Some problems of economic geography in Northern tripolitania: a study of agriculture and irrigation on the Jefara plain

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PART ONE cont'd

SECTION IV

TREE CROPS

CHAPTER 10

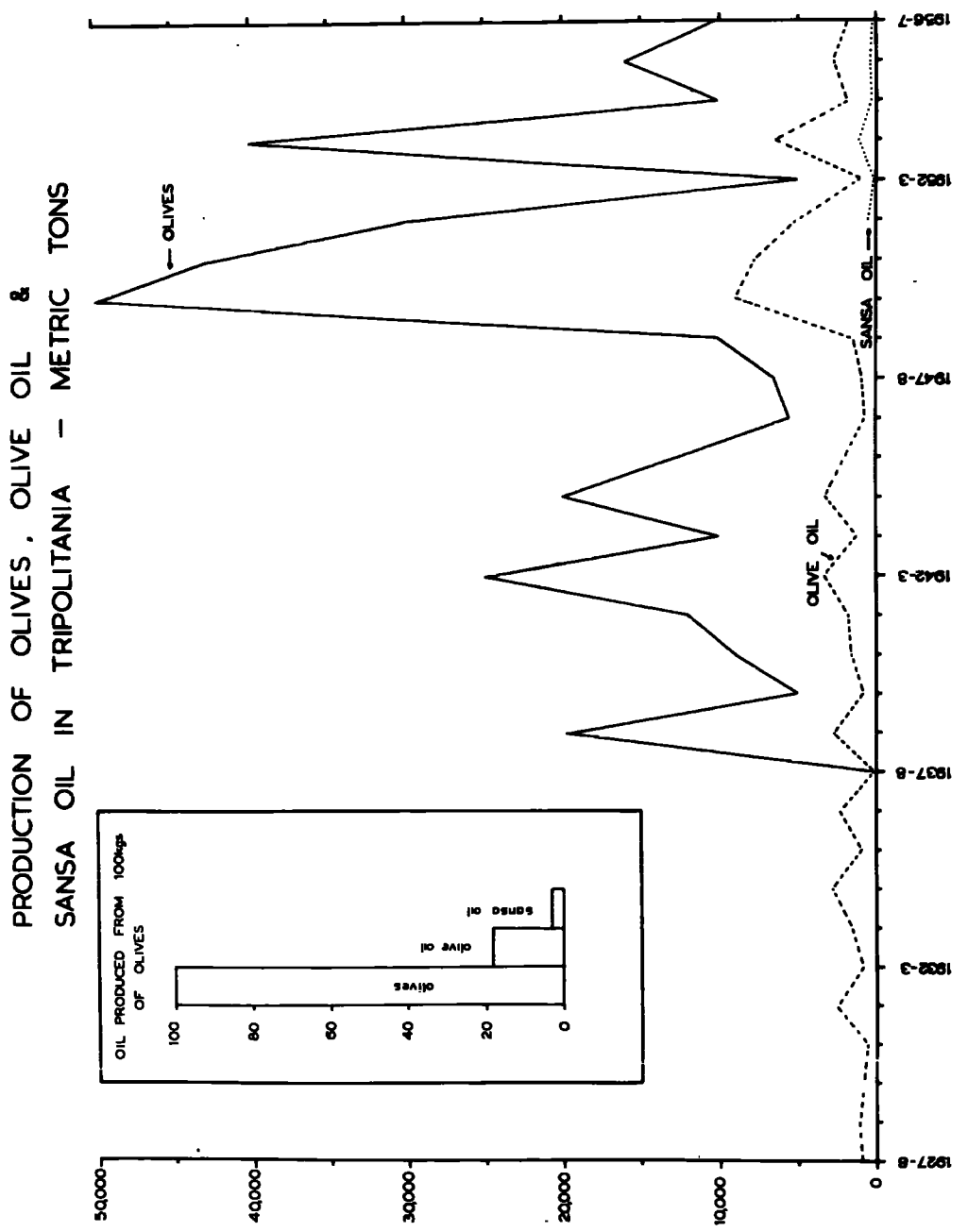
The Olive: dry or irrigated ?

A. Introduction.

The olive tree has a limited distribution in the world and is confined almost entirely to countries bordering the Mediterranean Sea. It thrives in areas which have relatively mild, moist winters and hot dry summers, but it will tolerate a little frost, although temperatures below 14°F. can have disastrous effects on the tree's growth. The 57°F. annual isotherm coincides approximately with the limit of olive cultivation. Cold winds and late frosts in spring may reduce yields. The water needs of the olive are small compared with most trees and cultivation is possible in areas which in some years receive as little as 6" of rain, provided that the average annual rainfall is 10-12". The best quality fruits are produced by trees growing on moderately fertile soils such as are found in many of the Mediterranean countries like Spain, Italy and Tunisia.

Olive trees have been grown in Tripolitania for at least 2,000 years and the existence of some 600 ruined olive-presses in the Jebel is evidence that the Romans produced olive oil in quantity. The tree lives to a great age and some old trees in the Jebel and the Wadi Beni Ulid may even date from Roman times. With cereal cultivation, the production of olive oil was the economic foundation of Roman settlement. In more recent years the olive has again returned to prominence, because, in the earlier phases, much of the Italian agricultural colonisation was dependant entirely on the planting of olives and the ultimate production of

Figure 28.


PRODUCTION OF OLIVES, OLIVE OIL &
SANSA OIL IN TRIPOLITANIA - METRIC TONS
OLIVES
OLIVE OIL
SANSA OIL
50,000
40,000
30,000
20,000
10,000
0
1927-8
1932-3
1937-8
1942-3
1947-8
1952-3
1956-7
OIL PRODUCED FROM 100kgs OF OLIVES
olives
olive oil
sansa oil
100
80
60
40
20
0

olive oil.

B . Number and Distribution of olive trees.

In order to fully appreciate the significance of the olive in the Libyan economy, and at the same time be aware of the importance of the Jefara Plain as a producing region, it is necessary to consider briefly olive cultivation throughout the whole of Tripolitania.

The number of olive trees in Tripolitania has grown considerably in the past 50 years (see fig. 23a and Appendix **VIb**). In 1910 there were about half a million Arab trees, nearly all of which were mature. The number of trees had remained fairly static under the Turkish regime but the arrival of the Italians brought radical changes. In 1920 there were no Italian owned olives but by 1925 the Italians had planted 680,000 trees (fig. 23b): this figure rose to 1,342,000 in 1933 and reached a peak about 1944 at 2,411,000. Since 1944 there has been a decline in the number of Italian trees. The figures for the total number of olive trees show a similar trend, reaching a peak of 3,381,000 in 1944, declining to 2,607,593 in 1933 and rallying to 3,000,000 in 1955. The number of Libyan owned trees has shown a steady but small increase from 1910 to 1944, followed by a slight decline. The ownership of olive trees in 1953 was as follows:-

Private Italian	51.3%
Libyan	31.8%
Demographic Italian	17.1%

In 1910 unproductive trees in Tripolitania made up only 10% of the total number of trees, but by 1931 this had increased to

50% and eventually reached a maximum of 66% in the late 1930's: in 1955 the number of unproductive trees had declined to 53% and in 1958 it was even lower. Today, however, there are probably still 1,500,000 immature trees in Tripolitania, consisting of 57% on Italian Concession and Libyan hawāza farms, 28% on Italian Demographic farms and 15% on Libyan sanīya farms. At present the total number of olive trees is still about 3,000,000, although Robb thinks that a figure of 5,500,000 is attainable in the future (20).

Analysing the distribution of olive trees throughout the provinces, two interesting facts emerge. Firstly Tripoli and Western Provinces have just over half (53.3%) of all the olive trees in Tripolitania, and secondly, the same two provinces have 62.5% of all the immature olives in Tripolitania:-

Table 10.1 Distribution of olive trees by province 1955.

Tripoli and Western Province 53.34% (33.34% productive plus 20% unproductive).

Eastern Province 36.66% (20% productive plus 16.6% unproductive).

Central Province 10% (6.7% productive plus 3.3% unproductive).

The figures for Tripoli and Western Province are minimal for the Jefara Plain, for they do not include trees at Gasr Khiar or Ghanima. The Jefara Plain has more olive trees than any other region and even though a large number of these are immature, it still succeeds in providing 30-40% of the oil produced in an average or fairly good year and up to 80% in drought years. When all the trees come into full production the Jefara Plain should be able to produce, on average over a period of years, 50-60% of Tripolitania's olive oil.

In Tripolitania it is difficult to find out how much land is devoted to olive cultivation. This is mainly due to the practical difficulties involved: in the oases the olive tree is scattered irregularly amongst other fruit trees and crops; in the Dune Jefara it is often interplanted with almonds and associated with the interculture of a cereal crop in the winter and groundnuts in the summer. The only figure# that seems to be available is that of 250,000 ha., given by Robb (20).

C. Varieties of olives grown; life-cycle and methods of cultivation.

The olive tree is grown under varied conditions in Tripolitania: on the sanīya farm in the coastal oases; on the larger hawāza farms in the sandy Dune Jefara; in the Jebel and along the pre-desert wadis of the Cretaceous dip-slope. At one time, except for haphazard watering in the coastal zone, the olive was a completely dryland crop, but during recent years the number of trees being irrigated on the Jefara Plain has steadily increased. The olive trees can be sub-divided into three main groups:-

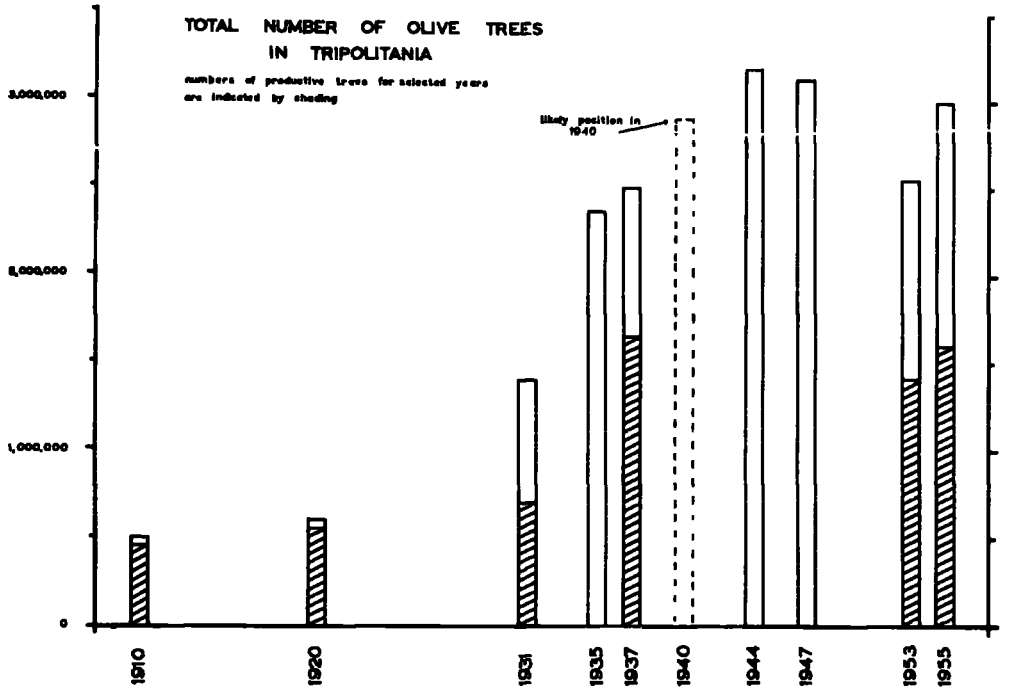
a. Indigenous.
b. Tunisian.
c. Italian.

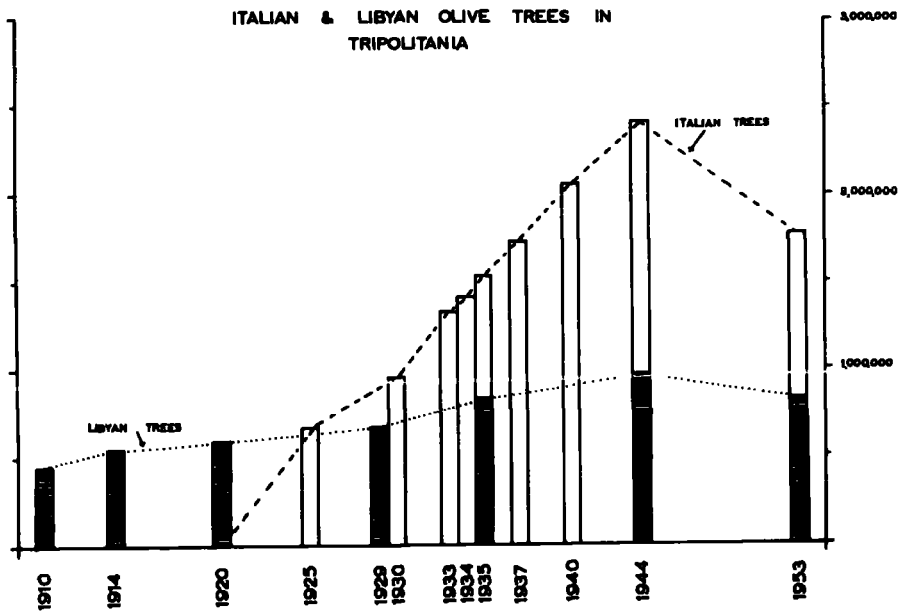
The indigenous varieties may have been introduced by the Romans, but since no research work has been carried out on this problem, it would be wiser to refer to them as local. The main local varieties are Induri, Gargashi, Gariani, Rasli, Hammudi, Grushi, Laghiani and Telfahi. However, there are numerous other varieties growing in the Jebel which usually take the name of the district where they are growing, e.g. Kussabat.

The Tunisian olive is represented by one variety, the Shemlali from Sfax in Tunisia. It is increasing in importance each year and is found both on the plain and in the Jebel. The Italian olive is represented by four main varieties: Frantoio, Moraiolo and Leccino, which originate in Tuscany, and the Coratina, which has its home in Apulia and Sicily.

Little is known about the characteristics of many of the local olives and there is scope for a considerable amount of research work. Marroni (10) points out the need for the identification of olive tree varieties in Tripolitania in various localities and for making recommendations based on their productivity, yield of oil, normal resistance against pests etc., as well as their characteristics concerning allogamy and autogamy'.

The olive usually flowers in March, fruits in April and is ready for harvest from October onwards; in the Jebel, however, harvesting may continue even into January. The olive is usually propagated by agamic means and rarely by seed. Native cultivation is still very primitive; the Libyan places an olive cutting at the bottom of a hole about 3' deep and them fills up the hole with soil as the cutting gradually grows up to ground level. By using this method the tree is firmly established and bears fruit at an earlier stage than trees raised from seed. Many of the local farmers still harvest the olive fruit by knocking or shaking the tree. Italian methods of cultivation are much less primitive: harvesting is carried out by hand picking, and pruning has been widely adopted; furthermore, fertilizers are being used more


TOTAL NUMBER OF OLIVE TREES IN TRIPOLITANIA
numbers of productive trees for selected years are indicated by shading
likely position in 1940
3,000,000
2,000,000
1,000,000
0
1910
1920
1931
1935
1937
1940
1944
1947
1953
1955


ITALIAN & LIBYAN OLIVE TREES IN TRIPOLITANIA
ITALIAN TREES
LIBYAN TREES
3,000,000
2,000,000
1,000,000
1910
1914
1920
1925
1929
1930
1933
1934
1935
1937
1940
1944
1953

extensively. Both Libyan and Italian farmers practise clean cultivation of two to three ploughings or discings in winter and spring, thus destroying weeds that would otherwise consume valuable moisture, and at the same time preventing capillary action in the soil. G.B. Mazzocchi, the F.A.O. horticulturalist, propagates olives by planting stump cuttings (ovules) and branch cuttings.

D. General résumée of olive cultivation in each province, with special reference to Tripoli and Western Province.

Eastern Province is predominantly an area of dryland olive cultivation and production naturally varies with seasonal conditions. The main varieties are Gargashi, Rasli, and Frantoio, which together yield about 15-18% oil. In coastal areas the olive is confined largely to the Italian farms, where it is widely spaced in plantation form. In the eastern Jebel the olives round Kussabat are Libyan owned and are irregularly distributed. Large Italian plantations are evident again at Tarhuna.

In Central Province there are no large plantations covering many hectares, but instead the old, stately, Libyan olives are scattered irregularly over the Jebel in a search for moisture. Of necessity all olive cultivation in this region is dry and the trees therefore abound in the wadis and depressions. Although the old tree yields well in good years, production fluctuates from year to year, as droughts are not infrequent. The main varieties are Ghariani, Grushi and Shemlali, and they give high oil yields of about 20%.

The Jefara (Tripoli and Western Province) is the most important olive growing area in Tripolitania. It has the largest

number of trees and very soon will be the leading olive oil producer. Generally speaking conditions along the coast, both climatically and edaphically are more favourable than anywhere else. The tree likes the light sandy, porous, surface soils, which are capable of absorbing heavy precipitation. Furthermore, the presence of a cemented layer, some metres below the surface, is useful to prevent the water from percolating too quickly beyond the reach of the olive roots; this hardpan is not completely impervious and does not prevent root development, which in the case of the olive, may be up to 15 metres underground. The coastal zone of the Jefara has the moderating effect of the sea during the hot summers, and coastal olives do not suffer the Ghibli in its most devastating form. But the olive growers still have their problems. The September rains, which are the most valuable because they help to provide a good amount of oil in the fruit, are unreliable and infrequent, and the most copious rains come in November and December. These latter rains have a harmful effect since the oil is unnecessarily diluted. Occasionally the autumn rains fall early and because temperatures are still very high there is an out-of-season blossom and fructification, which can often unbalance a tree for several years.

Local, Tunisian and Italian varieties grow on the Jefara. The local varieties are the most suited to the climate since they are the hardiest trees and fruit more readily; the Telfahi, however, has a tendency not to crop in some years. They are generally limited in distribution to the small coastal sanîya farms, where

they are scattered irregularly over the land, often only 10 metres apart. Trees give a regular harvest of small fruit which yield about 15% of oil. No recent figures for the distribution of local olive trees within the oases are available, but since the number of Libyan owned trees has not changed much over the last 30 years, Ferrara's figures can be used (5) - see Appendix **VIc** . He estimated that in 1932 there were just over 130,000 Arab trees on the Jefara, excluding Gasr Khiar. These today represent only 10% of all olive trees on the plain. Most Libyan trees are found in the oases of Zanzur, Zawia, Sorman and El Menshia; they decrease in number and density in the western oases and also inland at Ben Gashir, Azizia and Gasr Garabulli.

