcleaners.

The cooperative use of mobile threshing machines could be considered in areas with concentrations of barley production (such as El Dabaa) but would require the additional use of straw choppers to obtain chaffed straw, when labour would become a scarce factor.

4 - Water use. Many of the agricultural practices developed in areas of rainfed agriculture are concerned primarily with the better use and conservation of water.

5 - Machinery and implements. The replacement of the actual tools by improved ones would enable a greater volume of work to be accomplished with less effort and in shorter time. More technical and economical research on mechanization is required.

6 - Treatment of seeds. Some treatments against disease must be done for seed produced from infected fields. Covered smut and stripe disease can be controlled by chemical seed treatment and loose smut by hot water seed treatment. Diseases caused by rusts can be controlled by using resistant cultivars.

7 - Seed storage. A preliminary study indicated that the feed and food quality of barley stored in pits in the N.W. coasted zone is quite well maintained, but that the viability of the seed decreases considerably as a result of more or less air-light storage in the pits. A storage programme for seed grain seems therefore appropriate in the Zone.

2.2.1.5. General suggestions.

In addition to what has been suggested before it is necessary to undertake the following activities:

- Setting up of pilot farms under different conditions of irrigation and/or runoff.
- One oil press plant has been established by the Project in Burg-el-Arab. It is useful to establish another new and modern oil press in the area, and to modernise the existing oil presses in the Zone. There is also a need to control and improve gradually the conditions of work and traine the staff in the private oil presses in the Zone.

- It is preferable that oil presses are established in the four sectors gradually as the olive trees come into production, starting immediately with Mersa Matruh and later on with the sectors of Daba and Sidi-Barrani.
- The adoption of several cultivars with a successive period of maturity allows to prolongate the period of work of oil presses.
- It is essential to improve the storage conditions of the oil in E.G.D.D.O. oil presses.
- Appropriate and suitably sited storage facilities are required to ensure the availability of supplies at the right time and place.
- There is no need to emphasize the role of research in any programme of technological improvement. It is felt that a well equipped experiment station with a good and dependable supply of irrigation water should be established for the Zone. (see sect. 9.1).
- Extension services will have a crucial role to play in helping farmers to avoid failures resulting from the use of the wrong plant variety, new pest and diseases, and uncorrect methods of sowing or fertilization which might destroy their new confidence in modern technology.
- Agricultural development programmes call for large increases in trained manpower at all levels and in many specialized fields.
- Particular attention needs to be given to cost price relationship and other factors influencing the farmers incentive to purchase inputs in order to raise the production and sales.
- The adoption of modern technology inevitably involves the purchase of inputs such as manure fertilizers, pesticides and improved seed and also investment in irrigation equipment, implements, agricultural machinery and so on. This necessitates credit which can be given in kind rather than in cash and the repayment of the loan should be tied to the sale of the agricultural produced.
- Many of the difficulties of the small farmers arise from the fact that they have to sell their crops immediately after harvest (if not before) at the lowest prices of the season. This usually happens because they do not have storage facilities or need money at once or both. If supplies could be released to the market progressively the total proceeds would almost certainly be greater and would in any case be distributed more evenly. The provision of short-term credit on reasonable terms can help in this direction.

2.2.1.6 Strategy for technological improvement.

There are many advantages in emphasizing the increase of yields on existing areas by means of technological improvements. Perhaps the basic element in a strategy of technological improvement is the package approach itself. Rapid technological improvement in agriculture implies giving a high priority to agriculture in development plans. Marketing and storage facilities will need to be greatly expanded and improved not only for the increased quantities of inputs but also for the increased output that may be expected.

2.2.2. Crop rotation and intercrops.

2.2.2.1. Crop rotation.

Introduction.

The choice of a rotation depends upon the crops adopted to the particular soil, climatic and economic conditions. In addition, weeds, plant diseases and insect pests may limit the kinds of crops to be grown in a locality.

Rotation, except in the case of an alternate grain-fallow system, provide some diversification of crops.

The crops to be tried in the first phase should not be new to the general area and the pattern may well be changed with experience.

Based on the ecological requirements of vegetables and field crops growing in the area or in similar areas a good rotation is one that provides for maintenance or improvement of the soil productivity. Crop rotations can be very important under dry land conditions partly because of the difference in residual soil moisture left by different crops, as well as the length of the fallow period for moisture storage between crops.
Another important aspect of rotations under the conditions of the Zone is the amount of crop residue and root material which can be incorporated in the soil to increase water penetration and retention. To utilize fully the resources of the soil it is well to alternate as much as possible shallow-rooted and deep rooted crops and to fallow crops that furnish organic matter with those whose culture favors its decomposition. One major factor is the replenishment of nitrogen through micro-organisms (Astobacter) in the fallow period. Crop rotations should take into consideration the requirements of livestock in certain critical periods. Crop rotations in general and for vegetables in particular in the area must be very flexible and must be revised every year according to the quantity of rainfall and runoff and price in local market.

A - Crop rotations for vegetables.

Systematic crop rotations are not so common in vegetable growing as in general farming. There are a few principles that should be observed. In many parts vegetable crops are grown in rotation with general farm crops. Following are some species to be included in the crop rotation under irrigation and dry farming conditions. Some of them need to be tried before being planted on a large scale.

Winter vegetables: Peas, broad-beans, onions, tomatoes, radish, garden-rocket, turnip, cauliflower, lettuce, spinach, artichoke, beet, carrot, celery, parsley, strawbery....etc are important winter vegetables.

Summer vegetables: Important summer vegetables are: Watermelon, cucumbers, snake cucumber and some other cucurbitaceaes, tomatoe, cabbage, eggplant, pepper, spearmint, asparagus, okra, jew's mallow.

Table 41 illustrates crop rotations which can be followed under different moisture levels. Variations of these would be possible especially under conditions of higher moisture availability.

B - Rotation of field crops.

Most of the following field crops can grow satisfactorily in the zone under irrigation or dry farming conditions where runoff water is received. Some of them need to be tested before being introduced in the crop rotation.

Winter crops: Barley, wheat, lentil, chick-peas, lupin, safflower, anise, oats, vetch, lathyrus ssp, brassica ssp., are important winter crops.

Summer crops: Important summer crops are: Sorghum, sesame, peanut, sunflower, tobacco and maize.

The crop rotation for field crops as for vegetables must be very flexible. The land use should be determined every year in accordance with the quantity of available water and market conditions. Table 42 illustrates crops rotations which can be followed under different moisture levels. Variations of these would be possible especially under conditions of higher moisture availability. Crop rotations with pasture and fodder crop species are discussed below.

Table 41 CROP ROTATIONS UNDER DIFFERENT MOISTURE LEVELS (VEGETABLES)

Seasons	Suitable species under some different amount of water (rainfall + runoff)			Species suitable under watering conditions
	200 - 300 mm	300 - 400 mm	More than 400 mm	
1st winter	Broad-beans or onion	Broad-beans or onion	Broad-beans, peas, onions	Peas, broad-beans, onion tomatoes, lettuce
1st summer	Fallow	Fallow	Fallow	Watermelon and other cucurbitaceae
2nd winter	Broad-beans, onion	Fallow 1/	Fallow 1/	Turnip, beet, radish, carrot, parsley, celery
2nd summer	Fallow	Watermelons and some other cucurbitaceaes	Watermelons and other cucurbitaceae tomatoes	Tomatoes, cabbage, eggplant, pepper, spearmint, asparagus, okra, Jew's mallow.

1/ Fallow if to be followed by summer crop: if not, crop as in first winter.

Table 42 CROP ROTATION UNDER DIFFERENT MOISTURE LEVELS (FIELD CROPS)

Seasons	Suitable species under some different amount of water (rainfall + runoff)			Species suitable under watering condition
	200 - 300 mm	300 - 400 mm	More than 400 mm	
1st winter	Barley, lentil 1/	Barley, wheat, safflower	Wheat, barley, safflower	Barley, chick-peas, safflower, oats, vetch
1st summer	Fallow	Fallow	Fallow	Maize, sesame, peanut
2nd winter	Barley, lentil 1/	Broad-beans, lentils, chichpeas, lathyrus ssp. vetch or brassica ssp.	Fallow 2/	Wheat, lentil, lupin, brassica ssp. lathyrus ssp.
2nd summer	Fallow	Fallow	Sorghum, sesame, maize, pea-nut, sunflower	Sorghum, peanut, sunflower

1/ Due to the inter-annual fluctuations in winter rainfall crop failures are expected 1-2 times every five years which provide automatically an irregular barley - fallow rotation.

2/ Fallow in case followed by summer crop. Otherwise lentils or other legumes.

2.2.2.2. Interplanting and intercropping.

Interplanting and intercropping, as a means to increase the production and as a source of supplementary income, while tree crops are coming into production, has a merit. The fairly slow growth of fruit trees in general and of the olive, carob and pistachio in particular, leaves much ground unused during the first years, the returns from which will compensate partly for the time required for the trees to come into production. Such catch crops, however, should never be allowed to encroach on the soil needed by the trees for their normal development or compete with them.

Interplanting.

If perennial intercrops are being considered the grapes and almonds can be recommended, as they are most suitable plants for this purpose. Other fruit trees such as fig, apricot, pomegranate and peaches can also be cultivated as interplants, provided it is possible to take out the fruit trees at the right time (after 8-12 years). Figs, almonds and grapes begin to bear fairly early, little is gained by interplanting between such species.

Intercropping.

Annual intercrops have the advantage on perennial interplants to be given up less reluctantly. Intercropping should stop after 4-12 years according to the species, the development of fruit trees, and the moisture conditions of the orchards. Intercropping can be used only if the orchard receives a sufficient quantity of rainfall and runoff. Orchards can be irrigated if water is applied to benefit the fruit trees rather than intercrops.

a - Vegetables:

1 - Winter vegetables: Onions, broad-beans, peas, can be cultivated as intercrop between fruit trees under dry farming or irrigation conditions. Tomatoes are planted often under irrigation.

2 - Summer vegetables: Watermelons and some other cucurbitaceaes, tomatoes and some other vegetables are cultivated under dry farming or irrigated conditions.

b - Field crops.

1 - Winter field crops: Lentils, chickpeas and some other leguminous species can be planted as intercrops under irrigation or dry farming conditions.

2 - Summer field crops: Maize can be cultivated as intercrop but it is more desirable to plant pea-nut under irrigated condition or if the moisture in the soil is sufficient.

c - Fodder crops.

With ample moisture, as in some terraced wadi beds, row-cultivation of alfalfa in the first 5 years might be feasible and economic. With less moisture annual winter forage crops such as vetch are possible.

2.2.3. The supply of seeds and seedlings and the establishment of improved nurseries.

High quality seeds and seedlings are one of the principal means of raising crop production both in quantity and quality. The E.G.D.D.O. presently produces seedlings of fruit trees and especially of olive trees in its nurseries. Their production can easily be increased, improved and diversified. In collaboration with the Ministry of Agriculture, certified seeds can be produced on their own farms.

Supply of seeds and seedlings.

The seed is really the foundation for the success of the future crops. The seed should be true to the name, be viable, free from seed-borne diseases, free from weed-seed, foreign matter or mixtures. The farmers would appreciate if E.G.D.D.O. distributes selected seeds of barley, broad-beans and watermelons, seeds and seedlings of tomatoes and seeds and sets of onions. The zone uses annually between 1500 - 2500 tons of barley for seed. The quantity of seeds of other field and vegetable crops is relatively limited.

E.G.D.D.O. distributes every year at subsidized price between 40,000 - 80,000 fruit seedlings, according to the prevailing situation. The following points can be stressed.

- Practically only one species (olive trees) is distributed. Other species should also be distributed.
- More attention should be given to the cultivars and the quality of seedlings.

Establishment of improved nurseries.

A - Improvement of existing nurseries.

1 - Introduction.

E.G.D.D.O. has the following nurseries which serve the Zone: Nubaria, Burg-el-Arab, Fuka and El Qasr. The number and the total area of the nurseries are sufficient but it is difficult and too expensive to manage four small nurseries and so far away from each other. It will be better to establish one new big nursery in place of the four small nurseries.

2 - Improvement of existing nurseries

The existing nurseries need some improvement, in case, the E.G.D.D.O. decides to keep them as nurseries and instead of establishing a new modern nursery.

a - Establishment of auxiliary parts of nurseries.

To assure a good management of a nursery, it is essential to have a permanent source of sweet water, mother plants, sun shade or screen, cold frames, greenhouse and nursery equipment for ploughing, planting, grafting and pruning.

b - Tracks for nursery.

The tracks selected for nursery should be well drained, levelled and be free of pests and diseases.

c - Working of soil.

Good ploughing and weeding of the soil is essential.

d - Manure and fertilizer.

Manure and chemical fertilizer should be applied with sufficient quantity.

e - Irrigation.

It is necessary to give an optimum quantity of water. Irrigation with salty water should be avoided.

f - Seedlings pruning.

Seedlings should be pruned on adequate distance above the soil.

g - Grading of seedlings.

Before digging up it is necessary to put a ticket indicating the species, cultivars and rootstock. Good 1st class seedlings should be separated from the week and diseases seedlings.

h - Crop rotation.

The crop rotation in the nursery is very important. It is necessary to follow a quadriennal crop rotation.

i - Pest and diseases control.

Pest and disease control is essential in a nursery, because it is necessary to sell or distribute only healthy seedlings.

j - Mother trees.

It is necessary to establish a complete and good collection of mother trees in order to provide nurseries with the necessary bud wood and cutting material.

B - Establishment of a new nursery.

For the establishment of a new nursery the following suggestions are made:

1 - Purpose.

In order to maximise the use of facilities and staff and to minimize the cost, it is suggested that the nursery work would be carried out at a central station in which experimental and training activities would also be combined. For the same reason a nursery in a central station would be preferred over several small nurseries at scattered places. Furthermore, the new nursery should be used for the production and propagation of trees for windbreaks and sand dune fixation as well as for range and fodder services multiplication. An area of about 150 feddans will be sufficient for this purpose.

2 - Location.

With regard to location, the main factors to be considered are the availability of good quality irrigation water, good soil, distance to main road or especially railway facilities for staff (distance to nearest town) micro-climate, distance to beneficiaries.

3 - Existing nursery farms.

It is proposed that, following the establishment of the central nursery, the existing nursery farms at Burg-el-Arab, Fuka and El Qasr be maintained to be used as distribution centres, possibly also as sub-stations or as pilot demonstration farms.

4 - Some urgent recommendations.

It is necessary to provide this nursery with the following things:

- Necessary equipment such as: tractors, water trailers, sprayers, different kinds of ploughs, one greenhouse for mist propagation, and all other small equipment necessary for traditional work of nurseries.

- Necessary material such as: selected seeds, manure, fertilizer, plant protection material, and material necessary for grafting.
- Means of transport such as: one truck, one car and a motocyclette to assure the transportation of materials and persons.
- Necessary personnel such as: Agronomists, technical assistants, mecanicians and different level of technical labors.
- Financial autonomy in order to facilitate the proper running and optional productivity of the nursery.

2.2.4. Diversification and introduction of new species and cultivars.

The mono or bi-culture is the principal characteristic aspect in the Zone, with barley as field crop and olive and fig as fruit trees being the main species cultivated in the area. The diversification and the introduction of new species and cultivars will constitute a very important step towards the amelioration and improvement of the quality and the quantity of production.

2.2.4.1. Diversification.

The diversification of agriculture has many advantages in areas of under-employment where farming is not mechanized especially the following:

- Better income distribution throughout the year.
- Better utilization of soil.
- In certain cases more economical use of available water and other facilities.
- The spreading of risk resulting from crop failures due to weather and pests, and from price fluctuations.
- The problem of seasonal unemployment is less acute; seasonal employment is more regular, and the available man power is better distributed and utilized so as to create improved conditions for the permanent settlement of farmer families.
- On the other hand diversification should not be pushed so far in order to avoid inefficiency of marketing and processing.

The diversification means the plantation of more species, more cultivars and even more strains. The introduction of species, cultivars and strains tolerant of dryness and salinity is highly recommended. (see the following sub-section.)
The diversification also implies more variation in period of plantation mainly for vegetables and more variation too in the method of plantation and conditions of cultivation (irrigation, watering in the first stage of vegetation and dry farming) and adequate crop rotation.
For the diversification of agricultural production, the emphasis will be on increasing the production of horticultural crops, mainly fruits and vegetables. Diversification of production should cover a wider range, to provide a wider scope for choice and integration of crops and other anterprizes on optimal levels.

2.2.4.2. Introduction of species and cultivars.

The Zone, as stated before, is relatively poor in species and varieties. It will be useful and fruitful to introduce local species and cultivars from other areas of the U.A.R. and foreign species and cultivars from other countries of similar ecological conditions.

The new species chosen for the Zone should have adequate resistance to drought, as well as sufficient earliness to enable the crops to ripen before the dry periods begins. If new cultivars are used with suitable combinations of other input they are capable in some cases and under favourable conditions of raising yields several fold compared with those of local cultivars.

2.2.4.2.1. Fruit trees.

Beside, olives it is necessary to increase the area cultivated by other fruit trees like figs, almonds, grapes etc. mainly as interplant. It is also necessary to introduce some other new fruit species.

New species.

The new species to be introduced into the Zone should be suitable for this semi-desertique climate of the mediterranean. Their resistance to drought conditions should be proved. It is felt that pistachio, carob, pomegranate, apricot, peach, mulbery and prickly-pear, can play some part in the future economy of the Zone, especially carob and pistachio which withstand the dryness. Avocado can be tested in irrigated sectors and guava can be tested both under irrigation and dry farming conditions. Pomegranate and prickly-pear could be used as fence and windbreak.

New cultivars.

The improvement of fruits, by introduction, study and selection of the best cultivars and strains is very essential.

Olive cultivars.

Among the present cultivars it seems that Chemlali is the best one to be cultivated under dry farming conditions for oil, wetken is the best under irrigation, Kalamata and Hamid are especially used for pickling.
The following international collection of cultivars has been introduced by the project, in the Zone for adaptation studies and observation.

Olive oil cultivars.

Garboncella, Maurino, Leccio Oel Cesso, Frantoio, Canino, Rosciola, Casaliva, Correggiolo, Coratina, Pendolino, Tagiasco, Piagente, Leccino, Chemlali, Zalmati,

Olive table cultivars.

Salonenque, Verdale, Manzanella, Tanche, Bouteilian, Picholine, Bella di spagna, Itrana, Uovo di Piggione, Santa Caterina, Ascolana tenera, Gordales, Moraiolo.

Some local cultivars could also be introduced and tested. The selection of the better types among present population constitutes one of the most effective methods of bringing about improvements in olive growing.

Fig cultivars.

Existing cultivars are for fresh consumption. It is necessary to introduce and test some new cultivars for drying. The project has introduced from U.S.A. and Italy the following cultivars suitable for drying without caprification to be tried and propagated: Adratiac, Black Mission, Canadria, Brogiotto Bianco and Brogiotto Nero. Other cultivars like Dottato (Kadoda), Brown Turkey, Celeste, Magnolia etc.. should be introduced and tested too.

Almond cultivars.

Among the most important and valuable cultivars elsewhere are: Nonpareil, I.X.L. Texas and Ne plus Ultra.

The following cultivars has been introduced by the project: Non pareil, Ne plus Ultra and Texas from U.S.A., Abiad, Constantine, Zaaf and Achack which have proved superiority over foreign varieties in Sfax area (Tunisia) which is more or less similar to the Zone.

Grape cultivars.

The propagation of good varieties adapted to the environment is a relatively urgent problem to be solved. In the area, only table grapes cultivars and raisin cultivars can be planted.
The more important varieties to be introduced and tested are the following:
Thompson Seedless (Sultanina), Black Corinth and Muscat of Alexandria.
Almeria, Calmeria, Cardinal...etc are among the more important international table cultivars which should be introduced and tested in the area.
The project has established a demonstrative plots in some area of the Zone in 1968 and 1969 from the following cultivars: Banati, Roumi, Rozaki and Regina.
Other cultivars should be introduced and tested.

Apricot cultivars.

It is necessary to introduce some apricot cultivars to the area, the following are among the cultivars recommended: Royal, Blenheim, Tilton, Amor Leuch, Caninos.
Among local cultivars the following can be introduced: Baladi and Hamawi. These two cultivars have been introduced to Fuka farm from Syria, the vegetation in the first stage has been very good. Some demonstrative plots have been established in the Zone from the following local cultivars: Hamawi and Ammar.

Pistachio cultivars.

Some of the following cultivars should be introduced to the Zone in order to be tested:

- Achouri, Batouri and Ouleimi have been introduced from Syria.
- Ibrahimi, Owhadi should be introduced from Iran.
- Red Aleppo, Bronte, Kay, Trabonella, Kerman, Damghan and Lossen should be introduced from California. Seventy seedlings have been introduced to Fuka farm from Syria.

Carob cultivars.

Some cultivars should be introduced to the Zone in order to be tested:

- Tilliria from Cyprus
- Latissima, Saccarata, Racemosa, Amela and Battezzata from Italy

Other cultivars can be introduced from Spain, Portugal and other producing countries.

2.2.4.2.2.Vegetables.

The number of vegetables grown commonly in the Zone is relatively limited. There is a scope for introducing some vegetable species and cultivars and for an increase in area.

New species.

Many new species can succeed in the area, the following are among the more important: Garlic, asparagus, eggplant, pepper, pea, artichoke, spinach, beet, carrot, turnip, cabbage, cauliflower, parsley, celery, strawberry, okra, jew's mallow. For some time, the following species will continue to be the more important: onions, tomatoes, watermelons, snak cucumber and broad beans.

New cultivars.

Only the cultivars of the more important species will be indicated.

Broad beans.

It is necessary to introduce some cultivars from abroad to be tried in the area mainly under dry farming conditions. The local varieties such as Baladi, Saidi, Buhairi and Roumi can be compared and in order to know the best under local conditions.

Onions.

Some of the following cultivars can be introduced and tested: Australian Brown, Excel, Hybrid Onions, San Joaquin, Southport, Globe, Sweet Spanish, Yellow Globe Danvers. The local cultivars can be tried also such as: Buhairi, Saidi and Jiza 6.

Watermelons.

The following foreign cultivars should be introduced and tested: Dixie Queen, Blue Ribbon, Florida Giant, Klondike strains, Kleckly Sweet, Leesburg, Tom Watson, Congo, Giza 1.

Tomatoes.

The following cultivars can be introduced and tested: Bonny Best, Victor, Pear Harbor, Marglobe, Prichard, Pennheart, Stone, Money Maker, Canatella and Rutgers. Canatella, Prichard and Marglobe have been introduced and tested by the project. Canatella was the first as concerning quantity and Marglobe and Brichard the first as concerning quality and price.

2.2.4.2.3.Field crops.

The main field crop in the area is barley. It is more or less a mono cultivation. In this field it may be difficult to introduce other species on a large scale, because barley has a greater tolerance for salinity and drought than any other crop.

New species.

The following new species can be introduced and tried: sorghum, sesame, lentil, chickpeas, lupin, pea nut, sunflower, anise, tobacco and safflower. But barley continue to be the most important specie.

New cultivars.

Only the cultivars of the more important species will be indicated:

Barley.

A mixture of Mariuti and other cultivars is cultivated in the Zone. It is necessary to introduce some cultivars from other countries of similar conditions such as Compana, while Smyrna and California Mariout from U.S.A., Arabi Abiad, Arabi Aswad have been introduced from Syria and Martin and Beecher from Tunisia. The following cultivars have been introduced by the project also.

1 - Barley cultivars of the F.A.O. Near East wheat and barley programme (112 cultivars)

2 - The following cultivars original from Australia.
Prior, Noyep, Clipper, Bussel, Weeah, W.I. 2094/6, W.I. 2128/10, W.I. 2108/1, W.I. 2137/2, Beecher, Alyssinan, Research, Ablyn.

Some local cultivars from other areas can be introduced and tested.

Other species.

Some local and exotic cultivars of the following species should be introduced and tested: wheat, lentil, sesame, chick-peas, lupin, safflower, anise, maize, sorghum, peanut, sunflower and tobacco.

3. Animal Production and Range Management

Two basic lines of approach can be followed for the development of animal production in the project area. The first is through range management and an increase of productivity without the use of large feed inputs from outside the area. The second is through an intensification of animal production with the use of relatively large amounts of feed inputs from outside the area or from future irrigation projects in it. The inputs can be in the form of concentrates, hay, and irrigated foddercrops and pastures for grazing in situ. If the second approach is chosen, certain elements of the first will be applied as well, especially in the early stage of development.

The prerequisite for either way of development is the establishment of an adequate institutional and organizational structure. The second approach requires a greater departure from the traditional system of animal production than the first, but in both cases the changes can be brought about only gradually, and hence effective extension and demonstration work is indispensable.

3.1. Range management

Rational utilization of the range requires above all limitation of the traditional freedom which the livestock owners are used to, especially with regard to animal movements and to the total number of animals owned. The obstacles to be overcome are not only the result of centuries-old traditions, but also the result of economic considerations on the part of individual livestock owners, who are encouraged to increase their livestock numbers because of the high prices they can obtain for live animals by illegal export and import and because of the relatively low prices of Government and WFP supplement feed.

Range improvement based on the control of livestock numbers and the introduction of rational grazing systems should go hand in hand with the introduction of better animal management practices and veterinary services, which would help to increase productivity per animal and to overcome psychological resistance to the limitation of individual freedom.

3.1.1. The control of livestock numbers

If further deterioration of the productive potential of the range vegetation is to be avoided and regeneration is to take place, the total number of animals in the area must not exceed the carrying capacity of the range, taking into account an economic level of supplement feeding. Control of animal numbers would reduce the losses suffered under present conditions from periodic droughts, when there are serious shortages of herbage and feed for an animal population which has been free to multiply in good years.

The total number of sheep and goats, with limited amounts of supplement feed and a migration of an average 2 months per year from the Burg El Arab sector to the Nile Valley, at the proper stocking rate under the present production capacity of the range, would fluctuate between 280 000 per head in a drought year to 325 000 head in the four non-drought years out of five. The fluctuation bears no direct relation to the fluctuations of range production, which are much larger. In drought years greater use would be made of barley, concentrates and roughage, to make up largely for the lacking range herbage (see Figure 3). In years of above-average growing conditions, the quantity of range herbage would exceed animal requirements, especially in late winter and spring. This surplus could be utilized partly by

keeping the weaned male lambs and adults on the range for a longer period in summer than in years with average growing conditions. Furthermore, it is essential that in extremely good years the range should not be grazed at its full potential, so that palatable perennials would be able to extend their root system, to accumulate reserve nutrients, to flower and to produce seed.

In addition to controlling the total number of livestock in the area, it is also necessary to control long-distance movements within it. This would check excessive numbers of livestock from converging on an area which has relatively good vegetation cover in a particular season, thanks to good rains and improvement activities.

It is therefore proposed that the zone be divided into grazing districts 1/ Each grazing district would cover an area sufficiently large to allow for the short-distance migrations necessary for the best use of the vegetation in the various range types and would include the main traditional grazing grounds of the various sub-tribes living in its area. Livestock movements from one grazing district to another would be restricted to the minimum, and only in exceptional cases would such movements be authorized by the staff of the grazing district in question. South of the grazing districts, movements would not be restricted. Normally each grazing district would be self supporting insofar as range herbage is concerned. Shortage would be met through the provision of concentrates and roughages by the district cooperative. In a given year the amounts of concentrates and range roughages to be provided per animal might thus differ from one grazing district to another.

The animal numbers per grazing district, based on its total carrying capacity, are given in Table 12 (flock size prior to the new lambing sessinn; i.e. the basic flock). These figures should be periodically revised on the basis of further carrying capacity studies and of range improvement in each district.

The location and boundaries of the proposed grazing districts are shown on Map 3. The proposal to establish five grazing districts between El Dabaa and Sallum was adopted by the Government (Decision No. 13/1968 by the Chairman of the EGDDO). It is envisaged that one or two grazing districts will also be established east of El Dabaa at a later stage, the development of irrigation schemes in that area being taken into consideration, especially for the determination of the relationship between range sheep husbandry and the use of irrigated land for grazing, whether merely in the form of crop aftermath and ditchbanks, or in the form of irrigated pastures and foddercrops.

The limitation of the total number of sheep and goats in each grazing district is to be achieved through a system of licensing whereby the number of animals per individual owner is not to exceed a certain level. The excess adult females each year should be marketed through the cooperative, and the eligibility to obtain feed rations should depend on the sale of the required number of female animals. The animals constituting the basic flock will be earmarked or colourmarked and spot-checks on the number of adults and yearlings in the flock should be carried out periodically by the staff of the grazing district and by specially appointed guards. Owners whose flocks are found to include more adults and yearlings than is stated in the permit

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1/ A detailed description of the proposal is found in:

"Provisional outline for a range management policy in the North West Coastal Zone, UAR" by J.P.H. van der Veen, FAO Agronomist (Range Management), UNSF Pre-Investment Survey of the North West Coastal Region, UAR (Mimeo, Feb. 1967)

should either lose their entitlement to feed rations or be subjected to a fine. It must be recognized, however, that this method of control may be difficult to implement effectively in the first few years. It is therefore felt that the most effective means of control is the marketing of excess females through the cooperative. There are various difficulties with regard to cooperative livestock marketing, especially in view of the illegal sale of livestock to Libya and the illegal return entry of other commodities. However, it is felt that, without a system of cooperative marketing and a link between the breeder's fulfilment of his marketing obligations and his entitlement to feed rations, the control of livestock numbers will be very difficult, if not impossible.

The link with feed provision is important since, even with the recommended total number of animals, certain amounts of feed from outside the area will be needed. Feed obtained through the Government is considerably cheaper than feed obtained from the free market, and all feed imports into the area can easily be controlled, since only one highway and one railway lead into it. The measure of linking the feed supply with the breeder's obligations will certainly be very unpopular and politically difficult to implement. However, without effective control of livestock numbers no range improvement can be achieved and the productive potential of the range is bound to deteriorate further. With this in mind, the WFP feed assistance is to be used as a tool in initiating a range improvement programme based on the control of livestock numbers at levels in accordance with the carrying capacity of the range.

Control of livestock movements across the boundaries of the grazing districts for the purpose of grazing is to be carried out by specially appointed guards under supervision of the staff of the grazing district. In order to distinguish the animals of the different grazing districts, a distinctive earmark or colour branding will be utilized for each.

As pointed out above, various activities should be carried out in the grazing districts to improve the productivity per animal and especially to offset the impopularity of the control measures on livestock numbers and movements between the districts. Foremost among these activities is internal and external parasite control. This, a measure very popular among breeders, is one which will rapidly help towards an increase of productivity.

3.1.2. Improved Grazing Techniques

Several features of range herbage growth should be taken into consideration with regard to grazing systems. Foremost is the large quantity and high quality of grazeable herbage production in late winter and spring as compared to that of summer and autumn. This is schematically shown in Fig. 11. Secondly, the amount of herbage varies greatly from year to year. Thirdly, the composition, palatability and relative nutritive value of the various range types in the various seasons is of great importance in determining the best grazing system in relation to the seasonal requirements of the animal population.

At the proper stocking rate, the following plant growth-grazing seasons can be roughly distinguished in non-drought years:

a. Inadequate green herbage season: early October - early December.
b. Adequate green herbage season : early December - early April.
c. Adequate herbage season of dry ephemerals and largely green perennials : early April - middle July.
d. Inadequate herbage season of largely dry perennials : middle July - early October.

As the graphs in Fig. 11 show, a large surplus of herbage exists between early December and early April. This is because of the considerable growth of annuals at this time. Grazeable herbage production drops sharply between the beginning of April and the middle of July, when the annuals cease to grow. The growth of perennials slows down more gradually. However, the deficit in nutrition for the animals in that period is made up for by the dried-up ephemerals from the previous period. The total feed value of the dried-up herbage is considerably less than the total feed value of the surplus grazeable herbage produced in the previous period. The loss is caused partly by the removal of dry annual vegetation by wind, or its burial by drifting sand, and partly by a reduction in nutritive value due to lignification, ripening and drying.

Both the volume and the nutritive value of the herbage produced in the July-October period are small. Flowering and ripening of those perennials which have not flowered in late spring takes place in this period. Some perennials shed their leaves to reduce transpiration and enter a dormancy period. The nutritive value of dried-up perennials when grazed is less than in their period of active growth. Supplement feed is required in increasing amounts as the nutritional deficit from range herbage becomes larger, reaching its peak in September.

In the October - December period the new rains, combined with the mild temperatures, cause a rapid growth, especially of annuals. However, the amount produced is still less than the requirement, which increases because of the lambing which takes place in this period.

There is enough herbage in spring for a high level of animal population, but this would require either massive inputs of supplement feed for the summer and autumn, or large-scale movements of animals to irrigated land at that time. The first alternative is not economic 1/ and would, furthermore, be detrimental to the maintenance of range productivity, since the tendency to minimize supplement feed consumption and to overgraze the range would be difficult to stem. The second alternative is discussed later in this report and would largely depend on the possibility of raising sheep productivity enough for it to be able to compete with alternative use of irrigated land.

The present discussion of grazing techniques is therefore based on the recommended level of animal numbers (320 000 sheep equivalents in non-drought years), the surplus grazeable herbage of the December-April period being partly consumed as dried-up herbage in the early summer, since the months of minimum plant growth reduce considerably the year-long carrying capacity. The three main targets which should be aimed at in the consideration of grazing techniques are the increase of animal productivity, the decrease in cost of production and the decrease of losses in drought years. These aims can be served by the regeneration of range vegetation to its optimum potential, the emphasis being put on the increase of the total nutrients produced by the range vegetation in summer and autumn and in drought years. This is to be achieved mainly through an increase in palatable perennials, which provide more nutrients in summer and autumn, even though their nutritive value decreases at and after the flowering stage. Such perennials are, furthermore, able to utilize the scant moisture available in drought years to a greater extent. The perennials with these characteristics are at present most exposed to overgrazing. They can be found

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1/ See the mimeographed study "Comparison of outputs, inputs, cost and return of two levels of animal numbers on the range, using large and small amounts of supplement feed respectively, and using irrigated foddercrops as supplement". By J.P.H. Van der Veen, Range Man. Expert, N.W. Coastal Zone Pre-Investment Survey Project, (in preparation).

in various range types, but in such a depleted state and generally in such a low density that their herbage production during the summer and in drought years is only a fraction of the amount produced by less desirable species. Year-round protection for several years of those parts of the various range types where these perennial species are most abundant is the best way to increase their density and vigour. After they have attained a reasonable density, grazing of such areas should be restricted to summer and autumn to obtain the maximum benefit from their presence. Some grazing may be allowed in the early winter to make use of the early growth of annuals. Once every five years such areas could be rested in summer to enable the plants to flower and to set the seed needed for spontaneous reseeding.

The choice of areas where such a "winter - spring saving" (or "deferred") grazing system is to be practised, must be based on more detailed surveys in each grazing district. The extent to which the system should be practised in order to be most economical as compared to continuous grazing should be determined by experimental studies in the field. An indication of the range types and areas suitable for "winter - spring saving" is given hereunder: -

1. Artemisia herba - alba range type.
2. Suaeda pruinosa range type.
3. Parts of the Gymnocarpus decander range type on the slopes of the first escarpment where especially perennial grasses are present.
4. Those parts of other range types which have relatively good stands of Helianthemum, Echio chilon, Stipa spp. and Lygeum spartum.

As a whole, areas within about 15 km from the coast are more suitable for this system than areas further inland because, even where range types further inland contain suitable perennials, their active growth period usually terminates earlier in the summer than it does closer to the coast.

A grazing system based on the principle described above could consist of the following grazing sequence, for which the Sidi Barrani grazing district is used as an illustration: -

- October - November: Mainly the Suaeda and Artemisia range type would be grazed. Movements southwards would start late in November and be completed by the end of December. Liberal use of supplements reduces the amount of herbage grazed in this period.

- December - February : Grazing would be in the Anabasis and Gymnocarpus range types to the south. Especially if rains there have been good, grazing in these range types by part of the animals could be prolonged into the early summer.

- March - June : The flocks would move northwards at the beginning of March. During this period grazing would concentrate on the Plantago and Haloxylon range types. As indicated under 2 above, some grazing would continue in the Anabasis and especially Gymnocarpus range types further south. Parts of the Plantago range type with good stands of perennial shrubs (such as Echiochilon) and perennial grasses should be reserved for grazing in the next period. Provision should be made for spraying or dipping and sheep washing prior to shearing and wool collection in the southern areas, where limited animal concentrations would be regularly expected in this period. Animals from other areas would temporarily move to the dipping and washing centres and return to their respective grazing areas after shearing.

- July - September : During this period the animals depend greatly on supplement feed. Grazing should take place on the Suaeda and Artemisia range types, in addition to the Gymnocarpus range type along the northern escarpment (in the Sidi Barrani area limited to the northeast of the grazing district) and the reserved parts of the Plantago range type.

Of course, such a grazing system cannot be strictly adhered to, in view of the irregularity of rainfall, both within the rainy season and geographically. Nevertheless, it is felt that, if followed to the extent technically possible, the availability of summer and autumn herbage could be considerably increased, while the more desirable perennials would be in a better condition in the drought years.

The other way to increase the amount of feed units from the range in summer and to a lesser extent in autumn is by establishing suitable local or introduced perennial shrubs and grasses on selected range sites and particularly in valleys receiving runoff. This will be discussed in Sections 3.1.3 and 3.3.2.

As long as it remains difficult to direct the movements of flocks on the basis of technical considerations, the most obvious alternative grazing technique leading to a recovery and higher productivity of the range is a system of periodic closing of areas to grazing. As indicated earlier, such areas should at least contain a minimum density of stand of palatable perennials in order to make the effort worthwhile. A beginning with periodic closing of selected areas is being made in the first grazing district, Sallum.

3.1.3 Reseeding of the range

In most semi-arid range areas reseeding is considered uneconomic below 200-250 mm, especially when rainfall varies considerably from year to year. Apart from the valleys which receive runoff, there are certain locations in the project area where range reseeding may be feasible and economic because of the light soils and the high relative humidity during a large part of the year (especially close the coast). The establishment and use of short-term or long-term cultivated pastures in valleys will be discussed in Section 3.3.2, since such valleys are at present mostly cropped, and pasture production and utilization there should be considered as a special form of crop production.

Most of the work done in the past on plant adaptability and the establishment of range species was carried out in valleys receiving runoff. Outside such valleys, further experimentation is needed before definite recommendations on reseeding can be made.

The following sites and species are suggested for further work in this field, for reasons given below: -

1. Parts of Plantago range type in the Maktalah-Terfaya area which consist of inland dunes, and the inland sand dune area of Garawla. Experimentation by the EGDDO (Mr. Farouk Hussein) has shown that Panicum antidotale maintained itself well when transplanted to the inland sand dunes of Maktalah, following the destruction of the indigenous vegetation. However, in the lower parts, where especially Plantago albicans re-appeared after a few years, the Panicum tufts are suffering from the competition. Permanent establishment would require periodic cultivation between the rows and perhaps a light dressing of N fertilizer close to the tufts. On the higher parts, where less compacted but more drifting sand prevails, no establishment of local vegetation took place, with the result that even in the drought year 1968 the Panicum plants were very vigorous in spring and early summer, reaching a height of 70 cm. In this

part spontaneous seeding in previous years resulted in the establishment of vigorous seedlings on the lee side of the mother plants.

To avoid danger of wind erosion, the establishment of Panicum antidotale on these dunes could be in the form of strips alternating with strips in which the natural vegetation would be left undisturbed. A combination of this method with the establishment of rows of windbreaks consisting of drought-resistant tree species such as Tamarix, Prosopis, Acacia, and perhaps Pinus could be studied. Prosopis would have the added advantage of providing fodder through its pods.

2. The Haloxylon articulatum range type on the Negeila plateau. In this area there has been excessive ploughing for barley cultivation. Abandoned barley fields revert to a very poor range, with Haloxylon as almost the only sub-shrub. The area, which has a slight and fairly uniform slope, is quite large and has generally fairly shallow soil. In order to make better use of the land and rainfall, it is planned to establish water conservation demonstrations by the construction of low dykes parallel to the contour. Barley cultivation will be limited to a a strip upstream from the dyke, covering abuut 30 percent of the distance between the dykes. The remaining land will be reserved for grasing. A second strip upward from the barley strip is suggested for reseeding, while the last strip, just below the next dyke, would remain under natural vegetation. The area suitable for this development is confined mainly to the soils classified as III a and III b on the soil suitability map of the Negeila Pilot area. Species suggested for reseeding or transplanting include: -
   Oryzopsis miliacaea, Dactylis glomerata v. hispanica, Poterium sanguisorba (sanguisorba minor), and Pithyranthus tortuosus.
   In the barley strip, a rotation of barley with self-reseeding annual legumes could be studied.

3. Parts of the Artemisia herba-alba range type in the Maktalah-Terfaya area. Low-lying sections which receive runoff, have reasonably deep soil, and are within a few kilometres of the coast may be suitable for the establishment of Dactylis glomerata v. hispanica (which occurs naturally but very scattered), Oryzopsis miliacaea, Hyparrhenia hirta and Poterium sanguisorba.

4. Parts of Gymnocarpus range type on the northern slope of the first escarpment, and its transition to the "salt marsh" range type to the north. Only those parts would be suitable which have reasonably deep soil as a result of accumulation of colluvium, and the higher parts of the "alluvial fans". Relative air humidity is fairly high in view of the proximity of the sea. Where the topography makes mechanical means of seeding difficult, or there is an erosion hazard, pit-seeding or transplanting might be more desirable. In either system planting should be done parallel to the contour lines. The construction of small terraces may not be justifiable from the economic point of view for improved range, but strips of improved range could alternate with rows of fodder trees or shrubs if water accumulation were sufficient to justify it.

5. The edges and higher parts of the saline depressions in the coastal strip. A process of soil formation is taking place through soil accumulation around sub-shrubs (hummock-formation) whereby, depending on the soil texture, the salinity level is decreasing on the higher parts of the depressions through leaching in winter. In these cases, where the soil texture is fine, the salinity level will be high, but on coarse-textured

the salinity would decrease. Salt-tolerant shrubs with a better feed soil value than the existing vegetation could be established on such sites. Among these are Atriplex spp., while Prosopis juliflora might be suitable when the salinity level is sufficiently low. The latter would also be conditional to the establishment of productive cultivars or ecotypes of Cynodon dactylon. When proper grazing control is maintained, the establishment of Agropyron elongatum could be feasible.

6. Parts of the Artemisia and especially Haloxylon range types in the Sidi Barrani area, particularly west and southwest of Sidi Barrani, which are heavily infested with Asphodelus microcarpus.
This tuberous plant has low feeding value and is locally very dense, in particular on land which is occasionally used for barley cultivation. In cases where a sufficient number of good perennial species of the local flora is present, suppression of Asphodelus through the use of herbicides could be attempted, but in many cases removal through mechanical means followed by reseeding may be necessary. Apart from places where water accumulates through runoff, the species with the best chances of success are palatable local sub-shrubs and, on loamy sand, Plantago albicans. Where runoff provides better moisture conditions, the species mentioned under 3 above are suggested.

The means of establishment are through seeding, transplanting of tillers, or transplanting of rooted cuttings and mother plants. Competition from local species can be detrimental in the establishment stage or later, therefore the total elimination of the existing vegetation during the autumn of the year prior to planting (i.e. about one full year before planting), followed by disking in the spring of the planting year, is often recommended. This will also provide a good seedbed. Although this principle is felt to be sound for reseeding or transplanting of perennials in valleys for range reseeding proper, an evaluation of such areas should determine to what extent the existing vegetation should be destroyed. The effect of wind-erosion on bare ploughed land should call for particular caution. In many of the areas listed above, abandoned barley land can be found which is almost completely without plant cover. The use of such land would to a large extent eliminate the need to plough areas with a good plant cover in the areas listed under 2 and 4 above, while in the areas listed under 1 and 3 the present vegetation should probably be maintained in strips.

In areas where mechanical seeding is feasible but where the soil is somewhat stony or litter is abundant, (areas 2, 3 and 6) the use of a sod-seeder could be considered. In the inland dunes seed could be broadcast in late winter, following abundant rainfall. Coverage could be achieved through sheep trampling. Transplanting of tillers is more expensive but has the advantage of giving a higher percentage of survival in the first summer and the possibility of periodic cultivation between rows when the local vegetation re-appears. Where the land is too rough or too limited in size for mechanical seeding but a preparatory cultivation has been possible, broadcasting followed by dragging (tractor or animal drawn) can be applied. The drag could consist of a wooden bar, or of shrub-branches tied together as a sleigh, weighed down by a heavy object.

Cool-season growing species should be sown after the main opening rains in autumn, while summer-growing species should be planted in early February and their planting limited to good rainfall years.

As indicated earlier, data on the technical and economic feasibility of range reseeding in the region are scant. Any work to be initiated should therefore be on a limited scale at first, aiming at the collection of information on various aspects of this method of range improvement and especially on the economic aspects. In this connection it should be pointed out that some of the land where reseeding could be

attempted is at present used for intermittent barley cultivation. It will therefore be essential to demonstrate to the Bedouins that its use as improved range is more beneficial for the community than its present use, and that the traditional grazing rights and land use rights are taken into consideration when grazing permits are given for the reseeded range.

A pre-condition should be that grazing on reseeded range is effectively controlled. The management of such reseeded rangeland would be one of the responsibilities of the grazing district staff. It should be realised, meanwhile, that the effect on range improvement through reseeding in an area with such adverse climatic conditions as the N.W. Coastal Region can only be a fraction of the effect on range improvement through grazing control and other means of management.

3.2. Improved stockwater

At the recommended present stocking rate (320 000 sheep equivalent), an absolute deficit of stockwater west of El Dabaa exists only in the Sallum grazing district (see Table 16). This deficit can be met by using well water. However, the picture is different when the distribution of the cisterns is considered, and the number in both the Sallum and Sidi Barrani districts needs to be increased in order to reduce the average number of animals per cistern (which must be controlled) and thus avoid excessive grazing in areas around them. Furthermore, the cleaning of cisterns in certain areas where the cistern density is low at present would help in making better use of the range resources (always provided animal numbers are controlled). This applies especially to the areas in the South (see cistern map). While the average rainfall in the southern areas is low (estimated at about 50 mm/year), it seems that the variability from year to year is greater than it is closer to the coast. Therefore in years with comparatively good rainfall, the amount of herbage from annuals in those areas can be considerable greater than in other years. In such years the presence of more watering points in the southern range areas would enable more animals to be kept there in spring and early summer and therefore larger parts of the better range types further north could then be included in a programme of deferred grazing or complete resting.

Once stock numbers in the whole area were to reach 440 000 sheep equivalents, as a result of range improvement, the availability of stubble grazing in the Dabaa nile Water irrigation project and the intensification of goat rearing for milk production and other measures, there would be a small total deficit in the five grazing districts west of El Dabaa, as shown in Table 43. It is important to point out that this estimation is based on the present practice of providing stockwater from April to November only. If, on the other hand, research were to show that provision of water throughout the year would stimulate livestock production, the stockwater availability should be considerably increased over the levels indicated.

Table 43

ESTIMATED STOCKWATER AVAILABILITY AND REQUIREMENTS IN FIVE GRAZING DISTRICTS WEST OF EL DABAA IN 1985 AFTER RANGE IMPROVEMENT (ALL LIVESTOCK)

Grazing district	Available Dec. 1967	Required 1985	Deficit or surplus
	m3(1000)	m^3(1000)	m^3(1000)
Sallum	18	29	-11
Sid Barrani	59	68	- 9
El Negeila	45	42	+ 3
Mersa Matruh	47	35	- 8
Fuka	25	33	- 8
Total	194	207	-33

Apart from the question of winter watering, however, the provision of more water per animal during the periods of better feeding prior to breeding (early summer), and in the period before and after lambing, is considered essential to obtain the productivity levels indicated in Section 3.5. The estimated additional number of cisterns required to bring the total water quantity to the level required for the 440 000 sheep equivalents in 1985, including 80 000 milking goats, is given in Table 44. This number includes these which are to be cleaned in areas where the density of watering points is low (especially the southern areas), and the provision of additional watering points in the proposed dairy goat areas. In this connection it should be pointed out that an increase of watering points is only justified when accompanied by control of livestock numbers. Some areas in which the present range condition is good might be subject to severe overgrazing if new watering points were established without the proper control measures to maintain the range potentiality.

Table 44

PROPOSED NUMBER OF CISTERNS TO BE CLEANED AND REPAIRED

Grazing district	Approximate number of existing cisterns	Proposed number of additional cisterns
Sallum	63	35
Sidi Barrani	300	120
El Negeila	270	60
Mersa Matruh	200	60
Fuka	130	45
Dabaa East	80	25
Burg El Arab	125	25
Total	1168	370

Once livestock numbers are controlled, a greater density of watering points could also be useful to facilitate grazing, by alternately closing and opening the cisterns.

However, the customary ownership rights on the cisterns need to be considered. These rights are not officially recognized by the Government, but are valid for the bedouins, even in the case of cisterns cleaned and repaired by the Government. A collective form of ownership, either by the cooperative or the grazing district, would be desirable. Without such a form of communal rights it will be difficult to apply rational systems of rotational grazing between April and November.

Apart from the numbers and locations of cisterns which are to be cleaned, action is needed on technical improvements. First of all, the cisterns should be provided with a proper silt trap. Secondly, one or two proper watering troughs should be constructed adjacent to each cistern. They should be located in such a way that water from the catchment area does not run past the troughs prior to entering the cistern, in order to reduce to a minimum the soiling of the water by animal droppings. It is furthermore suggested that a mesh wire screen be put at the entrace of the cistern to prevent animal droppings and other coarse floating material from entering it. Especially where the cistern is also used for human consumption, a trial could be carried out with the establishment of a filter consisting of sections of successively finer material between the silt trap and the cistern (from coarse gravel to coarse sand). Cisterns located close to a house or other cisterns in the northern area which are used intensively for human and animal consumption could be provided with a hand-pump to facilitate water lifting (with the present system using a rope and bucket it takes one man about one hour to water 80 sheep). Regular cleaning of silt traps and screens is essential. A few of the bedouins may take care of the cleaning on their own initiative, but it is felt that proper supervision is needed by the cooperative or grazing district. The most efficient system would probably be that the cooperative or the grazing district assumes the responsibility for cleaning and maintenance and that a certain fee per animal be levied for this service.

The cost of cleaning and repair is about £E 220 per cistern. Including the silt trap and watering troughs, the cost is estimated to be £E 300. For the 370 cisterns it is proposed be cleaned, the total cost would thus be about £E 111 000. The cost of cleaning the silt trap is estimated at £E 2 per year. In addition, it is estimated that, even with the provision of silt traps, the cisterns need to be cleaned about one every five years in order to make use of the highest possible capacity. Such periodic cleaning is estimated to cost about £E 40 per five years, or £E 8 per year per cistern. The annual maintenance cost would thus be about £E 10 per cistern, or £E 15 000 for the 1 500 cisterns it is proposed should be functioning by 1985.

3.3. Supplement feeding

3.3.1. Concentrates, straw and hay

As illustrated in Figs. 3 and 11, range herbage availability in non-drought years is insufficient in summer and autumn even at the recommended reduced level of animal numbers. In drought years this shortage is considerably greater and covers a long period. In the present discussion, supplement feed requirements are considered at the recommended level of 320 000 sheep equivalents.

Apart from the quantitative shortage, the quality of the summer and autumn herbage is poor, especially in proteins. In drought years this can result in a lack of vitamins, especially vitamin A, which effects the performance of the ewes prior to and at the lambing time. Prior to breeding, concentrate supplements containing an adequate level of proteins would be beneficial for both ewes and rams.

Supplement feeding in non-drought years would commence with small amounts of concentrates at the end of June and early in July to increase fertility and to bring about a more restricted breeding and lambing period. To satisfy the requirements for

digestible proteins, a mixture of concentrates with a significant content of cottonseed cakes may be used in this period (0.20 kg daily per animal). The addition of 3 percent salt and an increased frequency of watering could be one method to improve the metabolism of proteins. Successive increases of concentrate and straw rations would be required from the end of July, to reach a maximum level at the beginning or middle of October, at which time they would provide about two-thirds of the total nutritive requirements of the animals. Then supplement rations would be gradually reduced, depending on the growth of the vegetation, which in average years can support the animals without supplement from the end of November. During most of the supplement feeding period, feed costs should be kept at a minimum: it is the pre-lambing and especially post-lambing period, when proper nutrition will affect the productivity most, that are most important.

During drought years supplement feeding is expected to be required from the end of March till the end of November, while small amounts of concentrates would in extreme cases also be required for nursing ewes in December, January and February. Apart from the December-February period, where the reduction of lamb mortality is the main concern, and the June-early July period, when concentrates would be required in connection with breeding, drought feeding is aimed mainly at survival rather than production. Therefore low-cost feed sources should be utilised to the greatest extent possible. This would include a rather large percentage of chaffed barley st aw in the ration, mostly obtained from reserves built up in the area during non-drought years (see Table 43). More than 50 percent of concentrate requirements in a drought year could be covered from the barley surpluses of non-drought years (see Tabe 43). As the present system of barley storage of only 2-3 years by individual producers results in relatively low losses, a system whereby the cooperative purchases part of the surpluses in peak production for sale to the Nile valley and uses the acquired funds for purchasing concentrates from outside the area in drought years, might be considered. Alternatively, the possibility of cooperative storage of part of the surplus barley in good years in specially constructed bins might be feasible.

The cooperative should also have charge of transfers of barley supply in the area. For example, if in one of the grazing districts the barley harvested in a given year is poor, quantities of barley should be obtained from a grazing district with surplus production. Only when no barley supplies are available inside the area would the cooperatives in a certain grazing district purchase concentrates from outside the area, so that the amounts of barley stored and the possible losses resulting from storage would be reduced to a minimum.

The necessity of linking the role of the cooperatives in food distribution with the marketing of surplus animals to facilitate the effective control of livestock numbers has been described in Section 3.1.1.

Although the actual daily rations are somewhat lower and the feeding period somewhat longer, for calculation purposes it is estimated that an average ration of 0.5 kg. barley (or concentrate of nearly the same feed value) and 1 kg. straw is required per sheep equivalent for three months in non-drought years and for seven months in drought years. In practice, the barley component in the average ration would be lower, in order to provide a certain amount of supplement feed for breeding, and in drought years to provide supplements for nursing ewes in the winter.

The amounts of concentrates and straw required, including the amounts needed for fattening and for donkeys and camels are given in Table 45. If all barley produced in the area and available for feed is used for this purpose, the amount of concentrates needed from outside the area, as expressed in barley equivalents, is 6 900 tons per year, fluctuating from 4 300 tons in non-drought years to 17 300 tons in drought years. It should be pointed out that the total quantities of supplement feed required for the

sheep and goats at the level of 320 000 sheep equivalents are less than 50 percent of the amounts consumed in 1965/66 and 1966/67 by 457 000 animals (516 000 sheep equivalents), as a comparison of Table 13 with Table 45 shows. Range sheep production at the lower level of animal population at the proper stocking rate will render relatively much more than it does at the prevailing high level of animal population, due to the greater percentage of range herbage and lower percentage of supplement feed in the total nutrition intake (see Fig. 3). The share of the range herbage in the total feed intake meanwhile fluctuates greatly, even in non-drought years.

Table 45

ESTIMATED SUPPLEMENT FEED REQUIREMENTS AND AVAILABILITY IN THE N.W. COASTAL ZONE AT THE RECOMMENDED STOCKING RATE (311,00 SHEEP EQUIVALENTS) 1/

I. Barley 2/

	Average per year during 4 non-drought years		Fifth year (drought year)		Total for five years		Average per year over five years	
	(- - - - - -		- - - - - - - -	tons	- - - - - -		- - - - - - - - -)	
Consumption:								
Human cons.	8 000		8 000		40 000		8 000	
Seed	2 000		2 000		10 000		2 000	
Feed, camels and donkeys	1 000		1 000		5 000		1 000	
Feed, sheep and goats	14 000		33 000		89 000		17 000	
Feed, lamb and cull fattening	2 700		2 700		13 000		2 700	
Reserve	5 500		-					
Total consumption		33 200		46 700		157 500		31 500
Production:		27 500		4 000		114 000		22 800
Deficit	5 700		42 700		43 500		8 700	
Obtained from migrations outside the zone		1 400		3 400		9 000		1 800
Supplied from reserve				22 000				
Required from outside the Zone		4 300		17 300		34 500		6 900

1/ To be increased by 6% without the need for extra feed if 30% of the total number of sheep and goats.

2/ 1 ton of barley equivalent to 1000 feed units.

(Table 45 cont)

II. Chaffed straw

	Average per year during 4 non-drought years	Fifth year (drought year)	Total for five years	Average per year over five years
	(- - - - - Feed Units (1000S) 1/ - - - - - - -			- - - - -)
Consumption:				
Feed, camels and donkeys	1 500	4 200	10 200	2 040
Feed, sheep and goats	5 600	13 000	35 400	7 080
Feed, lamb and cull fattening	600	1 200	3 600	720
Reserve	3 900			
Total consumption	11 600	18 400	49 200	9 840
Production:	11 000	1 600	45 600	9 120
Deficit	600	16 800	3 600	720
Equivalent of straw supplied through migration outside the Zone	600	1 200	3 600	720
Supplied from reserve		15 600		

1/ 5 tons of chaffed straw equivalent to 1,000 Feed Units.

3.3.2. Cultivated pastures

In the context of this report the above term is used for perennial grasses, fodder shrubs or annual foddercrops and pasture species to be grown in valleys and depressions which receive runoff. As there are alternative uses (fruit trees, vegetables, field crops) for such valleys and depressions, it would be good economy to use them for supplemental grazing or forage for certain categories of animals in certain parts of the year. Their use can be justified, especially for commercial goat milk production, lamb fattening and/or finishing, and the provision of hay for pregnant or nursing ewes prior to the new growth of the range vegetation (e.g. when rains are late).

Among the perennial species which proved suited to such locations, the following are the most promising:

a. Loam or sandy loam soil.

Phalaris tuberosa	Dactylis glomerata var hispanica
Agrophyron elongatum	Hyparrhenia hirta
Oryzopsis miliacaea	Medicago sativa
Festuca elatior var arundinaces	Poterium sanguisorba

b. Sandy loam or sand.

Panicum antidotale

Since annual fodder or pasture species generally are at their best for grazing just when or just after the range vegetation produces a surplus, their

cultivation should be considered entirely for hay production. Leguminous annuals would be preferred, since they may best fit into a rotation with vegetables or field crops. Among these, Vicia ssp. offer the best prospects on the heavier soils. If high yield is the main aim, barley would be the best choice for green cutting and hay-making. Further studies would be required to determine the highest-yielding annual legumes, to be grown alone or in a mixture with barley or Lolium rigidum. The possibility of establishing ley pastures consisting of a mixture of Lolium rigidum and self-reseeding annuals such as Medicago scutellata needs to be studied. Such temporary pastures (3-4 years) could be rotated with barley. Annual fodderorops could also be grown as intercrop between orchard trees in the first few years of establishment of the trees.

The possibilities of the cultivation and establishment of fodder trees and shrubs are discussed later in this report. For the establishment of perennial grasses in particular, fairly deep ploughing is required to obtain good moisture penetration in the year of establishment. To keep weed to a minimum, clean-fallowing during the winter prior to seeding is desirable. Establishment in lines, either with a grass seed-drill or by hand, would facilitate weed control and loosening of the soil for better moisture retention in following years. In some cases transplanting of seedlings offers a greater success of establishment.

As fodder reserves, the storage of pruned olive branches for using the leaves as feed in periods of shortage is recommended. Since the cultivation of pastures, fodderorops or fodder shrubs would be a new practice, adequate legal provisions should be made to discourage trespassing on such land. At present special guards are required, in addition to fencing, to keep animals out of cultivated pasture plots, even when established on private holdings, and punishment for trespassing is given only in cases concerning fruit trees, vegetables or barley.

It would be advisable to provide fence posts and barbed wire through the cooperatives at reasonable prices to enable farmers to fence such pasture fields. At present orchards are fenced with barbed wire and posts retrieved from the battle fields of the second world war. New supplies are not available. Cooperatives might subsidize barbed wire and fence posts from the proceeds of the WFP commodities sold.

An intensive demonstration and educational programme is required to make farmers aware of the advantages of cultivated pastures.

3.4. Goat milk production

The goat is an exceedingly important animal for the bedouin population in the project area. It does not produce much for the market, but it provides the people with indispensable protein food and fat. At the same time the goat harms the range considerably, being allowed to graze uncontrolled in too large numbers. Without sufficient culling and regular marketing, the number of goats, which is always exceedingly high, tends to increase continuously because of the high fertility of does. Thus the goat imperils the sheep, which is the mainstay of commercial animal production on the range.

It is indispensable that the number of goats be decreased as much as possible, but without hindrance to the development of milk production. Prospective requirements for goat milk in the next 20 years are estimated at 14 000 tons, an increase of 6 000 tons on present production. This quantity will be necessary to substitute an estimated 2 500 tons of sheep milk and 1 500 tons of camel milk actually produced in the area, and to satisfy the increased demand, estimated at 2 000 tons. It means that radical conversion of present primitive goat management into intensive goat-milk production management will be necessary. This intensification appears to be the only alternative to complete prohibition of goat breeding, in view of the harm goats can do to the range.

Intensive goat-milk production should be based on improved feeding with roughages, combined with increased rations of concentrates. The cultivation of fodder crops should be encouraged to complete the ration of roughages, which consists at present mainly of barley straw. Certain selected parts of the range inside the grazing districts should be reserved mostly for the milking goats, while in suitable locations fodder shrubs and fodder trees should be planted for goat browsing. To improve the conversion of feed into milk, genetical improvement of the goat population should also be planned.

Intensive goat-milk production means commercial production, and therefore the marketing of milk must be organized, with collection of milk based on cooperative milking parlours, and the milk pasturized and bottled or made into cheese. A related breeding programme should be initiated through a goat station, which would in addition provide demonstration and training for the bedouins.

Goat-milk production could start at the goat station in Fuka and be developed on dairy-goat pilot areas in Fuka, Garawla-Shabiat, and Qasr-Matruh, later being extended to other selected areas (see Fig.12). These areas would be potentially better areas for fodder shrub establishment and are located mostly in the narrow coastal strip with the relatively better rainfall and runoff needed for the cultivation of shrubs. Goat breeding is also planned in the areas of the extension of the Mariut irrigation project (Dabaa, El Hammam) where use will thus be made of the shallow, sloping and stony spots shich are not suitable for intensive irrigation. A projection of the production planned is shown in Tables 46 and 47.

Table 46

Prospective goat milk production in the N.W.Coastal Region

Year	Pilot areas		Areas of extension		Other areas		Total in the N.W. Coastal Region	
	Number of adult females	Milk	Number of adult females	Milk	Number of adult females	Milk	Number of adult females	Milk
		tons		tons		tons		tons
1970	25000	2000	40000	3200	35000	3800	100000	8000
1975	18500	2450	36000	3400	31500	2900	86000	8800
1980	14000	3300	30000	3800	28000	3200	72000	10300
1985	11500	3800	22000	5100	24500	600	58000	12500
1990	10000	4000	20000	6000	20000	4000	50000	14000

Table 47

Prospective meat production from 1000 goats in the N.W.Coastal Region

	Adults		Offsprings		Total production	
	Number	Liveweight	Number	Liveweight	Number	Liveweight
		kg.		kg.		kg.
Per head (indiv)	1	37	1	15	1	21.1
Total	220	8140	785	13125	1005	21265

Fast progress in milk production is planned through the combined measures for improvement of feeding, management, and breeding. It is estimated that by culling 40 percent of the worst goats and by improved feeding of the remainder, productivity could be increased to 200 litres per milking-goat in the milk-producing flocks to which organized selection will gradually extend.

In spite of good fertility, which is expected to progress steadily to 150 kids per 100 reproductive goats, meat production will not increase much because the number of goats is restricted. Nevertheless, the improvement of liveweight by fattening the kids cannot be recommended, because it will be more opportune to encourage the marketing of younger kids (suckling kids) for their particularly attractive meat. Thus decreased home consumption of goat meat may be expected, which should be substituted for by increased poultry production.

Feed requirements for goat milk production are shown in Table 48, which makes clear the importance of the proposed measures for range policy. The share of goats in range herbage utilization will greatly decrease, enabling sheep numbers to increase.

Table 48

Expected change of feed consumption due to the intensification of goat milk production

Origin of feed	Consumption of feed by primitive goats		Consumption of feed by milking goats	
	Per head	for 180 000 head	Per head	for 80 000 head
	Feed units	Feed units (1000S)	Feed units	Feed units (1000S)
Ranges	190	34 000	155	12 000
Fodder	45	8 000	80	6 000
Concentrates	45	8 000	120	10 000
Total	280	50 000	355	28 000

3.5. Prospects for animal production development on the range:

A number of measures has been proposed for the development of animal production on the range, apart from the use of irrigated land and organized fattening on irrigated land or in feed yards.

As these measures are inter-related and as their short-term physical and economic implications are at present difficult to measure or calculate separately, an attempt is made in this section to estimate roughly the medium-term effect of all these measures on range and animal production, and the main inputs required (feed and veterinary medicines) apart from labour, equipment and construction.

The main measures can be summarized as follows:

1. Control and initial reduction of animal numbers, guided movements of flocks, earlier off-take of slaughterable lambs and culls from the range.

2. Periodic resting of selected parts of the range, reduction of areas used for intermittent barley cultivation, cultivation of grasses, shrubs and fodder trees in valleys, reseeding and transplanting of some selected range areas.

3. The use of crop aftermath, ditchbanks, etc., in the Dabaa Nile water irrigation project for an average 1½ months and 4 months in non-drought and drought years respectively by the animals from the Fuka and Dabaa East grazing districts.

4. Animal health improvement through an effective animal health programme, with emphasis on parasite control.

5. A selection programme carried out among the flocks from a sheep and range station as centre.

6. A reduction in goat numbers and the development of commercial goat milk production through a programme of selection, breeding and management of goats for milk production.

The increase in animal numbers as a result of range improvement and the use of crop aftermath in the Dabaa irrigation project is shown in Table 49. The number indicated for 1985 is about the highest which can be achieved with the recommended level of supplement feeding and annual migrations of about 180 000 animals to irrigated land. The effect of the establishment of dryland cultivated pastures, fodder shrubs, fodder trees and some reseeding are included in the increase in carrying capacity.

Table 49

Increase in animal numbers 1967-85
(sheep equivalents, basic flock prior to lambing period) (Sept.)

Grazing district	1967	Proper stocking rate at present range capacity	1985 After 16 years' range improvement	Increase at proper stocking rate
	(- - -	- - - - - - - - - - - -	- - 1000S - - - - - - -	- - - - - - - - - - -)
Sallum	37	33	35	2
Sidi Barrani	110	75	95	20
El Negeila	143	46	58	12
M. Matruh	67	39	50	11
Fuka	25	36	64 1/ (50) 2/	28 1/ (14) 2/
Dabaa East	36	30	61 1/ (47) 2/	31 (17) 2/
Burg El Arab	98	51 1/	58 1/	7
	516	310	421 1/ (393) 2/	111 1/ (83) 2/
Additional number due to smaller consumption by goats		10	19 (17) 2/	9 (7) 2/
Total	516	320	440 (410) 2/	120 (90) 2/

1/ Including migration to irrigated land for 1½ months per year in non-drought years and 4 months in drought years from the Burg El Arab, Dabaa East and Fuka grazing districts, assuming execution of Dabaa Nile water irrigation project before 1985.

2/ Figures between brackets indicate the situation should the Dabaa irrigation not be executed.

Output levels for 1985 are based on the estimated production levels given in Table 50.

Table 50
Expected production level per 1000 animals in 1985
(subsequent to 16 years improved animal husbandry on the range)

Product	Category	Number of animals (1 000s)	Production kg
Sheep meat	culls	150	6 000
	offsprings	310	7 750
	Total	460	13 750
Goat meat	culls	133	5 320
	offsprings	872	15 945
	Total	1005	21 265
Goat milk	lactating goats	625	175 000
Sheep wool	all sheep	1000	2 500

Table 51 gives the feed inputs, the outputs and the value added (the output minus feed input) in the years 1965/66 and 1966/67, after reduction to the proper stocking rate at current carrying capacity, and the possible levels in 1985 if the proposed range and animal improvement measures are carried out. The table does not include fattening but does include commercial milk production from goats. For 1985, the added value is calculated after deducting also the cost of veterinary medicines from gross output.