90% of the olives on the Jefara Plain are on Italian Concession Farms, Libyan Hawāza farms and Italian demographic farms. Some of larger concessions may have up to 40,000 trees but the demographic holdings rarely have more than 1,000. All the trees are planted to a regular plan (see plates 21, 22 and 23) and are often intermixed with almonds. The Frantoio, which gives a large, easily harvested pulpy fruit of over 20% oil yield, was formerly by far the most important variety and today still makes up 60% of some plantations. However, in Tripolitania it only seems to bear a good crop once in two or three years. The Coratina olive trees are much less numerous, but so far they appear to give better yields under dry cultivation than the Frantoio. However, as more of the Italian owned plantations come into full production, it becomes quite clear that only along the coast are the Italian varieties vegetating properly and consistently bearing fruit.

The Tunisian Shemlali is increasing rapidly in importance, both on Italian and Libyan farms and most of the recent plantings on the Jefara Plain are of this variety, particularly along the coast. It is a regular bearer of medium sized fruit, which have an oil yield of a little under 20%. A large number of Italian varieties, especially on demographic farms, are being grafted with Shemlali (Farm study 25 is typical).

E. Yields and availability of moisture.

The main factor affecting the yields of olives is the amount of moisture available. Areas with a precipitation below 200 mms. are definitely marginal for olive cultivation, and where the precipitation is below 180 mms. olive cultivation is impossible. In Tunisia, olive oil yields have been measured in relation to the amount of water received by the tree. On irrigated lands which are given 8,000 m3/ha., the oil produced per hectare is about 1,200 kgs.; in Northern Tunisia, where the rainfall is 400-600 mms. the yield is 400-800 kgs., and in the Sfax region, where the rainfall is 200 mms., the yield is 300 kgs. Lewis discovered that olives at Sidi Mesri were being irrigated with 2,400 m3/ha. of water in addition to rainfall.

It is difficult to generalise about yields per tree on the Jefara Plain. Lewis estimates that the average yields for all districts, both Arab and Italian farms, is 29.3 kgs. of olives per irrigated tree and 17.5 kgs. per dry tree. Occasionally large mature trees, under favourable circumstances, may yield up to 75 kgs. of olives. A crop between 25 and 50 kgs. per tree is

considered satisfactory. Yields however fluctuate enormously from year to year. The following figures calculated from statistics supplied by Dott. A. Rompietti, give yields of olives per tree, for INPS settlements, in a dry and wet year:-

Table 10.2 Yields of olives on INPS farms, 1954/5 (dry year) and 1956/7 (wet year) Kgs./tree.

Settlement	1954/5 Dry	1954/5 Irrig.	1956/7 Dry	1956/7 Irrig.
Oliveti	-	7.6	10.02	44.0
Bianchi	0.96	6.26	9.02	10.22
Hashian	2.0	6.485	10.52	20.7
Giordani	-	2.844	9.37	21.2
Micca	5.12	10.18	10.91	17.1
Corradini	0.376	1.515	15.02	40.0

In the dry year, yields of dry cultivated olives were nil in two instances and the rest were all very low; yields of irrigated trees were also low, but nevertheless some were as much as seven times greater than those of dry cultivated trees. In a wet year, yields of dryland olives averaged about 10 kgs. per tree, whereas yields of irrigated trees ranged from 17 to 44 kgs. per tree. Even in wet years yields from dryland olives are poor.

On the Jefara, dryland olives are usually planted 20 x 20 metres or 30 x 30 metres*, and irrigated olives 10 x 10 metres or 10 x 20 metres. If the land is specifically designated for irrigated olives, and trees are planted closely, then there will be approximately four times as many trees per hectare than on land under dryland olives. Yields per irrigated tree are higher, and

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* Combrement (3) recommends that with a rainfall of 160-300 mms. trees should be planted 20-24 metres apart, and with a rainfall of 300-350 mms. 15-16 metres apart.

this, plus the greater density of trees on irrigated land, means that yields per hectare of irrigated olives may be as much as ten times greater than those from a hectare of dryland olives. G.B. Mazzocchi* claims that, with irrigation and the necessary associated application of fertilizers, the olive tree will give yields four times greater than with normal dry cultivation.

Martin (11 p.2) writes "Les cultures modernes ont généralement été faites en sec; il s'agit de plantations groupées en monoculture ou quelquesfois combinées avec des amandiers ou des céréals ... plus rarement on rencontre des oliviers qui profitent des irrigations par pluie artificielle ou canaux d'arrosage practiqués aux sous-cultures d'arachides ou de céréals'. The F.A.O. 1952 report on agriculture⊖ states: "a few of the olive orchards are irrigated but fundamentally olives are grown as a dryland crop. Water is very helpful and even essential in getting young trees started, but after the tree has 3-4 years start, it grows without water in the coastal belt". These descriptions of olive cultivation may have been truein the early 1950's, but today the situation is different. More olive trees are being irrigated and the switch from dry to irrigated cultivation comtinues. Farmers are realising that yields of dryland olives are generally unprofitable in most areas with less than 300 mms. of rainfall. They are also realising that good yields cannot be expected even

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* Personal communication.

⊖ B/90.

with a rainfall of over 350 mms., if vines or winter cereals are grown between the trees. When Lewis[*] submitted his report he concluded that some Italian farmers were irrigating their olives, for he quotes them as applying an average of 1,784 m3/ha. compared with 2,400 given at Sidi Mesri; apparently therefore under-irrigating.

The evidence for this switch to irrigation is abundant. The following table, giving the number of olive trees on the INPS farm settlements in 1954/5, shows that at Oliveti, Bianchi, Hashian and Giordani, there are more irrigated than dryland trees; at Micca only 3,000 more dry than irrigated. Ghanima stands out as completely dry. The latest figures available, which unfortunately are not complete for all settlements, indicate, if anything, a slight increase in numbers irrigated.

Table 10.3 Olive trees on the Italian Settlements (INPS) 1954/5.

Settlement	Dry		Irrigated	
	Total No.	No. Prod.	Total No.	No. Prod.
Oliveti	13,187	7,471	15,336	13,636
Bianchi	13,710	532	18,559	4,134
Hashian	1,566	520	3,860	1,636
Giordani	6,937	72	15,883	1,576
Micca	15,985	41	12,260	1,305
Ghanima	24,509	5,933	325	33

Reference to the farm studies also emphasises the farmers' desire to irrigate olives. It appears that many of the Italian varieties are not yielding at all well as they reach maturity and farmers are either irrigating them or grafting on Shemlali. At

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[*] Lewis, R. 'Irrigated Land-use and Irrigation Report'. L.A.T.A.S. Libya.

Ghanima, which as we have seen from the above table, is a settlement of dryland olive cultivation, grafting or irrigation is being tried. On farm 32, 30 trees have been irrigated and give 50% higher yields; on farm 33, 20 trees have been grafted and on farm 34, 50 trees have been grafted. Olive trees are often irrigated on the ENTE farms at Oliveti and Fonduk Et-Togar - see farm studies 35-40. On farm 41, which is typical of the sanīya farms in the Tripoli oasis, Induri and Laghiani olives receive incidental irrigation when other crops are watered. Most of the INPS farms at Oliveti and Bianchi are either grafting their Italian olives or irrigating them. The farmer in study no. 26 for instance states that all his olives are irrigated and give yields 8 times those from dry olives. Most of the Italian concession farmers round Tripoli, however, at Gargaresh, Gurji, Collina Verde and Tajiura, are neither irrigating nor grafting their Frantoio olives (see farm studies 7-10). At Gasr Ben Gashir (farm study no. 11) some Frantoio olives are partly irrigated. A farmer at El Maia (no.6) thinks that Frantoio olives need irrigating, even when the rainfall is 300 mms. The large concessions tend to remain dry but some olives on farm no. 4 (1,029 ha. farm) are being irrigated; the farmer considering that best results can be achieved with the Frantoio as long as it is irrigated.

Views on the profitability of the olive differ. On buying his farm a few years ago (study no. 3), Gargour found that all the olives were Italian and were not yielding very well. As a result he reduced numbers drastically and grafted the remaining 4000 trees

with Shemlali. Olives were to all intents and purposes abandoned in favour of citrus. Ricotti (study no. 2) has always considered that the olive has no future in Libya and from the outset he has concentrated on citrus. In contrast, on the Mitchell Cotts farm, the management has expressed its confidence in the olive by increasing the number of trees from 10,000 to 20,000. The Frantoio olive has been retained because it produces a good quality fruit, but it is thought essential to irrigate it.

One of the greatest disadvantages of the tree crop, particularly the olive, is the time it takes to reach maturity. Here again the irrigated tree wins. Local varieties of olives yield after 5-6 years if irrigated, but only after 10-12 years if dry; with the Italian varieties, it is 8-10 years and 15-20 years respectively. With irrigation, not only do trees yield more heavily, but they also start yielding at an earlier age. A further advantage of irrigation is that it allows winter and summer field crops to be grown between trees. With the dryland olive it is possible to grow winter cereals or vines between the trees for the first few years but only until the trees start producing.

It would appear that on the Jefara Plain the farmer is likely to reap best returns by retaining the Frantoio olive and irrigating it. One big difficulty is the fact that the Olive Fly (Dacus oleae rossi), which causes severe damage in all Mediterranean areas, seems to attack irrigated Frantoio trees more severely than any other tree. Irrigated Italian Frantoio growing near the coast

are most susceptible to attack. The following samples, which were taken by Martin (11), show how the olive fly prefers to lay its eggs in the large Italian fruits:-

Table 10.4 Percentages of olive trees attacked by the olive fly at Misurata, 1953.

Italian variety	dry	20%
Italian variety	irrigated	100%
Local variety	dry	0%
Local variety	irrigated	6%

The presence of the olive fly grub in the fruit destroys an important part of the pulp and leads to lower yields; furthermore it also triggers off bacterial processes which make the oil acid.

F. The olive oil industry.

1. Production of olives and olive oil. The only production figures available are estimates. The earliest are those of Ferrara (5) but many of these do not agree with those subsequently circulated by the Nazara of Agriculture. For example, for the year 1927 the files of the Nazara of Agriculture record the production of olive oil as 900 metric tons, whereas Ferrara gives a figure of approximately 5,000 tons.

It can be noted first of all that in Tripolitania, the production of olives, olive oil and sansa oil is increasing (see fig. 22 and Appendix VIA a). Taking the period 1928/38 the highest figure for olive oil production is 2,800 metric tons, in the period 1938/48 2,700 metric tons, but in the period 1948/57, 9,000 metric tons. Before and during the last war, the production of olive oil, in a good year, amounted to 2-3,000 metric tons, but more recently a good year will give

5-7,000 metric tons extracted from 30-40,000 metric tons of olives. Many of the Italian owned varieties planted in the late 1930's are now coming into full production. Further reference to figure 22 also shows that the olive crop fluctuates from year to year; for example, in 1951/52 the total production of olives was 30,000 tons, but in the following year it was only 5,000 tons. This variability reflects the predominance of dry cultivation. Total yields in pre-war drought years are lower than total yields of drought years in the post-war period. Prior to the war, olive oil production in Tripolitania dropped below 1,000 metric tons on several occasions and in 1937 was only 37 tons. Since the war, however, there has never been less than 1,000 metric tons produced in any one year. Most of the Italian trees fail to yield in dry years, so the higher yields in recent bad years can only be attributed to an increase in the number of olive trees irrigated.

Figures for olive oil production in the provinces are only available for a few years, the last being 1952. In fair to average years Tripoli and Western Provinces account for approximately 35-40% of the olive oil produced in Tripolitania. In drought years this percentage changes radically, and in 1947 the two provinces on the Jefara produced 811 metric tons out of a total for Tripolitania of 936 metric tons. This share exceeds 85% and is further evidence of the irrigation of olives in this region.

2. . Processing of Olives When the olives are harvested they are taken to presses where the oil is extracted. The

residue, or pulp, which is left after this first pressing, is called sansa. Sansa is also pressed and gives sansa oil. The olive oil produced in Tripolitania is very similar to that which comes from the Gabes and Sfax regions of Tunisia. It is strong, well-flavoured oil, excellent for those consumers who like full bodied oil for salads and cooking purposes (17 p.28). The Italian varieties yield the best quality oil. Yields of oil may vary from 12-25% of the volume of olives pressed, depending on the variety and whether the tree is irrigated or has to rely on rainfall for its moisture supply. Irrigated olives may yield more fruit, but the oil content may be lower.

Most of the oil presses in Tripolitania are old and produce a very acid oil, and generally the quality of the oil is below the standard demanded on the world markets. Four refineries exist in the Tripoli area and their production is consumed locally, largely by the fish canning industry. Most of the major mechanical olive presses are on the Jefara Plain, as is shown by the following table:-

Table 10.5 Distribution of types of olive presses.

Type	Tripolitania	Trip. & West.	East. Prov.	Central Prov
Mechanical	135	77	57	1
Animal	108	29	18	61
Hand	472	7	196	269

There are still a large number of hand presses in Tripolitania. Nearly all the sansa oil is produced by Industrie Riunite Pompeo Gherardi, which owns two out of the three existing factories. The firm extracts some olive oil of its

own, but it has to buy most of its sansa pulp (70%) from the many presses (about 500) throughout Tripolitania. In 1957 the firm bought almost 20,000 tons of sansa. The rate of sansa oil extraction is approximately 8% of the volume of sansa pulp (see fig. 22).

G. Marketing of olives.

Olive oil is one of Libya's principal exports and is likely to become even more important as more trees come into full production and new plantations are made. At the moment production is so variable that in some years exports may be nil. The value of olive oil exports in 1955 was £L417,000, in 1956 only £L61,335 (including sansa oil), but in 1957 it jumped to £L1,170,628.*

Average exports of both olive and sansa oil are steadily increasing as the following table shows:-

Table 10.6 Export of Olive Oil and Sansa Oil. (yearly average)

Period	Olive Oil	Sansa oil
1934-38	300 metric tons (with sansa)	?
1948-50	586 " " " "	?
1950-54	1,228 " "	431 metric tons
1954-57	2,739 " "	1,048 " "

Of the olive oil produced in Tripolitania, about half is consumed locally, about one third is despatched to Cyrenaica, and the rest is exported. Consorzio Agrario usually sells about 30-40% of the oil and the remainder is handled by private firms.

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* United Kingdom of Libya: 'External Trade Statistics'. Central Statistics Office, Ministry of National Economy.

During the period 1946-50 olive oil was bought at an average price of 19 piastres a kilogram, but in 1958 Consorzio was collecting medium quality oil of not more than 3% acidity from the presses, at 16-18 piastres per kilogramme: in the same year Hassan Kassaud, another olive oil exporter, was paying 17 piastres. Prices seem to be dropping slightly. In 1955 the average F.O.B. price of olive oil in Tripoli was £L257 per metric ton, falling to £L240 per metric ton the following year.

Libyan oil is exported in bulk and is often unlabelled and ungraded. Until recently Consorzio has sent nearly all its olive oil to Italy for refining, because no customs duty was payable. Consorzio representatives remark that without Italy, Libya would have difficulty in selling her oil since it has up to 7% acidity. There is no denying the low quality of Libyan oil, for each year high quality oil has to be imported — 40 metric tons in 1954/5. Today the Italian market is not so certain (22). In past years Libya has enjoyed preferential treatment under G.A.T.T., which allowed for the import into Italy of a certain quota of Libyan oil (2,500 metric tons) without payment of duty. Recently the Italian Government decided to introduce a 'Combination Scheme' which stipulates that Italian importers must buy local seed-oil at a fixed price in a given proportion to the quantities of olive oil which they import. In 1957/8 there was a good olive crop in Tripolitania and exports to Italy exceeded the customs free allowance. Libya is now agitating for an import quota of 10,000 metric tons.

Half the sansa oil produced by Industrie Riunite Pompeo Gherardi is used in Tripoli for the manufacture of soap and the like, and the other half is exported to Italy. Italy is near at hand and transport costs are low, and there is no import duty on sansa oil. Pulp is usually bought by Gherardi at 40 piastres a matar of 13 kgs.. In 1957 Sansa oil was sold at 17 piastres a kg., but if the olive crop is poor the oil may fetch 20-22 piastres a kg.

H. Libya and the other world producers of olive oil.

Olive oil is the sixth most important vegetable oil in world trade. It is not likely to increase in importance because with 15%, it has the lowest extraction rate of any of the vegetable oils. The main producers of olive oil in 1956 were as follows:-

Table 10.7 Main olive oil producing countries 1956

Country	Metric tons
Spain	396,000
Italy	170,000
Greece	163,000
Portugal	93,000
Turkey	90,000
Morocco	35,000
Algeria	26,000

In the same year as above Libya (i.e. Tripolitania) only produced 8% of Algeria's total. Trade in olives is almost entirely in the form of oil. The main importer is the United States. The leading exporter used to be Spain but this country has now been ousted from this position by Tunisia as is indicated by the following table:-

Table 10.8 Main exporting countries of olive oil in 1957.

Country	Metric tons
Tunisia	34,000
Spain	22,000
Morocco	20,000
Greece	15,000
Portugal	12,000
Argentina	8,000
Libya	5,500
Algeria	4,000

Even as an olive oil exporter, Libya is not very important and is overshadowed by her western neighbour, Tunisia, which exported nearly seven times more olive oil than Libya in 1957.

Since 1953 there has been a slight decline in world prices of olive oil. The Libyan Government, encouraged by Dr. E.M.Rascovich, believes that olive oil is one of the commodities with the best prospects of earning foreign currency and it is therefore implementing a policy to foster the production and export of olive oil by :-

(a) abolishing export duties,
(b) trying to obtain exemption from Italian import duty with G.A.T.T. approval,
(c) assisting olive growers - loans for equipment such as presses, advice on cultivation, introduction of cooperatives.

I. Summary and Conclusions.

Figures for the production of olives show how sharply yields of this crop can fluctuate from year to year. The olive in Tripolitania is still largely a dryland crop, and it does appear that, although one of the hardiest of tree crops, it suffers just as much in drought years as a field crop such as barley. The higher annual average production of post-war dry years suggests

that a large number of olives are in fact irrigated. In consecutive bad years, the Jefara commands a higher percentage of Tripolitania's olive production than any other area. Even in average years it produces 30-40% of Tripolitania's oil and this is likely to increase to 50-60% as many young trees reach maturity.

Since 1944 there has been a decline in the total number of olive trees in Tripolitania, due mainly to the fall in Italian owned trees; but since 1953 numbers have increased. This decline and revival can be attributed to the fact that between 1944 and 1953, many of the Italian trees, which came into production during that period, gave disappointing yields on the Jefara Plain and were thus destroyed. The Italian varieties of olive give the largest fruit and the best oil yield, but they do not give good yields under dry cultivation. To overcome the problem of poor and infrequent yields, the Italian trees have been either retained and irrigated, or grafted with Shemlali; or have been removed and completely replaced by Shemlali. Some Italian farmers are not sure that the Shemlali is the best graft; others consider the expense involved in purchasing grafts, plus the loss of possible revenue for 3-4 years whilst the graft takes, too great. If water is available it may be more profitable to retain the Frantoio olives and irrigate them, for they yield the best quality oil. Furthermore, it is far easier to obtain loans from banks if the money is to be used for development which includes irrigation.

The Jefara Plain has the largest number of olive trees. Most of these are Italian varieties, which are largely Italian owned and

at the same time immature. Bearing this in mind, it would seem that a further shift to irrigation is inevitable. Some farmers on the plain even consider it essential to water Tunisian olives, a fact suggesting that Tripolitania is a marginal area for olive cultivation. F.A.O. has been propagating olives at Sghedeida and Garrabulli but they have all been Tunisian or local varieties, not Italian.

The olive could become the leading crop in Libya if there is an expansion of dryland olive cultivation in the eastern Jebel associated with the control of soil erosion, and concomitant with this, more irrigation and grafting of olives on the Jefara Plain. Compared with countries like Tunisia, Spain and Italy, Libya is an insignificant producer. All the oil produced is so inferior in quality that it cannot break into the main world markets, and all exports are channelled to Italy, where the oil is further refined. This reliance on one market is dangerous and unhealthy, but until the quality of oil is improved, Libya can only hope that the Italian market remains open to her. The entire olive oil industry needs reorganising; all hand presses listed in table 10.5 should be scrapped and all olives in future should be handled by modern cooperative presses near Tripoli. Since the olive tree takes so long to mature and any changes in the industry are necessarily slow, it is doubtful whether private enterprise will have the enthusiasm for a reorganisation, as it did in the case of groundnuts. The Government must take the lead and make sure that more loans are made available for development purposes.

Is the olive tree still under dry cultivation, or is it being irrigated ? It seems reasonable to conclude that, except in favourable areas round Tripoli, a large percentage of olive plantations on the Jefara Plain are already irrigated and more are likely to be so in the future. Most of the irrigated trees receive only a supplementary type of irrigation.

CHAPTER 11

The steady expansion of citrus.

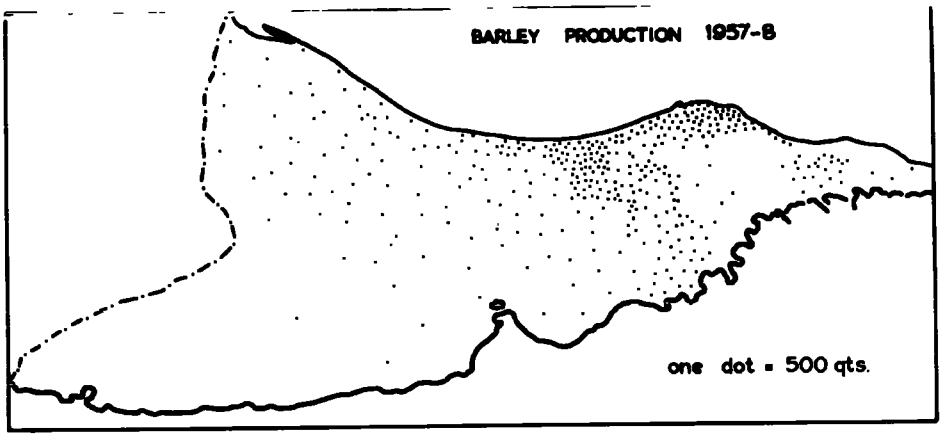
A. Introduction.

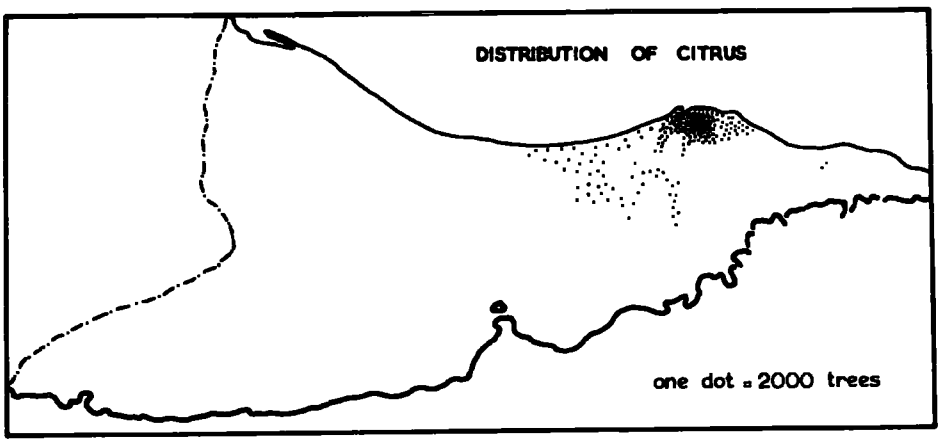
In Tripolitania, citrus, like groundnuts, are almost exclusively confined to the Jefara Plain and 93% of the trees are found in this region, all within the limits of sedentary cultivation. The highest concentration of trees is located round the town of Tripoli, particularly on its southern margins; other areas of importance are Zawia, Sorman, El Maia-Zanzur, Tajiura, Suq el Jiumaa, and the Suani Ben Adem-Ben Gashir district (see fig. 24b and appendix VIIa). The citrus tree is very sensitive and cannot tolerate saline conditions, and its present distribution is mainly within the bounds of the Tyrrhenian deposits where the water from the first and second aquifers is of excellent quality. Little or no citrus are grown in the eastern corner of the Jefara Plain, except on the Variani Concession where artesian water is being used (see chapter 6 and Appendix Vd).

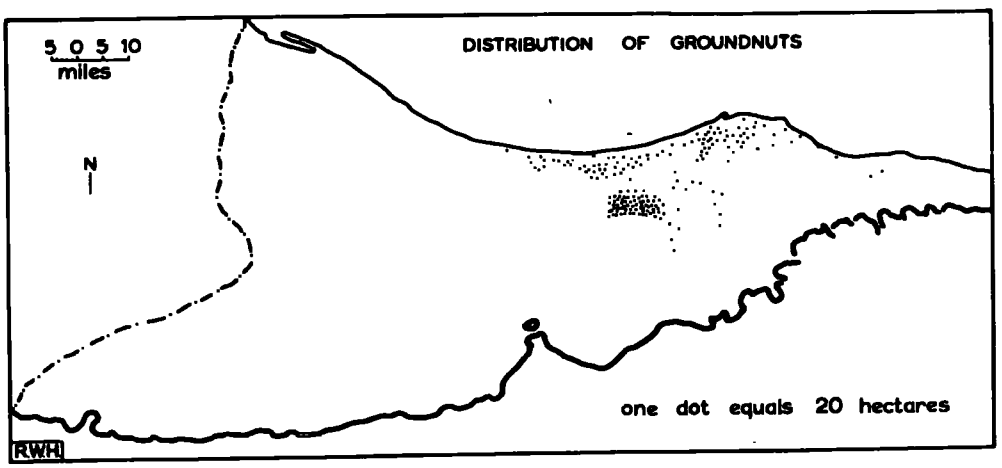
B. Types of citrus cultivation.

Citrus cultivation can be divided into several types according to the kind of farm on which it is found and also the purpose for which the crop is grown.

Citrus cultivation on the Libyan saniya farms is limited to the oases of Tripoli, Tajiura and Gurji, for the water in many of the western oases is too saline. About 20% of the citrus trees on the Jafara Plain are on the saniya farms. All the fruit is grown for local consumption and the citrus tree is scattered


BARLEY PRODUCTION 1957-8
one dot = 500 qts.


DISTRIBUTION OF CITRUS
one dot = 2000 trees


5 0 5 10
miles
N
DISTRIBUTION OF GROUNDNUTS
one dot equals 20 hectares
RWH

around the farm, having to compete in crowded conditions with numerous other trees such as date palms, olives and pomegranates. The number of citrus trees on each farm usually varies from 150-200 (farm study 42 gives 200 trees and the average number of trees on the demographic saniya is 150-200).

Most of the citrus orchards planted by the Italians before the last war were to satisfy home demands only and there was no real attempt to develop citrus in Tripolitania on a commercial basis. A small area of ¼-4 ha. in size was selected near the farm house and was enclosed by wind-break trees such as tamarix cupressus, eucalypts and casuarina. Inside this enclosed area, citrus trees, mainly oranges, were planted 3-4 metres apart (density of about 400/ha.). Examples of these small citrus orchards, which in 1939 contained about 30% of all Jefaran trees, can be seen from the air in plate 21, and also noted in farm studies 4, 5, 7 and 8. Naturally, most of the Libyan hawāza farms have small areas of citrus because as we have noted before, many of them are former Italian concessions. When water is available for irrigation most of the Italian demographic farms also have small citrus orchards, with the number of trees rarely exceeding 400.

There are, however, quite a number of specialised citrus farms on the Jefara Plain, which together account for at least 50% of all Jefaran trees. A few of the Italians, who took over private concessions before the war, decided that Tripolitania had distinct possibilities as a citrus growing country, and therefore

they devoted the whole of their farms to this crop. Some of the farms were nothing more than small orchards. Eugenio Finocchiaro, one of the leading citrus exporters in Tripoli, owns one of the small orchards, just south of Tripoli: this is only 10 ha. in size and was developed on Sicilian lines with the trees closely spaced, and irrigated by means of jedawl and small canals (as in plate 14).

Occasionally areas up to 50 and 100 ha. were developed for citrus production on some Italian concessions. One of the best examples of these is the Ricotti-Prina Orchard, which is described in farm study no. 2. The farm is 600 ha. in total area but one third of this represents unusable land; of the remaining 400 ha., 100 are under citrus and 300 under eucalypts. What is now called the 'old orchard' was planted to citrus before the war, with trees closely spaced in the Sicilian style. A few years ago Ricotti decided that citrus cultivation was likely to become more and more profitable and so he planted another 50 ha. of oranges and lemons; this time he used what he calls the American system with trees 3.5 metres apart and rows 6 metres apart. On his farm there are altogether 40,000 oranges (mainly Moro blood oranges), 7,000 tangerines, and a few lemons and grapefruit.

Gargour's farm at Tajiura (study no. 3) represents the most specialised and most modern of citrus orchards in Tripolitania and his recent plantings of trees have not been equalled by any other farmer. Gargour et Fils is a trading company of Palestinian Arabs who used to own citrus orchards in Palestine and export fruit from Jaffa to Western Europe. With the establishment of the

Jewish State they became refugees and they are now employing their talents in Libya both as citrus producers and traders.* The Gargour farm has 125 ha. under citrus and in the last few years about 60,000 trees, mainly oranges and lemons, have been planted. When all the trees come into full production citrus will be exported continuously from October until April.

Today, a few concessions are turning to citrus; the farmer of farm study no. 8 for instance, intends to develop 40 ha. of his farm at Gurji for this crop.

C. Varieties and Life-cycle.

The orange is the most important citrus tree, with the others, in order of importance, being lemon, tangerine and grapefruit.

There are many varieties of oranges and Rascovich (13) maintains that with local ones included, the total number approaches 100. The most important varieties are: Washington Navel, Toro and Tarocco (Sicilian). Tajiura Lin Demmi (local), Portugal, Doppio (blood), Late Valencia (Spanish) and Taffa, Callabria and Sucaro (Italian). The main varieties of lemons are: Locale, Commune, Peretto and Lunario (Sicilian), and Interdonato. Tangerines are represented by Avana, Sanguino, Clementina (hybrid tangerine-orange), Locale, Palermo and Sessima. Grapefruit varieties are limited almost entirely to Duncan and Marsh's Seedless.

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* A list of the principal exporting companies in Tripoli is given in a booklet entitled 'Libyan Commercial Information', produced by the Ministry of National Economy, United Kingdom of Libya, 1957.

Citrus trees flower in the period February - March, and the fruit is ready for harvest between October and April, depending on the type and variety of fruit. The most important varieties of oranges are sub-divided as follows:-

Early maturers:	Washington Navel: Late October to November. Toro: November - December, Portugal: December. Tarocco: December - January.
Main crop:	Demmi Tajiura: usually ready January - February although the fruit can be left on the tree until April.
Late maturer:	Late Valencia: this closes the season in March and April and supplies local summer demand.

D. Cultivation.

Citrus are usually propagated by grafting. The required variety of sweet citrus is grafted on to a bitter rootstock, which has been grown from seed. Many of the local Libyan farmers, however, use suckers for propagation. Like all trees on the small Libyan swani, citrus are planted very closely and are often as little as 3 metres apart. Most of the Italian trees are planted 4 metres apart and in 1939 Parrini (12) pointed out that this was too close, for he realised that with a 3 or 4 metres spacing, trees would be hopelessly overcrowded after 12-15 years. For oranges and grapefruits he recommended a 5-7 metres spacing, for lemons 7-10 metres and for tangerines 4-5 metres. The usual spacing in metres at present evident at Sidi Mesri is:-

Oranges	6 x 6 and 7 x 7 - depending on variety.
Lemons	8 x 8 and 9 x 9.
Tangerines	5 x 5
Grapefruit	7 x 7.

Mazzocchi* still considers that the trees at Sidi Mesri are too close and he maintains that oranges should be given a spacing of at least 8 metres, and lemons of at least 10 metres.

The fruit trees need attention during the winter and spring when they should be manured and the land between them ploughed. At Sidi Mesri, 200 qts. of organic manure is given one year and then in the following year 4 qts. of sulphate of ammonia, 12 qts. of superphosphate, and 4 qts. of sulphate of potash. The trees also need spraying in the winter and irrigating in the summer. The land is usually ploughed in the winter only, because in the summer the soil is moulded into squares and channels for distributing irrigation water (unless sprinklers are employed). Many citrus groves have their trees so closely spaced that only hand cultivation is possible.

E. Irrigation: Yields.

How much water does the citrus tree need ? In California, Hume considers that the tree needs between 8,750 and 11,250 m3/ha. (6). Table 4.14 suggests an actual irrigation need in Tripolitania of 6,278 m3/ha., but a requirement of 11,000 m3/ha. allowing for a 60% efficiency of water distribution, which is approximately that pertaining to canal irrigation of the type found on most farms. Mazzocchi has very definite views about the amount of water needed by citrus trees. According to him 14 irrigations are essential in the period April to October, and 8 in the period November to March. If canal irrigation is employed 800 m3/ha.

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* Personal communication.

should be given at each irrigation, making a total amount for the year of 12-14,000 m3/ha. - slightly more than the theoretical calculation given in table 4.14. With canals, he considers that trees need irrigating every 12-14 days, but with sprinklers every 10 days. However, only 400 m3/ha. is needed when the latter method is used, making a total for the year of only 9,000 m3/ha.

Bearing these facts in mind it is doubtful if the trees at Sidi Mesri are being given enough water. It was reported, on visiting the farm, that the trees are irrigated every 10-12 days in the summer, following the cessation of the rains in April, probably about 15 irrigations in all. Each irrigation is 300 m3/ha. so that the total amount given is approximately 4,500 m3/ha., which is well below the theoretical figure and that given by Mazzocchi. Either the trees are given insufficient water or the information collected is inaccurate.

According to Parrini (12), the Libyan farmer starts to irrigate after the fruit has set in the second summer month and applies water every 6-8 days; the Italian farmer gives 10-12 irrigations a year. Lewis averaged the number of irrigations on Italian farms at 21, each of 460 m3/ha., making a total of 9,660 m3/ha.; on Libyan farms he estimated 23 irrigations of 269 m3/ha., giving a total of 6,187 m3/ha.

Samples of irrigation rates in farm studies are:-

Table 11.1 Irrigation of Citrus.

Farm Study Number	No. of irrigations.	Amount per irrigation m3/ha.	Total quantity applied m3/ha.
4	12	400	4,800
5	12	300	3,600
7	12	400	4,800
8	12	500	6,000
38	20	400	8,000
40	22	400	8,800

Furthermore, farmer no. 25, who is not included above, gives 25 m3 per year to each tree and assuming 400 trees per ha. the total amount given is probably 10,000 m3/ha. Gargour gives his young trees 60 m3 a day, that is about 9-10,000 m3/ha. per year; Ricotti is probably applying less, 6-7,000 m3/ha. It thus appears that many of the citrus groves are receiving insufficient water.

Little information is available on yields, but according to Ricotti a good tree will yield 100 kgs. a year; his own trees yield on average 50 kgs., a figure which he considers satisfactory. Yields from most citrus groves are, however, far below this. Lewis found that the average on all farms on the Jefara Plain was 37.25 qts./ha., whereas Ricotti's trees are yielding something like 200 qts./ha. Lewis also discovered that the highest yields were on Italian farms in the Tripoli area, but even then only 80 qts./ha. were harvested; yields on Libyan farms were even lower. It is clear that most of the orchards are badly managed, under-irrigated, under-fertilized, and altogether given either insufficient or the wrong attention. When Gargour took over his farm in 1953, at that time a typical example of an Italian concession citrus orchard, the trees were in a poor state, and the total yield from

2,500 trees was only 400 qts., i.e. 16 kgs. per tree. In 1957 Gargour had improved the yield of these trees to 3,000 qts., i.e. 120 kgs. per tree, but he still was dissatisfied. On the Jefara Plain the bad management of orchards, the Mediterranean Fly and Cochineal pests, and a deficiency disease, are keeping yields extremely low.