Table 51

Sheep and goat production: feed inputs, outputs and value added
(For 1965/66 and 1966/67, at proper stocking rate for current carrying capacity: for 1985, estimated on the basis of 16 years range and animal husbandry improvement)

	1965/66		1966/67		Present range capacity, proper stocking rate		1985 After range and animal improvement	
Basic flock beginning of year (Sept.)	410 000		460 000		320 000 1/		440 000 2/	
Sheep equivalents at end of the year	460 000		516 000		320 000 1/		440 000 2/	
I. INPUTS A. Feed (Nov.-Nov.)	Feed units	Value	Feed units	Value	Feed units	Value	Feed units	Value
		L.E. (1000S)	mill.	L.E. (1000S)	mill.	L.E. (1000S)	mill.	L.E. (1000S)
Range herbage, proper use rate	65	-	80	-	67	-	85	-
Range herbage, overgrazing	27	-	27	-	-	-	-	-
Supplement feed excl. fattening	43	1 075	46	1 150	25	625	30	750
Suppl. feed for goat milk production	-	-	-	-	-	-	16	400
Migrations	4	100	6	150	3	75	9	225
Total feed other than range herbage	47	1 175	52	1 300	28	700	41	1 375
B. Veterinary medicines	-	-	-	-	-	-	-	47
TOTAL INPUT		1 175		1 300		700		1 422
II. OUTPUTS	Quant.	Value	Quant.	Value	Quant.	Value	Quant.	Value
	Tons	L.E. (1000S)	Tons	L.E. (1000S)	Tons	L.E. (1000S)	Tons	L.E. (1000S)
Sheep meat	3 590	718	4 270	854	2 900	580	5 000	1 000
Sheep wool	600	108	640	115	480	86	915	162
Goat meat	1 180	178	1 620	243	850	117	1 700	255
Milk		180		220		140	14 000	640
TOTAL OUTPUT		1 184		1 432		923		2 057
III. VALUE ADDED		9		132		223		635

1/ Including 80 000 goats

2/ Including 80 000 goats of which 50 000 on average are lactating annually. The majority are kept for commercial dairy production under management systems of varying intensity.

3.6. Fattening

Feeding experiments in the project area [1] demonstrated the good fattening capacities of sheep, as is usual in the fat-tailed animals on the ranges of the Near East countries. Reared on the scanty pastures and kept under a dry regime with minimum watering, these animals convert the feed excellently and their growth rates in the relatively short but customary fattening period (45 days) are often surprising.

Though the practice of fattening is fairly common in the area and the prices of animals sometimes reach surprisingly high levels, meat production through fattening is not yet fully exploited. The great fluctuation of prices makes the operation too hazardous to allow planned action for the future. Therefore effective control of smuggling should precede any improved system of marketing which includes preliminary fattening (finishing).

The conditions prerequisite to the effectiveness of fattening as part of a market system are as follows:-

- Stabilization of the market by a developed system of contracts concerning the modalities of marketing and of prices per kg. of liveweight fixed according to the quality (classes) of animals.
- availability of cheaply produced feed of good quality
- the separation of animals into uniform groups by category and condition to ensure properly balanced feeding.

These conditions would not necessarily be met merely by organizing fattening through the cooperatives. It would be too easy for traditional methods to prevail. Even more serious technical problems arise, an outstanding one being where to locate fattening for cheap feed. Feed for fattening should be consumed where it is produced. To further decrease the cost of feeding, the use of green fodder combined with intensive fattening rations is recommended. The efficiency of such fattening with sheep and its cost is shown in Table 52 and Table 53.

Table 52: Sheep meat production through fattening

Category	Starting weight	Increase of liveweight		Final liveweight
		after a month of grazing	after 1½ months of finishing	
	kg.	kg.	kg.	kg.
Ewes	36	-	9	45
Rams	41	-	9	50
Lambs	17	6	11	34

1/ B. Palian and A. El Say: An experiment with increased supplement feeding in a Bedouin flock, Mimeo, UNSP Pre-investment Survey Project of the N.W.C.Z., U.A.R. 1968 (in preparation).

Table 53: Estimated consumption per animal and cost of feed (consisting of green fodder and concentrates) for sheep fattening

Category	30 days grazing	for finishing			Total consumption	Cost
		First 15 days	Second 15 days	Third 15 days		
	kg	kg	kg	kg	kg	L.E.
A. Adult animals						
Green fodder	-	105	75	45	225	0.450
Concentrates	-	7.5	15	22.5	45 1/	0.720
Total feed cost						1.170
Feed cost per kg liveweight produced						0.130
B. Lambs						
Grass from cultivated pastures	135	-	-	-	135	0.205
Green fodder	-	60	45	30	135	0.270
Concentrates	4.5 3/	7.5	15	22.5	45 2/ + 4.5 3/	0.821 0.112
Total feed cost						1.408
Cost of feed per kg of liveweight produced						0.085

1/ Standard concentrate mixture (cube texture)
2/ 75% standard concentrate + 25% barley
3/ Barley or oats.

Such encouraging feeding costs form a basis for the gradual establishment of a cooperative market for animals as for other agricultural products. The organization of fattening could then be carried out with some feasibility, by, for example:-

- Contracting the fattening with farmers in irrigated areas and ensuring the agreed prices by corresponding multilateral arrangements.
- or, contracting only the first phase of grazing, while the finishing would be done in the cooperative fattening plants.
- or, contracting the entire fattening procedure in the cooperative fattening plants.

Centralized finishing in cooperative fattening plants should be taken into consideration because the concentration of animals so achieved would ensure classification and sale according to the quality of the finished animals. Industrial methods of fattening would be required in cooperative fattening plants. Probably the process of self-feeders would be the most suitable. In this case, the feed inputs needed to achieve the fattening shown in Table 52 would be as shown in Table 54.

Table 54: Consumption and cost of feed through the use of self-feeders
(For production as given in Table 52)

	Unit	Preliminary period of 30 days	For finishing			Total
			First 15 days	Second 15 days	Third 15 days	
Adults:-						
Quant. of mixed feed	kg.		34	34	34	112
Price of feed	L.E.		0.431	0.490	0.549	1.470
Price of feed per kg. of gain	L.E.					0.163
Lambs:						
Quant. of mixed feed	kg.	38	23	26	30	117
Price of feed	L.E.	0.497	0.322	0.322	0.439	1.813
Price of feed per kg. of gain	L.E.					0.107

While the costs of feed increase (preparation of mixed feed), the total cost of production remains the same because other costs decrease. An estimate of final production cost of organized fattening is shown in Table 55.

Table 55 Estimated cost of production cf organized fattening

Specification of costs	Adult animals		Lambs	
	on green fodder + concentrate	Self-feeding	on green fodder + concentrate	Self-feeding
	L.E.	L.E.	L.E.	L.E.
Starting value of animals	5.79	5.79	5.10	5.10
Cost of feeding	1.17	1.47	1.47	1.81
Other non-feed costs	0.78	0.37	0.37	0.44
Total costs	7.74	7.63	7.45	7.35
Prod.cost per kg. of liveweight	0.172	0.170	0.219	0.216

These prices, particularly for lambs, could be decreased by fattening on improved liveweights. But in any case fattening could be organized on a profitable basis, especially if a certain number of high-grade animals could be exported at higher prices. The whole procedure should be organized on a commercial basis, avoiding as far as possible any administrative complications. The price of finished or unfinished animals and the price of fattening should be paid immediately to the producers. Goat fattening can be considered only on the basis of very low prices for the non-fattened animals. This would favour the marketing of kids finished during the suckling period (young milk kids). Fattening organized on a large scale is an intermediate form of integration of ranges with irrigated land, as explained in 3.5. It is a short seasonal operation which does not coincide with the periods in which sheep should be fed in a complete system of integration. With the development of integration, it would be economic to organize fattening plants on the farms where the forage will be produced.

3.7. Integration with irrigated areas

From section 3.5. it is clear that the possibilities of development of animal production in the project area through range improvement and improved animal husbandry practices are limited mainly by the physical conditions, i.e. the low productive capacity of the range.

Further development could be achieved, however, by utilizing irrigated land in conjunction with the range. Under an intensive form of integration, productive sheep would be moved from the range to irrigated land, where an intensive form of feeding, mainly of green feed, would be applied during the period when the feed requirements for production are highest, i.e. from about one month before lambing till after weaning. Under this system most range grazing would take place in winter and spring, when the available herbage on the range reaches a peak (see Fig. 3), while during summer and autumn the animals, with the exception of young animals and rams, would be intensely fed on irrigated land. This would result in a considerable increase of animal productivity, while the total number of animals could also be increased, since a relatively smaller part of their nutrition requirements would be obtained from the range. Furthermore, range resources would be better utilized by greater consumption of the peak winter and spring herbage. The level of production also would be much less dependent upon climatic variation, with feed supplies during the productive period of the animals secured in the form of irrigated fodder crops.

A modified form of the intensive integration outlined above would be an extensive system of integration. Under this system, the animals would be kept on irrigated land for about 120 days only, during the period of scarce range herbage and of the early growth stage of the vegetation in early winter (Sept.-Nov.). The rations to be provided in this period would only cover maintenance. Lambing would take place on the range following the return of the ewes, somewhat later than at present. The ewes and suckling lambs would thus benefit from the period of high range herbage availability in winter and early spring. Supplement feed requirements on the range would be considerably less than at present. Sheep productivity would, however, be much less than under the intensive form of integration.

Integration of the range with irrigated areas could be carried out in three stages. During the first stage, a pilot farm would be established in an appropriate irrigated area (e.g. the Mariut extension project). Foddercrops would be produced and conserved (silage) by using modern techniques, in order to get a high production per unit of water and of land. Sheep from the proposed range and sheep station would be moved to the pilot farm in the summer for the application of the intensive form of integration and in the autumn for the extensive form. Various feeding systems would be tried, while a programme of selection and breeding for increased output under intensive feeding would be carried out. Cost of production data would be recorded for an analysis of economic aspects. Training would be pro-

vided for extension workers and farm managers.

In the meantime the number of animals on the range would be reduced and brought under control to match the range carrying capacity, and other range improvement measures would be introduced. Bedouins would be invited during this period to take their flocks to the pilot farm for demonstration purposes.

The second stage would start about two years after the pilot farm had started operations and would consist of introducing the extensive form of integration on other irrigated land with bedouin flocks, preferably from the area east of El Dabaa. A pilot farm would be set up to serve as a model and its technical staff would give guidance with the implementation. The fodder needed for the integration programme would be produced by the central cooperative in the grazing districts. Thus the production of fodder should be a large scale enterprise located in the distinctive zones of irrigated areas under a common centralized management. A certain part of the irrigated area for fodder production could be allocated in the zone of the Mariut irrigatio project, but obviously the main area for its production would be provided by the Dabaa Nile water irrigation project.

Three to four years from the beginning of integration, the intensive form (the third stage) could be introduced. The number of animals on the range would by then have been reduced to accord with its carrying capacity, and its productivity would have started to increase. As larger numbers of animals were gradually incorporated into the integration scheme, a slow but progressive and strictly controlled increase of animals on the range could be allowed. After about eight years, once the projected Dabaa Nile water irrigation scheme were in operation, the integration scheme could absorb progressively increasing numbers from the range.

This development is schematically illustrated in Fig. 13. The figure shows the combination of improved animal husbandry on the range, extensive integration and intensive integration in a long-term programme of development in which integration gradually becomes more important. The degree to which intensive integration will ultimately be applied depends partly on the amount of irrigated land which it proves economic to set aside for this purpose, and partly on the degree to which the system is accepted by livestock owners. As the extensive form of integration represents an intermediate phase in the gradual conversion of traditional range sheep production in to the intensive form of integration management, this phase could even be avoided by a suitably amended programme, if economic reasons were to call for such a solution.

If all the sheep were incorporated in the intensive form of integration, these could be as many as 860 000 very productive animals. The amount of irrigated land required for them would be about 30 000 feddans. Development efforts should aim at this distant target. As the number of animals would be strictly controlled in the grazing districts, integration should be organized within the same framework. With regard to the extension of fodder production in irrigated areas, two alternatives could be offered to the suitable, preliminary-trained breeders: either to have the normal number of animals on the range, or twice this number in integrated management (intensive system). Fig. 13 shows a dynamic but feasible trend of integration according to the detailed account of the proposal presented in the special report on this subject.[1] If the system were introduced as proposed, and if, of the number of anim-

1/ Palian, B. and J.H.P. Van de Veen: Long term projections of sheep production in the N.W. Coastal Zone. Pre-Investment survey of the N.W. Coastal Region of the U.A.R., January 1968.

als planned for the range, 80 000 were improved goats as proposed in section 3.4., the development of the various systems after 20 years should be as shown in Table 56.

Table 56

Details of Production systems after 20 years of range - irrigation integration

Production and management system	Range herbage used	No. of animals	Irrigated area required
	%		feddans
Goat milk production	12	80 000	-
Sheep production	29	107 000	730
Improved husbandry on the range	34	143 000	1 920
Extensive integration	25	215 000	7 600
Total	100	545 000	9 650

The productivity of the sheep population will steadily improve solely as the result of improved breeding and management. The estimate of productivity after 20 years of range-irrigation integration is shown in Table 57. The data concern meat production: wool production is expected to reach an average of 2.5 kg. and 4 kg. fleece weight respectively under the extensive and intensive forms of integration.

Table 57

Expected meat production from 1000 sheep in the integrated systems of management

	Adults		Offsprings		Total Production	
	Number	Weight	Number	Weight	Number	Weight
		Extensive form of integration				
		kg.		kg.		kg.
Individual animal	1	45.5	1	25	1	30.3
Per 1000 sheep	167	7605	474	11850	641	19455
		Intensive form of integration				
		kg.		kg.		kg.
Indiv. per head		50.5	1	32	1	35.3
Per 1000 sheep	167	8440	778	24896	945	33336

After 20 years a phase towards maximum intensity of integration will be reached in which, besides the improved dairy goat production, there will be 3 systems of sheep production concurrently in operation. From then on the most productive system (the intensive form of integration) will steadily prevail and contribute more and more to the development of animal production. Furthermore, new techniques are expected to be developed in the course of time as a result of particular research and of the general trend of technical progress and their application will only be possible through the adoption of the proposed new systems of management. The total animal production which can be expected after 20 years of the integration programme is given in Table 58.

Table 58

Animal production at the integration level after 20 years

Type of production	Milk	Meat				Wool		
		From adults		From offspr.		Quantity	Clean yield	Fineness
		Number	Quantity	Number	Quantity			
	tons	1000S	tons	1000S	tons	tons	%	
Dairy goat production	14000	17.6	651	62.8	1050			
Improved sheep production on the range		16.05	642	33.2	829	267	45	29-30
Extensive form of integration		23.9	1088	68.8	1695	358	45	29-30
Intensive form of integration		35.9	1715	167.3	5353	860	50	54'/58'

The fineness of wool depends on the quality of animal to be achieved by selection and by crossbreeding (see Section 3.8.).

Table 59 shows the feed requirements for the level of production shown in Table 58.

Table 59

Feed requirements of livestock 20 years after initiation of the integration and dairy goat extension projects

Type of production	Feed unit requirements			Total
	Range	Roughages	Concentrates	Feed units
	1000S	1000S	1000S	1000S
Dairy goats	12 000	6 000	10 000	28 000
Improved sheep on range	21 400	10 700	-	32 100
Extensive form of integration	30 000	14 300	-	44 300
Intensive form of integration	30 500	47 300	10 000	87 700
Total	93 800	78 300	20 000	192 100

3.8. Improved breeding

The development of animal production requires genetical improvement of local breeds to achieve the level of production planned. As the local breeds are well adapted to difficult environments but not improved by organized selection, special efforts should be made to improve their most important productive characteristics. In the initial stage the determination of characteristics as the criterion of selection will be most important; however, attention should also be paid to the methods of selection and mating. This requires the methods based on the genetics of population to be largely applied in practical selection, though suitable data from the breeds in question will not always be available. Research will therefore be necessary. All that is known and can be learned about the flocks would be relevant to special breeding plans for sheep and for goats. In this report only the principles of the breeding plans and their organizational aspect can be taken into consideration.

The rapid organization of breeding is essential if genetically improved animals are to be included in the plan of development. Since the animals of the project area form a rather primitive and genetically mixed population, the most valuable animals should be gathered into special flocks at a station where scientific methods of selection can be applied. The improved breeds resulting from research should be extended as a cooperative activity through the breeders in whose flocks the improved breeds would reproduce, as suggested in a special report 1/ to the Government.

Breeding of sheep: In the flocks depending solely on the range, only a slight and very gradual improvement of feeding conditions can be realized. At all events, the breeding plan will be flexible, distinguishing clearly the breeding of range animals (including animals from the extensive form of integration) from the breeding of animals belonging to the intensive form of integration.

As only a slight genetical improvement can be made in the range flocks, its chief interest will concern wool quality. Some improvement in fleece weight is also probable, but in meat production no significant result connected with genetical improvement can be expected. In the intensive form of integration, apart from a rapid genetical improvement of wool (quality and quantity), considerable progress in meat production through the improvement of fertility seems quite feasible, as the feeding level will not be an obstacle to this improvement.

Though the chances of selection with Barqi sheep are considerable because of the high heterogeneity of the breed, the progress expected would be too slow for the productivity required in the intensive form of integration. Therefore selection, as the only way of genetical improvement, belongs to the range flocks, while in the intensive form of integration selection plus an intensive crossing should take place. A crossing of Barqi sheep would even be desirable before proceeding with this kind of integration, so that the starting flocks could give a better return from the intensively produced feed. A three-breed crossing is recommended for this purpose, to blend the breeds before stabilization of the new breed, in which the grazing ability of Barqi sheep would be combined with the better fertility and good wool characteristics of the improved breeds. The right formula of crossing should be established through experimentation. It is supposed that a combination of mutton breeds such as Suffolk or Dorset Horns with the compromise breeds such as Corriedale, Tharghe or even Merinolandschaf would give a satisfactory solution.

1/ Palian B, and El Say A: Institutional aspect of development of animal production in the N.W. Coastal Zone, Alexandria, 1968.

The main criteria in selection of the wool should be the uniformity of fibres, defined as the textile ability of the wool. The measure of this ability would be the fitness for grading by ASTM Standards, which characteristic could be tested by laboratory analyses. This would be development towards the textile types of wool: the wool qualities shown in Table 60 are thought to be quite feasible on the basis of the wool characteristics shown in Table 22. In order to determine the important flocks upon which to base selection, a sheep station with a considerable number of animals should be set up as soon as possible.

The station's sheep should be carefully selected through purchasing singly the best ewes and ewe lambs. Rams from these, produced by good breeding techniques, would be used in the flocks of the best breeders, who are to be included in a breeding organization. These flocks would be supervised by the Extension Service so that an increasing number of better rams could be provided for the flocks of non-organized breeders. The distribution of rams would be a cooperative activity, but run in accordance with the needs of the Extension Service. This operation could be encouraged by some culling of young rams during their marking for the grazing districts, and by purchasing the best ram-lambs for rearing in the sheep station until the time of their distribution.

A balance between the prospective need for improved rams and their production under the proposed organization is given in Table 61. This is an indicative plan which is applicable in principle immediately without regard to the actual level of improvement. The distribution of selected rams would be concentrated in suitable areas from which the improved breed would gradually extend.

Table 60 : Expected improvement of wool quality in the N.W. Coastal Region as a result of organized breeding

Type of wool	Qualities of average Barqi wool after grading by the wool marketing consultant(purchasing price 18 piastres per kg.)				Average Barqi Wool 20 yrs after initiation of the planned breeding programme				Average cross-bred wool 20 yrs after initiation of the intensive form of integration			
	Allotment	Fiber fineness	Clean yield	Value after grading	Allotment	Fiber fineness	Clean yield	Value after grading	Allotment	Fiber fineness	Clean yield	Value after grading
	%	micr.	%	pts/kg	%	micr.	%	pts/kg	%	micr.	%	pts/kg
Sound :	1.22	58/60	45	39	1.74	58/60	50	44	1	60/62	55	49
	7.45	56/58	48	38	7.79	56/58	53	43	7	58/60	58.5	48.5
	15.75	46/50	50	35	8.12	50/56	53	42	16	56/58	61	48
	5.23	40/44	50	34	8.90	46/50	55	38.5	6	50/56	61	46
	1.67	30/36	45	28.5	4.45	40/44	50	34	1	46/50	62	34.5
Av. sound :	31	46/50	49	35.3	31	48/58	53	40.2	31	50/58	60	47.6
White tender	21.58	27-30	57.5	38.2	21.50	26-30	63	43	21.6	58/60	70	48.5
Fl. fleeces	4.67	28-35	50.6	29	4.60	27-33	55	33	4.6	54/60	62	39
Cotted	0.78	29-31	37.5	18	0.80	28-30	41	20	0.8	56/58	46	24
Av. fleece wool :	58	28-32	52	35.6	58	27-31	56.7	40.4	58	56/60	63	46.9
Wh. pieces	13.68	31-34	31	14	14.00	30-33	34.4	15.5	14	56/58	36.5	19
Bl. pieces	6.02	30-33	30.4	13	6.00	29-31	34	14	6	54/56	37.5	8.5
Stains	22.36	32-34	22.5	6.5	22.00	31-33	25	7	22	54/56	27.5	8.5
Av. wool	100	29-33	40	24.5	100	28-32	45	27	100	54/58	50	32.75

Table 61

Balance of rams according to breeding category of flocks

Category of flocks	Number of adult females	Yearly requirement of rams	Yearly production of rams	Difference
Station flocks	4 000	-	600	+ 600
Flocks of organized breeders	50 000	1 000	2 500	+ 1 500
Flocks of non-organized producers	200 000	4 000	1 900	- 2 100
Total	254 000	5 000	5 000	

Breeding of goats: Selection would be the most important method of genetical improvement of the goat population. To what extent crossbreeding would be suitable for the purpose needs to be determined by experimentation. An attempt to cross some foreign breeds of milking goats with local selected goats would be highly desirable; the Angle-Nubian and the Maltese (or some other Mediterranean type of milking goats) could be used. Details of breeding, including the plan of crossing, will be the subject of a special report on goat breeding. The principle of organization is the same as for sheep, except that, as the number of animals in the proposed goat station would be small, the recording would be extended from the station to the corresponding number of animals in the private flocks.

3.9. Poultry production

The project area is not a poultry production area and will not become one in the immediate future, as suitable feed has to be imported largely from other feed-producing areas. Some poultry exists and is cared for by the women, who use the family's food residues as the main feed. An attempt to increase the bedouins' consumption of eggs and poultry meat was made a few years ago by distributing some chickens produced in the poultry station established for this purpose in Mersa Matruh.

It is very probable that, as consumption in the area will increase generally, increased production of eggs and poultry meat will be necessary. Plans for this increase could be phased to follow upon the establishment of goat husbandry on a commercial production basis. For the time being a good model pilot poultry station, producing poultry economically, would be a reasonable achievement. The present poultry station runs at a loss, merely distributes chickens to the people and does not practise proper production techniques. The first step in plans for poultry production would, therefore, be its re-organization.

Two systems of poultry production should be developed in the station. The first, industrial poultry production, would be based on purchased feed and on high-producing breeds of fowls. At the present prices of feed and eggs in the project area (£E 0.036 -0.038 per kg. and £E 0.012 per egg), at least 210-220 eggs should be produced per hen for production to be an economic proposition. The second system consists of produc-

tion on cultivated grass lawns, irrigated with water from windmills, with the locally bred Fayoumy fowl. By supplying 20 percent of the required nutriments with grass and thus decreasing the cost of feeding, some 180-190 eggs per hen would be required to make production economic at the price levels quoted above.

It is clear that the prices of feed and the productivity of the fowls determine to a large extent the economy of the station, which would not produce a large number of chicks. To meet future requirements chickens for some distribution to non-breeders and to breeders of not more than 30,000 hens will be required. Thus the station's present number of about 3,000 hens will be quite sufficient. This is too small a unit to produce its own feed, which has to be purchased elsewhere, sometimes at high prices and sometimes with a less suitable composition of ingredients. The breeding capacity of the flock is negligible as an independent selection unit, which means that the station could not exist as an independent institution. It should be linked to an organization which has its own production of feed and which has an organized system of marketing. To establish highly productive flocks the chickens for flock replacement should be regularly provided from another station where properly organized selective breeding is possible.

Extension activity in poultry production could probably start with training at the station for selected people. Possibly some of the station workers, after being carefully selected and trained, could be assigned to start pilot poultry units. For this purpose it would be worthwhile to purchase a certain number of standardised poultry houses and equipment.

4. Forestry and Soil Conservation

Introduction

There is urgent need to check the water and wind erosion that have done great damage in the region over the centuries and to conserve soil and water resources for increasing the region's agricultural production. However, since water and cultivable land are scarce, forestry works cannot be established in block form; only row plantations as windbreaks, shelterbelts, roadside plantations or groups of trees, are possible at the outset. Exceptions are block plantations on sand dunes where the water conditions are particular.

The main purposes of forest work in the region are therefore as follows: to protect the crops from being blown down and physically damaged; to prevent soil and sand dunes from blowing away; to help reduce the evaporation of soil moisture and the transpiration rate of plants; to secure shade for animals; to produce fuel, timber and animal feed; and to improve the landscape and micro-climate.

4.1. Sand dune fixation

The two main kinds of sand dunes are the coastal maritime dunes and the inland dunes.

Coastal maritime sand dunes

As reported in Chapter 4, these consist of white oolitic sand, coarse in texture, very rich in calcium carbonate (80-100 percent), strongly alkaline (pH 8.0 - 8.5) and very poor. Their total area is estimated to be about 135 000 feddans, of which about 65 to 75 percent appear to consist of cemented dunes and 25 to 35 percent of shifting dunes. Since the crusted surface of a cemented dune is sometime covered with a thin layer of sand, close estimation of cemented dunes is difficult. The agriculturallly utilizable area of the maritime sand dunes can be judged from the following classification of them in the El Qasr pilot zone: shore dunes, 9 percent; cemented dunes, 54 percent; sloping area of dunes, 24 percent;

summit area of dunes, 7 percent and depressions 6 percent, out of which 2 percent are suitable for horticulture purposes.

The cemented sand dunes cannot be reclaimed but present no menace to the immediate locality. The shifting sand dunes, however, are a great threat to various cultivated and planted areas: their reclamation is technically feasible and it is necessary except where salt marshes or other unproductive land lies behind them, making reclamation uneconomic.

Priority for sand-dune fixation and afforestation should be given to the El Qasr area (from west of Mersa Matruh to Agiba) and to the western part of the Sidi Abd-el-Rahman. In the El Qasr area, the most populated part of the region, a mass of more than 2 000 feddans of moving sand dunes threatens to cover about 950 feddans of very fertile agricultural soils in the four villages Roman, El Qasr, Matarich and Oum-el-Rahman. One kilometre west of Sidi Abd-el-Rahman, one of the most beautiful resorts of the region, shifting dunes have already covered an asphalt road to a considerable height one km westwards.

The total area of sand dunes to be fixed in these two localities is estimated at 837 feddans, of which 777 feddans are at El Qasr and 60 feddans at Sidi Abd-el-Rahman.

Next in priority come the low sand dunes in the eastern part of the region, between Hammman and El Alamein, where fig tree plantations or land otherwise cultivated needs protection from northern winds and shifting sands. This area comprises about 1 900 feddans, on 900 feddans of which windbreaks should be established.

Detailed studies and demonstration projects have been carried out in all these locations. The demonstration projects covered every type of dune in the region and every objective of reclamation work. Field investigations were made, sites were mapped and their ecological value estimated, laboratory analyses were done, and the costs and benefits of the proposed works calculated.

In the El Qasr area, which is agriculturally very important, an experimental demonstration plot for sand dunes fixation and afforestation was set up in 1967. Although the year 1967/1968 was very dry and climatic conditions were not favourable, the work was carried out successfully, showing that through the application of suitable techniques these high and poor oolitic sand dunes can be fixed and rehabilitated. The results obtained encouraged both Government representatives and local bedouins to extend this kind of work.

The reclamation of maritime sand dunes can best be carried out through fixation by mechanical means as a first stage of provisional protection, and afforestation as a second stage for long-term protection. No agricultural cultivation on these poor, dry, shifting sand dunes, with less than 150 mm of annual rainfall, is possible in the first stage, except for figs on the low sand dunes in the eastern part of the region. Once the sand dunes are fixed and their soil conditions improve under the shade of the wood trees, other horticultural trees, or even forest trees, can be planted.

The following techniques for fixation and afforestation are suggested:- First a network of cross-fences should be prepared, the size of the squares formed depending on the steepness of the slope and the form of the dune. The squares should be smaller on top of the dunes and on the windward side, with an average pattern of 7 x 10 m. In some cases only linear fences set across the direction of the prevailing wind can be used.

As dead material, reeds (Phragmites communis) or any other dry material available can be used. It is also advisable to use live material such as Sacharum spontaneum, which grows very well on these maritime sand dunes. Fences should be sunk 15 cm and

rise 40 cm above the sand. With this size of fence squares, about 200 bundles of reeds are required per feddan, making the fence 1 200 m long. In places where intensive fencing is not economic, one or two rows can be located on the higher ridges of sand dunes or on the flat beach. When they are covered by moving sands, a new fence should be erected over the accumulated sand. Once the sand dunes are fixed by mechanical devices, plantation should be done with suitable drought-resistant tree species. Tall trees tolerant to strong winds should be chosen to secure a mixture of soil ameliorative and quick protection. Mixing Acacia cyanophylla with Tamarix articulata in a proportion of 4:1 achieves these aims. Acacia, which is a leguminous plant, grows quickly in the first year. It has a great crown and develops a root system which binds the sand well and improves soil conditions with its leaves and roots. It also produces palatable feed for animals. However, this plant is sensitive to the northern wind. Tamarix articulata is tolerant to wind and salt and has a very deep tap root, up to 8-10 m in depth. It grows higher on the dunes than Acacia but does not improve soil conditions.

In the El Qasr experiment, ten months old seedlings of Acacia cyanophylla reached an average height of 60 cm on the top of dunes and higher parts of slopes and 141 cm on the depressions or lower part of slopes.

The height of Tamarix ranged between 49 and 82 cm, while that of Acacia cyclops was about 60 cm. In addition to these two very drought-tolerant species, the following can be tried: Zizyphus spina christi and Acacia cyclops on the higher part of slopes; Prosopis juliflora on medium sites; and Eucalyptus gomphocephale and Casuarina equisetifolia on depressions where the water table is accessible. Artiplex sp., Nitraria retusa and Tamarix articulata, very salt-tolerant species, can be tried on the coast, at 150 - 200 m from the sea. Two-row windbreaks should be set up for every 150 x 300 m of cross fences.

Planting should be done at 60-120 cm depth, according to the particular situation, so as to use to the maximum the moist bottom layers of sand. Survival percentage ranged from 57 to 88 (average 68 percent) for planting in the very dry year 1967/68, with no irrigation for the seedlings. Big seedlings of about 1.20 - 1.50 m in height, grown in pots in a nursery, should be used.

Plantation must be done very carefully, only moist sand from the bottom of pits being used for filling the holes. Both the establishment of the fences and the planting of seedlings should be done only during the rainy period, when the sand is moist, to give the seedlings a better chance of survival and better growth.

The wood produced per feddan/year is estimated at 0.93 m3 on average, with great variations according to sites (depressions, top of dunes or maritime beach). With the price of one stumpage cubic meter of fire woood estimated at about £E 3, the average value of production per feddan during one period of rotation of 20 years should be about £E 56. To this value, a smaller value of leaves, pods and fresh twigs, which represent animal feed, can also be added.

Inland sand dunes

There are the following three different tracts of inland dunes, generally brownish-red in colour and finer in texture, in the project area:

a) moving sand dunes at Garawla, about 20 km east of Mersa Matruh.

b) semi-fixed dunes at Maktala, west of Negeila on the Libyan plateau

c) a large mass of moving and fixed sand dunes lying in the southern part of Dabaa, only part of which lies in the project area.

For this project the Garawla and Maktala sand dunes are important.

Since the sand dunes of Garawla, which have become mobile during recent years and have expanded very fast, now menace the Alexandria - Mersa Matruh highway, they should be fixed and afforested as soon as possible, the same techniques as prescribed for maritime sand dunes being used. As their ecological conditions are better than those of the coastal oolitic dunes, Pinus halepensis and fig trees can also be used, under the shade of the species mentioned in the previous section. In December 1968 and January 1969 a 30 feddan experimental plot of sand-dune fixation and afforestation was established at Garawla.

The Maktala sand dunes, which are semi-fixed, being covered with some shrubs, primarily Thymaelia hirsuta, are suitable for range and, at some locations, for watermelon cultivation, provided there are windbreaks to prevent ploughing from shifting the sand and cause the dunes to move.

Suitable tree species for windbreaks are Tamarix articulata, Acacia cyanophylla and Pinus halepensis, the last species being interchangeable with the other two fast-growing trees.

In conclusion, taking into consideration all economic and social factors, and especially the fact that soil once lost cannot be regained, sand-dune fixation and afforestation, and the establishment of windbreaks on dunes in the project area appears to be fully justified and very necessary.

4.2. Windbreaks and shelter-belts (Windscreens)

The establishment of windbreaks and shelterbelts is possible in the region only where good soils exist and where water conditions will be improved by such watering systems such as flooding, terracing, spreading or water conservation works. The recommendations made are based on detailed studies for windbreaks for each type of watering system carried out in the Negeila and Fuka pilot areas (Wadi Enthely, Wadi Abou-Moubarak, Wadi Wakal, Zagharat and Micro-Fuka demonstration projects).

a) Area proposed for windscreen protection

Based on the surface water survey, 6 000 feddans can be watered by winter flooding, 1 000 feddans by terracing, 3 000 feddans by spreading, and about 30 000 feddans by water conservation works, making a total area of 40 000 feddans for the whole region. All the areas mentioned are net areas.

It is estimated that the following lengths of windbreak correspond to one protected feddan: for flooding projects, 69 m of windscreens (comprising 23 m of shelterbelts and 46 m of windbreaks); for terracing projects, 100 m of windbreaks; for spreading projects 37 m of windbreaks; and for water conservation projects 54 m of windbreaks. This amounts for flooding projects to 414 km (comprising shelterbelts 138 km and windbreaks 276 km); for terracing projects, to 100 km; for spreading projects 111 km; and for water conservation projects 1 620 km, making a total length of 2 245 km of windscreens for the whole area.

In addition to the above, about 50 km in all of five-row shelterbelts are suggested for establishment between the coastal sand dunes where there are deep alluvial soils behind the ridge.