F. Statistical analysis of citrus cultivation.

The production of citrus is steadily increasing, as is evident in Table 11.2 below. Up to 1944 the total production of citrus did not exceed 3,000 metric tons in any one year. Between 1945 and 1950 it did not exceed 5,500 metric tons, but in the last four years production has averaged approximately 7,300 metric tons per annum. The biggest increase in production has been in oranges.

Table 11.2 Production of Citrus in Tripolitania. (metric tons)

Year	Oranges	Lemons	Tangerines	Grapefruit	Total
1937	1,370	669	246	-	2,285
1938	?	?	?	-	?
1939	800	500	200	-	1,500
1940	1,100	600	300	-	2,000
1941	1,500	600	400	-	2,600
1942	2,000	650	350	-	3,000
1943	1,250	500	250	-	2,000
1944	1,600	600	300	-	2,500
1945	1,900	700	400	-	3,000
1946	2,800	700	500	-	4,000
1947	3,150	750	600	-	4,500
1948	1,300	500	200	-	2,000
1949	4,000	700	800	-	5,500
1950	3,500	600	700	-	4,800
1951	4,000	700	1,030	-	5,730
1952	1,600	320	110	-	2,030
1953/4	3,500	600	400	100	4,600
1954/5	5,700	1,200	600	170	7,670
1955/6	5,900	1,100	650	200	7,850
1956/7	4,300	950	400	200	5,650
1957/8	6,000	1,000	800	200	8,000

In the late 1940's and early 1950's there was a big increase in the plantings of citrus and it has been estimated that the trees planted 1948-53 equalled those actually on the farms in 1945. The trees which were planted during this period are now coming into production.

The area of land under citrus is still expanding and between 1953/4 and 1957/8 that devoted to oranges increased by 45%, to lemons by 25.3%, to tangerines by 10.8% and to grapefruit by 22.2%. Orange trees are the most favoured.

Table 11.3 The area and number of citrus trees in Tripolitania 1953/4, 1956/7 and 1957/8.

Year	Oranges		Lemons		Tangerines		Grapefruit	
	ha.	trees	ha.	trees	ha.	trees	ha.	trees
1953/4	642	321,000	142	65,000	107	53,000	18	4,500
1956/7	900	450,000	180	75,000	120	57,000	22	5,800
1957/8[x]	930	462,000	190	78,000	120	57,000	22	5,800

[x] estimate

G. Prices.

Citrus are usually bought on the trees. The exporter will visit an orchard and estimate the quantity and quality of the crop, and then offer a price. Finocchiaro usually pays 2-3 piastres a kilogram and the following are his prices for the 1957/8 crop:-

Demmi oranges	3-3.5	piastres	per kg.
Portugal	2.5	"	" "
Navel	4-4.5	"	" "

Prices vary with the variety and quality of the fruit and the time of harvest. Ricotti sold his 1956/7 crop of about 8,000 qts. on the tree, for £L18,000 (about 2.25 piastres per kg.). Gargour's 1957/8 crop of 7,000 qts. probably realised £L7,500. The

estimated average price paid to farmers in the period 1946-50 is 1.6 piastres per kg. for oranges and 0.7 piastres for lemons; obviously citrus cultivation has become more profitable and today it probably accounts for at least 10% of total income on many Italian farms, although generally less than 5% on most Libyan farms.

H. Marketing.

Citrus are now becoming a significant export and should increase in importance because the export of groundnuts seems to be declining. The local consumption of citrus is steady at about 2,500 metric tons of oranges and 1,000 metric tons of other fruits, much of this being consumed in Tripoli, although a certain amount is sent by road to Cyrenaica. All the production over and above internal consumption is available for export, so that in the last few years, with production around 7,300 metric tons, the quantity available for export has been 3-3,500 metric tons.

The export of citrus in 1936 was only 33.7 metric tons, rising to 2,500 metric tons in 1950; today it is in the region of 3,500 metric toms, as was anticipated above:-

Table 11.4 Citrus exports from Tripolitania (metric tons)

Year	Tangerines	Oranges	Lemons	Grapefruit	Total
1953/4	90	2,993	47	36	3,166
1954/5	274	3,178	227	66	3,745
1955/6	90	3,115	280	27	3,512
1956/7	62	1,179	146	54	1,981
1957/8	210	3,240	117	59	3,629

The export of citrus each year has a definite cycle; oranges leave the country from October to May, lemons and grapefruit from

September to February, and tangerines from October to March (see Appendix VIIe).

In recent years there has been a reorganisation of the citrus trade in an attempt to break into the Western European markets. For this purpose technical rules were laid down for the citrus exporters (17). Fruit may be exported in three qualities: extra, standard and mercantile. However, exports of the first two qualities are only permissible if they are of the following varieties: Washington Navel, Oval Blonde (Portugal), Tarocco, Demmi Tajiura and Late Valencia. Varieties of sweet oranges which are not mentioned in this list may be exported as mercantile; only extra quality may be exported to Europe. These measures, which have been introduced to improve the quality of exports, are having some effect and Tripolitania is at last breaking into the European market. Prior to 1953/4 no citrus was exported to Europe, but in that year a small consignment of 30 tons was shipped, followed by 266 metric tons in 1954/5 and 519 metric tons in 1955/6.

Table 11.5 Destination of Citrus Exports 1956/7
(metric tons)

Country	Oranges	Lemons	Tangerines	Grapefruit
Malta	1,600	30	44	55
Germany	100	110	12	-
Italy	50	10	4	-
U.K.	?	?	?	?

The bulk of the exports is still mercantile and is going to Malta, but some exporters, such as Citexco (U.K.) Ltd. and Eugenio Finocchiaro, are sending small quantities of fruit to Britain. Finocchiaro exports citrus in 30 kgs. cases to England, Germany and Switzerland. Of his 1957/8 export, Germany took 2,800 cases

of oranges, United Kingdom 850, and Switzerland 400. In the same period he also sent 510 cases of grapefruit to Europe. He ships to London, Liverpool and Hamburg on a commission basis and his C.I.F. prices in European ports are usually £L50-£L80 per metric ton. Malta takes most of his poor quality fruit, unwrapped in 10-12 kg. boxes, at about £L25 per metric ton.

G. Conclusions.

In 1939 Parrini (12 p.7) envisaged 'grandi estensioni di terreno adatte per l'agrume'. The expansion of citrus cultivation, which has been taking place over the last ten years or so, is still taking place today. There is abounding evidence for this.

Many Italian farmers express their intention or desire to increase the area of their farm under citrus. When asked about their future plans, one of the most common answers is 'incrementare la coltura degli agrumi e immettere un impianto a pioggia'. In the studies, concession farmers 4, 5, 6, 7, 8, and 9 and demographic farmers 26, 28, 31 and 38 gave this type of answer.

As indicated by the following table money is constantly being loaned for the expansion of citrus cultivation.

Table 11.6 Loans by private banks for citrus groves and fruits etc. 1957.

Bank	Total amount loaned £L	No. of customers	Av. amount per customer £L
Banco di Sicilia	73,717	59	1,260
Banco di Napoli	6,473	14	462
Banco di Roma	-	-	-
British Bank of the Middle East	845,114	40	21,500
Barclays D.C.O.	-	-	-
Bank Misr	-	-	-
Total	925,304	113	7,744

In 1957 almost a million pounds were loaned out, some of it as credit on the crop, but much of it for the financing of planting.

The area of land devoted to citrus on the INPS farms continues to increase and in each year during the period 1952/3 - 1958/9 there have been plantings of citrus at Bianchi, Giordani and Licca:-

Table 11.7 Planting of Citrus on INPS Farms.

Settlement	1952/3		1953/4		1954/5		1955/6	1956/7	1957/8	1958/9
	ha.	nos.	ha.	nos.	ha.	nos.	nos.	nos.	nos.	nos.
Oliveti	-	-	-	-	-	-	?	-	-	-
Bianchi	11.92	6,680	2.49	1,980	6.69	2,472	?	1,896	1,385	5,095
Hashian	-	-	-	-	-	-		-	-	-
Giordani	4.92	2,592	4,84	3,560	1,24	789	?	2,178	3,047	11,086
Licca	6.86	1,316	8.16	3,644	3.17	2,170		1,886	9,325	5,140
Corradini	-	-	-	-	-	-		59	-	-

With the continued expansion of citrus cultivation it is highly probable that production will reach 20,000 metric tons in the next 20 years. With a very limited home consumption, the future of the industry depends on the export trade. What are the prospects ? As a citrus exporter, Tripolitania is confronted with many difficulties which cannot easily be overcome. She has to break into a high class market which will only take extra quality fruit and which is already supplied by well organised and capitalised producers such as Spain, Israel, Sicily and Morocco. Most of the European producers can send their oranges and lemons to Western Europe by train; the others in the various parts of the Mediterranean have infinitely better shipping facilities than Tripoli. The citrus tree in Tripolitania probably depends more on irrigation than in any other country, and this, plus the fact

that all packing material has to be imported, makes Libya theoretically a high-cost producer. One of the biggest problems in Tripolitania is that of pest and diseases. Infestations are heavy in some years and the effect on yields is considerable. The two main pests are the Mediterranean Fly and the Cochineal sucker insect. The Mediterranean Fly, Cerratitis Capitata, which lays its eggs under the skin of the fruit, attacks many of the coastal orchards and only inland areas such as Azizia, Gasr Ben Gashir and Suani Ben Adem, plus a few early varieties of trees along the coast, escape its ravages. Many of the European countries refuse to import fruit that has even a trace of this fly. The problem of the cochineal insect is summed up by Martin (9) 'La lotta contro la coccinigliа degli agrumi costitiusce dunque per la Libia un problema motto importante, nom solo dal punto da vista della sanità e delle produttività degli alberi, ma anche dal punto da vista dell'esportazione'. Cochineal did considerable damage in 1953 when it attacked groves in coastal areas as far west as Sorman, although not touching trees in inland districts at Azizia, Bianchi, Gasr Ben Gashir and Garabulli.

The main problem in the next few years is likely to be a deficiency disease. Almost all citrus groves, except those at Ben Gashir, bear leaves that are discolouring and showing yellow striations (1). Attempts have been made to discover the nature of the deficiency, but there has been little or no response to the application of all types of nutrients. Martin and Carraro suggest that the yellowing is due to a general hunger of the soil owing to

the lack of fertilizers prior to their experiments. In view of the observations made in chapter 3, it is probable that the deficiency is due to the non-availability of certain plant nutrients, especially iron, because of the high pH values of the soil. This deficiency disease, of which a similar type is affecting groundnuts, is widespread among the citrus and is one of several reasons for the low yields from most trees.

However, Tripolitania does have certain advantages as a citrus producer in the northern hemisphere. As we have seen in chapter 4, table 4.4, Tripoli and Azizia have warmer winter conditions than many other parts of the Mediterranean and the Portugal variety of orange, for instance, is ready for export in November in Tripolitania but not until the 15th December in Sicily. Tripolitania has 15-20 days advantage over Sicily which is the warmest part of Mediterranean Europe during the winter months. With the right application of fertilizers high quality fruit can be produced on the Jefara Plain and at the same time, despite the expense of irrigation, the exporter in Tripoli can buy his fruit at a cheaper price than many other exporters can do in other countries. Tripolitania is also fortunate in that any low quality fruit produced finds a ready market in Malta, only 200 miles away.

The need for new marketing arrangements is quickly being satisfied. The enforcement of certain export standards has reduced the exported citrus to a few good commercial varieties, and the establishment of Agrexport has at last enabled fruit to be sold in Western Europe markets. Agrexport, which is a co-operative

society of producers and exporters, has, with the aid of a loan from the Libyan Finance Corporation, set up a packing plant which sorts, washes, dries, brushes, waxes and grades the fruit. Now private firms are also setting up packing plants. If all these measures are carried out satisfactorily and methods of citrus management on the farms are improved, there is no reason why Tripolitania should not export high quality fruit to Western Europe on a permanent basis. Orange producers on the Jefara need to concentrate on early and late varieties, preferably the former because they suffer less attacks by pests, in order to benefit from the higher prices which these command abroad. Tangerine producers can find a ready market for the Clementina hybrid, for it is ready for export during the first fortnight in December, just in time for Christmas. Gargour thinks that more attention should be paid to the lemon since at the moment exports to Europe are almost nil. The late varieties of lemons in Tripolitania produce fruit which could be sold in Europe in the early summer when demand is high. The world production of lemons may not satisfy demand in a few years time and it will be a producers' market; even today, lemons, which grow well under the adverse conditions of the Jefara and are more resistant to disease than the other types of citrus, are fetching a better price on the European market than oranges. The only disadvantage of the lemon is that it lives 50-60 years compared with the orange's 70-80 years.

Shipping is the biggest problem that faces the citrus industry in Tripoli. Tripoli's fruit must be exported quickly in

in order to take advantage of earlier maturing dates, but even today ships do not call regularly or frequently. The Government must therefore encourage ships to call, by offering some kind of subsidy in the event of their leaving port without full cargoes. Finally it is important to remember that citrus production in Tripolitania is still very small compared with that of other producers; in Italy the production of oranges and tangerines is about 100 times greater than that of Tripolitania, and in the United States about 1,000 times.

CHAPTER 12

Other Tree Crops.

Of the remaining tree crops, almonds, date palms, vines and castor are the most important.

A. Almonds.

Almond trees, mostly in association with olives, were planted in large numbers by the Italians, particularly on their concession farms. However, the almonds were not destined to be a permanent crop. At one time the almond was not a common tree in Tripolitania and in 1912 it is doubtful if the number of trees exceeded 10,000; however, by 1925 there were 70,000 trees, by 1930 540,000, and in 1940 1,740,000. Numbers remained steady for a while after the war but by 1956 had dropped to 1,400,000. Today nearly all the trees are productive and they cover an area of approximately 30,000 ha.* About 73% of Tripolitania's almond trees are in Tripoli and Western Province and about 25% in Eastern Province; 80% of the nuts produced come from the Jefara Plain.

The production of almonds in Tripolitania has steadily increased from 20 metric tons in 1931 to about 3,000 metric tons in recent years. The almond tree is a much more reliable yielder than the olive and yearly production is much more stable. Production figures by locality show that Suq El Jiumaa, Garabulli, Aulad Ouein and Er-Regiat (Suani Ben Adem, Azizia and Gasr Ben Gashir area), and Sorman are the most important producing districts.

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* Cyrenaica has a much smaller area of almonds, and in 1956/7 was reported to have 1,300 ha. with 260,000 trees.

Table 12.1 Production of Almonds on the Jefara Plain by locality in 1957

Locality	Production (qts.)
Suq el Jiumaa	1,500
Tajiura	800
Garabulli	1,000
Aulad Ouein	1,200
Er-Regiat	1,800
Zawia	800
Sorman	1,000
Sabrata	500
Gasr el Khiar	600

The almond, which thrives in many countries bordering the Mediterranean sea, is well suited to the 'aziende' type of farming that was established by the Italians. The tree starts its cycle in December and is in flower by January or February, depending on the variety; the harvest is completed in July and the tree then rests for the remaining part of the summer. It therefore takes full advantage of the winter rains and the fruit is formed when there is still a moisture surplus in the soil; the tree also suffers little from the Ghibli except during the flowering period (see chapter 4), and can resist all but the worst droughts.

The almond is an inland crop on the Jefara because it dislikes the marine winds and also the crusty sandy-limestone soils encountered along the coast. It thrives in alluvial soils, and it is not surprising that the best areas, where the crop grows at present, are the patches of Intermediate Soil (see chapter 3) at Gasr el Khiar, Gasr Garabulli and Gasr Ben Gashir, which have a small clay content. In these favourable areas the tree needs little cultivation and little application of fertilizers.

Most of the almonds were interplanted with olives at a 9-10

metre spacing, in rows 18-20 metres apart; some of the concession farmers, however, even planted another row of almonds between the original rows, thus giving a final spacing of 9 x 9 metres or 10 x 10 metres, and a ratio of 3 almond trees to 1 olive tree. When the almonds were planted alone, as is the case for about 20% of the trees, they were usually spaced 10 x 10 metres. Occasionally almonds were planted in association with olives and vines, but rarely with vines alone. Vitale (17) was one of several Italian experts, who disliked the general policy of using the almond as a 'fill-in' crop until the olive started yielding. He maintained that if grown alone the almond would give good returns, 'il migliore sistema di impiantare il mandorleto consiste nell coltura specializata'. He also disliked the idea of interplanting olives and almonds for other reasons. The original idea behind this interplanting scheme was that when all the olives reached full production the almonds would be destroyed, leaving the olives spaced at 18 x 18 metres or 20 x 20 metres to continue under dry cultivation. The almonds would be removed when they would still have 30-40 years in full production. With trees interplanted at a density of 50 per ha. Vitale considered that it would be impossible to dig out the almonds without disturbing the roots of the olives. Today, trees are overcrowded on many farms in Tripolitania and irrigation is being practised to obtain better yields from the olives, but Mazzocchi has pointed out that this irrigation is detrimental to the almond tree.

There appears to be no local variety in Tripolitania and

all those to be found there at present are Italian. Almost all the trees have been grown from seed, although Mazzocchi is proving that better yields can be obtained from varieties grafted on to bitter almond rootstock from February to April. The main varieties grown (13) are:-

Pizzuta, which is known on the world markets as Avola Scelta, and has a large, smooth, hard-shelled nut.

Romana which yields a clear white nut in a hard smooth shell, and together with Pizzuta makes up 75% of the trees.

Fragiulus - a variety bearing a flat, elongated nut which has a semi hard shell.

A few other varieties from Sicily and Puglia area also grown. The varieties listed take 5-8 years to come into full production and they then bear every year for 30-40 years. Harvesting, which is carried out by shaking the tree, starts when the husk on the nut begins to split and the average yield of nuts in shell per tree is 3 kgs. Broc (4) suggests that Zaaf, Abiod, Constantine and Blanca Tunision varieties ought to be introduced. Although farmers applied for permission to uproot 200,000 trees in 1956, almonds have been much more successful than anticipated in many areas, and some farmers are reluctant to destroy them, preferring to retain them and continue with the olives and almonds in crowded conditions.