The area occupied by windscreens, which has been calculated only for flooding projects where shelterbelts and two-row windbreaks will be established, amounts to 4.5 percent of the whole cultivated land. For projects where windbreaks consist of a single row the cultivated land will not be effected, since the windbreaks will be located downstream of dykes, where the land is generally used for range.

b) Types of windscreen and their location

Since the main aim of using windscreens is to secure maximum protection for mimimum sacrifice of land, narrow windscreens are recommended. On the flooding projects located near the sea, where wind and salty air strongly affect the horticultural crops, a network of two-row windbreaks inside the reclaimed area is suggested, with shelterbelts of five rows, set across the direction of the northerly and westerly winds, along the peripheral dykes. On the basis of their form and the choice of trees, these are medium-dense windscreens. The windbreaks should be located on both sides of the dykes so as to make a chessboard of 150/300 m, the distance being smaller between the main windbreaks facing the North wind and greater between the secondary windbreaks. Windbreaks where the other three systems of watering are used will consist of one-row windbreaks running along the dykes and consisting of two species mixed alternately in the row. Their location downstream the dykes will avoid depriving the crops upstream of water and will afford shade to the animal grazing on the rangeland downstream.

In terracing projects windbreaks for westerly winds are also important. Their direction, too, corresponds to the direction of the dykes, which are built on the north-south contour line of the escarpment.

The average distance between windbreaks for these watering systems should range from 150 to 250 m.

The species recommended are those with large crowns. By their being intermingled, they will give a compact (dense) screen from top to bottom.

c) Wood trees recommended

The choice of wood trees depends on the soil and water resources and the recommended land use. All indigenous species recommended were first tested. For areas with deep soils under flooding (the best conditions in the region), evergreen and higher species with fastigiate shape and branched from top to bottom, such as Casuarina equisetifolia, are recommended. Along the peripheral dykes, outside the reclaimed area, Eucalyptus camaldulensis and Tamarix articulata are acceptable. The first, on account of its fast growth and loftiness, secures protection for agricultural crops; the second, being very tolerant to wind, protects the other two species against the northern and western winds.

For areas where soil and water conditions are less favourable and where the land is sloping, Tamarix articulata and Prosopis juliflora are suggested. Both are very drought-resistant, have large crowns, and are not palatable to animals. Prosopis juliflora, however, produces sweet pods which are very much liked by goats and sheep.

For terracing projects, where the amount of water provided by runoff is greater, Tamarix can be replaced by Casuarina equisetifolia, and Prosopis juliflora can be replaced by other fodder shrubs such as: Zizyphus spina-christi, Acacia cyanophylla or Haloxylon persicum.

d) The technique to be adopted in windscreen planting

The technique of planting should be such that local favourable conditions are exploited to the maximum and the effect of unfavourable conditions reduced to a mimimum. Thus an intensive system of silviculture should be implemented. The favourable conditions are the depth of the soil with good texture and the supply of winter water provided by runoff and rainfall. The unfavourable factors are the scarcity of rainfall and runoff, which are restricted to a very short period, the compaction of the soil and the very high rate of evaporation cuased by winds.

Thus it will be necessary to give special attention to ploughing in relation to soil conditions so as to increase the water storage capacity and to reduce evaporation; care being taken at the same time not to bring $CaCO_3$ or gravels to the top.

The use of one-year-old seedlings grown in pots in the nurseries is recommended where planting is not by cuttings.

Planting should be done at the beginning of the rainfall season, in normal holes, but deeper than normal for Tamarix articulata, Eucalyptus and Prosopis juliflora Due to the low level of soils moisture and the lack of rainfall for eight months, supplementary watering of transplanted seedlings in summer appears to be necessary during the first two years. It was estimated that at least one hundred litres of water will be needed annually for each seedling. This can be provided from underground water resources.

Hoeing in the first two years is also suggested to avoid evaporation. To secure a longer protection of the crops and sites and to produce a great quantity of wood or animal feed under the natural growing conditions of the region, a period of rotation of 25 years is considered adequate for Casuarina equisetifolia, and Tamarix articulata, while, for Eucalyptus camaldulensis and Prosopis juliflora, it should be limited to 15 years. To ensure permanent protection for crops under such a successive system of rotation, it is suggested that at least one row of each species for shelterbelts or two-row windbreaks stand permanently to furnish the necessary shelter, while the first row be cut earlier to ensure the necessary rotation.

For one row windbreaks consisting of two species with different periods of rotation, permanent protection will be secured by the alternate cutting of trees along the row. In order to increase the protective effect of windbreaks and to reduce the moisture consumption of water by shelterbelts, a thinning system after ten years in suggested. This will be achieved by cutting alternate trees.

e) Expected benefits

- Protective effect. It is evident that the growth and yield of olive, almond and carob trees in this region would be hopeless without an intensive network of windbreaks. According to studies undertaken by the Alexandria Faculty of Agriculture and the Expert's investigations in the field, the yield obtained from plots protected by windbreaks surpasses that obtained from open plots by an average of 20 to 50 percent. The difference depends upon the position of the plot in relation to the sea, the kind of fruit trees planted and the annual climatic conditions. For instance, during dry years or stormy years, especially in the blossom period, windbreaks secure 100 or even 200 percent better yields from orchard trees. The effect of windbreaks on the yield of annual crops, and particularly on that of earlier crops such as barley, is less than the effect on the yield of orchards, ranging from 10 to 30 percent. On the grazing land the provision of shade for animals by groups of trees or windbreaks is of very great importance. The project's animal husbandry expert concluded that the cold storms during January and February 1968 killed 40 percent of the lambs. On the other hand, it was observed that during the summer season under some scattered Prosopis trees existing in Garawla wadi, goats and sheep which found protection against the sun lost less weight and consumed less water.

- Production of wood and feed. Besides the protective effects, windbreaks will also produce a large quantity of wood and feed. The biggest quantity will be produced under flood watering on deep soil cultivated with Casuarina equisetifolia or Eucalyptus camaldulensis. Somewhat less will be produced by the water conservation works and spreading projects, from windbreaks consisting of Tamarix and Prosopis. Project studies indicated that, over a period of 25 years, a large quantity of wood might well be produced. Estimated wood production per one km of windbreaks is 325 m^3 on flooding projects with five-row shelterbelts and 117.5 m^3 on those with two-row windbreaks. Spreading and water conservation projects with single row windbreaks

should yield 15 m^3. For projects where fodder shrubs such as Prosopis juliflora will be used, animal feed under the form of pods can be produced in large quantities. One kilometre of windbreak with half the number of trees as fodder shrubs will possibly produce 3 000 kg on spreading and water conservation projects, and 8 000 kg on terracing projects during one period of 25 years.

Value of wood and feed produced

As information on stumpage is lacking, estimates of the value of timber and of feed in the form of pods are made at a relatively low price, i.e. at the cost of wood for feed. The estimated value of wood and feed over 25 years is £E 734 from one km of shelterbelts, £E 234 from one km of one-row windbreaks in flooding projects, and £E 68 per km of one-row windbreaks on spreading and water conservation project (wood £E 38 and feed £E 30).

f) Final recommendations

Priority for the establishment of windbreaks should be given to flooding and terracing projects, especially for areas lying immediately near the sea. Windbreaks and shelterbelts should be guarded for the first five years to keep away flocks until the trees become tall enough not to be damaged by grazing animals. In view of the lack of previous experimentation in the establishment of windbreaks as recommended in this report, experimental work on a small scale should first be carried out.

4.3. Fodder trees and shrubs

The greater part of the project area consists of range land which is the main source of feed for over 500 000 head of sheep and goats. Due to low rainfall and, in many parts of the region, shallow soils, the estimated carrying capacity of these lands is very low, ranging from 7.5 feddans to 30 feddans per sheep. Furthermore, due to the great variation in rainfall from year to year, herbage production fluctuates greatly.

The introduction of fodder shrubs would be one important measure for the improvement of range and animal feed production. Quantitatively and qualitatively the local supply of feed would be increased and annual production would be more constant, since, with their deep root systems, fodder shrubs are less affected by variability in rainfall.

Many of the indigenous shrubs have a relatively low plalatability, and the palatable shrubs at present provide feed of a fairly low nutritive value. The introduction of new species able to produce a high quantity of feed of good quality and adaptable to local conditions is therefore necessary, and the following are suggested: Prosopis juliflora, Ceratonia siliqua, Zizyphus spina-christi, Acacia cyanophylla, Acacia farnesiana, Haloxylon persicum and Medicago arborea. In locations receiving a minimum of 200 mm from rainfall and runoff, plantations of Spineless cactus (Opuntia ficus-indica) could be established. Some of the above species produce sweet pods and others palatable leaves and fresh twigs.

The fodder shrubs recommended can be introduced with sand-dune afforestation works and windbreaks or as special fodder plantations of groups of shurbs. The proposed total length of windbreaks to include fodder shrubs is estimated to be about 1 700 km and the proposed area under sand-dune fixation is about 1 000 feddans. The special fodder plantations, which will also provide shade for animals and check erosion, should be composed as follows:- On shallow and limited deep soils on the Libyan plateau, on Gymnocarpus, Anabasis and Haloxylon associations, Artiplex nummularia, Prosopis juliflora, Zizyphus spina-christi and Haloxylon persicum can also be established, the last three species first being tried on a small scale.

On medium deep soils of the plateau and the coastal plain, where conditions are better, Ceratonia siliqua, which is well known for the high value of its pods and its drought resistance, can also be used. Medicago arborea is recommended where moisture conditions are good (a minimum of 300 mm).

On the northern lands where there are hummocks around the salt marshes, Prosopis juliflora, Zizyphus spina-christi, Acacia cyanophylla and Acacia farnesiana. These shrubs on the hummocks (small hills formed by soil accumulation around the spreading shrubs) will increase the feed value of the vegetation on these lands and probably contribute to the soil building process.

The introduction of new species of fodder shrubs should be made gradually, starting where soil and water conditions are better within a proper system of management (rotation) to ensure constant annual production. In order to avoid the destruction of shrubs in the establishment stage and immediately afterwards, grazing should be controlled.

On areas where the natural vegetation is badly degraded, measures for establishing certain palatable and nutritious local species should be studied further. Convolvulus lineatus might be tried on loam, Echichylon fruticosum, Salvia aegyptica and Helianthemum europaeum on loamy sand. The advantage of establishing local species on ecologically suitable locations is that their spontaneous propagation will provide a better density of good species in such areas and in adjacent locations. Although it is difficult to estimate the production of the new species of shrubs, some orientative data can be given for the potentiality of the region, as follows:-

- On maritime sand dunes, one feddan of Acacia cyanophylla can produce an average quantity of 200 kg of leaves and fresh twigs per year for a period of 20 years.

- On medium deep soils per km of one-row windbreaks, with half the trees consisting of Prosopis juliflora, an average of 120 kg of pods per year can be produced. It is impossible to estimate future production for other shrubs proposed. In other Mediterranean countries with similar conditions, spineless cactus plantations yield 2 000 feed units per hectare (800 feed units per feddan) when planted under wadi runoff conditions where there is less than 100-200 mm rainfall, Carobs can yield about 400 feed units per feddan on sandy soil with 200-300 mm rainfall. However, long-term studies and measurements are required to provide cost and benefit data for both new introduced and local fodder shrub cultivation.

The protection of orchards and other plantations against grazing is of paramount importance for any development in the region. As barbed wire and fence posts are expensive and scarce, the use of live thorny hedges would be advisable. For this purpose, Acacia karoo and Prosopis juliflora or Lycium europaeum and Opuntia ficus indica are suggested. Lycium would provide valuable green browsing in drought seasons. Spiny cactus used as hedge could provide drought food by scorching of the spines.

4.4. Roadside plantations

The Alexandria-Mersa Matruh road, which is important for national and international traffic, runs along the coast, passing through semi-desert lands with monotonous open landscape and subjected to strong winds and storms. In order primarily to improve the beauty of the landscape and to provide shade, roadside plantations should be established. They would also provide protection for adjacent lands and produce wood and animal feed.

Trees could be established on 157 km of the 285 km of the highway, but, because good soils are generally scattered, roadside plantation is suggested for a total length of 96 km, divided into the following sectors: Alexandria to Burg-el-Arab

23.1 km; Burg-el-Arab to El Alamein 7.2 km; El Alamein to Dabaa 26.1 km; Dabaa to Fuka 16.5 km; Fuka to Mersa Matruh 23.1 km.

The plantations would consist of a row of trees on each side of the road, with the trees spaced at 5 m intervals and the rows distant 5 m from the edge of the asphalt. The tree species should be drought resistant and decorative and able to grow under dry conditions after watering for the first two or three years. Tamarix articulata should be used because of its drought and wind tolerance and its height. On the southern side of the road Tamarix should alternate with Acacia cyanophylla, which is small but has beautiful yellow flowers and dark green leaves. Cupressus sempervirens var. pyramidalis, is also recommended for roadside plantations in potential tourist centres such as El Alamein, Sidi Abd-el-Rahman, Dabaa, Fuka and Baqqush, where the amount of water which Cupressus requires is available. The total length of Tamarix and Acacia would be 87.5 km; that of Cupressus, 8.5 km. Planting for Tamarix and Acacia should be with one-year old potted seedlings, or, for the first species, with rooted cuttings. Cupressus needs two-year old seedlings. Crescent-shaped dykes should be made around the pits of seedlings to collect runoff during the rainy season. In the first two years, however, additional water supply should be given in summer.

For one km of road-side plantation with Tamarix and Acacia about 124 m^3 of water are needed, 80 m^3 in the first year and 44 m^3 in the second year. This water can be provided from local wells: where this is not possible it must be taken from the Alexandria - Mersa Matruh pipe line.

Each seedling should be protected by triangular fences made from palm trees or another material and the fences should be guarded. The approximate cost (the greater part of which is for fences and watering) of establishment, replanting and maintenance is £E 141 per km.

In view of the limited water resources, establishment should be carried out over a period of ten years, starting in the eastern part, where there is a great number of wells, and gradually passing to the western part where the Mariut extension project will provide irrigation as far as Dabaa. The gradual build-up will enable good techniques to be developed and good supervision and guarding to be provided.

The region has some very beautiful beaches, and resorts have already been set up at Agami, Sidi Dkeir, Sidi Abd-el-Rahman, Ras el Hekma and Mersa Matruh. The fine sand and dark blue sea form the attraction, but there is a dearth of trees to provide shade in the hot summer days and to vary the scene. Tree establishment along these beaches would not only add to their beauty and provide shade, but also afford protection against winds blowing from the desert. The difficulties offered by land lying below sea level and its salty seawater and by the strong salty winds could be overcome by choosing suitable species and techniques of establishment.

The green zones would consist of groups of trees and of linear plantations along some important routes and roads, especially along the seaboard. In some places, such as Sidi Keir and Sidi Abd-el-Rahman, the afforestation of mobile sand dunes located around these places will serve the purposes of green zones too. As decorative and adapted species under these conditions the following are suggested: Cupressus sempervirens, var. pyramidalis, Prichardia fillifera, Phoenix dactilifera, Araucaria excelsa, Tamarix articulata, Acacia cyanophylla, Ficus caryca, Myoporum pictinum, Schinus terebentifolius, Ponciana regia (only on protected places)...etc.

In order to reduce the harmful effects of salty wind and extremes of temperature a high rate of irrigation is necessary.

Other villages along the Alexandria-Sallum highway also need similar green zones. Of these, priority should be given to El Alamein, Dabaa, Negeila, Sidi Barrani and

Sallum, and species should be confined to the very drought resistant Tamarix articulata, Acacia cyanophylla and Prosopis juliflora, especially upon the plateau.

The type and location of green zones needed for each seaside resort and village should be determined by detailed local studies taking into consideration the soil and water conditions, local tourist requirements and financial resources. Such studies can only be undertaken after the general development plan of these localities is determined.

4.5. Tree seedlings propagation

To establish forestry on a long-term basis permanent nurseries should be set up for the production of seedlings. It is estimated that about two million seedlings will eventually be needed to implement the various forestry projects proposed for the region.

On the basis of the productive capacity of a normal nursery unit, the number of seedlings required year per year, and the nursery period of the seedlings, an effective productive area of two feddans for the nursery is required. An additional area of three feddans will also be needed for allied nursery activities, such as the transplanting of seedlings, storage of seeds, pods, tools and technical equipment and for buildings and future extension of the nursery.

It is proposed that a permanent central forestry nursery be set up at the main agricultural station in the region. This will allow for big capital investment on an economic basis, the application of modern techniques of production, and the employment of well qualified and competent technical staff to produce seedlings of good quality at low cost.

The most suitable site appears to be at Burg-el-Arab in the Mariut extension irrigation project, where good soils, fresh water and plenty of labourers are available and from where transport throughout the region is easy because of the proximity of the railway.

The existing small nurseries at Fuka, El Qasr and Burg-el-Arab should be retained as distributing centres for seedlings.

Species to be raised in the nursery would be: Acacia cyanophylla, Casuarina equisetifolia, Tamarix articulata, Cupressus sempervirens, both varieties, horizontalis and pyramidalis, Prosopis juliflora, Pinus halepensis, Eucalyptus gomphocephala, Acacia cyclops, Ceratonia siliqua, Zizyphus spina-christi, Haloxylon persicum etc...

The greater part of production should be done in pots and polyethylene bags. Although the balled nursery stocks appear to be costly in comparison with the naked root plants, the former system is more advantageous for this dry region with difficult soil conditions because it ensures higher survival and greater growth rates of seedlings.

Sowing of the seeds should be done in the proper season according to the age of different species and their ecological requirements. For instance, some fast growing species such as Casuarina, Eucalyptus and Acacia need 8-10 months to reach the proper size for plantation, while the seedlings of Pinus halepensis and Cupressus sempervirens need to stay in the nursery from 1 1/2 to 2 years. Also these two last resinous species must be sown only between November and January to ensure proper germination of seeds and to avoid damping off. Seedlings needed for sand dune afforestation should be of greater height (about 1.20 m) and these heights for Acacia cyanophylla seedlings are only attained after 12-15 months.

Transplanting of seedlings should be done only in the lath house, with roof, sides and doors covered with thin laths to give 50 percent shade.

Sprinkler irrigation is suggested to ensure a more uniform distribution of water and increased moisture in the air, and to avoid losses through deep percolation or runoff.

The lateral shade of the nursery should be secured by a network of windbreaks made of Cupressus sempervirens, var. pyramidalis or Casuarina equisetifolia with a cross-fence of 100 x 150 m. During the first period, until the wood trees are high enough, Arundo donax or Pennisetum purpureum can be used.

Seeds should be procured from selected and adapted trees in the region as well as from localities abroad with similar climatic and soil conditions.

Finally, an arboretum of ten feddans is recommended to produce selected seeds and to serve as a demonstration plot showing the best use of land under forestry cultivation.

5. Improvement of Agricultural Institutions and Services

5.1. Land Tenure and Settlement

In considering the scope of agricultural development in the region in relation to land tenure system it is necessary to gain a clear understanding of the nature and implications of the tribal land tenure system, its capacity to adjust and adopt itself to new agricultural developments and to changing environments and the methods of solving various problems associated with it.

The system was originally evolved to provide security under the hard and harsh desertic conditions of ardity and scarcity. A great degree of cooperation and mutual aid especially during periods of drought and famine is an important feature of the system.

This traditional system is based on the simple principle of co-relation between the territoral distribution and groups of families of homogeneous character (tribes, sub-tribes, clans etc..) in accordance with customs and traditions of each particular group. Each group constitutes an economic corporate unit with its own agricultural land and grazing areas and its own water points within the tribal territory.

The right of disposal of land rests in the family and not in an individual with the result that land cannot be alienated without the consent of family members or other members of the group. Further, rights rest in adult male members only. Though grazing rights are common, yet flocks of sheep, goats and other animals are not owned and managed on a common basis. This leads to overgrazing of the range lands and their improvement is a very difficult problem.

However, despite this traditional communal character of the tenure system, the process of individualization of holdings has been taking place particularly in areas endowed with favorable farming conditions. The process has further been stimulated by the desire of some tribesmen to

plant fruit trees, and by the improved communications and the transition from a subsistence economy to a market economy.

However, due to its being tied to strong tradition and customary laws, the system has assumed some rigidity and complexity. It has become incapable of adjustments to rapid technical, technological and economic changes and offers little incentive to more progressive and enterprising cultivators.

Any change or modification contemplated in the system is viewed with great suspicion by tribal chiefs who become afraid of losing their control and authority over the tribesmen. Further, it is also greatly feared that any change in the system will lead to disruption of the extended family system, traditional patterns of social relationships and social structure.

For agricultural development of the region and for bringing about an integration of tribal people with the rest of the country in economic, social and cultural fields, it is essential to bring about a change in their traditional ways of life and living. The land tenure system constitutes the corner stone in this process of development and sedentarization and requires modifications for the emergence of a new society with new institutions, new values, new norms and patterns of behaviour and action.

The problem is too complex for any single solution. The main issue is how to change a variety of situations both of land and water tenure and customs and traditions which exist now so as to achieve the objectives of agricultural development and of the economic, social and cultural improvement of the concerned population. This will involve the question of determination and transfer of rights and, in many cases, their legal establishment; that is, the conversion of customary tenure into statuary written tenure. The process will inevitably be long and difficult, but it must be carried out if any investments in agriculture in the region are expected to bear fruits.

In bringing about any changes and modifications in the system, it must be kept in view that these should be generally acceptable to the population and are brought about in a manner that they do not cause social

and psychological upheavels, unrest and harm. At the same time, the good features of the tribal organization like mutual cooperation and aid, sense of loyalty, honesty, uprighteousness, religious faith and social leadership are maintained and exploited.

The important objectives of changes in the land tenure system should him at better use of productive man-power and land. These changes should provide incentives to increase soil productivity and investments; make the system flexible enough for adjustments to changing technology and to good farm management practices, and to be compatible with national welfare goals.

5.1.1. Proposals for Improvements:

The following suggestions and recommendations are made for reforming the existing land tenure structure in the region and for facilitating the process of land development and settlement:

5.1.1.1. Starting of Land Registration and Cadestral Survey Division in the EGDDO and Registration of Rights

At present, the region has not as yet been subjected to any Cadastral Survey and mapping and no official legal records of tribal or individual land ownership are available in most cases. There is no legal demarcation of individual fields, holdings or boundaries. It is very essential to prepare a regional inventory and register of land with a view to determining the location, area, form of tenure, and legal status of all tribal holdings, cultivated or uncultivated land suitable for settlement.

A compulsory Land Registration programme should be intitiated in the region to cover and record all rights and claims in land including those relating to whether they are rights of ownership, usufruct, servitude etc.. A detailed proposal for an EGDDO Land Registration Section has been made separately in this regard.

In preparing maps for cadastral surveying and title registration, it is advisable in semi desert areas used for grazing or barley cultivation that these maps be prepared on a small scale (1:25000 or 1:50 000) ; while in

areas with more favourable conditions and suitable for development and individual holdings, the scale should be larger (1:5 000 or 1:2 500). On this latter scale, it will be possible to show individual boundaries.

5.1.1.2. Modifications and Changes needed in Legislation

In order to legalize the tribal ownership of land, the existing customary tenures must be transformed into statutory tenure. This transformation is necessary to provide security of tenure and incentives for improvements and to accelerate the process of land development and settlement.

To attain this objective, the Government enacted the Law No. 124 of 1958 governing the possession and utilization of desert lands by requiring tribesmen to acquire and establish their tenural rights in a legally prescribed manner. However, this Law did not take into consideration the customary and legitimate ownership rights acquired and established prior to this Act; and therefore, it gave rise to suspicions and worries amongst tribesmen and discouraged them from registering their tenure rights under this Law.

An effort was then made by the Government to rectify the situation by replacing Law No. 124 of 1958 with a new Law No. 100 of 1964. But even this new Law has some shortcomings which need to be overcome so as to achieve the objective of the legal establishment of rights and the rectification of the agrarian pattern in desert areas.

Therefore, the following changes and modifications in the 1964 Law are proposed in order to facilitate the process of converting the traditional tenure into a statutory one, settling tribesmen and for creating progressive and viable desert land development schemes.

1. Recognition and confirmation of customary rights

The provisions of the Law should be amended so as to recognize and confirm the tribesmen's customary rights to the lands which they have customarily possessed and utilized for at least 5 years prior to the promulgation of the 1964 Law. This recognition of rights should not

only be applied to that part of the tribesman's holding which he had planted with trees or cultivated or over which he built a house, but it should also be applicable to those parcels of his land which are dependent upon rainfall and cultivated seasonally with barley or with reseeded pastures for the production of animal feed. The recognition of rights of ownership should also be extended to all those persons who have their lands transferred to them by the customary holders.

2. Alienation of Lands (free or at nominal cost)

Land possessed customarily by tribesmen should be alienated to them, free of charge, within the ceiling limit set for land ownership, or at a nominal price not exceeding L.E. 1 per feddan. This will encourage the tribesmen to apply for the registration of their rights. The present provision of charging the tribesmen the value of land discourages most of them from applying for alienation, as they consider it strange to apply for the purchase of land which they possess and have been utilizing for generations. As the policy of the Government is to encourage bedouins to settle and reclaim desert lands, the present provision of charging bedouins the price of land should, therefore, be amended.

3. Adjudication of Rights

At present great confusion exists about tribal property and rights of occupiers both amongst tribesmen as well as the Government officials. A special provision needs to be made in the 1964 Law to set-up Field Adjudication Committees to determine the correct position about land and water rights. These Committees should work with the Land Registration Department and be responsible for recording rights in the Land Register correctly in accordance with the final results of the adjudication.

The Committee should consist of a representative of the Land Registry Department, a representative of the Justice Ministry, a representative of the EGDDO and one or two tribal representatives.

4. Provisions for Water Rights

The Law should also contain provisions to the determine water rights and to conserve, control and regulate the use of underground water resources in the region. As water resources are scarce, therefore it is proposed that water supply sources excepting those constructed by private individuals should be declared public state property and a proper efficient control be exercised on them. The use of private water resources should also be regularized through a system of licensing. Drilling of wells and construction of cisterns and/or gallaries should be subject to permission from the Government.

5. Provisions for Grazing Rights

The Law should likewise contain provisions to conserve and regulate the use of grazing areas in the Region. The range areas have been subject to rapid deterioration due to overgrazing and excessive ploughing. Under the present situation according to the tribal customary law, grazing areas are collectively held by the tribe and, therefore, grazing rights are, by and large, communal, whereas ownership of livestock is individual. Hence, no one has the incentive or the interest to protect the range by limiting the number of animal on it or improve it by other means. Consequently, it is very difficult under the customary law to achieve a balance between the grazing rights and the carrying capacity of the range. It is, therefore, necessary to make appropriate legal provisions to ensure control over grazing rights and to establish a sound-long-term range management practices by setting up a Grazing Authority for the establishment of grazing districts and for the enforcement of the legal provisionsin force as well as for the settlement of disputes liable to arise in connection of grazing.

6. Special Provisions needed for Land Settlement Schemes in tribal desert areas

The existing Law of 1964 includes provisions which could only be applied

in situations where settlement schemes are established in reclaimed irrigated lands, and they have little relevance to desert tribal areas depending mainly on scanty rainfall, some little underground water from shallow wells in certain places and in occupation by tribesmen. Therefore, for the success of settlement schemes in such areas, the following changes or modifications in the 1964 Law, and other legislation are needed.

(i) The present predetermined ceilings of (4.5 - 7.5 feddans) placed on the sizes of holdings to be distributed in reclaimed desert areas (Article 30 of the 1964 Law) should be removed by amending the relevent provision in the existing Law. The amended provision should provide flexibility in determing the size of a holding in a settlement area so as to allow for the establishment of viable holdings incorporating the concept of minimum target income and making possible full exploitation of the farmer's resources.

(ii) Reclaimed tribal desert lands inhabited by tribes should be distributed only to qualified settlers selected from among the present tribal occupiers of the area and other homogeneous groups, preferably belonging to the same tribe, and no proportion should be assigned to outsiders as stipulated in Article 30 (viz. farmers from congested areas, disable or retired military service men and agricultural school graduates), as it is doubtful whether such outsiders could achieve any success in such hazardous farming conditions or could live in peace and harmony with the bedouins of the area.

(iii) Concerning the new tenural arrangements, new relationship between the state and an individual settler should be clearly defined. The basis, method and mode of payment which a settler will have to make for the improvements should be clearly stated.

It is proposed full ownership rights should be granted to settlers subject to certain conditions, whereby, the State shall exercise control over the size and layout of holdings and determine the use

to which the land shall be put. The holding may be alienated to one individual person with the necessary qualifications for eligibility as settler; and no joint ownership of holding be permitted. Moreover, there should be no sub-letting or leasing in whole or in part; and holdings should not be subjected to subdivision and fragmentation consequent on succession. The heirs entitled to interests in a holding may assign their interests to a single holder. Furthermore, provision should be made for a holding to revert to the Authority in charge of the Settlement in case of a breach or default by a settler in fulfilling any of the conditions or obligations, after giving due notice and opportunity to him to explain such breach or default.

(iv) Provision should be made for setting up a special Committee for the Selection of Settlers consisting of technical and administrative staff and tribal representatives to inverview settler applicants, taking into consideration special qualifications set for eligibility such as age, health, education, marital status, number of dependents, farming experience, land owned etc.. The success of any settlement project will depend on the careful selection of prospective settlers.

(v) A provision in the Law should also cover the question of payment of compensation for lands already under customary possession but taken up for land settlement schemes.

5.1.1.3. Proposals for Choice of Settlement Areas, Settlement Patterns and Lay-out

In selecting suitable areas for settlement schemes, particular attention should be paid to more favourable areas which offer scope for assured production on the basis of good rainfall and soil conditions and availability of irrigation and other favourable factors.

The most suitable lay-out pattern for settlement schemes in the North-Western Coastal Region is the open country (dispersed) farmestead settlement under which farm houses are scattered all over the countryside; that is, the homestead of each settler is located within, or close to, his farming

unit. Compared with the village type of settlement, the dispersed farmstead system is usually more expensive in terms of the provision of social and public services, but on the other hand, the individual farmstead has the advantage of minimizing waste of time and energy on the part of the settler by insuring maximum proximity to his field and his animals. It also fits into the tribal way of dwelling. In certain cases, both of the above-mentioned systems may not fit in efficiently with the proposed engineering design of the project, and therefore, an intermediate type of settlement may need to be developed. As for example, in the case of Wadi Magid, the Line Village settlement was suggested because this will fit in nicely with the proposed canal system for diverting an distributing run-off waters over the Project's area. Under the line village settlement system, the settler will be concentrated along certain roads, running parallel to the proposed canals, with their farmsteads lying back from the road.

Concerning the layout of individual holdings, this will depend on the holding system adopted and on the results of the detailed soil survey which has to be carried out on the project area. The holding system to be suggested may either be the "one-plot" system or, the "multi-plot" system depending upon the variations in the Project's soils. The "one-plot" system is suggested for areas of, more or less, uniform soils type, where it is possible to establish viable sizes of holdings whereby each settler would have a separate farming unit, on which the homestead and the farm land are located. Under the (multi-plot) system, the farm will consist of several plots or parcels constituting a viable holding held under one title. If this system is adopted, then the project's area would be divided into fields representing the main soils types to be planted in accordance with the proposed pattern of utilization; and each field is, in turn, divided into blocks of cultivation. Moreover, each block of cultivation would be sub-divided into plots which are allocated to individual settlers. Accordingly each settler would have one plot in each one of major blocks of cultivation. Thus, the "multi-plot" farm

system has the merit of granting each settler an equal share in each soil type and thus ensures a uniform size of farms for all settlers. Moreover, large-scale cooperative utilization and operation which require more extensive use of mechanical and other modern farming techniques could be applied more efficiently in the "multi-plot" system where large blocks of cultivation make more possible the application of mechanization and other means of modern farming.

5.1.1.4. Supporting agricultural and institutional services

The economic and social objective of land development and settlement schemes cannot be fully realised without certain supporting measures required for facilitating the development process and increasing production and income. These measures consist of a variety of agricultural and institutional services which need to be coordinated for effective results. These services include agricultural extension, cooperatives, marketing, storage, credit, community development, provision of production requisites, and educational and healt services.

Following suggestions are offered in this regard:

(i) It is suggested that for settlement schemes a Planning and Management Committee should be set-up to deal with policy matters and to plan the channeling of all these services in a coordinated manner so that settlers have access to all of them as far as possible and know how to use them.

(ii) Training of Settlers in Farm Management practice and subsidization

Settlers should be imparted training in farm budgeting and in planning their resources to earn a satisfactory income. As during the initial four or five years, settlers will not attain the expected potential of farm income, they will require financial assistance to attract them to stay on the land. This assistance should preferably be made in kind on selective basis.

(iii) Involvement of Settlers in Settlement Schemes

It is important that settlers should be chosen in the early stages of a settlement project to involve them in the planning and execution works to impart them training and use them for such tasks as hedge and wind break plantation, preparation of lay-outs, land levelling etc...

5.2. Improvement of Agricultural Institutions and Services

Cooperatives and Credit

In considering the scope for the development of the cooperative movement in the region one has to take into consideration various aspects like the possibilities of the horizental or vertical expansion of the movement, modifications or changes needed in the cooperation law, impact and influence of the tribal social organisation, problems of management, supervision, account keeping, and last but not least the role of cooperatives in land settlement schemes.

The development of the Cooperative movement in the region on sound and healthy lines would depend on eliminating or minimizing factors and causes that obstruct progress and healthy growth. It is desirable to build a close link of the cooperative movement in the region with the national movement, expand types of activities which are according to the needs and wishes of the local population, involve the tribesmen closely and actively in the organisational and management activities, devise permanent and suitable arrangements for the training of the staff and members, institute a well-devised simple system of keeping accounts and records, recoveries of debts and outstandings and organising efficient channels for timely, regular and reasonably priced supply of needed goods and services, credit facilities and incentives to staff to live and work under unfavourable and harsh conditions.

The following suggestions are made for the development of the movement in the region.

5.2.1. Scope for expansion of the movement

It is felt that the present number of cooperative societies in the region is quite large and there is only a very limited scope of organising a few more cooperatives in the region. A maximum number of

about fifty societies will be sufficient to meet the needs of the region. Efforts and energies will therefore have to directed towards improving the working and management of the existing societies. It is further felt that multipurpose type of Cooperative Soceity meets the requirements of the region.

5.2.2. Modification of the existing Cooperative Law

No special modification or change in the existing Law is needed for this region. The task of improvement and development of the movement can be handled within the framework of the existing law.

5.2.3. Impact and influence of the Tribal Social Organisation

As a Sheikh is the most powerful, influential and naturally accepted leader in the tribal organisation, no cooperative movement or society can succeed in this part without his assistance and cooperation and he cannot be easily ignored. It is, therefore, necessary for the cooperative staff to be very tactful in handling the Sheikh, and enlisting his cooperation. At the same time, the staff should endeavour to build direct contacts with other members also and try to educate them about the true and real nature of cooperation, their responsibilities and duties as members and encourage them to participate actively in the management affairs and problems. The dependence of cooperatives on sheikhs should be reduced in a gradual manner without invoking their hostility.

5.2.4. Agricultural Credit

At present cooperatives are playing an insignificant role in the field of agricultural credit. Farmers depend on private merchants to meet their agricultural credit needs. It is necessary that the Co-operatives should play a vital role in supplying agricultural credit needs of tribesmen. The difficulty in advancing loans for agricultural

purposes, the loanee should provide a collateral guarantee from his tribe who should be held morally responsible for re-payment of a loan as is the practice now in case of private creditors.

It is estimated that annual agricultural and marketing purposes will be about L.E.200 000. The National Agricultural Credit Bank is reluctant and hesitant to invest funds in the region mainly for lack of suitable security and guarantee of its capital. It is suggested that the funds available from the sale of WFP commodities in the region be converted into a revolving fund to finance the agricultural credit demands of the cooperatives.

5.2.3. Literacy Campaign and Training

As mass illiteracy is a great obstacle in the spread of the cooperative movement in the region, special efforts are needed to organise adult education campaigns, particularly for members of cooperative societies jointly by the Education as well as the Cooperative Departments. Assistance of 'ASFEC' should be enlisted in this task for organising regular campaigns. Similarly, the training of members in the principles and role of cooperation, management of societies affairs and their responsibilities, obligations and duties as members and office bearers is very important. It is suggested a Cooperative Training Centre be established in the region with the cooperation and help of 'ASFEC' for organising regular training classes for members and office bearers on the basis of a well devised training programme.

Training of the cooperative staff is also of no less importance. Training programmes on regular basis should also be instituted for them in the proposed Training Centre or at some other suitable institute.

5.2.6. Field cooperative organisation and setting up of mobile units.

At present, the General Cooperative Society at Marsa Matrouh deals directly with the field cooperative societies without involving the sector level. It is suggested that sector level Cooperative Societies

should also be created with membership consisting of field Cooperative Societies in the sector. These sector level cooperatives should then be affiliated to the general Cooperative Society at Marsa Matrouh. This will help in decentralization of control and management and better and quick servicing of local cooperatives.

It is further suggested that Mobile Units should be created as an essential part of the general Cooperative Society with at least one mobile unit for each sector. These units should be attached to the proposed sector level Cooperative Society for routine administration and functioning and be supervized by the Sector Officer. The main job of these mobile unit should be to ensure a regular and quick servicing, supplies, marketing, animal husbandry aids, and training and guidance to a scattered population and to overcome problems of long distances. It is further suggested that the area of operation of a Cooperative Society should not exceed 25 kilometers.

5.2.7. Cooperative Staff

The hard and harsh living conditions of the region necessitate more favourable service and living conditions to attract well qualified, competent, willing and devoted Cooperative staff. There should be special backward area allowances, good travel facilities and housing accommodation for the staff. Further the existing store building in each local cooperative should be enlarged to provide rest house facilities for overnight stay, and board, bath etc., for the benefit of the Cooperative Staff and office bearers. Further, in each sector, suitable living quarters should be provided for employees.

5.2.8. Marketing and checking of Smuggling

As livestock and livestock products constitute the main production of the region, therefore, cooperatives will have to play an important role in organising marketing activities and promoting the economic interests

of its members. As prices of livestock are very high across the border in Libya and as the same tribal system prevails there with close kinship ties, therefore, there is a great temptation for smuggling sheep and goat across the border. Any marketing system will have to take into consideration this factor. The success of the cooperative marketing will depend upon prices offered to members which should be more or less at par with prices accross the border so as to minimize smuggling. It is suggested that a subsidy fund should be created through a gradual increase in the subsidized prices of animal feeds, sale proceeds of all confiscated sheep and smuggled goods, levying of veterinary fees and through Governmental Contributions. This fund, should be utilized to support marketing of sheep and goats in the region particularly in the border areas and for paying reasonable prices to members for their products with a view to eliminate the temptation for smuggling.

5.2.9. Role of Cooperatives in Land Settlement Programmes

It has already been mentioned that a multipurpose type of Co-operative Society will meet the requirements of the Region for the routine and ordinary functions of supply, servicing, redit and marketing.

However, it is strongly felt that it will be necessary to organise separate multipurpose type of Cooperative Societies exclusively for land Settlement Project Areas whose membership will be confined to settlers or their relatives and dependents. It may even be necessary to make membership of a Settlement Cooperative compulsory for a settler who may not be entitled to take possession of his farm unless he joins the Cooperative. This condition may be necessary keeping in view the special and extra ordinary conditions, difficulties and problems associated with the successful establishment of a Settlement Scheme. The settlers have to adapt to new and changed conditions through a

long and difficult period and process of transition and adjustment and it will be the job of the Settlement Cooperative to ensure that adequate and efficient services are organised for settlers, including Community life and group activities. The Settlement Cooperative will not only aim at arranging supplies/services, credit and marketing facilities for settlers but it will also prepare development and agricultural plans both on long and short term basis for the Project and undertake functions and activities involving group action like management and control of irrigation system, use of mechanical power, control of pests and diseases, planting of windbreaks, maintenance of Community Services and works, and so on.

5.3. Agricultural Extension

Experience in extension work in many developing countries shows that the main task of the extension service in under developed situations is to concentrate on measures that would result in substantial increases in agricultural production and would promote and accelerate the process of agricultural development. The problem is one of demonstrating and convinving to farmers how they can improve themselves within their own environment and surroundings through changes and adjustments in their ways of thinking and acting and methods of farming and family living. The task becomes very difficult and complicated when one is dealing with rural populations which are mainly nomadic or semi-nomadic with a tribal social organisation system and rooted strongly to tradition and custom. In such situations, the pattern of agriculture is generally of subsistence type with primitive tools, low levels of soil fertility, and harsh and arid climatic conditions.

The real problem facing extension workers in such a situation is that of social adjustments and of a change from extensive to more intensive forms of production by bringing about changes in old and primitive methods of farming through an understanding of the indigenous culture, customs, attitudes and other material and non-material aspects of a traditional economy of a tribal community.

The planning and designing of various development projects for agricultural development of the region is quite inseparable from

the planning of agricultural and institutional phase of development. The attainment of objectives of planned agricultural development will depend to a great extent on the extent to which the individual farmers understand and appreciate the need and importance of various development programmes of educating and enlightening them through a well organised Extension Service which should have an adequate number of field Extension workers, well trained both in theory as well as in the practical aspects of extension work and who have all the facilities and all physical and material resources to carry out an effective extension work. In this respect, it is important that extension workers stay for extended periods in their respective areas instead of being transferred frequently, in order to get to know the people personally and gain their confidence, personal relationships and contacts are very important.

The following proposals are made for organising the Extension Service in the region.

1) Basic approach - (Multipurpose Single Village level worker)

The basic idea is that in bringing new methods and techniques of agricultural production and of community development the approach should be simple. The tribesman should not be confused through bombardment of new ideas by various government development agencies trying to do so all at once and working independently from each other. For example, one day the social education worker goes to the village to spread knowledge about social education; the next day, the agriculturalist descends on the village with new ideas of crop production; the third day, the forestry man preaches about the benefits of forestry and so on. The result will be that the villager will get confused, will lose interest and become apathetic

with nothing happening and nothing being acheived.

It is therefore essential that at village level there should be a single approach and efforts of all development agencies for improvements and uplift of the rural people should be co-ordinated at village level through a multipurpose village level worker. This will have the great advantage of economizing in Staff and funds.

This worker will be trained in all disciplines of agriculture, so that the farmer is saved from the confusion and waste of time of dealing with a multitude of field workers of various departments coming to him very often sometimes with contradictory sets of recommendations and suggestions. This approach will also suit the physical environments of the region where population is scattered and spread over vast distances.

In an area with a widely scattered population as the Zone, where the majority of the families have radio sets, radio programmes are an important tool to discriminate information.

There should be one village level worker for each cooperative society and he should also act as the Secretary of the Cooperative Society in his area.

2) Main functions of the village level worker

The main function of the VLW will be to introduce new ideas and values to the villagers with the help of technicians or subject matter specialists of various disciplines. He will arouse interest in various specialist subjects in the community in which he is working and will undertake technical follow up wherever possible. His most important task will be the dissemination of knowledge and advice on agricultural and allied matters to increase production and undertake additional tasks of community development.

It is suggested that the Alexandria local radio station should broadcast a weekly or bi-weekly programme prepared on subjects as animal health control, feeding, range improvement, spacing of trees, pruning, time of harvesting, irrigation practices etc.

Meanwhile, the village extension worker should be briefed and trained by the various specialized subject officers in the field, in addition to periodic refresher courses at the regional Head Office in Marsa Matruh. The field training of the extension worker could consist of the joint execution of one or more field demonstrations for the farmers.

Periodically, the Extension Officers (Village Level Workers) should be invited for training and demonstration courses at the proposed range and sheep stations, pilot farms, central nursery to get acquainted with the developments of experimentation and with modern techniques of agriculture and horticulture. In this region, he will concentrate on crop production, horticulture, forestry, range management, livestock improvement and community works like construction and for maintenance of irrigation works, Community Services and so on.

The adoption of modern methods of farming and the success of the Extension Agency will rest on an organised and concerted effort and action in inter-related agricultural fields of research and teaching and training and the cooperation between these various agencies. It will also greatly depend upon the effective cooperation between the Extension Agency with Cooperative irrigation, forestry, Animal Husbandry, Engineering and other Administrative and technical departments.

It is essential that problems of effective coordination at all levels and all complementary measures such as agricultural demonstration, improved techniques of farming, credit, supplies etc., are thought of and taken in a planned and well coordinated manner.

It is suggested that a Regional Agricultural Extension directorate by set up as an essential part of the Division of Agriculture in EGDDO at Marsa Matruh. Further, a Regional Extension Advsory Committee under the regional Controller of EGDDO at Marsa Matruh be established as an organising and coordinating body, its membership consisting of the various regional subject matter specialists of different disciplines at Marsa Matruh, representatives of the Ministry of Agriculture and other concerned ministries and organisations.

Further, the proposed central nursery, the proposed range, sheep and goat stations and pilot farms in the region be utilized for pre-service and in-service training, short term refresher courses, specialized training in subjects like poultry, fruit plantation; animal husbandry and range management techniques etc., for village level workers as well as for farmers and other technicians.

5.4. Organization of animal production and health services.

Traditional forms of animal production have so grown together with the tribal life of the bedouin society that the proposed development can be realized only through the gradual application of well-balanced measures promising as much as possible an immediate profit for the producers. However, the achievement of such spectacular results may be expected only after a strict application of complex or rather less popular measures which require a persistance feasible only through corresponding institutional organization.

A fundamental institution for the initiation of improved methods of animal production will be the Station (Sheep and Range Management Station, Goat Station, Poultry Station) where the improved techniques will be first experimented and then demonstrated. In the establishment of improved techniques, research institutions, represented by the Desert Institute will participate through the organization of experiments in the Station. These experiments will aim at the improvement of technical methods which will be immediately implemented in the Station pilot production.

As it is not expected that the individual bedouin could implement the advanced methods of production while living within his traditional surroundings, it is necessary that all extension activities be channelled through the cooperative organization; but, real cooperative organizations do not exist in the Coastal Region, therefore a very strong extension service should be established (in the GDDO) which will be able to organize the cooperatives, to teach the bedouins how to manage their organizations and to train them in the advanced techniques.

Advanced techniques may be implemented only in the market productions where problems, concerning the improvement of production and marketing are closely linked. Therefore in the beginning a priority should be given to the improvement of marketing which would stimulate the interest of the people for the animal production. First, a cooperative organization for wool marketing will be established, then other marketing organizations dealing with other important products will follow. These organizations will encourage the cooperative forms of production ; such as fattening of

lambs, production of eggs, production of cheese and even cooperatives for cultivation of ranges in the fenced plots.

The station flocks will not only participate in all these activities but also they will have a special task of demonstrating the best methods of production and at the same time they will increase the capacities of productions which will facilitate the initiation of organizations. The Station flocks will be particularly indispensable for the cooperative breeding organization, for the reason that only here scientific selection can be performed, in order that its results may be extended within the breeding organization.

Proposals concerning the extension service indicate that the existing technical service in the GDDO should give place to more up-to-date management by gradually forming a highly-qualified technical staff and furnishing the necessary equipment for a future extension service. In such a way an operative service will be established which will be able to fulfil the above mentioned task. This service should be competent enough, so as to take care of the Animal Production Station where field trials and demonstration experiments on the improved animal production are carried on. It will also manage a practical school in the Station, where the technical staff and the cooperative people engaged in the above mentioned organizations will receive the necessary training.

In the same way the veterinary service should evoluate by developing an operational detachment from the ordinary veterinary administration. This operative service should take a corresponding initiative in animal health production in order to train the cooperative people how to protect their animals by applying the prophylactic measures instead of the inefficient curative treatments. This evolution of the veterinary service will be firat required for the systematic eradication of parasites in the Coastal Zone. Therefore in a special proposal to the Government concerning the plan of animal health protection)[1], the advantage of an integrated veterinary service which is supposed to be closely linked to the extension service was explained and the corresponding reorganization recommended. However, various opinions lacked temporary solutions which are almost indispensable such as in the case of the post for a veterinary official in the GDDO, in order that a closer collaboration between the existing veterinary service and the GDDO could be established.

5.5. Establishment of Grazing Districts.

As mentioned in Section 3.1.the establishment of Grazing Districts is a major factor for the development and the proper utilization of the range resource. A number of their functions would be the following :

a. Control and regulation of animal numbers in order to ensure an optimum sustained level of production of range herbage. Periodic review of maximum stock numbers in the light of range conditions.

b. Control of animal movements between grazing district areas in order to ensure that range development in any particular Grazing District would not be endangered by large-scale animal incursions from outside the district. Animal movements between districts would only be allowed following special approval from the Grazing District concerned. Animal movements South of the districts is free, and if necessary certain routes could be assigned for animal movements through a district for marketing.

c. Advice and guidance on seasonal migrations for grazing within the District by animals belonging to the district, based on patterns as explained in Section 3.1. Ultimately, a cooperative pattern of flock herding could be envisaged whereby grazing takes place on seasonally allocated range sections.

d. To provide the Cooperatives with elements and data for a proper policy on feed supplements for each grazing district, based on range and animal conditions, availability of individual or communal stocks of locally produced barley and straw, requirements for buffer-stocks of feed as insurance against delays in rainfall and to prevent movements to other districts in cases of differential early rainfall.

e. To assist the Cooperatives in the movement of barley and straw from surplus to deficit districts, and to stimulate the formation of feed reserves from local barley and straw production.

f. To determine if and when large-scale migrations to irrigated areas are required in drought years and to facilitate and direct such movements. Transport should be largely by rail. At the proposed level of animal numbers and the proposed level of supplement and drought feeding, no large-scale migrations in drought years are expected to be required (except in the Burg El Arab district where a higher seasonal stocking rate is foreseen in view of annual migrations to the adjacent irrigated areas). While supplement feeding in normal years is proposed to be relatively low, large amounts would be required in the drought years in order to avoid large-scale migrations.

g. To establish range reserves for drought periods, determine areas for range regeneration through resting and deferred grazing, to prevent trespassing and regulate subsequent use of such areas. Furthermore, to stimulate the establishment of cultivated pastures, foddershrubs plantations and fodder production for lamb fatteming, dairy goat production and drought reserves on private holdings. To execute reseeding on selected sites and in water conservation projects. On some of the area improved through the described action the range productivity could be increased to such an extent that fencing would be justified in order to ensure their proper utilization and management.

The Grazing Districts should be duly constituted as a public body having legal authority to execute the functions described above. The function of controlling animal numbers and animal movements between Districts is of particular importance. The issue of grazing permits or licences should be one of the prerogatives of the Grazing Districts as a means to achieve these control functions. Among the means suggested to enforce the control function are : depriving owners of trespassing flocks from all or part of the feed rations made available through the Cooperative, fines, or ultimately even confiscation of a certain percentage of the flock. Because it is physically almost impossible to control the flock size per owner through inspection in the field, the only way in which adequate off-take can be

ensured is through controlled marketing of the culled females. Therefore, the proper performance of the Grazing Districts would, to a large extent, depend on the supporting institutional framework, including marketing, Cooperatives, extension service, and veterinary service.

The Grazing District should be constituted in such a way that, ultimately, the livestock owners would feel that it is working for their benefit rather than against it, despite the inevitable initial curtailing of traditional freedom of the individuals in order to safeguard the interests of the community and of future generations. It is suggested that, while the Grazing Districts would initially be directed and staffed by Government officials, provisions are made that eventually the breeders are represented, possibly through an organic link with the Cooperatives in the territory of a Grazing District. In addition, a consultative board could be envisaged to have periodic meetings in which the actions and measures taken by the Grazing District are discussed. The final authority over the Grazing Districts, meanwhile, would remain vested in the Government agency responsible for the maintenance and proper utilization of the range as a renewable natural resource. The G.D.D.O., through a well organized Range Management Department (or Range Management Section of an Animal Production and Range Management Department) would assume this over-all responsibility over the Grazing Districts.

The boundaries of the proposed Grazing Districts are shown on Map 3. The two districts East of El Daba would be established when the role of the irrigation projects will be determined vis à vis range grazing

5.6. Marketing

5.6.1. Wool

As a result of a study of the factors contributing to the conditions under which the wool within the project area has been sold over a period of years, and the attempts made by the EGDDO office to help the marketing of wool through the cooperative system, the Consultant found that the wool was being sold to the manufacturers in almost an unsaleable condition which resulted in the manufacturers being reluctant to want to purchase the wool, little own pay a reasonable price per kg.

With the wool used during a preliminary training programme the Consultant was able himself to grade and classify wool into grades and types (see Table 62) most suited for a larger cross section of the manufacturing trade, which would enable the wool to be absorbed into more than one section of the industry, thus encouraging a greater demand for the wool which in turn increases its marketing value.

The proposed graded types are subject to annual variations in respect to Burr content, length, and general condition of the wool necessitating the possibility of increasing the number of types suggested. The percentage of the various grades and classifications of the wool graded showed the feasability and necessity of a full grading and marketing programme being introduced, which is the only basic method of obtaining the full value of wool as a selling commodity.

Another factor which contributes to the low yielding capacity of the wools in this region, which again retards the price value is the large quantity of sand and dirt, which adheres to the skin and wool of the sheep. To help eliminate this sand and foreign matter, an extensive programme is warranted to encourage the necessity of washing the sheep prior to shearing.

Having analysed the potentials of wool marketing, within the project area the Consultant has submitted this proposal.

Table 62 LIST OF PROPOSED GRADED TYPES AND DESCRIPTIONS FOR FLEECE WOOL

TYPE	Visual Spinning quality	Tensile strength	DESCRIPTIONS	Approximate Estimation of Wool in project Area		
				%	Bales	Tons
			A. FLEECE WOOL			
Extra Fine	58^S / 60^S	SOUND	Average to good length. Heavy Condition 3" to 3½"	2½	175	17½
F i n e	56^S / 54^S	SOUND	Average to good length. Heavy Condition 3" to 5"	13	620	62
Medium	50^S / 46^S	SOUND	Good length. Heavy condition 6" to 7"	27	1190	119
Strong	44^S / 40^S	SOUND	Average to good length. Heavy condition 6" to 7"	9	430	43
Extra Strong	36^S/ 30^S	SOUND	Average length Heavy condition 5" to 6"	3	140	14
Fine Backs	56^S/UP	TENDER	Thinly grown Webby wool	28	1320	132
Strong Backs	50^S/DOWN	TENDER	Thinly grown Webby wool	9	420	42
Fine Black	56^S/UP	SOUND	Average length heavy condition	4	185	18½
Strong Black	50^S/DOWN	SOUND	Average length heavy condition	3½	160	16
Cotted	Mixed quality	TENDER	Inferior Type	1	40	4

Table 62 (continued)

B LOWER TYPE WOOL

Fine White Pieces	50^s / UP	Average to Good Length . Heavy Condition	38	560	56
Strong White Pieces	46^s / DOWN	Average to Good Length. Heavy Condition	32	475	$47\frac{1}{2}$
Fine Black Pieces	50^s / UP	Average to Good Length. Heavy Condition	25	370	37
Strong Black Pieces	46^s /DOWN	Average to Good Length. Heavy Condition	5	75	$7\frac{1}{2}$
LAMBS	MIXED	Average Length and Style Heavy Condition	-	-	-
STAIN	MIXED	LOW TYPE	22	1760	176

To introduce any basic method of wool grading and marketing it is essential to have trained personnel, so at the completion of the training programme the trained personnel under the guidance of an expert, would be able to implement a grading and marketing system.

5.6.1.1. Training Programme

Taking into consideration the present sheep population of the project area=300 000 sheep, which would equal approximately 800 tons of wool per year, the number of technically trained personnel required to implement a full grading and marketing system would not exceed 25 nr.

The period of training would be for six months, starting in the month of "November" of any one year, so that the completion of the training would coincide with the commencement of the shearing season which is the months of April and May, allowing the trained personnel to immediately implement the grading with the new seasons wool clip.

The syllabus of training would cover a selected theoretical training plus an extensive period of concentration of the practical and visual application of wool in relation to length, spinning quality, tensile strength, Burr content, colour and yield, which are the main factors contributing to wool place in various manufacturing fields.

Various selected courses would be given at the appropriate time during the training programme covering wool stores management and teacher training to the selected men showing the correct aptitude for the required position.

At the completion of the training programme, a break down of the technically trained staff and their required positions would be as follows:

1. Wool store manager
2 Teachers
5 Wool or bin overlookers
15 Wool graders

5.6.1.2. The Method of Purchasing

The method of purchasing the wool would be through the cooperative centres, when after purchasing the wool would then be transported to the main grading and marketing centre for grading and future marketing.

Prior to the shearing season of each year, the two technically trained teachers would demonstrate to the Bedouins throughout the project area, how to wash their sheep and skirt their fleece, with the understanding that if this was done they would receive a higher price from the cooperative for their wools at the time of purchasing.

A series of schools would be held for a period of 1 to 2 months, and training would be given to the man in charge of each cooperative, which would give him some knowledge of wool, and the method applied to the skirting of a fleece.

To improve the standard of buying, a roster system of buying-days at each cooperative within each sector would be organised, enabling a technically trained man from the grading centre to be present at the time of purchasing. A set standard of prices would be allocated to the man in charge of each cooperative centre, for distribution to the Bedouins showing the prices that could be paid for wools that had been skirted or unskirted.

To further encourage the Bedouin to wash his sheep before shearing and also sell his wool through the cooperative system, an advance payment on his wool in relation to his sheep number could be made.

5.6.1.3. Grading

Having the technically trained staff as follows:

1 Manager
5 Wool or Bin overlookers
15 Wool graders

The grading and marketing centre would then operate as one complete working unit with the 15 graders as the main producers, the weekly production could be visualized as 27 000 kg of graded wool per week, making a daily output per man at approximately 300 kg.

Taking the sheep census of the project area as a guide, the annual wool quantities are approximately 800 000 kg.

Having one bale of wool to represent 100 kg, this would give an annual consumption of 8 000 bales per year to be marketed. A sales allocation could be adopted that after every 2 000 bales that had been pressed of the graded wool, a sale would be held.

5.6.1.4. Marketing in Conjuction with the Cooperative System

The wool marketing sales allocation and purchasing wool price fixation, would be controlled by a central committee or "marketing board" comprising of nothing less than 3 men or nothing more than 5 men.

This committee would also control the allocation of money for the purchase of wool through the main cooperative centres down through to the smaller cooperative centre or collection points.

This committee could be made up as follows:

1 Senior representative of the EGDDO office
1 Senior representative of the cooperative system
1 Representative of the breeders of bedouins
1 Manager of the wool marketing centre
1 Counterpart who has overseas experience

5.6.1.5. The Auction System of Selling

The Consultant is of the opinion that the only feasible way to obtain the maximum price for any marketed goods, particularly wool, is by an auction system.

The purpose of the grading of wool before marketing is to grade the wool into types and classifications which would suit the requirements of a larger cross-section of the manufacturing industry, thus enabling

the manufacturers of various sections of the trade to purchase wool most suitable for his particular requirements, irrespective of the number of buyers or manufacturers that are directly concerned with the purchase of the local wools, an auction system of selling encourages a greater price competition by buyers of various graded types, where as the method at present being adopted by the cooperative and manufacturers on a pre-arranged price only leads to a greater price fixation by the manufacturers.

At the completion of the annual marketing season, or if preferred during the season, profits derived from marketing would be channelled back through the cooperative to the Bedouins.

5.6.1.6. Costings

The central cooperative would be responsible for the costs as shown below in relation to the technical training period which would be for six months. The costs, totalling £E 4 900, would be:

Salaries in relation to the technical training programme for 25 men.	£E 2 500
Renting of building and equipment required for training	£E 600
Purchase of wool for training programme estimated quantity 10 tons	£E 1 800

The installation and initiation cost in relation to equipments and building which is required to implement the grading, would be met by the central cooperative. These costs, totalling £E 21 000, would be:

The construction of a grading and marketing centre of approximately 22 000 sq. Feet	£E 20 000
Equipment required as shown in Appendix A	£E 1 000

Equipment to be imported would cost US $ 5 000 in all and consist of the following:-

1 Wool pressing machine	at US	$ 2 500
1 Bale stacking machine	" "	$ 1 500
1 set of Clock faced scales	" "	$ 1 000

5.6.1.7. Profit in relation to cost

Being organized as one complete working unit, the necessary technical and labour staff requirements to run the grading and marketing centre would be as follows:

1 Manager	3 Clerical staff
5 Wool or Bin Overlookers	18 Unskilled labourers
15 Wool graders	

Taking the average buying price of local greasy wool for the 1966-67 season, which was 18 piastres per kg for a yield of 30 percent, and the manufacturers cost of imported greasy Iraqi wool of the same season, which was 49 piastres per kg, for a yield of 70 percent, (see Tables 63 and 64) as examples, the break-down of costs and income, under a working capital of 200 000 £E for the purchase of wool and labour costs, would be as follows:-

A total purchasing and grading cost of 19 1/2 piastres per kg.

This figure is made up from 18 piastres per kg for purchase, 1 piastre per kg for labour costs and 1/2 piastre for transport costs. Labour costs include skilled and unskilled labour on a daily output of 300 kg per grade.

Transport costs cover transport from cooperative centres to the grading centre.

Taking into consideration the limited type of grading which has been done on the imported Iraqi wools in comparison to the graded types of local wools recommended and considering that the process of grading wool into types and classifications, regardless of whether the sheep are washed prior to shearing or not, increases the yield content of more than 60 percent of the fleece by 15 to 20 percent (thus helping to meet the requirements of a larger cross section of the manufacturing trade), the minimum increase per kg, after the grading and marketing through an auction system, on a 15 to 20 percent yield increase on 60 percent of the fleece wool, should be some 22 percent to 35 percent.

This is equivalent to 6 to 8 piastres per kg on the buying price, and gives an after cost increase of 4 to 7 piastres per kg. This should equal a 15 percent to 25 percent increase on the working capital.

A certain percentage of this profit might be deducted by the central cooperative over a period of years in repayment of the initial costs of the project.

Table 63

Prices of local wool in relation to yield 1/

Greasy wool prices	Yield	Scoured wool or C.O.F. prices
piastres per kg	%	piastres per kg
60.75	70	87
53.75	65	83
47.50	60	79.25
41.50	55	75.50
36	50	72
31	45	69
26	40	66
22	35	63
18	30	60

1/ Calculated from the 1966-67 prices of 18 piastres per kg of 30% yield.

Table 64

Prices of imported Iraqi wool in relation to yield 1/

Greasy wool prices	Yield	Scoured wool or C.O.F. prices
piastres per kg	%	piastres per kg
49	70	70
43	65	66.50
38	60	63.50
33.25	55	60.50
28.50	50	57.50
25	45	55.75
21	40	53
18	35	50.50
14.50	30	48

1/ Calculated from the 1967 prices of 49 piastres per kg of 70 % yield

5.6.1.8. Conclusion

It is to be mentioned that the capital costs and capital income in relation to wool grading and marketing are subject to annual fluctuations which are mainly brought about by quality and quantity in relation to demands and to increases in labour costs.

It is suggested that the most suitable position for the building of a grading and marketing centre in the project area would be Mersa Matruh, as this is the most central position in relation to sheep numbers and transportation of wool from the various sectors within the project area.

The necessity of a programme of washing the sheep prior to shearing is of a paramount importance, and all measures should be taken to encourage Bedouins to do this.

The recommended sheep dipping structures along the project area could be utilized for this purpose. Sea water could also be used.

List of required equipment for a grading Cum marketing coentre

Grading tables
Bin dividers
Mobile steel baskets
Large steel trollies
Small wooden trollies
Type boards for bins
Lot dividers for show floor
Lot number plates for show floor
Bale hooks
Bale openers
Wool press
Bale stacking machine
Set of scales.

5.6.2. Meat

5.6.2.1. Future livestock and meat supplies

Livestock production from traditional animal husbandry on improved range is expected to be less in the long run than livestock production resulting from the integration of range grazing with fodder supplies from irrigated areas. Table 65 shows the estimated meat supplies under each system.

5.6.2.2. Present and future meat demand

IWP estimates the meat demand for UAR in 1962 at 9.6 kg per head. (Near East Study, Vol. II, p. 51). In this figure there are offals of 2.1 kg included. There is an increase foreseen to 12.1 kg in 1975 and 15.5 kg in 1985.

For the zone these figures have been changed. Despite the fact that due to the relative poverty of the population it would be expected that meat consumption per capita is less than the national average, the actual average consumption is believed to be considerably higher. This stems from the fact that the majority of the zone population consists of animal breeders, and the breeder as producer eats more meat. The population of the zone have a lower consumption of eggs and fish which are only produced to a small extent in the zone. Meat consumption - including offals - has been assumed at 12 kg/head for 1967; 13 kg/head for 1970; 15 kg/head for 1975; and 18 kg/head for 1985. Overall demand in the region in these years is shown in Table 65.

5.6.2.3. Condition of the marketed goods

Egypt as well as its neighbour Libya have a "buyer's market". The buyer is in the stronger position to choose in what form he wants to get his goods: as livestock, frozen, chilled or canned meat, or as sausage.

With respect to the Egyptian situation the expert found out that the best price could be achieved in selling chilled meat to the "consumer cooperative" of Cairo at a price of about 35 to 40 piastres per kg carcass weight. It seems that this big organization could be capable and reliable contractor to the farmers' cooperative. In addition to this there are a number of bigger organizations - the army, hospitals and kitchens of large factories - to which deliveries could be made directly. But the inland price is very low, compared with that Libya would pay. Here appeared the lack of the field market study which the expert had advised at the beginning of his assignment. This study shoud be carried out as soon as possible to avoid wrong investment of money.

The relationship between what is offered for sale to middlemen and what the latter can reasonably accept for the ultimate buyer must not be overlooked. The offer of goats and of ageing animals as consumable meat is likely to be rejected by cooperatives and private dealers outright. But even within the range of the marketable livestock the quality differs much. The buyer of the cooperative therefore has to have a good knowledge of grading and price-differentiation. The differentiation of the prices within the grades is to be formed according to the rule of supply and demand.

5.6.2.4. Marketing of meat

5.6.2.4.1. Introduction

In the present state of development there is practically no wholesale trade of meat in the zone. As the zone is a surplus district, it could as well be a supplier of meat as it is now a supplier of livestock.

Table 65

FUTURE SUPPLY AND SURPLUS CAPACITY OF LIVESTOCK AND MEAT

SHEEP						GOATS					
Year	Population	Turn-off rate	Supply (alive)	Average liveweight	Supply of meat (live-weight)	Year	Population	Turn-off rate	Supply (alive)	Average liveweight	Supply of meat (live weight)
	(1000s)	%	(1000s)	kg/animal	tons		(1000s)	%	(1000s)	kg/animal	tons
Under traditional animal husbandry on improved range 1/						Under either system					
1970	300	42	126	30	3 780	1970	100	65	65	20	1 300
1975	320	45	144	31	4 464	1975	80	70	56	21	1 176
1985	370	50	185	33	6 105	1985	80	80	64	22	1 408
Under integration of range with irrigated areas 2/											
1970	300	45	135	31	4 185						
1975	330	50	165	33	5 445						
1985	490	60	294	38	11 172						

SURPLUS

Year	Supply of sheep meat and goat meat	Human population of the Region	Meat consumption per head	Total meat consumption	Surplus for export from region	Average liveweight (sheep and goats)	Surplus of small animals for export
	tons	(1000s)	kg	metric tons	tons	kg	—
Under traditional animal husbandry on improved range 1/							
1970	5 080	90	13	1 170	3 910	28	1 396
1975	5 640	115	15	1 710	3 930	28.2	1 394
1985	7 513	160	18	2 772	4 741	30	1 247
Under integration of range with irrigated areas 2/							
1970	5 485	90	13	1 170	4 315	27.4	1 575
1975	6 621	114	15	1 710	4 911	30.0	1 637
1985	12 580	154	18	2 772	9 808	35.2	2 787

1/ Non-integrated production: Traditional range sheep husbandry with recommended improvements in the coming decades, using limited amount of concentrates and straw as supplements

2/ Integrated production: Range sheep husbandry based on gradual integration with irrigated land, thereby achieving higher productivity per animal

There is also a refrigeration warehouse in Matruh which belongs to the nationalized Gerco Refrigeration Company. This coldstore was closed and could not be visited. It could possibly be the beginning of a future meat marketing centre.

The transport of frozen and chilled meat from Matruh has also been considered. If a large extended export to Libya were to develop, the future contractor would have the choice between livestock and chilled or frozen meat.

The big inland contractor - the consumer cooperatives in Cairo - is very interested in chilled meat of the zone too.

Due to the inland maximum retail price regulation the preliminary price offered by the consumer cooperative was £E 0.35 - £E 0.40 per kg, chilled sheep carcass, whereas the expected export price is £E 0.27 per kg liveweight, which would be equivalent to £E 0.54 per kg, chilled sheep carcass. That means the best inland offer is 30 percent under the export offer. To do the slaughtering in Matruh would raise the problem of who and where. Up to an amount of 200 sheep weekly, slaughtering could be done by one or more of the private butchers in Matruh on the basis of a work-contract with or without the sale of some by-products to them. When the transfer of meat out of the zone either through export or in transfer to other parts of the country is bigger, as it can surely be expected to be be in the near future, a modern meat plant with its own slaughterhouse should be planned.