Exports of almonds from Tripolitania average about 500 metric tons per annum valued at about £L100,000, and they comprise approximately 5% of Libya's total exports. 100 kgs. of nuts

from the tree yields about 25 kgs. of almond kernels, of which about 20 kgs. are suitable for export. About 70% of the nuts produced are of the hard-shelled type and in 1958 they were being bought by the exporters at approximately 8 piastres per kilogram. With a 20% extraction, and shelling baggage and transporting costs of 4 milliemes per kg. Consorzio's F.O.B. price in Tripoli harbour was 47.2 piastres per kg., and 57.2 piastres C.I.F. in London and 57 piastres C.I.F. in Germany. It is generally calculated that the prices paid to the farmers are about one fifth of those reigning on the world market. Most of the shelled almonds go to the United Kingdom:-

Table 12.2 Exports of almonds from the 1954/5 Crop.

	metric tons	value £L
Total export	467	108,347
Export to U.K.	406	91,635
Export to Germany	43	13,320
Export to other countries (Malta and Denmark)	18	3,392

Exporters were paying 20 piastres per kilogram of soft-shelled almonds in 1957 and 16 piastres per kg. in 1958. The soft-shelled nuts are sold in shell for family consumption abroad, and in 1958 the F.O.B. price was 16.4 piastres per kg. and the C.I.F. price 17.5 piastres a kg. The Libyan soft-shelled almond is inferior in quality to that produced in Italy and therefore only small quantities are sold in U.K., most exports going to Germany.

One of the most important advantages of the almond is the fact that it will keep indefinitely, and if an exporter has difficulty in finding a ship, they can be stored for several

months or several years if necessary. Because of its good storing qualities there is no real cycle in the export of the almond:-

Table 12.3 Monthly export of Almonds 1957/8

July 1957	5,080 kgs.
August	5,080 "
September	49,696 "
October	48,920 "
November	46,310 "
December	35,720 "
January 1958	29,110 "
February	15,200 "
March	10,160 "
April	62,500 "
May	25,510 "
June	66,305 "

Libya is still a very small producer of almonds compared with Italy, which has an average annual production of 50,000 metric tons, Spain 30,000, U.S.A. 20,000, Iran 7,000 and Portugal 5,000.

The almonds is giving far better yields than the Italians ever envisaged and in many respects has shown itself more adaptable to the local environment than the olive. The Italians made a mistake when they planted a larger number of hard-shelled varieties, because soft-shelled nuts command a much higher price abroad. At the moment few trees are being planted on private farms; on a few of the INPS farms trees are being planted to complete the development of each holding.

Table 12.4 Number of almond trees on INPS farms.

Year	Oliveti	Bianchi	Hashian	Giordani	Licca	Corradini
1952/3	753	229	52	140	?	535
1954/5	1,160	7,543	649	5,051	7,575	22,714
1958/9	1,160	27,555	649	34,855	37,639	32,157

More almonds could be planted in the Inner and Dune Jefara, particularly near Azizia, Suani Ben Adem and Gasr Ben Gashir.

B. Date Palms.

Numerically the date palm is very important and its fruit provides a large part of the Libyan's staple diet, but commercially it is insignificant. The total number of trees in Tripolitania is approximately 1¼ million and annual production varies from 20,000 to 40,000 metric tons. The date palms are mostly mature and are distributed, 50% in Eastern Province, 45% in Tripoli and Western Province, and 5% in Central Province. In the Jefara region, palms are grown almost exclusively in the coastal oases, and here they constitute about 15% of the farmer's income. Nearly all the palms belong to the Bikraari variety which produces tough, coarse yellow dates that rarely mature in most years, and only a small percentage even in the hottest years. Farm Study 41, which describes a 1.5 ha. farm at Fashlum, indicates that there is a total of 80 palms belonging to the Hamury, Ba'udi, Ta'buni and Khurra varieties; each palm yielding 19-25 kgs. 20 kgs. is considered a good yield and the average for the Jefara coastal oases is about 12 kgs. The date palm is confined to parts of the Jefara Plain where the water table is near the surface, because it likes to grow with its roots reaching down into water; it is therefore limited in distribution to the coastal oases and the spring-line oases near the Jebel (see fig. 15 for the depth of the water table on the Jefara Plain). The palms find the best water in the Tripoli, Suq el Jiumaa and Zawia oases, and here densities reach 100 per ha.; to the west the density decreases and at Zuara there are only about 40 palms per ha., however it is still

nevertheless very important because of its tolerance of saline water.

The distribution of palms taken from 1952 tithe assessments, shows that Suq el Jiumaa and Zawia are the most important districts:-

Tripoli District	16,834	trees assessed.
Suq El Jiumaa District	167,029	" "
Zawia District	474,449	" "
Zuara	62,407	" "

From the following table it appears that the most important oases for date production are Zawia, Suq el Jiumaa, Regdalin and Gasr el Khiar:

Table 12.5 Production of Dates by Mudiriya in 1958 (qts.)

Tripoli Oasis	900
Suq el Jiumaa	12,800
Tajiura	250
Garabulli	108
Zawia	25,200
Sorman	1,100
Sabrata	2,300
Ajelat	1,600
Zuara	1,500
Regdalin	9,000
El Assa	780
Tiji	8
Jaush	600
Gasr el Khiar	4,000

The Tripolitanian date has no commercial possibilities and at the same time does not even provide a satisfactory food for the local population. According to Dowson (9), mature dates on palms in Irak and Tunisia have a 12-20% moisture content, but Tripolitanian dates in the same condition have a moisture content of 40%. Dates will not keep unless they have three times more sugar than water, and this is rarely the case with Tripolitanian dates. In many

years a surplus of dates is produced in Tripolitania but only a very small quantity is exported because of their appalling quality; they are generally inferior to the low quality dates produced in Irak. Western Europe demands high quality fruit and this is supplied by Tunisia, Irak and Algeria. The only possible way of utilising the local date is by distilling it for industrial alchohol, converting it into date syrup, or grinding it down and making an animal feed.

C. Vines.

The table vine has never been very important on the Jefara Plain because its production has always been for family consumption and for a very limited market in Tripoli. Most of the Libyan and Italian farmers grow a few vines to produce table grapes for domestic use, and the number of vines has changed very little over the years, and probably does not exceed 100,000-200,000. The sharp fluctuations in the total number of vines is due to changes in the popularity of the wine varieties, whose numbers rose sharply before the war and since have subsequently declined.

Table 12.6 Total number of vines in Tripolitania in Selected Years.

1925	920,000
1930	1,361,000
1937	29,061,000
1940	41,298,000
1944	42,525,000
1953	10,576,892
1956	1,650,000

The remarkable increase in the number of wine varieties in the 1930's is associated with the large plantings on the many concess-

ions that were being established at this time. Most of the vines introduced were grafts of budwood from Italy and Tunisia, and nearly all plantings were in rows between olives (see plate 22 and table 2.6). With Italian colonisation riding on the crest of a wave the prospects for the wine industry were rosy.

The Jefara is a healthy region for the vine, and it grows exceedingly well with minimal applications of fertilizers in the moisture areas that have over 250 mms. of rainfall. The Ghibli winds, however, are dangerous, and the vine is more susceptible to drought than the olive or almond. The wine varieties start yielding after 3-4 years, and are usually grown in rows and pruned very short, as is the custom in Tunisia and Sicily.

With the departure of large numbers of Italians, the wine drinking population has declined, and with independence has come a Moslem government which, for religious reasons, discourages the drinking of wine. These two facts, in addition to the taxes imposed on the vine, and the expansion of irrigation conjoined with raising of cash crops, has resulted in the vine becoming increasingly unpopular, and numbers have been reduced on almost every farm.

Gargour for instance (Farm Study 3) soon uprooted the 35 ha. of vines that were on the farm when he bought it. Reference to other farm studies indicate that none of the Libyan hawāza farms has vines, and that of many of the Italian farms the area devoted to vines is in the process of being reduced:-

Table 12.7 Vine cultivation and Farm Studies.

Farm Study	Area or No. of vines	Farmer's Policy
5	8 ha.	To reduce area.
6	35 "	No change.
7	4 "	To reduce area.
8	2 "	" " "
10	10 "	" " "
11	60,000 trees	No change.
24	2 ha.	To reduce area.
27	1 ha.	" " "
28	1 "	" " "
29	1 "	" " "
30	1 "	No change
31	1 "	" "
32	23 "	" "
33	11 "	" "
34	22 "	To reduce area
35	5 "	" " "
36	4 "	" " "
37	3½ "	" " "
38	5 "	" " "
39	6 "	" " "
40	9 "	" " "

The contraction of the number of vines has been most marked and rapid on the Jefara Plain; understandably so, because the greatest expansion of irrigation has occurred in this area. This is borne out by comparing the figures for the provincial distribution of vines in 1945 and 1953:-

Table 12.8 Provincial Distribution of Vines, 1945 and 1953 (Nos.)

	1945	1953
Tripoli and Western Province	33,574,325	4,281,150
Eastern Province	8,886,971	6,285,519
Central Province	640,000	10,223

Today with the total number of vines in Tripolitania only about 1½ million,* there are probably barely ½ million on the Jefara

* In 1957/8 there were 910,000 vines in Cyrenaica, almost as many as in Tripolitania.

Plain. The present production of wine grapes is about 2,000 metric tons annually and of table grapes about 3,000 metric tons annually.

Despite the tremendous decrease in its popularity, Sidi Mesri is still carrying out experiments on the vine and the varieties Italia, Baresani, Prio Vana 14, and Panse Precoce, are being grown. These flower February to March and yield fruit from August to September. The normal practice each year is to give the vine one or two irrigations of 400 m3/ha., and two or three cultivations. Some manure is applied and the vines yield 4-5 kilograms per tree after 2 years growth.

It is disappointing that the number of vines has declined so rapidly, but it is clear that there is no future for the wine industry under the conditions that exist at the moment. In 1958 the number of grapes harvested was still sufficient to produce 400,000,000 litres of wine and the 1957 vintage was still untouched* The price paid for wine grapes dropped from 250 milliemes per kg. in 1957 to 150 milliemes per kg. in 1958. There is no tradition of wine making in Libya and few of the Italians are skilled at this art, and as a result no expensive wines are produced. It is also doubtful if Tripolitanian wines could compete with the cheaper wines consumed in France, Italy or Spain, should import restrictions be lifted by these countries. The sandy nature of the atmosphere and the poor quality fruit rule out the possibility of a dried fruit industry. Rascovich considers the only possible

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* Sunday Ghibli, 24th August 1958.

policy is to allow the number of wine varieties to decrease and to concentrate on improving the quality of table grapes produced by grafting. Only on some of the EPS farms does the plantings of vines appear to be taking place; plantings in recent years being as follows:-

	Bianchi	Giordani	Licca	Corradini
1956/7	-	0.5	17.98	260.8 ha.
1957/8	86.15	79.44	98.5	51.7
1958/9	65.3	96.75	29.5	-

D. Deciduous and Other Fruit Trees.

These include apricots, peaches, apples, pears, plums, pomegranates, figs, medlars and mulberries. None of them has any commercial importance. Figs and pomegranates are found on most Libyan farms and are grown for family consumption. The pomegranate is a useful tree because it can withstand heat and alkaline soils, but the fruit of the present local variety easily burst open. Fig trees are more numerous and are grown widely on the Jefara Plain, particularly in coastal areas where they fruit and vegetate well; they are drought resistant but they do need some moisture at fruiting time, otherwise they vegetate excessively and no fruit is formed. Apples, pears and plums are not very important and do not find local conditions really suitable. Plums could be better adapted to local conditions by grafting on to a bitter almond rootstock.

Although less numerous than figs and pomegranates, apricots and peaches are more important to this study because they do offer possibilities for development. All the apricots are local

varieties, called mushmesh by the Libyans, and are grown from non-grafted seedlings along the coast. Peaches have the same distribution but most of them have been introduced and grafted on to the bitter almond or the local apricot; the main varieties are May Flower, Triumph, Amsden and Vainquer. In coastal areas both the apricot and the peach suffer infestations of the Mediterranean Fly, but trees which escape attacks will give yields of up to 3-400 kgs. per tree. Away from the coast apricots and peaches are not attacked by the Mediterranean Fly; Azizia, Gasr Ben Gashir and the Inner Jefara are very healthy areas, but they are much drier. This is one of the most difficult problems on the plain, for the best moisture conditions are to be found near the coast but these are the most unhealthy areas for many of the tree crops, particularly olives, citrus and deciduous fruit. Broc (4) considers that the cultivation of apricots could be profitable in the Inner Jefara and that the deficiency of rainfall could be overcome by water-spreading. He makes a theoretical calculation of the possible income that could be derived from 500 ha. of land around the Wadi el Hira, which is at present used for cereal cultivation. He considers that with 70 extra trees per hectare, and with fruit selling at 1.5 piastres per kg., the possible income for a 20 year period would be £L308,000, that is about £L31 per ha. per year. There is obvious scope for some expansion of the growing of deciduous fruit in the Inner Jefara and parts of the Dune Jefara. Mazzocchi has been growing peaches and apricots under dry cultivation in the Jebel at Tarhuna and Gharian, and by grafting on to

hardy wild almond rootstocks he is achieving remarkable yields without any irrigation whatsoever. The main difficulty would appear to be the lack of a market; Tripoli's intake is very small and although a few tons of apricots are exported to Malta every year, there must be an improvement in the quality of fruit and the refrigerator shipping services, before commercial export could be started.

E. Miscellaneous Tree Crops.

1. Castor. This tree or bush crop (see plate 25) appears to have spread over the Jefara Plain during the last 10 years, propagating itself almost like a weed. Many of the Libyan farmers are planting the seed with a little water, and then leaving it alone to look after itself. The castor bush has many valuable attributes: it is very hardy, grows rapidly and needs little attention except for the harvesting and the husking of the seed; it grows well on waste land, makes a good dune fixer and wind-break; and the castor seed, when harvested, has good keeping qualities. The castor bush likes the Jefaran environment and its numbers are steadily increasing each year. It is particularly popular on the Libyan hawāza farms (see studies 12, 13, 14 and 16), on the inland saniya, and also amid the shifting cultivation patches in the Inner Jefara.

The demand for castor oil on the world market is quite good. It is used as a lubricant, for medicinal purposes, and for making paint, varnish, plastics, synthetic rubber and soap. Two factories for the production of castor oil were started

in Tripolitania after the war, but they are now being forced out of operation because the quality of their product is so low. Exports of oil have declined and the emphasis is now on seed. Exports for certain recent years are :-

Table 12.9 Exports of Castor Seeds and Oil in recent years

Year	Castor Seed		Castor Oil	
	M.T.	£L	M.T.	£L
1950	?	?	300	?
1954	1102	31,839	408	40,285
1955	2625	114,441	331	27,653
1956	2153	137,750	79	8,886
1957	1209	215,303	?	4,716

Most of the seed and oil exported goes to Italy because there is no tariff barrier. In 1957 Italy took castor seed valued at £L215,093 and castor oil valued at £L2,989; the United Kingdom is the only other notable importer of castor oil. The main exporters are Mitchell Cotts and Consorzio. Efforts have been made to grow castor in plantations but these were not economically successful. Agronomically the Jefara Plain seems well suited to a growing of castor and at present the main control on expansion is foreign competition, for even on the Italian market there is competition from seed produced in Kenya, South Africa, Sudan and other North African Countries. The total world production of castor beans or seed in 1958 was estimated at 528,000 metric tons;* about 60% of this was in India and Brazil and these two countries are responsible for about 65% of the castor trade; both are likely to have increased

* Castor Beans, International Report, World Crops, May 1959.

production in 1959. Production is also expanding in the U.S.A. which is the major importing country, and in 1958 irrigated bushes in California already supplied 20% of domestic requirements.

2. Forage Cactus. The high water needs of the major forage crop, lucerne, have already been emphasized and there is no reason why cactus could not be more fully utilised as animal feed. The Prickly Pear cactus (Opuntia Spp.) grows well in the coastal areas of Tripolitania. It is hardy, drought resistant, and in both its dried and fresh state compares favourably with other possible sources of animal feed such as carob, olive oil cakes, barley hay, and lucerne. The local farmer uses the prickly pear mainly for hedging, and rarely does he feed the leaves to his animals unless there is a severe drought. Prickly pear could best be developed for livestock in areas which have less than 150 mms. of rainfall. Rowland[*] states that in such areas with a three year old plantation, one ha. of 4,000 plants would supply enough leaves to feed 30 sheep for 200 days. In South Africa it is reported that yields of 600-1,000 qts./ha. are being obtained. Although not as high as for lucerne these yields are in areas of very low rainfall where there has been no irrigation. The planting of the prickly pear should definitely be encouraged by the Government.

3. Carobs. Although grown in many parts of the Jefara Plain, the carob is not really popular among the locals, and the total number in existence is small. The Tempiotive, Kyruiotike

[*] B/96 p.135.

and Sarahine varieties which have been introduced, thrive on the deep, permeable, limey soils of the Jefara Plain and many fine specimens of trees can be seen. Ecologically the carob is one of the tree crops which is most suited to conditions in the eastern Jefara. It is a large leguminous evergreen which in August yields a 5-6" pod which will keep for as long as three years. The pod and its seed can be used for both animal and human consumption. The carob, however, takes so long to reach profitable production that the local farmers understandably are not enthusiastic. It first starts to yield when it is 10 years old, but it is not in full production (75-100 kgs. per tree) until it is 80 years old. Abroad there is only a small demand for the carob, and with its unpopularity at home, production is likely to be static at the present annual average of 1,000 metric tons.

4. Eucalypts. Private farmers have at last realised that the eucalypt can be a profitable agricultural crop. Two varieties are grown in Tripolitania: Eucalyptus Camaldulensis and Eucalyptus Gomphocephala. These trees grow rapidly on the Jefara Plain in areas of over 200 mms. of rainfall, and after 25 years they are full grown and ready to be felled. After the tree is cut down it is not killed, and many shoots are sent up from the stump. If three of these are selected and allowed to grow for a while two can be cut down to supply small timber after a few years, and the remaining one can be left to form another tree, which in its turn can be felled when 20-25 years

This process can take place about 5 times and a farmer who grows a large area of eucalypts will always have some trees to fell in order to bring in some much needed money during a drought period. Farmers are being encouraged to plant trees by the Forestry Department, and seedlings are offered for sale at the nominal price of 2 milliemes each. It is estimated by forestry officers that the private farmers on the plain are planting about 1,000 ha. of eucalypts annually. (For reference to one particular farmer who grows eucalypts see farm study 2).

5. Pistachia Vera. This is not a common tree and only two plantations are to be found on the Jefara Plain: one on the eastern side of the Tripoli-Tarhuna road, just south of Gasr Ben Gashir at the margins of sedentary cultivation, and the other at Sabrata. Mazzocchi is using the plantation south of Gasr Ben Gashir to supply grafting material (see plate 26). The pistachia is a nut tree that is grown widely in the Mediterranean area and it has very similar habits to the almond. Like the carob, it is a tree which is ecologically suited to Tripolitania, but it has no commercial possibilities at present.

SECTION V

FIELD CROPS

CHAPTER 13

Groundnuts: the major water consuming crop.

A. General Information.

Of the twelve species of the genus Arachi, only Arachis hypogaea is of economic importance. Although very close to the pea family and often referred to as a peanut, the groundnut resembles a nut in taste, flavour and many other respects.[*] It is an annual field crop, growing in the warm season in tropical and sub-tropical climates and because it demands a moderate amount of moisture is generally found in areas of at least 1,000 millimetres of rainfall. Heavier soils give the highest yields but lighter soils give better quality nuts. Jefaran soils are either sandy or light sandy loams, well-drained and well endowed with calcium carbonate, and they allow easy cultivation and lifting of the crop and do not stain the white shells. These soils, however, suffer from the non-availability of plant nutrients.

Today the groundnut grown under full irrigation, is the chief cash crop in Tripolitania and is Libya's leading export. There is some home consumption by Europeans in Tripoli and also by the local Libyans, who like to eat the roasted groundnut while sipping their small glasses of tea, but the bulk of the crop is exported in shell to Western Europe. The Jefara produces about 99% of all Tripolitanian groundnuts and a high proportion of farmers, particularly Italian, grow this crop. Read Lewis[θ] reports the following figures

[*] Klages, K.H.W.: 'Ecological Crop Geography'.

[θ] Lewis R.H.: 'Irrigated Land-Use and Irrigation Report'. L.A.T.A.S. Libya.

for Italian farmers: Oliveti, Zawia and Sabrata area 44.5%; Hashian, Bianchi, Giordani, Micca 100%; Tripoli and Fonduk Et-Togar 60%; Garabulli 33.3%; Azizia, Gasr Ben Gashir and Suani Ben Adem 23.5%. In the Zawia area Theodorou* has shown that in 1954 the average value of groundnuts was 40.5% of the total average gross income on Italian farms, and 2.4% on Libyan farms. At the present moment the number of farmers growing groundnuts is higher than ever before, and the value of the crop represents over 50% of gross income on many farms.

B. Varieties.

There are three main varieties grown on the Jefara Plain:-

a) Local Red (Spagnola Rossa) sometimes referred to as Tripolina or Italiana, and marketed and exported as Tripoli 4. It is a Valencia type of groundnut with erect habits and large pallid green leaves; it has a short life-cycle of only four months and is therefore classed as early maturing. The shell or pod is long and narrowish and contains up to four small red kernels, hence its market name of Tripoli 4, although the average number of kernels per pod is usually three. The Local Red produces good quality nuts which compare very favourably with the best which are produced in Spain and other countries; it has good resistance to Cercospera and Rhizoctonia, the kernels are easily extracted from the shell, germination is good and the nuts are easily lifted; premature sprouting is, however, a problem. According to Oram (7) farmers space their seeds

* B/96.

31 cms. x 16 cms.

b) Local White or Egiziana. This is a Chinese type of groundnut of more spreading habits than the Local Red and therefore classified as semi-erect. It produces a broader shell which usually contains two large white to pale-pink nuts and is exported as Tripoli 2. It has a five-month life-cycle and is a late maturer. It also has good resistance to sprouting but is more susceptible to Cercospera and Rhizoctonia than Local Red. At planting it is more widely spaced by the local farmer and rows are usually 36 cms. apart and seeds 20 cms. apart, but despite this its yields are higher than the Red, although it has a higher percentage of pods without kernels.

c) Virginia Bunch. Introduced by the Americans, this groundnut, locally known as Americano, is increasing rapidly in polularity. The pods grow in a bunch fashion around the roots at the base of the plant and usually contain two large kernels of pinkish colour. It is exported as Tripoli 2 and basically has much the same qualities as Local White. It has a five-month life-cycle.

The local varieties were originally the most popular but now Virginia Bunch is increasing in importance and is tending to oust the Local White.

C. Cultivation by farmers.

After being handshelled mainly by women, groundnut seed is planted usually two per hole between April and the end of June and the crop is harvested from September until late November; most of

the planting, weeding and harvesting is done by hand. Since higher yields are obtained with a close spacing there is a strong argument for retaining hand planting for by this method 250,000 plants can be grown per hectare whereas with mechanical planting the maximum possible density is 175,000 per hectare. Sometimes plants are threshed mechanically but rarely planted mechanically, and as long as labour is plentiful and cheap the continued use of hand planting will give good yields, which will help in some measure to counteract the high irrigation costs.

The crops which are likely to be in rotation, if in fact a rotation is practised, are summer cereals such as maize, 'gseb' (millet) and tobacco, and occasionally winter crops such as potatoes, legumes and small grains. Groundnuts, however, often dominate the rotation on many farms and some farmers cut out their second winter crop, such as potatoes, in order to prepare the land fully for an early sowing.

D. Cultivation of groundnuts at Sidi Mesri.

Methods of cultivation, such as preparation of the land, application of fertilizers, seed spacing, tillage, rates of irrigation, date of sowing and harvest, seem to offer scope for improvement particularly if production is to be maintained at the present level. It was with this consideration in mind that the experimental plots of groundnuts were visited at Sidi Mesri on 26 October 1957. Here all seed is sown between the 1st and the 20th of May in order to obtain the highest yields and miss the winter rains at harvest time. The Local Red is planted in rows 30 cms. apart with 20 cms. between each plant, Local White and

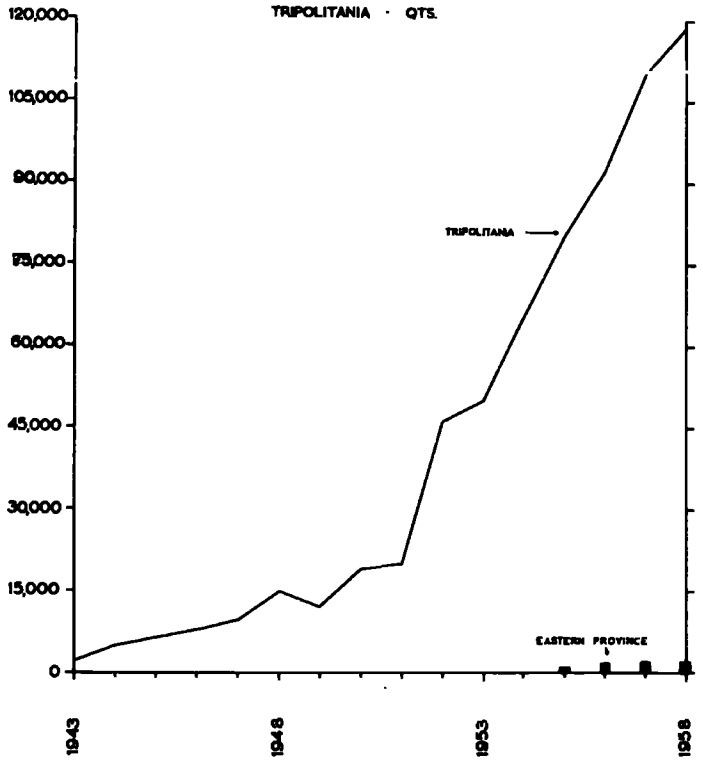
Virginia Bunch 50 cms. by 20 cms. The local farmer is obviously planting his Local Red too closely and in some cases is also sowing his seed either too early or too late. Other references to the cultivation of groundnuts at Sidi Mesri will be made in later sections on yields, and profitability.

The F.A.O. started experiments on groundnuts in Libya in 1954 and so far it has tried Virginia Bunch, Kanlikoro, Cote d'Ivoire, Virginia Jumbo, Tennessee Red, Improved Valencia, North Carolina, and Virginia Runner. Of these only Virginia Bunch has shown signs of being a likely introduction and in 1955 five tons of seed of this variety were imported from the U.S.A. and the 60 tons of groundnuts subsequently harvested were distributed to the farmers on the Jefara Plain. It is now grown fairly widely but even so is unlikely to completely displace either of the two local varieties because experiments have shown that neither of these is degenerating badly.

E. Analysis of crop statistics.

The rise im importance of the groundnut is quite phenomenal. Before the last war the Italians only grew a few hectares and most of these were largely experimental; their lack of interest and foresight is borne out by the limited number of Italian references available on this particular crop. The following figures, obtained from the Statistics Section of the Nazarat of Agriculture, show the increase in the crop's popularity:- (see also fig. 25a)

PRODUCTION OF GROUNDNUTS IN TRIPOLITANIA - QTS.



MONTHY EXPORTS OF GROUNDNUTS FROM TRIPOLI

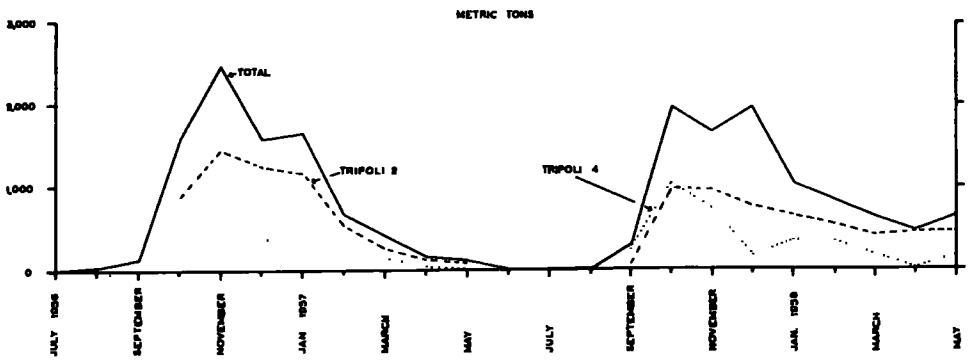


Table 13.1 Production and area of groundnuts in Tripolitania 1943-58.

Year	Production in quintals	Area in hectares
1943	2,000	628
1944	5,000	750
1945	6,500	1,010
1946	7,800	1,000
1947	9,750	1,100
1948	15,000	1,250
1949	12,000	1,250
1950	19,200	1,600
1951	20,000	1,600
1952	31,620	3,080
1953	50,000	?
1954	65,000	?
1955	80,000	?
1956	92,024	3,954
1957	110,428	4,475
1958	119,631	5,138

Production has increased nearly 60 times since 1948 and now seems to be steadying slightly. Figures for the production and area of groundnuts by provinces illustrates the importance of the Jefara Plain:-

Table 13.2 Provincial Production and area of groundnuts. 1945, 1950 and 1956.

Year	Tripoli and Western Province		Eastern Province	
	qts.	ha.	qts.	ha.
1945	6,000	950	500	60
1950	18,000	1,500	1,200	100
1956	90,899	3,879	1,125	75

In 1945, Tripoli and Western Province produced 92,3% of all Tripolitanian groundnuts, in 1950 93.75% and in 1956 98.8%. The figures for Tripoli and Western Provinces are exactly equal to those for the Jefara Plain because no groundnuts are grown at Gasr Khiar and Ghanima parts of the eastern Jefara which lie in eastern Province. In 1945, 83.3% of Tripoli and Western

Province's production came from Tripoli Province but in 1956 only 38.2%; it is clear therefore that groundnuts were introduced immediately after the war to the area round Tripoli but since 1950 the main expansion has been in the west.

Several demographic settlements of the Instituto Nazionale della Previdenza Sociale (INPS) are located in this western area of expansion and statistics have been kindly supplied by Dott. A. Rompietti, the director:-

Table 13.3 Production and area of groundnuts on INPS Farms 1953-1958.

Year	Oliveti		Bianchi		Hashian		Giordani		Micca		Corradini	
	qts.	ha.	qts.	ha.	qts.	ha.	qts.	ha.	qts.	ha.	qts.	ha.
1953	1894.0	107.3	6387.3	325.0	672.2	40.1	6570.0	287.9	5120.0	225.1	44.1	3.2
1954	2424.5	116.3	8611.0	353.5	795.0	32.3	11618.5	332.4	7595.0	254.6	27.7	2.9
1955	3455.0	164.8	9431.2	388.4	1325.0	52.9	11132.0	383.4	7654.0	249.9	25.0	3.6
1956	4156.0	191.1	10951.6	490.4	1319.0	59.7	13578.0	500.7	6629.6	269.1	26.8	2.7
1957	6000.0	220.0	14000.0	600.0	1600.0	65.0	11226.0	453.0	6653.0	259.0	-	-

The area of groundnuts has increased steadily in the Oliveti, Bianchi and Hashian regions, but at Giordani and Micca an initial increase has been followed by a slight decline. Groundnut cultivation was tried at Corradini (Ghanima) in the east but has since been curtailed because of inadequate water supplies for irrigation.

Following the large expansion in the area under groundnuts since 1943, what is the present distribution pattern ? Distribution figures provided by the statistics section of the Nazirate of Agriculture are available for the agricultural years 1955/6, 1956/7 and 1957/8, the last two being merely estimates, increases of 20% and 8% respectively. The 1955/6 figures are therefore

used to determine the distribution pattern :-

Table 13.4 Distribution of groundnut production on the Jefara Plain. 1956.

Locality	Production in Qts.	Area in ha.
Hadba el Khadra	7,775	311
Gurji	3,600	150
Suk el Jiumaa	1,672	76
Sgedeida	7,020	234
Tajiura	4,500	180
Garabulli	1,250	50
Azizia	2,350	94
Suani Ben Adem	6,600	220
Total Tripoli Province	34,767	1,315
Jiuddaim	9,720	360
Zawia	11,592	504
Sorman	3,250	125
Sabrata	1,210	55
Azzahra (Bianchi)	10,000	500
Naseria (Giordani)	10,000	500
Ameria (Micca)	8,000	400
Hashian	2,000	100
Maamoura	360	20
Total Western Province	56,132	2,564

These figures have been used to draw fig. 24c which shows distribution by the means of dots. The large concentration in the area of the Istituto settlements of Bianchi, Giordani and Micca is evident, and the other important areas are Zawia, Jiuddaim and Sorman in the west, and a circular area bounding Tripoli in the south running from Gargaresh through Hadba el Khadra (Collina Verde) and Ain Zara to Sghedeida. Groundnuts are also grown in smaller quantities round Suani Ben Adem, Azizia and Gasr Ben Gashir. The area in the east is very small and is mainly found on the Variani Concession.

F. Yields.

Yields have grown steadily in the last fifteen years. In 1947 the average yield for Tripolitania was approximately 10 qts./ha. whereas today it is about 20 qts./ha., although some of the better farmers even produce 30 qts./ha. Yields vary considerably according to locality, type of variety grown, time of sowing, spacing of plants, applications of fertilizers and water, and nature of rotation.

On the basis of the figures for production and areas by locality in 1956 which have already been quoted the following estimates of yields have been calculated:-

Table 13.5 Yields of groundnuts by locality, 1956.

Locality	Yields in qts./ha.
Hadba el Khadra	25
Gurji	24
Suk el Jiumaa	21.9
Sghedeida	30
Tajiura	25
Carabulli	25
Azizia	25
Suani Ben Adem	30
Tripoli Province	26.4
Jiuddaim	27
Zawia	23.1
Sorman	21.82
Sabrata	22
Azzahra	20
Naseria	20
Ameria	20
Hashian	20
Kaamoura	18
Western Province	21.6
Eastern Province	15

The average for the whole of Tripolitania is 19.5 qts./ha. but in Tripoli and Western Province most yields are in the low 2o's and

Maamoura is the only locality with less than 20. Yields are higher in Tripoli Province, particularly in the Sghedeida and Suani Ben Adem areas, than in Western Province. Since Maamoura and Suk el Jiumaa have the lowest figures it would seem that yields on Libyan farms are lower than on the Italian farms. In the coastal areas from Homs to Misurata, which lie east of the Jefara Plain, yields are poor mainly because of the low quality of water used for irrigation and it is not surprising that the proportion of Tripolitania's groundnuts coming from here is slowly declining.

Lewis gives some figures of yields by locality which he worked out from questionnaires; these also suggest lower yields on Libyan farms:-

Table 13.6 Yields of groundnuts by locality in qts./ha. - After Lewis.*

Locality	Libyan Farms	Italian Farms
Oliveti, ~~Bianchi~~ and Sabrata	14	18.33
Hashian, Bianchi, Micca, Giordani and Maamoura	12.5	23.4
Azizia, G. Ben Gashir and Suani Ben Adem	15,667	13.35
Tripoli and Fonduk	13.54	13.66
Garabulli, Ghanima and Gasr Khiar	10.66	13.0

On the whole these figures taken from Lewis are lower than those worked out from government statistics but this is understandable because the former relate to a time several years

* Lewis, R. op. cit.

earlier. Except for Azizia, Gasr Ben Gashir and Suani Ben Adem, yields on Libyan farms are lower than Italian; the average yield for all localities is 15.552 qts./ha.

The most reliable figures for the Istituto farms can be computed from the statistics supplied by Rompietti, which have already been quoted:-

Table 13.7 Yields of groundnuts for INPS farms, 1953-57. (qts./ha.)

Village	1953	1954	1955	1956	1957
Oliveti	17.6	20.8	20.9	21.8	27.3
Bianchi	19.6	24.5	26.4	21.2	23.4
Hashian	16.8	24.6	23.2	22.02	21.8
Giordani	22.8	35.0	29.1	27.0	24.6
Micca	22.7	22.8	30.1	25.38	25.78
Corradini	13.69	9.4	6.9	10.0	-

Yields have shown a steady increase at Oliveti; at Bianchi, Hashian, Giordani and Micca there has been a rise followed by a slight fall, with 1954 or 1955 appearing to be the peak years. Yields at Corradini are very low showing how production is affected if insufficient water is given.