For the purpose of slaughtering a bigger number of animals in Matruh, certain improvements are necessary. They are described later in the report.

5.6.2.4.2. Marketing facilities

The farmers' cooperative

At present there are practically no Barki sheep sold in the Nile valley. Therefore it can be assumed that the non consumed supply of 100 000 to 200 000 sheep are smuggled to Libya. Wholesale trade ends finally in illegal export.

It would be too easy to blame the private dealers for not fulfilling their duty in a way within the frame of legality. It is not the dealer alone who has the profit of smuggling. In paying prices which go up to twice the normal inland prices, he gives a part of his smuggling profit to the breeder.

As it has proved in other countries, the farmers' cooperatives are good instruments for the collaboration which is so highly necessary in this country. Generally, a support of the cooperatives by the government can be welcomed. It should however be done with measure and control. The danger of nursing an unfit bureaucracy is big. The cooperatives should prove their economic ability in daily competition with the private dealers. This is especially true in wholesale and export trade. If the cooperative wants, or has to enter in the marketing business, it has to have first a capable man with an adequate authority. There is no need for a separate Marketing Organization beside the farmers' cooperative.

The livestock marketing man should have his position in the central cooperative in Matruh. With the progress of his work he could choose and train his helpers in the different cooperatives of the zone. In that form marketing could grow as a branch of each cooperative. The number of employees of all marketing branches may differ corresponding to the success of the cooperative in competition with private dealers and to the season, if there is more or less export out of the zone.

The following points are useful to bear in mind, especially for the central cooperative in Matruh, with regard to policy in livestock marketing:

a) Keep the costs low, especially the cost for administration.

b) Act fast according to the given price-situation in a certain moment. Long-term programs may follow if the marketing-branch is well established. Work first with cash payments. Advance payments or postponed payments could be accepted in a later period.

c) Determine the prices to the breeders as precisely as possible. A grading system may help for this purpose. Weighing is better than estimation. Weighing of carcass after slaughtering is more accurate than grading of live animals.

d) Use a greater number of grades for buying from farmers than for exporting or selling.

e) Let the cooperative have an adequate gross-profit out of which it pays all general costs (as transport costs). In that way the account for the farmer should be clear and easy to understand e.g. "for mature sheep grade B the price paid from the cooperative at warehouse X is £E 0.245 per kg liveweight."

Livestock Markets

The number of the existing three markets is sufficient. The locations are well chosen for the zone. If there should be much export of livestock via Sallum in the future, an additional market should be established in Sallum too.

The selection of market days could be improved. They should be organized so that the majority of dealers and also the chief dealer of the central cooperative could visit all the markets in one week, e.g. Hammam: Thursday and Friday; Matruh: Saturday and Sunday; Barrani: Monday and Tuesday; Sallum: Wenesday.

Advice on improvement through market reports and the grading system are mentioned elsewhere. They are the main means to develop marketing in the zone.

In addition, the following improvements should be made:

1) installation of a veterinary service at the markets. Livestock should not be allowed to leave the market without evidence that it has been examined by the Veterinary's Office.

2) Installation of a separate quarantine and treatment section for sick animals.

3) in the long run, the erection of higher walls or sheds to protect the animals against sun and storm. Establishment of feed and watering facilities is advisable. The use of water and feed, however, has to be stopped at least 3 hours before the market begins to avoid over feeding.

If the authorities decide to build a slaughter house and meat plant in Matruh, there should be a new market erected near the slaughter house, which allows an easy flow: marketing - slaughtering - cooling - processing of meat - processing of by-products. This is described below.

The Sallum market may be used as a direct export market in inviting foreign (Libyan) dealers to attend and buy on that market. The elimination of market fees in order to have a so-called free market is no real problem. The fee could be paid in Sallum by the seller. More difficult is the control of prices. The seller and the Libyan importer must avoid declaring too low prices to reduce the state income in hard currency. The nomination of trustworthy sales' agencies and their control could be a measure against these practices. The cooperative could be one of such sales' agencies.

Another problem is the limitation of the offer for the Sallum market. If Nile Valley sheep are allowed to come to Sallum the offer may be very high for the Libyan demand and the price decrease. The profit for the zone may then be very low. But the profit to the country as a whole may be larger, when more sheep are exported than the zone can deliver. The fixing of a maximum profit for the country as a whole, and for the zone, cannot be done before a study on Libyan livestock is carried out.

5.6.2.4.3. Marketing channels

Assembly

The coastal strip of the zone, 520 km long, has 3 market places. The average distance from the pasture or villages to the nearest market is about 50 km. This makes it necessary to consider well the problem of assembly and transport to the market. Up to now, the assembly has been solved by the individual breeders or small groups of them. They brought the animals to be marketed in smaller or bigger herds. If the cooperatives however intend to collect the livestock in places nearer to the breeder, the question of assembly places arises. In seasons of drought, if there is lack of feed and water (and in such times big quantities of livestock have to be collected within a short time), the assembly places need to have an adequate equipment.

Assembly places are to be organized in centers from which more than 100 animals regularly are sent to markets or other production units as e.g. finishing plants. They should be favourably located near and in cooperation with the warehouses of the cooperatives. The main installations for organized assembly places are:

1) Adequate amount and quality of water and facilities for its provision to the animals.

2) Feed for the period of assembling, and feedtroughs.

3) Walls and shelters to protect animals from storm and sun.

4) Bigger assembly places should have a quarantine for sick animals and medicine and instruments for their treatment.

5) As far as grading is made in the assembly places a fenced scale has to be there, the scale being equipped with a cage to ease the scaling.

If there is a transportable scale already in the warehouse for scaling feed, an additional cage of wood or iron should be made to adjust the scale for livestock weighing. The scales should have a capacity of 200 - 600 kg and should work accurately with a maximum margin of error of 0.5 percent. There are Egyptian made scales on the market which can be used for that purpose. Their price is between £E 40 and £E 60.

Transport

While in many other parts of the world the factors of time and loss in transport play a large role, this need not be true in such an extended country with dispersed settlements and few fields but much (even poor) pasture between them. In such an area driving livestock slowly on hoof for distances of 10 - 20 km per day may not result in loss of weight. This is in many respects a good means of transportation not only for transport from the farmer to the market but for other livestock transports too. The requirements are: sufficient time, adequate pasture and enough security against pillage and illegal exchange. This traditional way should be kept in mind even by organizations like farmers' cooperatives which pay a little more to a shepherd than farmers do. In Table 66 the costs of the different means of transportation for livestock and meat are compared.

As Egyptian transporters (except railways) do not deliver written offers for transport costs, the cost calculation is based on verbal information. For ship-transport the information came from an Egyptian agency of Italian shippers. There is some hope shipping could be done by an Egyptian company. In case no Egyptian shippers can be found, the biggest part of the freight cost may have to be paid in foreign and hard currency. This may affect the balance of payment of the country. But in contemplating this the whole export transaction must be considered.

The local variations in cost of transportation has had a grave and lasting influence on the construction of slaughterhouses, meat plants, and meat combinates in many countries. Because of this range of costs the trend is to establish plants in the production areas. But this cost factor is not the only one. It is just one of a group of factors.

The discussions with transport enterprises such as El Nasr Co., Geroo Refrigeration Company, and the State Railways showed that these firms calculate high profits or do not in every case meet the specific needs of the cooperatives. El Nasr Co. and the Railways have no double floored cars or waggons to decrease transportation costs. If the transportation of livestock or meat is to be a constant duty of the cooperative, the possession of such trucks is advisable.

Table 66

ESTIMATED TRANSPORTATION COSTS FOR SHEEP AND GOATS IN £E

per 1 000 animals or their equivalent 1/

	a	b	c	d	e	f	g	h	i
km	Costs	alive on hoof	alive per truck	alive per train	alive per ship	frozen per truck	chilled per truck	tinned per truck	tinned per train
290 (Matruh-Alexandria)	vehicle costs		240	95	-	180	360	100	77
	muscle-loss		35	30	-	10	20	-	-
	excrement-loss		170	160	-	-	-	-	-
	Shepherd	50	55	55	-	-	-	-	-
	Total	50	500	340	-	190	380	100	77
520 (Matruh-Cairo)	vehicle costs		360	134	-	290	580	150	107
	muscle-loss		70	66	-	17	34		
	excrement loss		200	190	-				
	shepherd a.o.		100	100	-				
	Total		730	490	-	307	614	150	107
1300 (Matruh-Ben-Ghazi)	vehicle costs		1 050		500	1 600	3 200	520	
	muscle-loss		140		120	42	85		
	excrement loss		240		220				
	shepherd a.o.		200		200				
	Total		1 630		1 040	1 642	3 285	520	
2 300 (Matruh-Tripoli)	vehicle costs		1 800		800	2 800	5 600	950	
	muscle-loss		200		190	75	150		
	excrement loss		270		250				
	shepherd a.o.		400		400				
	Total		2 670		1 640	2 875	5 650	950	
Average 1 total 2/		0.172	1.250	1.025	0.745	1.137	2.251	0.390	0.227
Average 1 total 3/		0.00478	0.03472	0.02847	0.02069	0.03158	0.06253	0.01083	0.00631
Average 1 total 4/		0.01012	0.07353	0.06029	0.04382	0.06688	0.13241	0.02294	0.01335
ranking acc.	cheapest costs	1	7	5	4	6	8	3	2

1/ 1 000 animals equal 36 tons liveweight, 17 tons carcass weight or 15 tons tinned.

2/ for 1 000 animals 3/ per ton liveweight 4/ per ton meat.

Explanatory notes to Table 66

Column a) Muscle-loss and excrement loss depend on length of journey, calculated value per head (36 kg. x £E 0.180 = £E 6.50)

Excrement-loss can easily be recovered. The price can easily be raised for that amount because the buyer receives the animals with empty stomachs and intestines. A condition for having not more than average losses is a good treatment, feeding and watering of the animals transported, one shepherd in each vehicle to raise fallen animals, not more than 4 animals per square meter. Feed costs per day and animal are calculated at £E 0.002.

Column b) A condition for this type of transport is adequate pasture on the way.

Column c) Truck is with trailer, both double floored. These are the prices of an unconfirmed offer of the nationalized transport company (El Nasr Co. Alexandria), reduced by 25 percent on the assumption the cooperative will use its own trucks.

Columns d and i) These costs are derived from the official freight-tables of the railway organization. A reduction of 25 percent for bigger quantities has been made.

The costs are rather high because the railways do not use double floored waggons.

Column e) Unconfirmed offer of shipping agent Mohamed Metwalli, Cairo, who works for an Italian firm.

Columns f and g) Unconfirmed offer of Gerko Regrigerator Co. Heliopolis.

Column h) Unconfirmed offer of El Nasr Transport Co., Alexandria.

It will be seen from the table that transport on hoof is cheapest. But the distance, of course, is limited. Transporting tinned meat is next cheapest. However, there is little possibility for export. The army, however, might very well be a potential consumer and an enquiry should be developed along these lines. (The cost of tinning meat and the change of value of the tinned meat is not expressed in this study.) Transport by ship is an interesting proposition for long distances. For inland transport, frozen or chilled meat is cheaper to transport than live animals. Live animals transported by train can compete with chilled meat transported by truck. However, when animals are not slaughtered locally, the region is deprived of the advantages of employing men for slaughtering and processing.

5.6.2.5. Grading of livestock

Due to grading or classification the market is essentially easier to survey and the market reports can be better utilized. The expert worked out suggestions for the grading of sheep and goats. The suggestions are formulated in the form of standards. In their application they are not restricted to the North Western Coastal Region but can be used for the whole country.

5.6.2.6. Market outlets outside the zone

The question of where to sell livestock and meat cannot be viewed only from the standpoint of the profit of a private enterprise or cooperative. The profit of the entire country must be taken into consideration. In Egypt, there is on the one hand a shortage of meat and, on the other, a shortage of foreign currency.

Libya is prepared to pay a high price for Barki sheep. It is therefore advisable the export as many sheep as Libya can accept at these high prices and close the gap by importing meat at world market prices from other countries. In this way, Egypt may gain currency or can purchase more meat for its home consumption.

Smugglers are said to pay prices of about £E 0.30 to £E 0.40 per kg liveweight to the farmers, or even more. The farmers' cooperative which made a legal export contract could not get a better price than £E 0.265 per kg. The reasons smugglers can pay better prices are: they sell in smaller units and bypass the exporter in Egypt and the importer in Libya, they can take advantage of the official rate of exchange and manipulate costs at the border. In addition they are said to have a high profitable return freight e.g. transistor radios etc. which bring them extra profit. Certainly the prices which smugglers pay to the farmers are very high indeed, and any buyer competing with them has to take this fact into account.

On the other hand, the risk for the smugglers is low. During a period of one year the customs police did not capture more than 500 sheep. That is less than half percent of the sheep which were probably smuggled in that period. The cooperative does not yet have the right contractors in Libya. There is an admitted 33 percent gain for a business which binds the capital for just a few days. However, even if the cooperative could find better contractors it could not save as many costs as the smugglers do. While the risk of smuggling continues to be low there is little hope for the cooperative to step effectively into the export business.

Even if there was some equilibrium between the higher costs of the cooperative and the risks of the smugglers, there would still be the question of whether or not to invite private traders to export legally and use their old established business connections. They could possibly make better contracts and bring more hard currency into the country than cooperatives. But the cooperative should also increase its efforts to get better export prices. The following are the necessary steps:-

1. Make a market survey to the Libyan livestock and meat market.

2. Explore the price situation.

3. Find the most capable importers.

4. Find the most suitable places to send livestock or meat.

5. Eventually establish their own export agency in Benghazi or elsewhere.

If the risk of smuggling is high enough, the prices for livestock in the free markets of the zone will come down to an inland level. Then there would be an opportunity to sell within Egypt too. The cooperative could then sell to the centers of consumption with the private dealers. Cairo and Alexandria would be the preferred main market outlets.

5.6.2.7. Slaughter Facilities

The Matruh slaughterhouse does not reach the minimum standards of the European slaughterhouses described in the OECD brochure AGR/I (66). It covers the present demand of the Matruh municipality. It is

very probable that other Arab countries have no import regulations which prescibe a higher sanitary level than that of Matruh. With an investment of about £E 10 000 for,

a) better water supply,

b) better canals,

c) repair of the concrete floor in the building,

d) establishing a concrete floor in the yard and before it ,

e) more hanging facilities,

The capacity of the existing slaughterhouse could be brought up to 100 000 sheep and goats per year. Most of the investments except that for (e) should be made even if the production is not increased.

The capacity of 100 000 sheep is calculated as follows: 20 small animals per hour x 16 hours work during a two shifts day x 300 working days per year. This capacity could be, according to verbal information, accepted by the Matruh Gerco Cooling and Freezing Stores for some time to come.

In case of use of this full capacity an investment for 3 trucks is necessary, one closed truck for transporting the car cases hanging on hooks to the cooling stores, and 2 open trucks for the transport of non-edible by products. The cost for these 3 trucks is estimated at about £E 40 000.

It is felt that the capacity of the present slaughter house is adequate for quantities of up to 30 000 animals per year (in addition to the existing demand of the municipality). It is more economical to work a certain period with the plant of this size than to invest money for a plant of which the production is based on a still uncertain export (to Libya, Cairo or elsewhere)

However, if the annual amount is expected to exceed 30 000 animals per year constantly, the construction of a new slaughterhouse should be taken into consideration. This slaughterhouse should have its own cooling or freezing stores or it should be near the existing refrigeration units. Unfortunately the Gerco cooling store in Matruh has been built as a separate unit which does not easily allow incorporation a slaughterhouse and meat plant. For future constructions of this type incorporation should be considered initially in the plan.

The plan of a combined unit for marketing, slaughtering, processing, and cooling for livestock, meat and by-products is described in the following section.

5.6.2.8. A meat plant or meat combinate for Matruh

The term meat combinate is used for a meat plant in which not only slaughtering and meat production is done but also many by products such as blood, bones, intestines, hides horns and so on are treated and transformed into semi-products or end-products.

A meat plant is a unit where extensive processing of by-products is generally not done.

The various arguments for and against the construction of a meat plant are as follows:

1) for the construction: Meat and meat products, especially tinned meat, can generally be shipped cheaper than livestock when there is no adequate pasture to bring them on hoof to the point of destination while grazing.

If livestock is slaughtered in the zone, there is the possibility of employing at least 1 man for each 1 500 sheep slaughtered and shipped yearly for the slaughtering process. Furthermore, for dealing and treatment of by-products at least 2 other men have to be employed. If there is a considerable amount of tinning or sausage production there is work for at least one more man per 1 500 sheep yearly.

100 000 sheep sold as meat outside the zone would provide the zone an additional employment for 180 - 300 men. With modern machines the production of saleable goat-meat products is possible. This could help to solve the question where to sell the old goats.

2) Against the construction of a meat plant: The guaranteed or even estimated turnover of the meat plant is in the present stage not sufficient. The risk of export is high and it is not yet known if Libya would be ready to pay the higher price for meat. The risk is high that smuggling will continue and the plant have no raw material to work with.

For inland trade, the meat plant and its outlets have to compete entirely with the existing butchery and meat industry. Even if this industry is technically not very well equipped, it has well-trained workers and dealers. For the expert it is as good as sure that a cooperative or government-operated small enterprise - as the Matruh meat plant would be - would have to compete with them strongly. The situation would be different if large organizations such as the army, the consumer-cooperatives or others were to make long-term contracts with the meat combinate. But these organizations are ready to pay only inland prices which the breeders of the zone are now not willing to accept as long as smuggling brings a higher profit. Or in other words: the additional profit from production and cheaper transport which could be achieved by a meat plant, or combinate, is in the range of 2 - 5 percent of the value of sheep. It cannot compete with the profit of smuggling, which is now higher by at least 36 percent (£E 0.265 per kg export price is 36 percent more than £E 0.180 per kg, which is the inland price) and perhaps even by 100 percent or more (£E 0.30 to £E 0.40 per kg smuggling price is 66 - 122 percent more than the inland price)

It is praiseworthy that the government or the cooperative want to take measures to help the farmers and to ban smuggling at the same time. In the field of marketing and meat production, however, there is no technical or commercial means which could bring 30 - 100 percent gain of the turnover.

Broadly, the meat plant should be constructed and organised as follows:-

1) It is a technical advantage if the livestock market, the slaughter house, the refrigerator and freezing rooms and the rooms for meat handling and processing and the rooms for handling and processing the by-products are located so near to each other that the flow of goods can occur with low costs. For such a combined unit the name of meat-combinate is used in other countries.

2) A meat-combinate for a capacity of 100 000 sheep and goats per year may cost approximately £E 750 000. An investment of £E 5 to 10 per 1 sheep capacity per year is justifiable. The capacity of meat plant has a very big elasticity, especially if work can be done in 2 or 3 shifts. A second factor, which makes the amount for the necessary investment uncertain, is that the grade of meat-processing is unknown up to now. If meat is tinned and a reasonable sausage production is done, the investments are much higher than in the case of pure slaughtering. The third factor which greatly influences the cost of investments for a meat combinate is the degree of processing of the by-products. It can range from bone-oil extraction and blood and bone meal production to the leather industry.

3) The management of a Meat Combinate or even a meat plant needs trained men with sufficient background technically and in economics. The success of such an enterprise can be much effected by the ability or disability of this staff of leading men. If the government or the cooperative is not sure of finding the right men, it might be better to leave the management in private hands than to suffer a loss.

Preliminary economic account for a Meat Combinate:

	£E
Investments	750 000
Interest for the Investment (5 percent p.a. of investment)	37 500
Amortisation during 25 years = 4 percent p.a. of investment	30 000
Input 150 000 sheep, each 6.5 T.L.	1 075 000
Output or Turnover	1 265 000
Gross earnings (15 percent of output)	190 000
Costs for 150 employees 4 percent p.a. of output	50 000
Interest and amortisation (see second & third line)	67 500
Other costs and gain 5,7 percent p.a. of output	72 500

5.6.2.9. Finishing centers

However, since conditions in the zone are such that there might easily be a short finishing period between two marketing transactions, it is not inappropriate to make a few remarks about finishing here.

a) The inland market would be profitable only for lambs and kids in a Mariut finishing center at present official prices or expected lower future prices.

b) Discussions with the consumers-cooperatives in Cairo showed that they want the meat as lean as possible. Therefore the case for the construction of finishing centers for livestock for the inland market is marginal.

c) If export prices are not higher than £E 0.265 per kg liveweight, finishing is on the edge of profitability. It is justified however if livestock can be bought under that price and the importer insists on having finished or fattened animals.

d) Finishing centers for meat for export should not be built before export has proved profitable. Meanwhile finishing if necessary should be done in a temporary way without high costs for fixed installations.

e) The finishing center of the central cooperative would be best located in Mariut because there feed is cheaper. It is so much cheaper that transport costs from Matruh to Mariut and back could be borne, if livestock were exported from Matruh by ship or via Matruh and Sallum.

f) As the Libyan market generally is closed from May to September, the

fattening centers could help to bridge the period. But the high costs of this bringing should always be taken into consideration.

5.6.2.9. Market reports

The understanding of the events happening on the markets cannot be attained only by visits to the market by individual sellers and buyers, representatives of organizations and other interested persons. The comparison of prices, amounts and, in part, also of the qualities can to a certain degree be furnished in a form which often makes visits to the market superfluous. This task is fulfilled by the market report.

The necessity of market reports for the farmers as well as for the government is indispensable. The main objectives are:

1) In a "market economy" such as Egypt has, the breeder receives his principal incentives through the market.

2) A government which wishes to exert some control over individual breeders needs information. Undoubtedly the best information is the market report.

In the following it is shown how in 4 steps a valuable market report can be introduced:

1) The first step is, that in every market the person who now collects the market fee, or his helper, collects the following unformation:-

   a) number of livestock of each animal group (sheep, goats, camels, others).

   b) price paid by the buyer to the seller for each group. From these two informations after each market day,

   c) the average price for each animal group can be calculated

   d) the numbers a) and average prices c) should be published after each market day.

2) After the personnel has been trained the next small step can be taken.

   e) livestock of each animal group is to be divided in the respective groups. e.g. sheep in: lambs, yearlings, mature sheep; and goats in: kids, yearlings, mature goats.

In this way the report gains much in quality. The average prices will be calculated from each group e.g. Lamb a.o. separately.

3) The next step is to introduce scales on the markets, for the sheep and goats and such small animals.

   f) each animal or group of animals which belongs to the same grade (as mentioned under e) is now weighed. The weight is fixed and recorded by the employee of the market and told to the buyer and the seller.

During an introductory period of at least one year it should, however, be the free choice of the breeder and the seller to make their contract on the basis of "head of animal" or on "live weight". It is sure that the live weight-basis is the more correct one but it will need a long education to bring farmers and dealers to that point. Meanwhile they should be free to choose the type of contract. However, weighing has to be made independent of their desires. In other countries weighing has been introduced by law. This might be one of the future steps in the country's marketing policy.

g) After the introduction of weighing the market report shows now two additional figures from each group: the average weight of the group and the average price per kg of that group.

4) The fourth step needs the presence of a well-trained employee in the market. He should be able to classify each group in quality classes as described in the following paragraph.

The costs and benefits of introducing a market report cannot easily be compared as the advantages to the user of the market and to the authorities cannot easily be expressed in figures.

The costs for the first three steps are so low that they do not exceed £E 0.02 per sheep or goat, i.e., the present market fee. The work can be done by the personnel currently engaged in the market. Only the introduction of grading brings higher costs by employing an expert. Then the market fee might be raised to £E 0.03. The benefits are:-

1. Better market information to producer, dealer and the authorities.

2. Bargaining based on live-weight is fairer than that based per head. Scales installed at the markets can be used also for other purposes e.g. to check the effectiveness of feeding. This may favour productivity in livestock production.

3. Stronger competition between dealers resulting in fairer prices.

4. Selling at organized markets needs less time.

The market report should be published as soon as possible. If the cooperatives do not bargain at the markets, thus decreasing the value of markets, they should publish their prices and turnover beside that of the official markets. In this way the best type of survey can be accomplished.

5.6.3. Olives

Estimated production.

The present average production in the Zone is about 1400 tons and the future production of the present plantation is about 4500 - 6000 tons and the production can be at least doubled if the development agricultural plan of runoff, sheet runoff and underground water is realized. The preceding figures do not take in consideration the future olive plantation in the Mariout Extension Project, and the area of potential irrigation by galleries in the El Qasr area and from bores in the synclinal of Fuka.

Olive harvesting.

In the Zone olives are usually harvested before ripening. In this case the oil quantity and quality is less than optimal. Usually, some time elapses between harvesting and processing because of the long distance between the farm and the oil pressing plants, lack of means of transportation and the low capacity of the oil pressing plants. The first requirement is that olives are transported to the press as quickly as possible in order to have oil with a low acidity.

Processing facilities.

There are two old pressing plants in the area belonging to E.G.D.D.O. with two tons of capacity per day, one in Burg-el-Arab and the other in Mersa Matruh. In addition more than 7 private and primitive oil press plants exist in the area, each of them having a capacity of about 50 tons per season. The cost of processing is relatively high. The oil press charges 25% of the oil or L.E. 0.03 per kilo of olives to be processed. E.G.D.D.O. oil press plants and some Bedouin families process limited quantities of olives into pickled or salty olives which are often sold or consumed locally.

Cost of transport.

Transport charges are from L.E. 0.003 - 0.01 per kilo for a distance of 15-100 km. Rail transport is relatively cheap but it would require again reloading and transport. Road and truck transport in some cases is by far the most preferable method of transport

Containers.

The containers in use for olive pickling are tins, while the containers used for olive oil are tins and mainly sacks.

Marketing channels.

The buyers at the market are mainly the following:

1 - Retailers. The quantities purchased by private retail shops are relatively small

2 - Merchants are the largest purchasers and buy a big quantity of the olive production.

3 - The processing industry. The E.G.D.D.O. oil presses buy in some cases the oil from producers

Price.

Information obtained from producers indicated that the average price received by these producers varies between L.E. 0.05 and L.E. 0.08 according to the cultivars. With a very few exceptions the prices received by these producers were generally less than half the maximum prices recorded at the retail market.

Producer indebtedness.

One problem which confronts some olive producers is their indebtedness to merchants. A government or cooperative credit institutions does not exist or has never been active in the zone, consequently the producers have from the beginning been dependent on the merchants for their credit needs. Besides being in debt for their seasonal production loans, many producers are indebted to local retailers for their food requirements, clothes...etc.

Recommendations.

The successful introduction of improvements in the marketing of olives and oil in the zone will be dependent upon an adequate marketing organization in the olive producing areas.

- It is recommended that the introduction of improvements is undertaken gradually and initially on a pilot project basis.

  Demonstration of improved practices would be one of the major objectives of the pilot project, with special reference to picking, transporting and marketing. It is proposed that two areas would be selected. The following main criteria should determine the areas to be selected.

- Every one comprising a potential production of at least 50 M.T. One of the areas should be as near as possible to the oil press plants.

- The producers concerned of every area are members of one tribe and one cooperative.

- The producing units are located in the same sector in order to avoid that the project is stretched out over too long a distance.

- To carry out these activities a manager with adequate background and experience in marketing and cooperative management would be needed with some assistants.

- Concerning the indebtedness to merchants the desirability should be investigated of arranging with the Agricultural cooperative Society that it substitutes in the pilot project area the credits provided up till now by the merchants. The possibility of utilizing W.F.P. sale proceeds at low cost on a revolving fund basis can be suggested.

- It is desirable to avoid a sudden and abrupt change in the marketing system. The cooperative should be given responsibility but gradually.

- The desirability to expand olive production in Mariut Extension and possibly other area in Western part of the Zone deserves consideration.
  If approximately 5 000 feddans of olive will be put under irrigated cultivation in Mariut Extension, and if it is possible to increase also horizontaly and vertically the production of mainly olives near the galleries in Mersa Matruh and bores in Fuka synclinal area where a big amount of underground water is

expected, the supply might well be increased with an additional assured annual production of at least 10 000 M.T.

- Attention should be given to the introduction of cultivars suitable for oil and pickling and appropriate pickling methods and techniques.
- For pickling olives, it is advisable to delay harvesting as long as possible to allow the fruit to reach its maximum size. For oil cultivars a complete ripenning of the olive is required.
- It is useful to modernise the existing oil presses in the Zone in order to increase the percentage of oil, reduce the cost of processing which is relatively high at the present. The private oil press plants should be under the control of E.G.D.D.O. and a licence should be issued.
- It is essential to improve the storage conditions of the oil in the E.G.D.D.O. oil presses.

6 Staff Requirements & Training

The development of agriculture in the zone requires as a basic condition the establishment of a strong and coherent organizational structure staffed with competent personnel and equipped with operational facilities. A well organized administrative structure is therefore very essential and special attention is needed for clearly defined procedures for recruitment, training and orientation of the staff.

The E.G.D.D.O. which is responsible for the development of all desert areas all over the country, has the staff as shown in Table 67 operating in the N.W. Coastal Region in various fields.

According to this table, out of a total number of 180 persons, 114 employees are at the Zonal HQ and 66 at Sector level. Further, out of the total strength of 180 employees, 73 are University graduates while the remaining 107 are of secondary school level.

In considering the problem of assessing staff requirements and their proper training, the problems and peculiarities of the region have to be noted. In this region the major problem is the development of pastoralism and the efficient utilization of limited surface and underground water resources for improvement of the life of the tribal people who are strongly rooted to tradition and customs. Therefore, there is a need for a special type of administrative structure which should be suited and adopted to the hard and harsh desertic conditions, with an understanding of the problems of the tribal people.

After careful studies and investigations, the FAO team members have assessed requirements of staff and needed training in each particular field for the successful implementations of various proposed projects and plans and schemes.

The aggregate estimates of staff required for the region as a whole as assessed are shown in Table 68 for the years 1975 and 1985 respectively.

Table 67 - E.G.D.D.O. Staff in the North Western Coastal Zone [1]

Fields or Departments[2]	Number			Qualifications						
	Zone H.Q.	Sector	Total	University Graduate				Secondary Education		
				Agr.	Engineering	Others	Total	Agr.	Others	Total
A. Agriculture										
1)Agronomy	20	30	50	6	-	-	6	44	-	44
2)Horticulture	3	4	7	3	-	-	3	4	-	4
3)Plant Protection	5	4	9	5	-	-	5	-	4	4
4)Forestry	2	-	2	2	-	-	2	-	-	-
Sub Total A.	30	38	68	16	-	-	16	48	4	52
B. Animal Production										
1)Animal Husbandry	1	-	1	1	-	-	1	-	-	-
2)Veterinary Services	2	-	2	-	-	-	-	-	2	2
3)Range Management	2	-	2	2	-	-	2	-	-	-
Sub Total B.	5	-	5	3	-	-	3	-	2	2
C. Land & Water										
1)Soil & water	12	-	12	-	12	-	12	-	-	-
2) Farm Machinery	5	4	9	5	-	-	5	-	4	4
Sub Total C	17	4	21	5	12	-	17	-	4	4
D. Institutions & Services										
1) Land Tenure & Settlement	12	6	18	4	-	-	4	10	4	14
2)Cooperations	18	12	30	3	-	11	14	10	6	16
Sub Total D.	30	18	48	7	-	11	18	20	10	30
E. Others	32	6	38	-	2	17	19	-	19	19
Grand Total	114	66	180	31	14	28	73	68	39	107

1) Excluding general service.
2) Arranged according to the proposed organizational structure for the zone.

Table 68 Proposed Staff Requirements in the Project Area

Fields or Depts.(1)	1975										1985									
	H.Q.		Sectors		Co-ops		Stations		Total		H.Q.		Sectors		Co-ops		Stations		Total	
	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T
A. Agriculture Division																				
1. Horticulture	2	-	1	-	-	-	3	6	6	6	3	-	2	-	-	-	4	7	9	7
2. Agronomy	1	-	1	1	-	-	1	1	3	2	1	1	1	2	-	-	1	1	3	4
3. Plant Protection	1	1	1	1	-	-	-	-	2	2	2	2	1	5	-	-	1	1	4	8
4. Forestry	2	3	-	-	-	-	1	1	3	4	4	5	-	-	-	-	1	1	5	6
Sub-total A	6	4	3	2	-	-	5	8	14	14	10	8	4	7	-	-	7	10	21	25
B. Animal Production Division																				
1. Animal Husbandry	2	1	2	2	1	2	1	1	6	6	2	3	3	3	2	4	2	3	9	13
2. Range Management	1	-	2	3	-	-	1	1	4	4	1	2	3	5	-	-	1	3	5	10
3. Veterinary Services	-	-	2	2	-	-	-	-	2	2	-	1	5	5	-	-	-	-	5	6
Sub-total B	3	1	6	7	1	2	2	2	12	12	3	6	11	13	2	4	3	6	19	29
C. Land & Water Division																				
1. Farm Machinery	1	-	1	1	-	-	-	-	2	1	1	1	1	3	-	-	-	2	2	6
2. Soils																				
3. Surface Water	4	7	2	2	-	-	-	-	6	9	4	7	2	2	-	-	-	-	6	9
4. Underground Water																				
Sub-Total C																				

(1) Excluding the Division of Administration

To be contd.....

Table 68 (continued)

	1975										1985									
	H.Q.		Sectors		Co-ops		Stations		Total		H.Q.		Sectors		Co-ops		Stations		Total	
	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T	E	T
D. Rural Institutions & Services																				
1. Land Tenure & Settlement	2	2	2	3	-	10	-	-	4	15	3	3	3	4	-	12	-	-	6	19
2. Extension	2	-	5	-	1	40	-	-	8	40	5	-	2	-	3	40	-	-	10	40
3. Co-ops	1	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	2	-
Sub-total D	5	2	7	3	1	50	-	-	13	55	10	3	5	4	3	52	-	-	18	59
E. Marketing Board																				
1. Wool	1	4	-	-	7	15	-	-	8	19	1	4	-	-	7	15	-	-	8	19
2. General	2	-	1	2	-	-	-	-	3	2	3	-	2	9	-	-	-	-	5	9
Sub-total E	3	4	1	2	7	15	-	-	11	21	4	4	2	9	7	15	-	-	13	28
F. Coordination & Programming																				
1. Economics	1	1	-	-	-	-	-	-	1	1	2	2	-	-	-	-	-	-	2	2
2. Statistics	-	1	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	2
Sub-total F	1	2	-	-	-	-	-	-	1	2	2	4	-	-	-	-	-	-	2	4
Grand Total (2)	23	20	20	17	9	67	7	10	59	114	34	33	25	38	12	71	10	18	81	160

(2) Excluding the possibility of a few further staff for Soils Surface Water and Underground Water.