It has been mentioned earlier that in order to obtain maximum yields the date of sowing must be neither too early nor too late. Oram's researches have revealed the following results:-

Table 13.8 Yields of groundnuts in relation to date of sowing (10)

	Tripoli 2	Tripoli 4
7th April	95%	63%
21st April	80%	48%
7th May	168%	133%
21st May	115%	141%
4th June	57%	111%
20th June	84%	103%
	100% = 17.3 qts.	100% = 10.8 qts.

The best time for sowing is during the first three weeks in May, earlier sowings giving poor germination and later sowings resulting in a harvest when the rains have started.

Yields vary with the amount of fertilizer applied and the type of rotation practised. The ideal combination of fertilizers seems to be 1.5 - 3 qts. of sulphate of ammonia (21% nitrogen), 4.5 qts. superphosphate (18% phosphorous) and 1 qt. of sulphate of potash (48% potassium). Application of nitrogen increases yields but if more than 4 qts. are given per hectare then quality is reduced and the plants are more susceptible to disease. Phosphates assist maturation and encourage the formation of heavy nuts; potash applications tend to make the plant taller and give a higher number of kernels per pod. Highest yields are obtained from land which is only cropped with groundnuts once in every three years, but unfortunately in Tripolitania many farmers are growing groundnuts on the same piece of land year after year. Compared with continuous cultivation of groundnuts, yields are increased by 104% after a green manure crop, 47% after bare fallow and 57% after millet.

Yields clearly vary with variety. At Sidi Mesri Local Red give 18-20 qts./ha. and Local White and Virginia Bunch 20-22 qts./ha. F.A.O. Field trials carried out by Oram in 1954 and 1955 gave the following results:-

	1954	1955	qts./ha
Local Red	-	21.1	
Local White	32.3	29.3	
Virginia Bunch	29.9	28.2	

Spacing is an important factor affecting yields and

fortunately Oram (7) has done valuable research on this question. He emphasises that trials have clearly shown the value of close spacing both for rows and seeds. The difference between the best and the worst spacing may well give yields which differ by as much as 10 qts./ha. With the Tripoli 2 varieties, in fifteen out of sixteen cases the spacing of seed at 10 or 15 cms. resulted in higher yields than 20 or 30 cms. Egiziana and Virginia Bunch therefore like a close spacing of 30 x 15 cms., which incidentally can only be achieved by hand planting because the best mechanical spacing is 50 x 15 cms. or 50 x 10 cms. The farmer seems to think that the Local Red needs a closer spacing than the other two varieties and often plants two per hole; this assumption is erroneous. The best spacing appears to be 30 x 20 cms. for the hand planter and 50 x 20 for the mechanical planter.

It has already been indicated by reference to Ghanima and Eastern Province, that insufficient irrigation or the use of poor quality water gives low yields. Theodorou[*] has shown that on Italian farms in the Zawia area, single-cropped irrigated land under groundnuts gives a higher yield than intercropped irrigated land under groundnuts, 19.57 qts./ha. as compared with 15.15 qts./ha. The effects of irrigation are greatly reduced if weeds are not eradicated; unweeded trial plots have shown yield reductions of 50% in 1954 and 66% in 1955 compared with hand weeded plots.

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[*] Theodorou op. cit.

It is interesting to analyse the yields of new varieties which have been tried in Tripolitania. In the table below, from Oram (9), the yields of several of the new varieties are listed and are compared with those of the established local varieties:-

Table 13.9 Yields from varieties grown at Sidi Mesri.

Variety	yields of trial 1954 qts./ha.	yields of trial 1955 qts./ha.	Extension trial kgs. per kg.	% of total pods having kernels 1	2	3	4
Local White	32.3	39.3	22.8	25	73	2	0
Virginia Bunch	29.9	28.2	23.0	17	82	1	0
Konlikoro	26.4	25.6	-	21	78	1	0
Virginia Jumbo	-	24.9	-	20	78	2	0
Cote d'Ivoire	25.4	24.9	-	10	37	52	1
Chinese White	-	18.3	-	17	82	1	0
White Spanish	27.3	22.9	22.5	25	75	0	0
Tennesse Red	21.6	21.2	21.4	14	39	42	5
Local Red	-	21.1	15.0	16	37	42	5
Valencia	-	19.9	14.9	13	37	44	6

Of the white groundnuts, the Local White and Virginia Bunch gave the highest yields; the latter did well on extension trials and gave a high percentage of two kernel pods. There is little to choose between the three red varieties; Tennesse Red did well on extension trials but otherwise there is no real reason for substituting it for the Local Red. By weight the red varieties have a higher percentage of sound pods.

It would seem that the three varieties currently grown on the Jefara Plain are well suited to local conditions and there is little likelihood that another foreign variety will be introduced in the near future.

G. Water requirements of Groundnuts.

The groundnut is an annual summer crop which needs full

irrigation throughout its whole life-cycle. Workers in the United States (14) have calculated that it needs 25" of water i,e. 6,250 m3/ha. and Mitchell's studies on evapo-transpiration in Malta suggest something in the order of 7,000 m3/ha. Maximum water is needed by the crop during the flowering and pod development period. The Italian farmers, who were settled in the area south of Misurata by the Italian settlement agency, Ente per la Colonizazzione della Libia, were instructed that groundnuts should be given an irrigation of 600 m3/ha. every 10 days making a total of 6-7,000 m3/ha. The instructions were based on experiences of irrigating groundnuts on the Jefara Plain.

At Sidi Mesri, in 1957, groundnut seeds were planted with an initial irrigation of 350 m3/ha. with subsequent irrigation depending on the weather, but usually after 20-25 days. Under normal summer conditions there is an irrigation every 10-12 days, but if the weather is abnormally hot this may be reduced to 8-10 days, and even 6 days if there is a severe Ghibli. The usual amount of water given at each irrigation is 350-400 m3/ha. but this is stepped up to 450 m3/ha. when it is very hot. The total amount of water given per life-cycle varies between 6,000 m3/ha. in a cool summer, 7,000 m3/ha. in a normal summer and 9,000 m3/ha. in a very hot summer. Since Tripoli 4 has a shorter growing season it requires less water than Tripoli 2; the former is given about 12 irrigations at Sidi Mesri and the latter 14-15 irrigations.

In order to determine the rates of irrigation and the amount of water given on private farms, the writer referred to the

figures given by Lewis and also asked for relevant information in the questionnaires which were distributed in August 1958. Lewis' figures* are as follows:-

	Italian Farms	Libyan Farms
Average number of irrigations	28	18.3
Average amount per irrigation	492 m3/ha.	234 m3/ha.
Average annual amount	13,776 m3/ha.	4,282 m3/ha.

The Libyan farmer irrigates less frequently and gives a smaller amount of water per irrigation than the Italian; the Libyan clearly under-irrigates, hence the low yields on many of the small Libyan farms. With 28 irrigations and a total amount of water at 13,776 m3/ha. the Italian farmer is probably over-irrigating.

Lewis' figures were based on only a small number of farms and are not necessarily typical. Furtherrore, they are several years old, and the farmer today has had more experience at irrigating groundnuts. Information extracted from the questionnaires recently circulated, is presented in table 13.10.

In this table, the number of irrigations given in 1958, which is considered an average year, is usually in the range 15-20. The amount of water applied at each irrigation is generally 300-400 m3/ha. The concession farms seem to be applying about the right quantity of water, but several of the demographic farmers are over-irrigating. The amount of water needed does depend on the method of irrigation.

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* Lewis op. cit.

Table 13.10 Irrigation rates for groundnuts, 1958.

No. of Farm Study	No. of Irrigations	Amount per Irrigation m3/ha.	Total amount m3/ha.	Type of Farm
4	16	400	6,400	Concession
6	18	400	7,200	"
8	15	400	6,000	"
10	20	400	8,000	"
11	16	400	6,400	"
25	15	1,200	18,000	Demographic
26	21	300	6,300	"
27	25	680	17,000	"
30 Sprinkler	20	520	10,400	"
Canals	20	700	14,000	
31	22	630	13,860	"
34	15	1,000	15,000	"
35	16	350	5,600	"
36	16	350	5,600	"
37	15	350	5,250	"
39	16	350	5,600	"
41	15	800	12,000	Saniya

H. The Profitability of the Groundnut.

Despite the high cost of irrigation water the groundnut still remains a profitable crop, otherwise there would not have been such a sharp rise in production since the war. What payment can the farmer expect ? He can either sell his groundnuts on the local markets, or send them to an exporting company.

Weekly market prices in Tripoli, which are generally comparable with those paid by exporting companies, are available from the Statistics Section of the Nazirate of Agriculture, and those for 1957 are as follows:-

Table 13.11 Average weekly market prices of groundnuts.
(per kilogram)

January	8.26 piastres	July	10.2 piastres
February	9.6 "	August	10.4 "
March	9.19 "	September	9.31 "
April	9.75 "	October	8.7 "
May	9.25 "	November	7.65 "
June	8.94 "	December	7.4 "

Prices are at their lowest October-January when supplies are greatest, and highest in July-August when the crop is only just being started to be harvested. It pays the farmer to lift his crop in August if he can still obtain good yields, otherwise it is better to store it until well after the new year. Wholesale prices in Tripoli fell from an index of 100 in 1946 to 80 in 1950, and are now about 66.

The price paid to the farmer by the exporting companies has also dropped in recent years. In 1949 it averaged 8.3 piastres per kg., and for the period 1949-50 the average was even higher at 9.3 piastres. In order to establish present buying prices several of the leading groundnut exporters were visited. In the year 1956/7, which was a good crop year, Gargour et Fils paid an average of 10 piastres a kilogram for good dry standard quality nuts, but prices had to be lowed when the 1957 crop became available and 7 piastres per kg. was the average price with occasionally 8 piastres being paid for really good nuts. By January 1958 only 6.5 piastres were being paid per kilogram.

In 1957 Consorzio Agrario, the Italian Co-operative established before the war, paid 8.5 piastres a kilogram for standard quality nuts, having up to 4% of one kernel pods and 1% impurity, not differentiating between Tripoli 2 and Tripoli 4. About 6 piastres a kilogram were paid for black or damp nuts. For the same crop Hassan Hessaud was paying 5-8 piastres per kilogram for average nuts and occasionally 10 piastres for really good nuts.

Prices paid to the farmer have definitely fallen for in

1946 12 piastres was a good average price, in 1950 10 piastres and today 8 piastres.

No work has been done on the actual costs of growing groundnuts. Oram states that the crop is relatively expensive to grow, costs being around £L50 per hectare. After visiting the Government farm at Sidi Mesri in October 1957 the writer was able to make some estimates in production costs. It must be remembered that at Sidi Mesri groundnuts are grown under near optimum conditions, and there is no desire for a profit. Since efficiency is not therefore of great importance production costs will be near the maximum for the Tripoli area. Costs are as follows:-

(a) 120-125 kgs. per ha. of seed at £L8 per qt.	= £L9.6 to £L10
(b) 3 qts. of Ammonium Sulphate at £L2.4 " "	= £L7.2
(c) 5 qts. of Superphosphate at £L1.2 " "	= £L6
(d) 1.5 qts. of potassium sulphate at £L2.5 per qt.	= £L3.75
(e) 4 labourers per ha. at 20 piastres a day for 4-5 months	= £L89.6 to £L112
(f) Cost of water at 5-7 milliemes per cubic metre.	
At 5 milliemes for Tripoli 4	= £L24
At 5 milliemes for Tripoli 2	= £L30

With a yield of 22 qts./ha. and a price of 8 piastres a kg. - Income for Tripoli 4 = £L160
Approx. cost of raising crop = £L140
Profit £L20

With a yield of 22 qts./ha. and a price of 8 piastres a kg. - Income for Tripoli 2 = £L177
Approx. cost of raising the crop = £L169
Profit = £L8

Even the government farm can make a profit of 14.2% on Tripoli 4

and 5% on Tripoli 2, so private farmers should do even better. Tripoli 2 is the most risky because it matures late and often fetches a low price of 6.5 7 piastres per kg. On the government farm there is a loss of £L19 per hectare if Tripoli 2 only fetches 7 piastres a kilogram. Farmers contrive to grow Tripoli 4 because it can be marketed earlier and can usually be sold at 8 piastres a kilogram. Water costs make up 17-20% of total growing costs.

In 1946 groundnuts were fetching up to 13 piastres per kilogram and thus it is not surprising that an area under this crop increased enormously. Today the market has steadied, and unless costs can be reduced there is unlikely to be a further expansion. Oram argues that if a farmer has more than a few hectares of groundnuts, he can reduce costs by mechanisation because hand labour is not cheap on a cost/efficiency basis and furthermore casual labour tends to be unreliable. Mechanisation may not however bring down costs in relation to yields, since as we have seen already maximum yields can only be obtained by hand planting.

I. Pests and Diseases.

Cropping trends reflect the popularity of a crop, which in turn depends on many factors. So far we have discussed the types of varieties grown, yields, water requirements and profitability; other factors are pests and diseases, overseas marketing trends and capital and credit facilities.

Pests do not present a serious problem although the mole cricket can be a nuisance on some farms. Fungal diseases are more prevalent and are having a slight influence on yields. Cercospera,

a leaf fungus commonly called 'leaf spot', attacks all varieties, but is more severe in the case of Virginia Bunch. The other troublesome fungal disease is Fusarium which often develops if plants are too closely spaced or overirrigated. Fungal diseases can be avoided by having a rotation and not sowing groundnuts on the same land for three to four years, by not giving too much nitrogen, by not planting too close, by not leaving irrigation water standing, and finally by harvesting the groundnuts as soon as they are mature, especially before the autumn rains. Fungal diseases are most common in September and October, so the early maturing Tripoli 4 is less susceptible to them.

Since no alternative profitable summer crop has been discovered groundnuts are often continuously grown on the same piece of land year after year. As a result a deficiency disease has appeared, showing itself as a progressive yellowing of the leaves which is usually accompanied by Cercospera; Tripoli 4 is usually more susceptible than Tripoli 2, although yields of both are severely reduced. The groundnut is a very exhausting crop and Oram (10) has shown in rotation trials that wheat yields after groundnuts are sometimes reduced by as much as 50% compared with yields after fallow, even though adequate fertilizers have been applied. Efforts have been made to find out which mineral is deficient. There is little response to phosphate unless applied to land recently brought into cultivation, little response to nitrogen unless applied to soils very low in agonic matter or badly leached by irrigation water, and little response to applications of

potash. There seems to be no shortage of the major plant nutrients.

A previous chapter has indicated that Jefaran soils are likely to suffer from a non-availability of plant nutrients because pH values are over 8 and the soil is therefore extremely alkaline. Under such conditions plants have difficulty in absorbing enough phosphate, iron, manganese, boron and other trace elements. The problem of the groundnut deficiency disease has been briefly studied by Willimott (15) and he has initiated experiments to try to ascertain the effect of high alkalinity on the availability of certain nutrients. In trials the pH of a treated box of soil was lowered to 7.4 by watering with diluted sulphuric acid. Groundnuts grown in this box did not exhibit yellowing as early or as severe as those in untreated boxes. Much work still needs to be done.

The problem is becoming acute and since yields are falling so disastrously, some farmers are reducing their area under groundnuts. In the questionnaires farmers were asked their future plans and few replied that they intended to increase their area under groundnuts as they had been doing in the past. Here are two typical answers given by farmers in the Bianchi area where groundnut cultivation is the most intense:

(1) 'Piantagioni di olivi, mandorli, agrumi in sostituzione delle arachidi perche le medesime sono affette da marciume'.

(2) 'Cereali e foraggio - poco arachidi causa marciume'

Groundnut production is suffering.

J. Exports of Groundnuts.

Conditions for exporting groundnuts. In the early 1950's exports began to increase more rapidly each year and the newly arrived F.A.O. experts immediately realised the need for some compulsory standards for the export of edible groundnuts. In December 1954 certain trial standards were established by the government (1); these form the basis of those in existence today. If groundnuts are to be sold for immediate consumption and are not to be processed for oil the appearance of the shell is of the greatest importance, because buyers in the United Kingdom will pay up to 80% more for high quality Valencia type nuts which can be bought from Spain, Tripoli and Israel. Shells must be large creamy coloured and without stains; they must be dry with a maximum humidity not exceeding 6% and the kernels must rattle when the shell is shaken. For export, Tripolitanian groundnuts are divided into two types:-

(a) Tripoli 2 - each pod of 15 mms. minimum diameter should contain two kernels. Composed of Local White and Virginia Bunch varieties.

(b) Tripoli 4 - each pod of 14 mms. minimum diameter should contain 2-4 kernels. This type is represented by Local Red.

In addition each type is further sub-divided by quality, according to the percentage of shells or pods not conforming to the rules laid down, into Extra, Standard and Mercantile. Crops failing to reach export standards can be sold locally or exported to the Mediterranean countries at lower prices.

Table 13.12 The Trend of Groundnut Exports, 1945-57.
(Total groundnuts exports per calendar year)

Year	Quantity in metric tons	Value	Percentage of crop
1945	23	£L23,000	11.5%
1948	54	£L54,000	3.6%
1949	104	£L104,000	11.68%
1950	107.838	£L98,000	5.6%
1951	495.216	?	25.18%
1952	986.25	?	31.8%
1953	4,133.392	?	82.5%
1954	5,150.0	£L583,000	77.2%
1955	6,080.0	£L633,145	76.0%
1956	9,190.0	£L818,408	99.5%
1957	10,590,0	£L847,228	87.2%

Almost all exports from Tripoli are in shell for direct consumption and during the last few years the groundnut has been Libya's chief export. In 1945 exports were a mere 23 metric tons valued at £L23,000, but in 1957 they had been increased to 10,590 metric tons valued at £L847,228. The proportion of the total crop exported has fluctuated, between 5 and 10% in early years to 82.5% in 1953. Figures have remained high, and in 1956 practically the whole crop was sent to Western Europe to take advantage of good market conditions.

Figures for calendar years are misleading because the export year is more akin to the agricultural year. Exports start in September and tend to die out by June (see fig. 25b).

Of the 1956 crop of 9,202.4 metric tons, 8,773 tons were exported bwteeen the months of August 1956 and May 1957 inclusive (see Appendix **VIIIa**). During this period 65.7% of all groundnuts exported were Tripoli 2 and the remainder Tripoli 4 (34.3%). Of the Tripoli 2 groundnuts 57.3% were standard quality, 42.7%

mercantile; and of the Tripoli 4 53.32% were standard and 46.48% mercantile.