These staff requirements do not include unskilled workers or other routine administrative personnel. The proposed technical requirements in personnel (excl. Administration) call for ..78.. college graduates and ..138.. technicians by 1975.

These proposed requirements will call for a small increase in the total staff by 1975 with some adjustments and reallocations in selected technical fields. At full development, an appreciable increase in all fields will be required to satisfy the needs of agriculture in the Project area by 1985.

The Chart in Figure 14 illustrates the proposed organizational set up of E.G.D.D.O. in the North Western Coastal region. It is to be composed of four Divisions, viz., Agriculture, Animal Husbandry, Land and Water and Rural Institutions. There is a separate fifth division of Administration. Each division shall consist of a number of sub-divisions as illustrated in the Chart. The same organizational structure may also be suggested for the four sectors of the Region with some adjustment in consonance with the immediate needs and the special conditions prevailing in each sector.

As shown in the Chart of the proposed organizational structure, two bodies are suggested to be established to assist the Director General of the Zone in handling the problems of marketing and coordination. These are the Marketing Board and the Coordination and Programming Committee, both of which would be under the Chairmanship of the Director General and composed of Divisions Directors and representatives of other Government bodies, the Central Cooperative Organization and private concerns. It is also proposed that a permanent secretariat is attached to the Marketing Board as well as to the Coordination Committee to function as its technical arm in the collection of data, the analysis of the problems as they arise and to suggest and design technical solutions. As the need for immediate action in several fields of marketing is already in evidence, it is strongly recommended that immediate action is taken to establish and staff the Marketing Board and its technical secretariat.

Staff re-allocation and recruitment

A study of the tables 67 and 68 shows that some of the assessed staff requirements can be met through proper re-distribution and re-allocation of the existing staff after imparting them proper training and orientation.

In order to improve the working and efficiency of the organization delegation of adequate powers both administrative and financial, at all levels especially to the Regional Director and heads of divisions is very essential. It will be a proper thing to review the power structure from time to time to delegate additional powers, if deemed necessary, for the successful implementation of various projects and programmes.

As basically the implementation will be on Sector and village basis, it will therefore be necessary to strengthen the administrative structure at Sector and village level and increase the number of workers at these levels.

Farm Level Approach

At present no staff is operating at the farm level. It is proposed that at the farmer's level, apprach should be through a multi-purpose village level-worker who will serve as eyes and entennae of various departments concerned with agricultural and rural development. This farm level worker will be imparted an intensive cource of pre-service training in a Community Development Training Institute in the field of Agriculture, Animal Husbandry, Forestry, Horticulture, Cooperation, Social and Extension, Education, Range Management, Irrigation, Farm Machinery, Poultry, etc., according to the regional requirements. During the training period, stress will be on practical aspects of various disciplines. The village level worker will be supported and assisted through technical experts of various departments at Sectoral and regional levels, to solve his field problems and keep him abreastof new research findings and new knowledge for the benefit of farmers.

In order to attract suitably qualified and competent staff to work under the hard and arid desertic conditions particularly at village level, a hard-ship allowance on a sliding scale basis should be paid to village level workers and sector level officers, taking into consideration the location of duty stations, amenities available, communication facilities, climatic conditions etc.

Training of Staff

Regular and permanent arrangements for the pre-service, and in-service training of the staff at various levels should be made in cooperation and collaboration of involved departments within the Region as well as outside short term training and refreshers courses both for officials and non-officials be arranged at various research stations and training centres within the region.

In the fields of range management and animal husbandry, in-service training for technical subject matter staff and for general purpose extension workers is to be provided through special training courses, initially at Marsa Matruh, eventually at the proposed range management, sheep and dairy goat stations. Extension workers should obtain additional training and experience through field demonstrations in which the subject matter specialist and the extension worker cooperate. Visits would also be arranged to experimental and research projects carried out by research workers, in order to acquaint field officers with the progress of experimentation, and in order to secure the chanelling of practical problems from the field to the reseach staff.

A course in range management and soil conservation should be established at the Alexandria Faculty of Agriculture to enable students to obtain training in these fields of which the application is limited mainly to the Western and Eastern Coastal Zones of the U.A.R. Field officers in these fields should be chosen mainly from those graduates which have taken these subjects as minor or major study courses.

While planning for training programmes at the university level, more attention should be paid to field crops, horticulture and forestry production under dry land conditions or with limited amounts of irrigation. It is suggested that range management be included in the programme of the faculty of agriculture at Alexandria and that in the Animal Husbandry courses

attention be paid to sheep husbandry on the proposed range dairy goats. Students at the Alexandria University in the fields of Range Management, Forestry, Ecology, Animal Production should have the opportunity to do practical work on the sheep and range station and other stations in the Zone during at least one summer vacation, whereby they would be given a certain allowance.

Special training courses should be organized for staff of the E.G.D.D.O. and other institutional bodies working in the Zone, in which new staff members would get general background information on the special conditions in the Zone and on the progress of experimentation and other development aspects. In addition, an annual seminar including field trips is recommended in the various technical fields in order to serve as a "refresher" session and to serve as a platform for the exchange of views and information between the technical workers concerned, and to provide up to date information on progress in the various fields under similar conditions, in other countries.

Special two-week training courses are recommended to be held during the summer for the primary school teachers in order to help them in the teaching of certain basic elements of agriculture in the Zone to the two highest grades of the primary school.

Chapter VIII

CONCLUSIONS AND RECOMMENDATIONS

1. Ecology

The region is destined to be mainly an area of extensive range grazing, although strong measures must be taken to prevent further depletion of the range and to restore its capacity to earlier, better levels.

It was estimated that the drought year 1967/68 reduced the feed intake from the range by half. There should be further studies to determine more accurately the relation between climate and range production and botanical composition.

Crop production possibilities in the region are strictly limited to small plots. At present much barley is grown and this is harmful on land which gives yields only in good years and which is left without vegetation for grazing in fallow years. Olives, also quite extensively grown, will only give good yields in the region if they are watered in summer as well as in winter. From an ecological point of view, it would be more advisable to cultivate early fruit crops, which would tap the soil water reserves during spring and early summer. Also, vegetables should be cultivated, as the problem of agriculture in the region is to take advantage of the small amount of suitable land and scarce and fleeting water supply to produce high value commercial crops as quickly as possible.

While the hard conditions imposed on the vegetation by the lack of rain are tempered by the high air moisture, this does not render the region as suitable for agriculture as is sometimes thought, and the climate is still to be defined as arid - maritime rather than semi - arid. The dew forming in autumn and winter is also of less use to plant growth than is frequently supposed. However, some studies on its formation and effect would be worth carrying out.

The temperature is the most favourable feature of the region's climate for agriculture, but low night temperatures in February are a handicap to the cultivation of crops such as string beans and tomatoes, and the mildness is inimical to some fruits - to pistachio, for instance. Finally, the frequent and strong winds of the region do harm to the vegetation.

2. Crop Production

The general shortcomings in present crop production are as follows:-

- The number of species and cultivars planted in the region is relatively limited.
- The seeds used by farmers are not selected. They may be mixed and are not free from seed diseases.
- The soils are not well ploughed and prepared and the shallow working of the soil is not applied sufficiently. The implements used locally need to be improved.
- There is practically no use of fertilizers or green manure. Manure is used on a relatively small scale.

- Growers have failed to fight pests, with the excuse that the poor crops do not pay for expensive spraying.

- The principles of crop rotation are not known in the area and often the same species are planted in the same land every year.

- Research work is on small scale and fragmentary.

- There is no agricultural extension service or agricultural education institution in the region.

- A government or a cooperative credit institution has never been active in the region.

There are also some specific problems concerning perennial and annual crops.

- Orchards in some cases are not well located or not protected against animals. The lack of barbed wire to protect orchards is one of the important obstacles for the expansion of fruit trees in some areas. The problem of pollinisation is not always taken in consideration. Trees are mostly planted too densely in the region.

- Pruning is ignored by the majority of farmers in the region and there are no skilled pruners or foremen in the area.

- The ground water is not fully utilized for fruit trees, especially olive trees. Olives are harvested before the optimal maturity. The oil press plants in the region are few and very old. Practically only one oil variety (Chemlali) is cultivated. There are no facilities for oil conservation. The existing nurseries need to be improved.

- At present the barley is harvested by pulling the whole plant from the soil, which is slow and encourages wind erosion.

- The grains of barley are stored in general in pits in the ground. This method has the disadvantage that viability of seeds decreases considerably.

The diversification of crop production in the region is generally recommended. This can be achieved with the following measures:-

- The area of some other species and cultivars should be increased. Carob, pistachio. pomegranate, apricot, peach, mulberry, prickly pear and Casterbean can succeed, especially carob and pistachio which withstand the dryness. Avocado can be tested in irrigated sectors and guava under irrigation and dry farming conditions. Pomegranate and prickly-pears could be used as fence and windbreak. More exotic and local cultivars should be introduced and tested.

- The selection of the better types among present populations constitutes one of the most effective methods of bringing about improvements in olive growing. Many new species of vegetables can succed in the area, especially asparagus, artichoke, eggplant, pea, spinach, carrot... etc.

- Maize, sorghum, lentil, chickpeas, lupins, oats, vatches, peanuts, sunflower and safflower can be introduced and tested, although barley will continue to be the most important.

- The production of seedlings can easily be increased, improved and diversified. In collaboration with the Ministry of Agriculture, certified seeds can be produced on the farms of EGDDO.

The better cultivation methods which should be practised include the following:-

- The soil should be properly ploughed in the autumn to increase the penetration of rain water. However, the soil should not be turned over but rather opened up as done at present, but to a deeper level. Land cultivation and shallow working of the soil have many advantages. But further studies are required to determine the economically optimum number of cultivations.

- The replacement of the actual tools by improved ones would enable a greater volume of work to be accomplished with less effort and in shorter time. More technical and economical research on mechanization is required.

- Manuring is very important under dry farming conditions and fertilizing and manuring are also very important under irrigated conditions. Further studies are required to determine the response to fertilizer and manure, and to determine the economics of fertilizer application. The concentration of sheep flocks in sheep pens at night is recommended so that manure can easily be provided.

- Without suitable crop protection measures the increased yields obtained through the use of improved varieties, fertilizers and irrigation are in danger of being wiped out by pests and diseases. The economics of crop protection require further study especially in the conditions prevailing in the region and insecticides should be distributed at subsidized prices at least during the first five years period.

- Crop rotations can be very important under dry land conditions. Triennial or at least biennial crop rotations should be followed, some leguminous crops should be introduced and cultivated on a larger scale. Crop rotations should take into consideration the requirements of livestock in certain critical periods. If perennial intercrops are being considered, grapes and almonds can be recommended as they are the most suitable plants for this purpose.

There is an urgent need for supporting services, credit facilities, storage and marketing arrangements, etc. Recommendations in these items are given elsewhere. Here it is sufficient to emphasize that:-

- A well-equipped experiment station with a good and dependable supply of irrigation water should be established and used also for seedling propagation, seed multiplication demonstration and training.

It is specifically recommended that:-

- More attention be given to the question of choice of site for the establishment of orchards. The soil should be deep so as to be able to retain moisture.

- Wire net cages or thorny branches be put around tree trunks where damage from animals is fenced, or preferably, barbed wire fences be put around the orchards. EGDDO could distribute the barbed wire at subsidized prices. Alternatively thorny plants could be planted round the orchards.

- The problem of pollinisation be taken into consideration for some fruit trees species, mainly almonds, pistachio and carob.

- Fig plantations for dry consumption and of vineyards for raisins be set up, mainly in locations more distant from markets.

- Fruit trees be planted less density. More will be lost by planting them too closely than by planting them too wide.

- Pruning be done late and more often but less severely. The training of skilled pruners and foremen is necessary.

- Summer irrigation be assumed during at least the first few years after the plantation of fruit trees, especially olives. Infrequent deep irrigation is better than frequent shallow irrigation.

- Harvesting of olives for pickling be delayed as long as possible to allow the fruit to reach its maximum size. For oil cultivars a complete ripenning of the olive is required. It would be advisable to introduce the harvesting equipment on a larger sacle.

- Another new and modern oil press be established in the area and modernise the existing oil presses be modernised to increase the percentage of oil and reduce the cost of processing. There is also a need to control and improve gradually the conditions of work and train the staff in the private oil presses. The oil presses should be established in the four sectors gradually as the olive trees come into production, starting immediately with Mersa Matruh and following with the sectors of Dabaa and Sidi Barrani.

- The adoption of several olive cultivars with a successive period of maturity be adopted to allow prolongation of the period of work of oil presses. It is essential that the storage conditions of the oil in the EGDDO oil presses be improved.

- The existing nurseries be improved, if they are to be retained. Preferably the nursery work should be carried out at a new, thoroughly equipped central station.

- Scythes (seef) or even sickles be used for barley harvesting. The cooperative use of mobile threshing machines could be considered in areas with concentration of barley production but would require the additional use of straw choppers to obtain chaffed straw whenever labour became short.

- A storage programme for seed grain be introduced, in view of the disadvantage of the present more or less air-tight storage in pits.

3. Animal Production and Range Management

One of the main obstacles to the development of animal production in the region is obviously the old tradition which, under the influence of the difficult environment, developed to its present day form. Improvement of livestock production cannot be achieved through any bettering of the traditional forms, but only through the initiation of special well studied projects and measures, which together would set in motion the expected and needed process of development. This inevitably entails a gradual loss of the traditional freedom of range utilization, while gradually other controls would be required as well to achieve the desired development goals.

Once the way of development has been decided upon a gradual implementation of improved techniques and new organizational forms will take place. This would be through the gradual implementation of special projects and in some instances through their sucessive initiation when the implementation of one project is depending upon the progress in realisation of others. These special projects, each of which requires a detailed plan of operation, would be the real instruments for the Government to push the intended development of animal production and range improvement.

According to the study of the long term prospects and the possibilities of development described in Chapter 7, a list of recommended projects, plans and measures is presented below. While most of these have to be implemented in stages,

some could be implemented within a few years.

1. The Establishment of grazing districts as fundamental units for improved range management. The suggested territorial location of the grazing districts is in accordance with the distribution of animal numbers and grazing resources, and with the administrative organization of the area, particularly in relation to the location of cooperative centres. All steps for range improvement (control of animal numbers, improved management, provision of supplement feed etc.) would be realized through the grazing districts. Their establishment would be a gradual process, which should be strongly stimulated, because the successful realization of other projects will depend upon the progress of range management.

2. Feed Policy. A proper price and supply policy of feed provided by the Government and WFP could be an instrument to promote a rational range utilization and animal husbandry development on a sound basis. The supply of feed for range animals at prices well below the world market level, while animals are sold at prices far above world market levels, stimulates the increase of animal numbers to a level which has disastrous results for the range. At the existing high livestock prices, a higher price level of feed in non-drought years would cause a larger off-take of animals in such years. Lower feed prices could be considered for emergency drought situations, for feedlot fattening, dairy goat and poultry projects.

3. The eradication of parasites should be carried out in the cooperatives as an obligatory condition for grazing on the range. This is the only project which can be generally applied immediately, once the necessary material is available and some preliminary training of stockmen in the cooperatives has taken place. As the bedouins are very keen on animal treatment, complete parasite eradication should be linked to the Grazing Districts as a means to stimulate the breeder's interest in the establishment and proper functioning of the latter.

4. Establishment of a nursery for seed and tiller propagation of range and fodder species. Such a nursery should form part of a central irrigated station for propagation and experimentation for horticultural, agricultural and arboricultural species and crops. Seeds and tillers produced at this station would be used for reseeding, establishment of special-purpose pastures and forage crop cultivation in barley-forage rotations and intercropping in young orchards.

5. Establishment of ownership rights and means of protecting cultivated pastures The range improvement plan as outlined in this report envisages the establishment of special-purpose cultivated pasture for lamb fattening, dairy goat production and as drought reserves. Such pastures could either be established by the Grazing Districts for controlled communal use, or by individual farmes for their own use.

The following measures are proposed in order to enable and stimulate the development of such pastures.

a. Ownership rights. As much of the land suitable for cultivated pastures and cultivated fodder-shrubs falls under the customary or tribal individual use rights, part of their development would have to take place on land falling in this category. At present title deeds can only be given for orchards with a permanent source of irrigation water. It is essential, however, that farmers who wish to develop cultivated pastures or fodder shrub plantations should be given the necessary security of tenure.

b. Legal protection against trespassing. Customary law provides for the punishment of owners whose animals cause damage to orchards and crops. As no tradition of cultivated pastures or fodder crops exists, no recourse to customary or statutory law exists with respect to the protection of such pastures. If the establishment of improved, reseeded or cultivated pastures or foddercrops is to develop, either by the Gnazing Districts for controlled

communal use, or by individual farmers on their own land, legel provisions are required for the protection of such pastures.

c. Provision of fence material. At present fence posts and barbed wire are not available through commercial channels. Fencing is essential for the establishment and subsequent use of cultivated pasture and fodder plantations on individual holdings, while for the less intensive improvements of large areas through management (resting, deferred grazing) and reseeding, other, less expensive methods of control could be used.

It is proposed that fence material be provided to the farmers at a subsidized price. As the farmers would also be interested in obtaining fence-material for orchards and vegetables, the same arrangement could be made for such crops. In order to stimulate the establishment of cultivated pastures on individual holdings, a provision could be made that fence material for orchards is made available at a subsidized price on the condition that a certain percentage of the fenced area (say 15 percent) be planted with perennial pasture or fodder species.

6. The establishment of a Sheep and Range Management station. The purposes of the station are to carry out demonstrations and training and to conduct experiments in improved methods of range management and range sheep production. Furthermore, the station flocks will be used for selection on scientific lines and will therefore be of particular importance for the genetic improvement of the sheep population. Important subjects for research include studies on range productivity, carrying capacity, economic and technical aspects of reseeding and of cultivated pasture and fodder crop production.

7. Extension of the improved breed and organization of breeders. In addition to the scientific plan of breeding, which will be realized in the Sheep and Range Management Station, a practical programme for extension of the improved breed should be worked out. The improved rams produced at the Station will be used for reproduction in selected flocks of the best breeders, who will be gradually organized in a specialized cooperative organization for breeding. The best ram lambs from these flocks would be purchased for rearing at the Station in order to be used for systematic replacement of rams during the registration of animals in the grazing districts.

8. Establishment of a Goat Station. The station should be for breeding milking goats, the breeding to be extended to the most favourable areas of the region. From the initial 50 selected goats at the beginning of the first year, the station flock would increase quickly to the final number of 250 heads. This size of flock would be necessary to carry out the intended experiment of crossing two exotic breeds with the selected local goats till the end of the 15th year.

9. Goat milk production. The project would deal with the extension of commercial milk production and would include cheese manufacturing from goat milk, to be first experimented with and demonstrated in the Goat Station. The extension of this production, which would depend upon the results obtained at the Goat Station would be achieved through the creation of cooperative milking parlours where the goats will be milked for marketing. Some administrative steps (in Grazing Districts) for the restriction of goat numbers, if issued at the right time, would probably encourage the people to breed higher productive milking goats. In the proposed dairy goat production areas, which are located along the coast, improved pastures and fodder shrubs would have to be established on land receiving winter flood water and sheet run-off.

10. A wool marketing project would start with the training of graders assigned to the cooperatives in November of the first year after the arrival of a wool marketing expert. For the following shearing season, cooperative marketing would be

organized in one of the 5 central cooperatives. Further extension of the cooperative marketing system would be gradual till the building of a shed for auction sales, when this system can be generally applied.

11. Poultry production. The aim of the project would be to improve management of the existing poultry station, and initiate advanced production units inthe vicinity of Mersa Matruh and the propagation of improved breeds according to the requirements of producers. The first step for the improvement of poultry production would be the organization of the Station on a sound economical basis.

12. Fodder production in reclaimed land with Nile water irrigation. Several of the proposed development projects, such as fattening, finishing, and especially the integration project, require fodder production on irrigated land. The most feasible area for such production from the point of view of management and organization is in the newly reclaimed areas in the eastern part of the region. If the development proposals for which fodder production is needed are to be implemented, a project could be undertaken to study and apply the best possible technical methods, production costs etc. Following this, the production could be expanded in accordance with the fodder requirements of the fattening and integration projects.

13. Fattening and marketing of livestock. Price fluctuations in the region at present are a factor discouraging fattening on any large and organized scale, especially when export is considered. Cooperative marketing will inevitably fail as long as price differentials favour illicit exportation. Meanwhile, lamb fattening, in feed yards or by grazing green forage, and selling lambs in the Nile Valley could be a profitable undertaking in the absence of the higher prices from illegal exportation. A fattening plant for sheep could be developed and gradually expanded on irrigated land, whereby cattle fattening could keep the plant busy in the off-season for sheep. Organized or licensed marketing of culls, meanwhile, is felt to be essential for an effective control of animal numbers on the range.

14. The development ofintegration of range sheep husbandry with irrigated farming. This is a long-term plan aiming at a gradual change from year-long utilization of the range to mainly seasonal use in the winter and spring season, when range herbage production shows a marked peak which cannot be fully utilized under the present year-long grazing system. Under the proposed integration plan part of the animals would be fed on irrigated land during the period of low range herbage availability (summer and autumn). The intensity of feeding and the duration of the period during which the animals would stay on irrigated land would be gradually increased, while, through breed improvement, the animals' response to higher levels of nutrition and management would greatly improve. The plan first of all requires the establishment ofa pilot farm on land irrigated with Nile water, which would serve as a nucleus for the extension of the integration plan on adjacent irrigated land. This farm would be used for experimentation, training and demonstration, and would include the 300 feddans of irrigated land mentioned under item 3. Fodder production for the integration plan should be on a high technological level and the irrigation system should be adapted to mechanical forage harvesting in order to enable forage conservation, mainly in the form of silage.

15. Development of institutional and administrative structure. Even for a gradual application of the proposed animal production plans a considerable number of technical staff would be indispensable. In addition, many problems requiring the involvement of scientists will have to be dealt with. All projects with the exception of the stations, which are more likely to be managed by the Government, should be the responsibility of the cooperative organization. As the cooperative organization presently has no suitable technical staff, it is assumed that the Government administration would give full support to the cooperatives by initiating these projects for them, by training the necessary technical staff and by constantly providing advice to the staff and the producers on improved methods of production.

In order to fulfil this big task EGDDO should improve its technical services by establishing a strong division for animal production and range management, as well as by developing close collaboration with research institutions. This collaboration would be most efficient if done through a single institute, (for example the Desert Institute), concentrating on practical applied research and developing efficient cooperation with other research institutions (especially with faculties of agriculture and with veterinary research laboratories). In such a way the technical service of EGDDO would gradually develop into a real extension service and the Desert Institute into a specialized institution which would provide the scientific background of the extension service.

As there is at present little incentive for the technical staff to make the greatest possible efforts towards the success of a project under the difficult conditions in the region, it is suggested that a system of special financial remuneration or promotion be developed for the technical staff of such projects who show extraordinary competence and diligence in the execution of their task.

16. Legislation and related administrative measures. While education, training, demonstration and cooperative action are some of the important tools through which the proposed development in animal production is to be achieved, certain projects and development measures cannot be properly implemented without adequate legal provisions. This is of particular importance in cases where actions by individuals may harm the interest of the community at large or the interest of future generations. Some cases in which legislation is needed are listed hereunder.

a. Control of animal numbers. The Grazing Districts should have adequate legal backing to carry out their function of controlling, and, if needed, restricting sheep and goat numbers and animal movements across boundaries of the Grazing Districts.

b. Trade Control. Certain basic measures required for the development of animal production cannot be carried out as long as the illegal trade across the Western border, involving illicit export of sheep, continues. Particularly the control of animal numbers, which is essential for any programme of range improvement, will depend on the possibility to channel the off-take of surplus numbers through controllable outlets instead of the present illicit flow.

c. Eradication of parasites. Treatment for parasite control should be made compulsory in order to reduce re-infestation to a minimum.

d. Protection of improved range, reseeded range and cultivated pastures or foddercrops. The grazing districts should have the legal authority to exclude grazing in parts of the range area, and in improved or reseeded rangeland, for certain periods. Adequate legal measures for enforcement should be provided. Legal recognition of exclusive grazing rights of individuals on cultivated pastures or foddercrops established on their farms should be provided for.

e. Subsidies. Administrative arrangements could be needed for subsidies for certain expandable items (e.g. barbed wire and fence posts).

f. Conservation of wild life. While the immediate economic interest may be small, it would be of general interest that adequate legislation on hunting and trapping, mainly of gazelles and birds, be enacted and enforced. Gazelle-hunting from cars, which has caused the extinction or near-extinction of this species in several Near East Countries, should be dealt with particularly, even though at present it is not yet very common. Bird-trapping, if allowed to increase without limitation, may cause a reduction in numbers of species which are beneficial for agriculture from the point of view of insect control.

17. Service fees. A number of the above measures should be implemented through the cooperatives and include cleaning and maintenance of cisterns, maintenance of storm shelters, wool grading and marketing, control of parasites, and, eventually, animal marketing. The measures require expenditures of a recurrent nature. For this purpose it is suggested that a head tax or service fee per animal be collected annually and deposited into one or more autonomous revolving funds to cover the cost partially or fully. This would also constitute a direct incentive and encouragement to the breeders to take a more active interest in the proposed measures.

18. University Chair. A chair of Range Management should be established in the College of Agriculture of the Alexandria University, and this subject should be taught as a selective course for students in the Animal Production and Agronomy Departments.

Due attention should also be paid to dryland farming, soil conservation and related fields in the curriculum, in order to prepare students for the specific requirements of agriculture in the region.

4. Forestry

1. Under the existing climatological conditons of the region, forestry is an essential element of a sound land-use policy. It is required as a measure helping to improve yields in an area of wind and sun, to control erosion, to provide fuel, timber and animal feed, and to improve landscope and microclimate.

The scarcity of water resources and the limited area with good soils hamper the establishment of forest under block forms and only linear plantations such as windbreaks, shelter-belts, roadside plantations and groups of trees are possible, with the exception of sand dune fixation areas, where intensive afforestation is recommended.

Accordingly, the following works are suggested:-

- 2 300 km of windbreaks and shelter-belts.
- 1 000 feddans of sand dune fixation and afforestation, of which 800 feddans on maritime sand dunes and 200 feddans on inland dunes.
- Large-scale establishment of fodder trees and shrubs.
- 96 km of road-side plantations along the Alexandria-Mersa Matruh highway.
- Green Zones along the sea-resorts and some villages.

2. Windbreaks and shelter-belts should be established only where water conditions will be improved by some system of irrigation. Their form, structure, constituent species, technique of establishment, cost and expected benefits data should be related to the different systems of watering. In general, they should be narrow windbreaks which will ensure a maximum protective effect with minimum sacrifice of agricultural land.

3. Sand dune fixation should be introduced first at El Qasr, then in the Sidi Abd-el-Rahman and Garawla localities where mobile maritime or continental sand dunes threaten to cover good agricultural soils, roads and even villages. Prior to afforestation, fixation by mechanical devices such as cross-fencing is suggested. Afforestation should be carried out in stages; first by using pioneer and ameliorative tree species, and then by planting more valuable species for wood and fruit production

4. Fodder trees should be introduced on limited and medium deep soils on the range land, on the plateau, on the coastal plain, and on land with hummocks, in order to increase their herbage value and produce animal feed for the dry season. The trees will ensure also shade for animals and help soil conservation.

5. Roadside plantations are suggested only on a third of the length of the Alexandria-Mersa Matruh road, where soil conditions and water resources are better and where touristic objectives require this work.

6. In order to execute the above programme of work, the following supporting services will be necessary:

- Production of about two million of seedlings, for which a central nursery together with an arboretum at Burg-e-Arab is recommended.
- A special forestry section in EGDDO
- Training technical staff and skilled labourers for field works.
- Continuation of field investigations and establishment of new experiments to provide more accurate technical and economical data and to serve demonstration purposes.
- Provision of the necessary tools and technical equipments
- forestry extension work.

5. Agricultural Institutions and Services

(a) Land Tenure and related issues

Conclusions

1. The existing communal ownership of land does not provide security to the cultivator and his investment and results in lack of initiative and of incentives for permanent improvement.

2. The tribal land tenure and social situation poses some obstacles for the economic development of the region. The absence of any legal written records of rights in landed property and the nature of customary ownership means that the acquisition of tribal property for public or development purposes will give rise to a large number of claimants for compensation and will be fraught with great difficulties.

3. The tribal organisation limits the choice of settlers because the selection of outside settlers will be considered an imposition upon them and will meet stiff opposition and resistance.

4. The range land is common property while flocks of sheep and goats that graze on the range are owned individually. This leads to over grazing of the range, a decline of soil fertility and a deterioration of the natural vegetation.

5. Due to lack of proper tangible security as a consequence of the joint ownership of land, making available institutionalized credit for agricultural purposes to individual cultivators is very difficult.

6. On the other hand, the tribal cohesion and close kinship ties may facilitate the organisation of Cooperatives and a good marketing system.

Recommendations

To promote settled communities and to provide security of tenure as an incentive for permanent improvement of land, it is recommended that:-

1 - a programme of cadastral surveys and mapping and land registration in the region be started immediately. For this purpose, a Land Registration and Cadastral Survey Division should be established in EGDDO.

2 - Law No. 100 of 1964 be modified and amended to provide for:

i - recognition of customary rights of tribesmen over lands which they traditionally possessed and utilized for at least five years prior to the promulgation of the law.

ii - alienation free of charge or at a nominal fee to those possessing tribal land by custom.

iii - establishment of Field Adjudication Committees as part of 1964 Law to determine the correct position of land and water rights.

iv - the determination of water rights and the conservation, control and regulation of use of underground water resources in the region.

v - the conservation and regulation of use of grazing areas through a Grazing Authority which would establish grazing districts and enforce the legal provisions relating to grazing.

vi - flexibility in determining the size of holding in a settlement area so as to allow for the establishment of viable holdings on the basis of income expectancy and to make full use of the farmer's resources.

vii - the distribution of reclaimed tribal lands depending on rainfall and runoff only to qualified settlers selected from the present tribal occupiers of the area and to other homogeneous groups, no portion being assigned to outsiders, as at present stipulated in Article 30 of 1964 Law.

viii - definition of the tenural relationships between the State and settler-tribesmen, stating the basis, method, and mode of payment etc. Full ownership rights should be granted to tribal settlers, subject to certain conditions whereby the state will excercise control over the proper use of land and water resources.

3 - the choice of settlement areas be confined to parts which offer scope for assured production on the basis of good soil and water conditions and other favourable factors.

4 - the settlement pattern and the lay-out pattern of individual holdings in a settlement area be determined according to the size of the settlement Area, its location, number of settlers' families and their wishes and aspirations, soil types and water resources, lay out of irrigation systems and projects roads, number and types of Community Services to be made available, and cropping patterns to be adopted.

5. no settlement schemes be planned without the supporting measures and services required for developing settlements and increasing production and income. These services and measures include agricultural extension cooperatives, marketing, storage, community development, provision of production requisites and educational, health and transport services.

6. the selection of settlers be made before the work on a settlement starts

and the settlers be involved in the establishment of a settlement project and given intensive training.

(b) Cooperatives

Conclusions

1. At the present cooperative movement is dominantly influenced by tribal leaders and is not run in a democratic manner.

2. Cooperatives are considered only as a means of obtaining Government aid and subsidies.

3. The real role and objectives of the cooperatives are generally not appreciated.

Recommendations

To rectify the situation outlined above, it is recommended that:

1 - sector level cooperative societies be created to serve as a link between the field cooperative societies and the General Cooperative Society at Mersa Matruh. Further, 4 mobile units, one for each Sector, should also be created as an essential part of the General Cooperative Society and attached to the proposed sector level cooperative societies.

2 - cooperatives be made the main source for the supply of agricultural credit in the region. The sale proceeds of WFP should be utilized for creating a revolving fund to finance the agricultural credit demands of the cooperatives.

3 - a subsidy fund be created to encourage cooperatives to undertake marketing successfully, especially of livestock and livestock products.

4 - literacy campaigns and training be organized for cooperative members, including the tribal "Sheikhs" and leaders, who should be encouraged to use their influence in a more positive way for the movement.

5 - better service and living conditions be provided in the region to attract well qualified and competent staff.

6 - separate multipurpose-type cooperatives be organized for settlement areas and their membership be confined to settlers or their dependents and relatives. It should be compulsory for a settler to become a member of the cooperative society upon taking possession of his holding.

(c) Agricultural Extension

Conclusions

The existing state of agricultural extension work is fragmentary and not of the desired extent or level. As many fields of development are not covered, many modifications and changes are needed for the organization and development of a proper Agricultural Extension Service.

Recommendations

To create an effective Agricultural Extension Service it is recommended that:

1. an Agricultural Extension Wing be created as an integral part of the

Agricultural Division in EGDDO.

2. ther be one multipurpose village-level worker for each cooperative society. He should also act as secretary to the cooperative society and do extension work in the fields of agriculture, horticulture, cooperation, forestry, range management, animal husbandry and community development.

3. a team of subject-matter specialists in various disciplines be provided at sector and headquarter level to advise, assist and guide the village-level worker in the discharge of his functions and responsibilities.

4. a Regional Extension Advisory Committee be set up. It should consist of representatives of various departments such as agriculture, horticulture, forestry, animal husbandry, range management, social welfare, etc., under the Chairmanship of the regional controller of EGDDO at Mersa Matruh, and should organize and guide the extension activities in the region and bring about effective coordination amongst various departments and programmes of development.

5. a Central Extension Training Centre be established for pre-service and in - service training of village - level workers and to provide refresher courses and short duration training courses, mainly for officials.

6. Radio Alexandria be utilized more extensively to relay programmes relating to agricultural topics and development in the region.

Chapter IX

RECOMMENDATIONS FOR FURTHER INVESTIGATIONS

1. - Crop Production.

1.1. - Research Station.

There is no need to emphasize the role of research in any programme of technological improvement. Agricultural research in the Region should aim at serving agricultural development rather than agricultural science. In view of the shortage of research workers and facilities, it is important that research be focused on priority problems and critical bottlenecks in agricultural development. It is felt that a well equipped experiment station with a good and dependable supply of irrigation water should be established for the Region. Such a station should also be used for seedling propagation, seed multiplication, demonstration and training. With regard to location, the main factors to be considered are the availability of good quality irrigation water, good soil, distance to main road or especially railway, facilities for staff, microclimate, distance to beneficiaries. As far as the last factor is concerned, a location in the center of the Zone is preferable (e.g. near Mersa Matruh). However, the lack of sufficient quantities of good quality irrigation water and land eliminates this possibility. Fuka could be taken into consideration because good prospects of underground water availability are indicated. The station could be located in the Mariut Extension Irrigation Project, where water and land are available. The closest possible location to a railway station and to a major village should be chosen. Training of research staff could take place at this station.

1.2. - Outlines of a Research Programme.

The following subjects are proposed for experimentation and research, in order of priorities.

1 - The establishment of a collection of species and cultivars of fruit trees, vegetables and field crops. Exotic and local species and cultivars from other areas of U.A.R. should be introduced and tested under local conditions.
Fruit trees: Olives, figs, almonds, carob, pistachio, grapes apricots... etc. Industrial trees: Castor-bean.
Vegetables: Watermelons, tomatoes, onions, broad-beans, artichokes, peas...etc.
Field crops: Barley, wheat, lentils, chickpeas, peanut, sorghum, maize...etc.

2 - Establishment of some comparative field studies. The aims of this kind of work are:

- To make some comparative observations about the growth and the production of some existing and new species under some different ecological and cultural conditions in the field of farmers.
- To show at the same time to farmers how to establish the orchard on a sound technical basis and how to apply modern agrotechniques.

The following experimental field plots among other can be undertaken.

- Comparative plots of existing fruit trees species (olive, grapes, almond, fig) under different moisture levels and in different sectors of the Zone.
- Comparative plots of new species (apricot, peach, carob, pistachio...etc) under different levels of moisture.
- Comparative plots for spacing between trees (e.g. olive: 10 m by 10 m, 15 m by 15 m, almonds 7 m by 7 m and 10 m by 10 m, grapes 4 m by 4 m and 6 m by 6 m) according to the available moisture in the sites.
- Comparative plots for intercrops (e.g. olive or carob without intercrop, and with annual and perennial intercrops).
- Comparative yield trials of cultivars of field crops and vegetables, priority to be given to barley.

The following requirements are very important for the good success of the experimental field plots.

- Choice of good cooperative farmers who are ready to apply the modern agrotechnique.
- Good selection of soil and sites.
- Good choice of seedlings which should be free from pests and diseases.
- Good preparation of the land.
- Plantation before the end of December, January, February, according to the species.

3 - The selection of local cultivars for drought and salt tolerance, especially for olives, fig, almond and grapes

4 - The study of pruning methods and their effect on productivity: mainly olives, figs and grapes.

5 - The study of olive propagation by methods other than grafting by approach which is slow and expensive. The best period for propagation should be determined.

6 - The evaluation of different harvesting methods and their economic aspects.

7 - Cultivation methods: the optimal spacing, mainly between fruit trees under different moisture conditions (see sub. 2). Soil cultivation: mainly the economical optimum number of cultivations.

8 - Water requirements and salt tolerance of the main species: olives, figs, almonds, carob, pistachio, grape, watermelons, onions, broad-beans, tomatoes, barley...etc.

9 - Manure and fertilizer requirements under dry farming and irrigated conditions. Detailed studies on cost and return from various application rates, time and method of application...etc are required in the Zone to ascertain the economy and intensity of fertilizer use.

10- The maturity period of olives in order to find the optimal harvesting time for olive oil and pickled olive.

11- Applied experimentation of pest and disease control, especially for olives, figs, almonds, grapes, watermelons, tomatoes, onions and broad-beans. The establishment of a calender of treatments. The economics of crop protection should be especially studied.

12- Crop rotations for field crops and vegetables. Crop rotations under dry farming conditions should be studied mainly under winter flood and sheet runoff conditions. Until a central station could be established some of the experiments proposed could be carried out at the Burg-el-Arab, El Qasr or Ras-el-Hekma farms. The experimental demonstrative farms could be established on private farms.

1.3. - Cooperation and Coordination in Research.

The cooperation between E.G.D.D.O. and the Desert Institute should be strengthened. The field staff of E.G.D.D.O. can consult the respective specialists of the Desert Institute on the methods, procedures, sampling techniques...etc, to be followed for a certain field study.

While the concerned specialist of the Desert Institute visits the experiment periodically, discusses problems and provides advice, in cases where laboratory facilities are needed, the Desert Institute would make these facilities available and would assign a staff member to carry out the laboratory work. The Desert Institute can, furthermore, assist with analysis and evaluation of the data obtained from the field or laboratory study. In certain fields experimental work is also done by the Ministry of Agriculture either in the Zone or in other parts of the country. This applies primarily to field crops (e.g. barley), vegetable and some fruit trees mainly under irrigation. In order to avoid duplication it is essential that cooperation of this ministry be ensured in those fields.

It is therefore suggested that the responsible authorities be approached to form a permanent body (committee) meeting for example twice a year, to coordinate the research-work for agriculture in the Region.

2. Animal Production and Range Management

2.1. General

The proposed improvement of animal production in the Region would include quite drastic changes from the traditional methods. This, in addition to the absence or scarcity of production and other data, means that a considerable amount of experimental work is needed as an integral part of the development activities in order to achieve the goals.

Since many activities concerning the development of animal production will materialize through the cooperatives which at present have no adequate staff, E.G.D.D.O. will carry out such work in the name of the cooperatives. These are intended to develop simultaneously into self-governing cooperative organizations. In order to perform this large task the E.G.D.D.O. should have the fullest possible support from research. It is proposed that most of the research be carried out by one scientific institution. This institution can be the Desert Institute which was formerly established especially for this purpose. Mutual relations and reponsibilities should be regulated through detailed plans and programmes in such a way that investigation would be mainly the reponsibility of the Institute and application of the E.G.D.D.O. Mutual consultation between the research organization and the E.G.D.D.O. in an institutionalized form as well as on an informal, personal basis, is a prerequisite in order to ensure the most effective way to transform research information into action programmes, as well as to provide the research workers with the most important problems of production requiring experiments and investigations. In such a way in the long run the E.G.D.D.O. will develop into a proper extension service and the Desert Institute into a specialized research institution, which can ensure the scientific background of the extension activities.

In order to fulfill this task the Desert Institute should gain a very high prestige by forming a competent committee consisting of reputable animal production scientists and by developing a close collaboration with other scientific institutions; particularly with faculties of agriculture and

veterinary research laboratories. This committee should be responsible for the research policy in animal production concerning plans, personnel and budget. It should formulate the programmes of research in consultation with individual research workers and with the concerned department of the E.G.D.D.O. These programmes would be presented to the yearly conferences of the Desert Institute, where the results of work will be analyzed and the proposed plans approved.

As the subject of research in question will be focused on the development of better systems of animal production, these improved systems should be experimented and demonstrated in good stations (governmental farms). In addition to the purpose of experimentation and demonstration, the station flocks will be particularly important for selection purposes. The size (number of animals) of the station flocks will be considerable because all stud males for the entire animal population of the region will be produced there. In order to ensure a full collaboration of research with related activities, it would be necessary that the E.G.D.D.O. and the Desert Institute organize their field research, demonstrations and training in the same station. The station would be managed by the E.G.D.D.O., while the experiments and the scientific selection (aimed at the production of stud males) would be done by the Desert Institute. Mutual relations and responsibilities would be regulated through the plans of the Station and through the operation programmes of the experiments and studies.

The general plan of research will include all aspects of production where an improvement of methods and organization is desirable. In such a way the problems for scientific examination would be amalgamated in the production problems being their integral part. Therefore a classification of the problems for integrated activity of the E.G.D.D.O. and the Desert Institute on the applied research can be as follows :

PROBLEMS FOR STUDY AND INVESTIGATIONS :

Research work can be related to the following lines of production:

1. Range sheep production
2. Integrated sheep production
3. Milking goat production
4. Camel production
5. Wool

Research under range sheep production should be concerned with:

Sheep and Range Management Station : Organization.

Range improvement :

Study of range types and the present carrying capacities in different areas of grazing districts.
Nutritive value of different plants and range types.
Improvement of range (different assoc.) by protection, deferred and rotational grazing.
Improvement of selected range sites by reseeding and its economic aspects.

Feeding and Management:

Problems related to fattening.
Supplement feeding on the range.
Improved watering.
Protection against storms; housing, shearing sheds etc. .
Health protection - with investigation of diseases in animals (related to the veterinary research laboratories).
Economic analyses of production (related to faculties of agriculture).

Breeding :

Recording and practical selection in the Sheep and Range Management Station.
Definition of criteria in the selection of Barqi sheep (wool quality and quantity).
Methods of testing.
Statistical parameters and relations between particular characteristics.
Elaboration of breeding plans.
Extension of the improved breed in the region.

Research under integrated sheep production should be concerned with:

Sheep and Range Management Station :

This station differs from the station ad 1.1. by a farm for fodder-crops, which should be established for integrated management (organization problems).
Fodder production under irrigation (production studies in collaboration with Fodder Crops Branch, Ministry of Agriculture).
Forage conservation and feed manufacturing (In collaboration with the Fodder Crops Branch, Ministry of Agriculture).

Range improvement : Same as ad 1.2.

Feeding and management :
Lamb fattening.
Techniques of feeding (self-feeding, ration-feeding, differentiated feeding for a maximum efficiency).
Housing of animals in the farm, storm shelters and sheds as ad 1.3.4.
Farm management, economic analyses of production (related to faculties of agriculture).
Health protection - with investigation of diseases (related to vet. lab.).

Breeding :

Crossing experiments in order to find a suitable formula for crossbreeding.
Plan of crossing and breeding in the Sheep Station.

The items listed under breeding for range sheep production

Research under milking goat production should be concerned with:

Station for milking goats : Organization.

Cheese manufacturing (related to the corresponding branches in faculties of agriculture).
Range improvement :

Cultivation of shrubs and edible trees, reseeding of pastures.

Feeding and management :

Fattening of kids during the suckling period.

Feeding of goats for milk production.

Problems of management including the suitable building for the goats.

Economic analyses of milk and cheese production (related to faculties of agriculture).

Breeding :

Crossing experiments in order to solve the main problem whether inbreeding or crossbreeding.

Recording of milk yield in the breeding flocks.

Elaboration and application of a breeding plan.

Research under camel production should be concerned with:

Reconnaissance study of camels as eaters of plants not palatable for other animals on the range.

Research on wool should be concerned with:

Examination of wool for the purpose of selection.

Examination of wool for special studies concerning items 1. and 2.

Services for wool marketing organization.

As this plan of research should be worked out as the integral part of programmes concerning the proposed special projects in animal production its realization should be related to the implementation of these projects. Therefore the realization of the research programme must be gradual but always related to the over-all development plan. The given programme above is only an outline or broad systematization of fields which should be worked out (at the actual level of knowledge about feeding, breeding and management) until the particular problems for experimentation are well defined. These experiments should be accomplished according to plans having objectives containing the corresponding contribution to the indicated problems. They will be performed in the proposed sheep and range management station (or in the goat station), or at least will be carried out from there. Therefore the establishment of stations is an important condition for a successful realization of the entire plan of applied research.

2.2. Selected research items :

In addition to the list of research fields given above, certain selected subjects on which field experimentation will be required are dealt with hereunder in more detail. Some of the suggested experiments and studies are to be carried out at the sheep and range station, while others are to be conducted in other range areas and private flocks as well.

2.2.1. Range Management :

(i) Productivity and carrying capacity studies.

a. Quantitative herbage production measurements.

These should not be restricted to the area of the range station. Clippings are to be carried out at least twice a year in small exclosures in the main range types. The quantitative measurements should be continued for at least five years. Only the current year's vegetation growth is to be taken from edible plants. In case of less palatable plants normally grazed to a small extent only, a small part of the current year's growth can be taken. The exclosure is to be changed each year before the autumn rain to a new location close to the original site.

b. Carrying capacity studies.

These should be confined to the range station and additional fenced paddocks elsewhere as they involve the use of animals under controlled grazing. Principally, the use of different stocking rates is proposed while livestock, lambing percentage, lamb weight, wool and milk production are recorded under each treatment (each stocking rate) in case of year-long grazing. Under the conditions of the region, however, seasonal grazing of the various range types is felt to be more appropriate. In this case liveweight changes are the main animal measurements for each period of grazing on a particular range type under the different stocking rate treatments. It is suggested that 3 stocking rates be compared for each range type, of which one is based on the present carrying capacity estimation for the particular range type. For example, in the Sidi Barrani region, the following pattern could be applied :

No. of sheep per treatment	Grazing period	Range Type	Present estimated carrying capacity (feddans per sheep/ Month	Stocking rates (treatments) to be compared (feddans per sheep/Month)	Area needed for each treatment (feddans)
25	Dec. 1 Jan. 15	Anabasis articulata (Abu Mazhut) area	2	A 1.5 B 2.0 C 2.5	A 56 B 75 C 94
25	Jan. 15 Feb. 28	Gymnocarpus decandrum (Between El Fakhri coop. and Abu Mazhut)	1.66	A 1.2 B 1.66 C 2.0	A 45 B 62 C 75
25	March 1 June 30	Plantago albicans (South of Maktila-Terfaya)	0.625	A 0.5 B 0.625 C 0.75	A 50 B 62 C 75
25	July 1 Aug. 31	Suaeda pruinosa (W. of El Fakhri)	1.66	A 1.2 B 1.66 C 2.0	A 45 B 62 C 75
25	Sep. 1 Nov. 30	Artemisia herba-alba (Maktila-Tarfaya)	0.625	A (0.5)0.25 B (0.625)0.3 C (0.75)0.37	A (37.5)19 B (47)23.5 C (56)28

During the September-November 30 period supplement feed will be provided covering about half the animal's feed requirements (straw and barley or concentrates equivalent to 37.5. Feed units for the 3 months); the number of feddans needed per sheep/month and the area required per treatment would thus be about half of what is required without supplements. The latter figures are shown between brackets.

An addititional amount of supplement feed (7.5 feed units per animal) is to be used in other periods to stimulate fertility and production (e.g. before breeding and for lactating animals in December). In drought years (about once per five years) an estimated 147 feed units per animal would have to be provided in the form of straw (210kg) and barley or concentrates (105 kg.).

In addition to animal measurements, vegetation measurements would have to be carried out to study the effect of the different stocking rates on the development and condition of the vegetation. Permanent transect lines are suggested as a means to study the trend of the vegetation.

The grazing plots need to be fenced in order to avoid grazing by animals other than the experimental animals. It would be preferred that the grazing trial would be carried out for the whole year's cycle. If this is not possible, trials could be set up in one or more of the range types for the indicated periods. The trials should be carried out from the proposed sheep and range station; it is suggested that the station would contain land belonging to the Plantago and Artemisia range types, while in addition, sections in the other range types be fenced off for experimental purposes.

c. Productivity studies of cultivated pastures, fodder crops and reseeded range.

Whereas the establishment of cultivated pastures and range reseeding has proved to be successful at sites receiving moisture from run-off and on loose sand of the inland sand dunes, few data are available on productivity and longevity under grazing or clipping. Yield studies have to be carried out over a period of about 5 years in order to cover years with varying climatic conditions. As a start, yield measurements could be made of the Phalaris tuberosa plot in a valley at Ras el Hekma; of the transplanted Panicum antidotale in the Maktila inland dunes, the reseeded Oryzopsis miliacaea and Poterium sanguisorba at the Abbas Muftah farm South of Sidi Barrani. Similar studies could be made after establishment trials of Medicago sativa and Onobrychis viciaefolia under winter flood irrigation or on valley terraces, (possibly as intercrops during the first five years of orchard establishment with large amounts of flood water), local perennial grasses and legumes such as Dactylis glomerata var hispanica , Hyparrhenia hirta (Andropogon hirtum) and Lotus creticus (especially for reseeding at favourable sites), other introduced perennial grasses and fodder shrubs (e.g. Opuntia Ficus-indica, Atriplex vesicaria and Atriplex nummularia).

Yield studies could furthermore be made of annual legumes (e.g. Vicia ssp) and self-reseeding annual legumes such as Medicago ssp, in rotation with barley.

Yield data will have to be interpreted in economic terms in order to enable decision-making for land use, comparing orchards, vegetables and field crops with cultivated pastures, fodder crops and fodder shrubs used for fattening, dairy goat and other specialized forms of livestock production.

(ii) Management studies.

As most range types contain annuals as well as various sub-shrub species, of which the productivity, regrowth, flowering and seed production are affected by the season, intensity and duration of grazing, it is important to study the impact of such factors in greater detail. For example, on certain range types the herbage from annuals will to a large extent be lost if not utilized in winter and early spring as a result of covering by sand or removal by wind, while in others dried-up annuals will remain available for grazing in summer. On the other hand, grazing of certain sub-shrubs in their early growth stage (winter-spring) may reduce their total yield and capacity for flowering and seed production considerably. This problem of the optimum intensity and duration of grazing in spring applies particularly to the Plantago range type, where the annuals are easily lost for grazing due to covering by sand or removal by wind, but where sub-shrubs such as Helianthemum and Echychylon can provide valuable summer grazing if not grazed too heavily in spring.

Other aspects of management may require studies on such aspects as rotation grazing, the requirements of rotation grazing for parasite control, the effect of supplement feeding on selective grazing habits, etc.

(iii) Elimination of undesirable species.

Especially in the Sidi Barrani area dense stands of Asphodelus microcarpus are found, often on land which has been ploughed at one time or another. Studies are required on means and cost of control. In some locations, mechanical control may only be feasible if it can be followed by successful reseeding or transplanting. In other areas, good grazing species may establish themselves fairly rapidly and, if not overgrazed, may be able to compete successfully with any new incursions of Asphodelus. In this respect the

transplanting trial of Panicum antidotale in the Maktila sand dunes, following ploughing and elimination of Asphodelus, is of interest and needs to be followed by further studies. In this case, occasional cultivation between Panicum rows may be needed to prevent excessive competition by local species.

Studies on the removal of Thymelia hirsuta in the Plantago range type and its replacement by local or introduced palatable fodder shrubs could only have practical value if the new vegetation would be well managed and proper grazing control established.

2.2.2. Animal Production.

(i) Survey of the production capacities of the local animal population :

The survey should be carried out in private flocks in order to complete the data about the productivity of animals under the existing conditions. The wool characteristics in sheep and the milk yield of goats will be particularly interesting elements for examination. Reconnaissance studies should furthermore be made of camels in order to provide more information about these animals needed for the estimation of their real prospects as range animals. The next steps in the survey of production capacities will be confined to the station flocks where the production under controlled feeding conditions will be examined. Under controlled conditions the objectives of examination will be sometimes modified, as in sheep, in which the fertility, growth rate and conversion of feed will be the most important characteristics.

(ii) Comparative study of proposed systems of sheep management :

The proposed systems of sheep husbsndry as the improved range management, the extensive and intensive form of integrated management, should be established in the sheep and range management station, the latter two in cooperation with the pilot farm on irrigated land. In the experimental phase these systems should be examined from the technical, organizational and economical point of view. Particular technological details especially concerning the technique

of feeding in big agglomerations of flocks (on the irrigated farm) should be experimented and modified according to the results of these investigations. The improved systems should be adopted on the station according to the results of the economic appraisals in such a way that these systems would be the model for changes of animal husbandry in the Coastal Zone.

(iii) Genetical improvement of sheep and goats :

Without regard to the breeding methods which will be used the selection will always be the basis of genetical improvement. The first step towards organized selection will be through the establishment of a simple but strictly applied system of recording in the flocks of the Sheep and Range Management Station. This also will be the first step towards the application of scientific methods in selection, which will materialize through all necessary examinations, leading to the establishment of selection indexes for practical use. In the part of the sheep population which will be gradually improved through selection only the intensity of improvement should be permanently studied through the comparison of productivity of improved and unimproved flocks. It means that some flocks of unimproved Barki sheep should be permanently recorded. In other parts of the sheep population where crossbreeding will be implemented, the additional problem for research will be the investigation of a right formula of crossing. The number of exotic breeds for this experiment should be reduced by a careful choice of one breed for improvement of wool and another for improvement of meat (lamb crop.). The plan of crossing can be done according to the following scheme :

Ewes : B Rams : B, M, and W

First gen. : $B + \frac{B.M}{2} + \frac{B.W}{2}$

Second gen.: $B + \frac{2B.2M}{4} + \frac{2B.2W}{4} + \frac{2B.M.W}{4} + \frac{B.3M}{4} + \frac{B.W}{4}$

(B = Barki sheep, M = imported meat type breed, and W = imported wool type breed)

A similar crossing experiment should be performed also with goats. Therefore the same formula as for sheep can be implemented, only the exotic breeds will be both for the milk and meat as local breed the selected goats will be used.

(iv) Improvement of fertility :

As the low fertility can frustrate all plans for intensification of sheep production the problem of fertility should be examined separately from the genetical and physiological point of view. The genetical relation between the primary sexual characteristics and fertility should be investigated in order that the criteria of fertility for the selection could be improved. This study should be done by collecting the necessary data in the station flocks. The physiological examinations will handle mostly the feeding and the details of management which can influence the fertility of sheep. Additionally also the implementation of hormones for encouragement of fertilization in experimental animals should be tried.

(v) Examination of diseases in animals in connection with the proposed regular disease control programme :

Specimens for coprological examinations should be collected from the animals in different localities of the N.W. Coastal Zone and the regular health survey should be organized as a routine practice of the Veterinary Service. The coprological survey would be particularly important in relation to the parasite control programme and the systematic diagnostic survey in relation to the advanced feeding programmes. By changing the feeding conditions new diseases may appear with increasing frequency, as for instance the disease caused by anaerobes. A careful examination of new diseases as well as the diseases which can appear at increased frequency would be very important.

(vi) Goat cheese production :

As the proposed production of goat cheese is to be absorbed by a market unfamiliar to this product, the initial experiments should aim at trying different renown cheese types. Following these initial trials the technological aspects of the chosen type of cheese have to be worked out in greater detail. It is suggested that the laboratory work will be done in the Alexandria Faculty of Agriculture, whereas the milk for these examinations would be produced in the station flocks.

3 - Forestry and Soil Conservation.

In order to use moreintensivelythe natural resources of the region, to check and to improve the recommendations made on the project as well as to provide more accurate data further investigations and experiments should be carried out along the following lines:

- The effect of windbreaks and shelter-belts for the increase of the yield of different agriculture crops.
- Ecological studies relating especially to soil moisture content on all sites where plans for forestry works should be carried out.
- The proper type of windbreaks, structure, location and orientation for different natural conditions and various kinds of irrigations.
- The suitable tree species which will ensure the maximum protective effect and produce greater quantity of wood, and feed, on various sites and kinds of projects.
- The minimum quantity of water and proper period of irrigation needed to be applied in the first two years for tree plantations on various soils.
- The suitable planting techniques for establishment of trees on dry sites, especially on the plateau.
- The proper techniques for producing the seedlings in nursery of good quality at a low cost.
- Establishment of suitable sizes of mechanical devices for sand dune fixation, and new raw local materials which can replace reeds, with a view to reduce the present cost of sand dunes fixation.
- The growth of wood trees in volume and the yield of fodder shrubs on various sites in order to estimate correctly the expected forestry production in the Zone.
- The wood technological analysis of different species of trees growing in the Zone in order to establish the best utilization.
- Economical investigations in order to provide more accurate data regarding the cost of establishment and quantitative value obtained by forestry works through protection and production.
- The suitable methods to protect forest plantations against animals with low cost.

- The setting up of an experimental Forestry station consisting of an Arboretum and nursery in order to introduce and investigate the growth and development of new species in the region, to produce selected seeds for nurseries and to improve the technique of planting and producing seedlings.
- The establishment of new experimental-demonstrative works on the field for the following kind of works: windbreaks under spreading irrigation, water conservation and terracing projects; fodder shrubs on the plateau and coastal plain; windbreaks on the maritime and inland sand dunes for protection of different fruit trees and range; afforestation of some salt marshes.

4 - Rural Institutions

Following recommendations for further investigations in the field of Land Tenure and Settlement are made :

1 - Carrying out detailed investigations into land and water rights in each area selected for development or settlement or re-settlement purposes with a view to analyse problems relating to acquisition of land, payment of compensations, eviction cases, resolving of land, payment of compensations, eviction cases, resolving conflicting claims, selection of settlers and so on.

2 - Undertaking studies and surveys into various rural and socio-economic aspects of tribal life which will affect the success or failure of Agricultural development and settlement plans, and determining the absorbing capacity of the area for settlement and re-settlement activities.

3 - Studying changes and modifications needed in tribal peoples attitudes, customs, culture and ways of thinking and acting so as to cultivate and develop in them new outlooks, new values, and new norms suited to an age of science and technology preserving at the same time the good characteristics of the tribal system.

4 - Formulation of settlement and lay-out plans for other areas to be selected for settlement or re-settlement purposes, in the future.

5. Recommendations for further investigations in livestock and meat marketing.

Implementation of a market study of the Libyan livestock and meat market. This study should clear the prices in whole sale and retail trade, the price-fluctuation during the year and the price-differences in various parts of the country. During the study contracts with capable Lybian importers could be made. The establishment of an own export agency in Benghazi or another city should be taken into consideration.

The future chief of the livestock and meat marketing branch of the central cooperative should have the possibility of a further adequate in practice training in countries with good marketing installations as all Central, West and North European states have. A fellowship of at least 6 months should be provided for that purpose.

The application of the grading system can be improved by slaughtering and comparing the meat quantity and quality with the before chosen grades of live animals. The graders should attend the slaughter process to correct their knowledge in grading.

The detailed plans for the construction of the plant would generally form the subject of special studies to be made through collaboration of a meat technologist, an architec and an engineer.
It would be advantageous if the architect and the engineer have worked before in the same or a related field. The meat technologist should also have a knowledge of the construction problems. If it is the wish of the U.A.R. Government, the Expert could work on that task at a later period. Otherwise, the help or advice of the FAO Animal Health Branch could be requested to solve the problem in the best way. There are private firms too in many countries who can be engaged as contractor-designers.

Appendix I

ESTIMATED PRESENT CARRYING CAPACITY, AREA AND LIVESTOCK NUMBER AT PROPER STOCKING RATE PER RANGE UNIT IN THE GRAZING DISTRICTS (BASED ON YEAR - ROUND GRAZING)

Range Unit 3)	Area	Feddans	Hectares	Carr. Cap. 1)	No. of sheep equivalents 2)
a.	Sidi Barrani Sheet 4)				
Ib	Haloxylon	5 575	2 230	15	371
IIb	Suaeda	8 150	3 260	10	815
IIIb	Plantago	16 430	6 430	12.5	1 286
IVb	Gymnocarpus S.E.	10 912	4 365	17.5	623
Vb	Anabasis S.	51 900	20 760	25	2 076
b.	Sallum Sheet 4)				
Ia	Haloxylon	3 925	1 570	15	261
IIa	Suaeda	1 875	750	10	187
IIIa	Plantago	14 200	5 680	12.5	1 136
IVa	Gymnocarpus S.E.	7 525	3 010	17.5	430
IVc	Gymnocarpus N.W.	28 200	11 280	20	1 410
Va	Anabasis S.	300 525	120 210	25	12 021
Vc	Anabasis N.	77 475	30 990	22	3 099
VI	Salt Marsh	14 875	5 950	25	595
Total, range without supplements		541 212	216 485	22.2	24 310
Additional capacity from suppl. feeding, 5)					8 508
	Total :	541 212		16.4	32 818

1) Feddans (acres) per sheep equivalent per year. See footnote 1, table 1, Sect. 3.22
2) Number of sheep and goats at the end of the summer; i.e. without culls, lambs and kids exceeding the number needed for replacement. If goats consitute 30% of the total number, the latter can be increased with 6%.
3) Refers to range units on master map of carrying capacity.
4) Refers to sheets of the master map of carrying capacity, based on the 1:100 000 topographical map sheets.
5) Average 57 kg. barley and 114 kg. straw per sheep equivalent per year.

II. Sidi Barrani Grazing District

Range 3) Unit	Area	Feddans	Hectares	Carr. Cap. 1)	No. of sheep equivalents 2)
I	Anabasis area	200 137	80 055	25	8 005
II	Gymnocarpus/Artemisia area S of Bir Hashim	8 800	3 520	17.5	502
III	Gymnocarpus area along railway till Eastern border	112 862	45 145	20	5 643
IV	Plantago area S. of Alam El Hammam	20 687	8 275	17.5	1 182
V	Haloxylon area S. of Wadi Kharuba	19 352	7 740	15	1 290
VI	Suaeda Central area, W. of Abu Mazhut track	64 787	25 915	20	3 229
VII	Suaeda Eastern Area between Abu Mazhut and Bir Hashim tracks	22 437	8 975	17.5	1 282
VIII	Haloxylon area N. of Central Suaeda area	13 950	5 580	20	698
IX	Gymnocarpus (H.Th) of Central Suaeda area	38 025	15 210	10	3 802
X	Haloxylon (Th.As) N. of Western Suaeda area.	15 925	6 370	15	1 062
XI	Plantago belt	119 850	47 940	7.5	15 980
XII	Artemisia belt West	17 300	6 920	17.5	983
XIII	Artemisia belt East	25 062	10 025	7.5	3 342
XIV	Haloxylon belt West	44 600	17 840	15	2 973
XV	Haloxylon belt East	23 325	9 330	17.5	1 332
XVI	Suaeda area Buqbuq	2 650	1 060	7.5	353
XVII	Gymnocarpus Sanyat Sabil	39 037	7 710	17.5	2 230
XVIII	Gymnocarpus S. of Sawani Al Khur	19 275	15 615	10	1 927
Total, range without supplements :		808 065	323 225	14.4	55 816
Additional capacity from suppl. feeding, 5)					19 535
	Total :	808 065	323 225	10.7	75 351

III. El Negeila Grazing district

Unit 3)	Area	Feddans	Hectares	Carr. Cap. 1)	No. of sheep equivalents 2)
a.	Sidi Barrani Sheet 4)	37 400	14 960	22	1 700
Ia.	Anabasis area	37 400	14 960	22	1 700
Va.	Gymn./Art. area	40 500	16 200	17.5	2 314
VIa.	Gymn./Th. area	17 812	7 125	20	890
[illegible]	Suaeda area N.W.	39 712	15 885	15	2 647
[illegible]	Suaeda area N.E.	2 150	860	25	86
VIIIa.	Gymnocarpus area N.W.	4 837	1 935	15	322
b.	[illegible] Matruh Sheet 4)				
Ib.	Anabasis area	194 600	77 840	22	9 730
II.	Suaeda area S.	76 075	30 430	15	5 071
[illegible]	Suaeda area N.E.	48 475	19 390	25	1 939
IVb.	Suaeda area N.W.	5 575	2 230	17.5	318
Vb.	Gymnoc./Art. area	2 450	980	17.5	140
VIb.	Gymn/Th. area	3 300	1 320	20	165
[illegible]	Heloxylon area	89 825	35 930	20	4 491
VIIIb.	Gymnoc. area North	60 875	24 350	15	4 058
IIc.	Gymnoc. area N.E.	21 087	8 435	25	843
Total, range without supplements		644 673	527 870	18.5	34 714
Additional capacity from suppl. feeding, 5)					12 150
	Total :	644 673	257 870	13.7	46 864

V. Fuka (Daba West) Grazing District

Range Unit 3)	Area	Feddans	Hectares	Carr. Cap. 1)	No. of sheep equivalents 2)
I.	Anabasis area South	100 600	40 240	25	4 024
II.	Anabasis area North	69 300	27 720	20	3 465
III.	Foothill area Fuka basin and Arad area	30 800	12 320	15	2 053
IV.	Artemisia area, and Fuka basin	104 775	41 910	10	10 477
V.	N.W. Coastal Area	9 825	3 930	20	4 912
VI.	N.E. Coastal Area	31 000	12 400	17.5	1 770
Total, range without supplements		346 300	138 520	12.9	26 701
Additional capacity from suppl. feeding, 5)					9 345
	Total :	346 300	138 520	9.6	36 046

VI. Daba East Area

Range Unit 3)	Area	Feddans	Hectares	Carr. Cap. 1)	No. of sheep equivalents 2)
I.	Coastal Zone West	59 100	23 640	17.5	3 377
II.	Artemisia/Plantago belt	102 600	41 040	10	10 260
III.	Artemisia/Anab. area	66 025	26 410	15	4 401
IV.	Anabasis (Art.) area S.	73 250	29 300	25	2 930
V.	Anabasis/Gymnocarpus area	8 800	3 520	22	400
VI.	Coastal Zone East.	15 300	6 120	20	765
Total, range without supplements		325 075	130 030	14.7	22 133
Additional capacity due to supplement feeding 5)					7 746
	Total :	325 075	130 030	10.9	29 879

VII. Burg El Arab Sector

(including the part on the Daba-El Alamein Sheet)

Range Unit 3)	Area	Feddans	Hectares	Carr. Cap. 1)	No. of sheep equivalents 2)
I.	Salt marsh N.W.	36 325	14 530	20	1 816
II.	Salsola tetr./art.(Alamein N.)	30 775	12 310	15	2 051
III.	Artemisia/Anabasis belt	126 600	50 640	22	5 754
IV.	Anabasis area (Alamein S.)	51 550	20 620	25	2 062
V.	Central Artem./Plant. area	150 275	60 110	12.5	12 022
VI.	Salt marsh N.E.	35 175	14 070	25	1 407
VII.	Noea/Sals. Central East area	79 200	31 080	20	3 960
Total, range without supplements, Burg El Arab:		509 900	203 360	17.5	29 072
Additional capacity due to supplement feeding and 2 months migration outside the range					22 231
Total capacity, Burg El Arab Sector:		509 900	203 360	9.9	51 303

IV. Mersa Matruh Grazing District

Range Unit 3)	Area	Feddans	Hectares	Carr. Cap. 1)	No. of sheep equivalents 2)
a.	Mersa Matruh Sheet 4)				
Ia.	Anabasis area South	149 900	59 960	25.5	5 996
IIa.	Anabasis area North	46 300	18 520	17.5	2 645
IIIa.	Gebel Shaquqa and Matruh plains	34 975	13 990	25	1 399
IVa.	Coastal Suaeda area	29 575	11 830	20	1 478
Va.	Gymnocarpus area Garawla escarpment slopes	47 925	19 170	15	3 195
b.	Ras El Hekma Sheet 4)				
Ib.	Anabasis area South	89 050	35 620	25.5	3 562
IIb.	Anabasis area North	30 875	12 350	20	1 543
IIIb.	Coastal Zone	54 625	21 850	20	2 731
Vb.	Artemisia area	98 665	39 510	15	6 585
Total, range without supplements		582 000	232 800	19.9	29 034
Additional capacity from suppl. feeding, 5)					10 197
	Total :	582 000	232 800	14.7	39 331

Appendix II

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