Of the 1957 crop of 10,428 metric tons, 9,517 metric tons were exported between the months of September 1957 to August 1958 inclusive. 64% of the groundnuts were Tripoli 2 and 36% Tripoli 4, roughly the same proportion as the previous year. The Tripoli 2 is sub-divided into .1168% extra, 47% standard, 44% mercantile and 9.07 sub-mercantile, the overall quality being generally inferior to that of 1956. Of the Tripoli 4, 55% were standard, 41.68% mercantile and 2.17% sub-mercantile, little different from the previous year.

Table 13.12 Main European markets for Tripolitanian groundnuts.

Country	1954/5	1955/6	1956/7	1957/8
Italy	3.019%	4,935%	16.27%	32.9%
U .K.	46.5%	23.68%	37.4%	24.68%
Germany	19.45%	39.5%	19.7%	16.75%
Holland	15.65%	11.51%	11.57%	14.68%

Up to 1951 exports were largely to Italy because of the favourable import quota given by the Italian Government. In 1951 and 1952 Italy, Tunisia and France took the bulk of the exports, but in 1953 with a sharp rise in the amount of nuts sent abroad, the Western European markets came into prominence. In 1954/5 and 1955/6 exports to Italy were small and the United Kingdom and Germany were the chief importers, but by 1958 Italy again takes the largest share of exports -- evidence of stiffer competition in the Western European markets, with Tripoli falling back on the Italian market.

The countries have differing tastes in groundnuts (see Appendix **VIIIb**). In 1956/7 Italy took mainly mercantile Tripoli 2 (65.3%), the United Kingdom mainly standard Tripoli 4 (65.4%), Germany standard Tripoli 2 (80.7%), Holland mainly standard Tripoli 2, Malta mainly mercantile Tripoli 2 and 4 and Tunisia mainly mercantile Tripoli 4. Only Italy and Malta take sub-mercantile nuts.

The Export Cycle. - see fig. 25b. Exports are seasonal, starting in September and building up to a peak in October, November and December. Exports of Tripoli 2 generally exceed those of Tripoli 4 in most months except sometimes in September and October. Of the Tripoli 2 nuts standard quality nuts were generally higher than mercantile in 1956/7 but lower in 1957/8 particularly after Christmas. On average exports of standard Tripoli 4 exceed those of mercantile quality.

Export Prices of Groundnuts. If groundnuts have only 4% of one kernel pods and if 1 kg. of nuts gives 900 grams. of kernel, then they are considered standard quality. Standard nuts were bought from the farmer by Consorzio in 1958 at 8.5 piastres per kilogram. These were then sorted and put into 30 kgs. bags for shipping to Holland and Germany and 28 lbs. for shipping to the United Kingdom. F.O.B. prices for the 1958 crops worked out at about 9.1 piastres a kilogram (i.e. 8.5 piastres for the farmer, 0.4 piastres for the cost of sorting and 2 piastres the cost of bagging and transport to the ship). Total Cash Insurance Freight (C.I.F.), which includes a small percentage for Consorzio, was 11.2 piastres per kg. = £L112

per metric ton. If the market price in Western Europe is less than £L112 per metric ton then it is the farmer who is paid less. The average F.O.B. prices in Tripoli per metric ton of standard quality was quoted by the Chamber of Commerce as follows:-

July-December	1955	£L92.5
Year 1956		£L109
Year 1957		£L112

C.I.F. prices of Libyan groundnuts in Western Europe ports in the export year 1956/7 averaged £L130 per ton extra quality, £L115-120 per ton standard quality, and £L104-109 per ton of mercantile quality. Insurance and freight usually adds £L10 per metric ton to F.O.B. prices. The C.I.F. prices are rather high when it is considered that at the same period the average price of Sudanese shelled nuts was between £L78 and £L73 per long ton, and those for Nigerian shelled nuts were also fetching similar prices. Tripolitanian groundnuts are unshelled and depend on their good quality to command high prices.

World Producers and Exporters of Groundnuts. In order to place the Tripolitanian groundnut industry in its right perspective, it is necessary to look at world production and trade. Although of tremendous importance to Libya, her groundnuts only form a minute part of the world trade in this commodity. The increased groundnut production in Tripolitania has been in line with the trend in world production. In the period 1935-39 the average yearly world production was 9,564,000 metric tons, 1945-49 10,810,000 metric tons, and in 1958 it had reached 15,500,000 tons. The figure for 1957, 14,400,000 metric tons was 25% up on the 1950-54 average.

The chief producers in 1956 were India - 4,267,000 metric tons, Communist China - 3,336,000, French West Africa 1,100,000, Nigeria 800,000, U.S.A. - 729,000, Argentina - 310,000, Burma - 198,000, Brazil - 185,000. Some of the principal world exporters were Nigeria with 455,200 metric tons, French West Africa 293,200, Sudan 64,400, India 12,400, Indonesia 1,600. In the same year Libya with a production of 9,202 metric tons (i.e. .073% of the world total of 12,682,000 metric tons) exported 8,773 metric tons (i.e. 1.93% of Nigeria's exports).

K. Conclusions.

Production has been expanding every year since 1945. Yields per hectare at first rose considerably but are now steadying. The quality of groundnuts exported has declined because many farmers have such large areas of groundnuts that they lack the labour and storage facilities to lift the crop quickly before the rains; for the same reason many farmers cannot get their crop to market in October and therefore cannot benefit from the best prices on the European market. In June 1958 there was still a small amount of the 1957 crop to clear and some sub-mercantile groundnuts had to be exported. The appearance of a deficiency disease has also caused some farmers to cut down their acreage. Competition from other shell exporting countries is now fiercer; Egypt and Sudan with the help of government subsidies are undercutting Libya by 10%, China has very cheap labour and therefore low production costs, and Israel has a high technical level of cultivation. All groundnuts in Tripolitania are grown by private farmers and there are no subsidies. Speculation has now been killed and production will

rationalise itself. The Jefara is good land for the groundnut and although the crop seems to be approaching the peak of its popularity* it will continue to play an important part in the economy of Libya as long as high yields and good quality are maintained.

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*The Groundnut crop may well have reached its peak of popularity for the November 1959 issue of Barclays, D.C.O. 'Overseas Review' states "the crop (1959) is well below that of last year since a smaller area was planted, and certain areas have suffered from disease".

CHAPTER 14

Cereals and Supplementary Irrigation

A. Introduction.

In order of importance, the main cereals grown on the Jefara Plain are barley, wheat, maize, forage cereals such as oats and millet. In Roman times, Tripolitania like Cyrenaica, was an important grain producer, and exports to Rome were considerable. Today cereals are raised under varying conditions and grown extensively throughout much of Tripolitania. Most winter small grains are grown on dry land but an increasing area has been devoted to irrigated cultivation in the last few years. Before the Italians arrived the production of wheat was very small and barley reigned supreme. As a dryland crop, the latter is grown over wide areas of the Inner and Dune Jefara and in small areas between palm trees on the sanīya farms of the coastal oases. After 1912, particularly in the 1920's, many dryland Italian Concession farms were established. Very little land on each of these farms was set aside for cereal cultivation alone, and most of each farm was planted to olives and almonds, with winter cereals being grown each year between the trees. The practice of growing wheat and barley between tree crops was continued until the trees reached maturity, although today some farmers still continue to grow field crops between productive trees. Part of the winter cereal crop on Demographic farms has been irrigated ever since the settlements were started. It is true to say, however, that after the 1939/45 War, even until 1950 and later, the area of irrigated

winter cereals in Tripolitania was very small, but in recent years, conjoined with the expansion of groundnuts and the introduction of irrigation for the olive tree, an increasing part of the barley and wheat crop has been irrigated. Italian and Libyan methods of cultivation differ considerably. The Italian concession or demographic farmer grows his winter cereals between tree crops and usually has some form of rotation; in contrast the Libyan usually grows his crop in the zone of shifting cultivation in the Inner and Dune Jefara, the land generally lying fallow for several years, although occasionally being cultivated continuously.

The summer cereals, Maize and millet, are of minor importance and their distribution is confined to the coastal oases and the small oases near the Jebel.

B. Barley.

This crop is the hardiest of the winter cereals. Although giving low yields, local varieties are able to withstand the dry and hot conditions that prevail in some winters, and they mature more quickly than local varieties of wheat. Barley forms a large part of the Libyan's staple diet and is the traditional winter cereal crop of the Jefara Plain; it is usually grown under a single crop system, mainly in the area of shifting cereal cultivation in fig. 9. In the Inner and Dune Jefara, barley is scattered by hand over the land after the first substantial autumn rains, and is then roughly covered with soil by ploughing with a primitive wooden scratch plough. (More details on shifting cultivation have been given in chapter 2). The farmer

sows his seed over a wide area because he is interested only in a large multiplication of seed not a high yield per unit area. A good harvest is only gathered if the winter and spring rains are satisfactory. The six-bladed local barley varieties are short-strawed and well adapted to dry cultivation. In very dry winters, however, the straw becomes soft and this leads to a loss of harvest. The harvest is usually in April. The annual production of barley in Tripolitania for the period 1930/1 - 1957/8 is given in Appendix **IXa** . Figures show that the crop is intimately related to rainfall amounts and it is interesting to compare production figures with the rainfall graph given in fig. 10d. In the drought years of 1935/6 and 1946/7 the production of barley dropped to 3,000 and 1,700 metric tons respectively; in the wet years 1943/4 and 1948/9 production soared to 125,000 and 135,000 metric tons respectively. An average yield is meaningless, but total yields of over 40,000 metric tons are usually considered satisfactory. The area actually sown to barley each year seems more stable than production and averages about 250,000 ha., although in drought years it contracts and in 1946/7 was only 9,250 ha. It is clear that in Tripolitania barley still is predominantly a dryland crop.

The provincial distribution of the barley crop is given for several years in Appendix **IXb** . In the present context it is sufficient to quote figures for three selected years: average, good and bad.

Table 14.1 Provincial Distribution of Barley Production in three selected years (metric tons).

Year		Tripoli & Western	Eastern	Central
Average year	1956/7	48,076	15,678	12,372
Good year	1944/5	29,000	45,000	21,000
Bad year	1946/7	8,310	8,700	-

In a good year Tripoli and Western Province produced 34.7% of Tripolitania's barley; in a bad year about 50% and in an average year 63.1%. On the Jefara Plain the Barley crop is less affected by drought than it is in other areas and in recent years, since 1950, the Jefara has emerged as the most important barley growing area in Tripolitania.

Statistics are available, for two recent years, for the provincial production of barley on cabila land on the one hand, and on Italian demographic and Italian and Libyan hawāza farms on the other. These offer the first opportunity for an assessment of the amount of irrigated barley produced.

Table 14.2 Harvest of Barley on Cabila and Azienda Land, 1954/5 and 1955/6. (metric tons) (3)

Cabila Dryland

Year	Tripolitania	Trip. and Western	Eastern	Central
1954/5	32,500	20,000	2,000	10,000
1955/6	74,000	35,000	17,000	22,000

Azienda Land

Province	1954/5		1955/6	
	Dry	Irrig.	Dry	Irrig.
Tripolitania	2,300	1,000	4,170	2,350
Tripoli & Western	2,000	750	2,400	2,150
Eastern	250	250	1,700	200
Central	50	-	70	-

Tripoli and Western Province produced 61.5% of Tripolitania's

total cabila barley production in 1954/5 and 47.3% in 1955/6. On the Azienda land the same province produced 87% of the dry barley in 1954/5 and 52.5% in 1955/6, and in the same two years 75% and 91.5% of the irrigated barley respectively. Today the Jefara Plain is probably yielding an average of 50% of the cabila land barley, 70% of the azienda dryland barley and 80% of the azienda irrigated barley.

Figure 24a, which is based on the statistics given in table 14.3, shows how the main concentration of barley production is in the areas of sedentary cultivation - Tajiura, Zawia, Azzahra, Gasr Ben Gashir and Suani Ben Adem, with other areas of lesser importance being the Dune Jefara, and the Inner Jefara south of Tripoli. There is little or no barley produced in the south-west.

Table 14.3 Production of barley and wheat by locality on the Jefara Plain (Quintals)

Locality	Barley	Wheat
Tripoli City and Suk el Jiumaa	8,300	3,800
Tajiura	6,400	1,500
Garabulli	7,000	200
El Alawna and Aulad Ouein	2,300	1,700
El Kanajda	2,400	200
Er-Regiat	10,700	2,800
El-Khetna	4,200	1,400
New farms in above areas	42,800	7,000
Zawia and Azzahra	59,400	8,200
Bir el Ghnem	3,100	1,400
Sorman	6,200	1,800
El Haamoura	300	100
Sabrata	7,900	2,500
Ajelat	6,000	1,700
Zuara	7,400	1,200
Regdalin	5,800	1,600
El Assa	3,900	2,100
Tiji and Jaush	200	120
Gasr el Khiar	1,000	300

Although a very hardy crop, more barley is being irrigated

at present than ever before. Appendix IXc gives the yearly production and areas of barley on the IEPS demographic farms from 1952/3 to 1956/7. By comparing the first and last years it is seen that at Oliveti, Bianchi, Hashian and Micca there has been a considerable expansion of the area of irrigated barley at the expense of dryland barley. At Giordani there has been an expansion of both the irrigated and dryland barley area, but the expansion of the irrigated area has been greater. Corradini (Ghanima) alone remains entirely dry. It is impossible to refer to the farm studies in detail, but barley is irrigated on the following Libyan hawāza: 12, 13, 14, 16, 17, 18, 20 and 21; on the ENTE farm 36 at Oliveti; and the private sanīya farm, 42. Barley is also irrigated on some of the Italian concessions but unfortunately insufficient information is given in the farm studies. Plate 19 shows barley being irrigated by sprinklers on an Italian concession farm at Gasr Ben Gashir.

Yields of dryland barley are very low. In a wet year (1943/4) the yield for Tripolitania was 4.515 qts./ha., in a drought year (1946/7) 1.9 qts./ha., and in an average year (1956/7) 2.7 qts./ha. As a rule no fertilizers are given to dryland barley, and yields naturally fluctuate with the rainfall. Provincial yields for an average year, show that Tripoli and Western Province have the highest yield with 4.57 qts./ha., Central Province next with 3.2 qts./ha., and Eastern Province the lowest with 1.18 qts./ha. On the Jefara Plain, Lewis* found little difference between yields

* Lewis, R.: 'Irrigated Land-Use and Irrigation Report', L.A.T.A.S., Libya.

of dryland barley on Arab land and yields on Italian land. The areas with the highest yields for both types of land were Tripoli, Fonduk el-Togar, Azizia, Gasr Ben Gashir and Suani Ben Adem. Theodorou* states that, in the Zawia area in 1952, the yield of dry, single-cropped barley was 1.5 qts./ha. on Arab farms, and 2.9 qts./ha on Italian farms. Despite Lewis' findings, it seems that Italian farmers are getting higher yields per hectare. Every year yields in the Inner Jefara are low and rarely exceed 2 qts./ha - see plate 28.

There is a big difference in yields per hectare between dry and irrigated barley. At Sidi Mesri, one hectare of irrigated barley yields 30-35 qts., whereas one hectare of dry barley only yields 6 qts.⊖ Appendix **IXb** gives the difference in yields between dry and irrigated barley over a period of five years on the INPS farms. Irrigated yields are generally 4-5 times greater, although they do fluctuate according to the amount of rainfall. Only about half the quantity of seed is sown on dry land compared with irrigated land.

The barley crop is much more important to the Libyan than to the Italian. Theodorou calculated that in the Zawia area, barley represented 30% of the total value of production on Libyan farms and only 4% on Italian farms. Since this crop is so important, and because local varieties have such limited possibilities, experiments are being carried out at Sidi Mesri to find an early maturing, high yielding dry barley, and a high yielding irrigated barley, which will grow well under local conditions. Seed, 80 kgs.+ for irrigated land and 60 kgs. for dry land, is usually

* B/96
⊖ Personal communication - Khairi Sghaier.

sown during the first three weeks of November. Varieties being tried are: California, Club Lariout, Jordan, Merzana and Athenais. Mariot has yielded 40 qts./ha. under irrigation. Experiments are also being carried out on local varieties such as Wadi Mejenin, Tobruk and Hon.

C. Wheat.

Wheat is much less important than barley and in recent years the production of barley has been 3-4 times that of wheat. However, in the last decade, 1950-60, there has been no evidence of an expansion of the barley acreage, but in contrast there has been a general increase in the area of land devoted to wheat. In the period 1942/3 to 1949/50 the area of land under wheat in Tripolitania ranged from 17,000 to 35,000 ha., with 1946/7 an exceptional year with only 8,150 ha.; in 1955/6 it was 44,460 ha., in 1956/7 80,392 ha. and in 1957/8 58,000 ha. Figures for the total production of wheat in Tripolitania, which are given in Appendix **IXa**, are not as closely related to rainfall as are those for barley. This is due to the fact that a larger proportion of the wheat crop is irrigated. Wheat usually finds conditions too harsh in the Inner and Dune Jefara, and in the areas of shifting cultivation, it is limited to distribution to the heavier lands (tin in Arabic - see chapter 3). A little wheat is grown on the coastal sanīya farms, but most is produced on the larger hawāza farms.

The provincial distribution of wheat is given in Appendix **IXb**, and as in the case of barley three representative years are taken:-

Table 14.4 Provincial Distribution of Wheat Production in three selected years (metric tons)

	Tripoli & Western	Eastern	Central
Good year 1956/7	11,479	2,927	8,150
Average year 1944/5	8,500	2,500	1,000
Bad year 1946/7	538	508	-

In a good year, Tripoli and Western Province produce 50.5% of Tripolitania's wheat, in an average year 70.8% and in a bad year 51.5%. Tripoli and Western Province is therefore the most important wheat producing area in all years.

Table 14.5 indicates how much of the provincial production of wheat is produced on cabila land and how much on dry and how irrigated azienda land.

Table 14.5 Harvest of wheat on cabila and azienda land in 1954/5 and 1955/6. (metric tons) (3)

Cabila land	1954/5	1955/6
Tripolitania	4,350	10,650
Tripoli and Western	3,500	7,000
Eastern	100	1,250
Central	750	2,400

Azienda land	1954/5		1955/6	
	Dry	Irrig.	Dry	Irrig.
Tripolitania	2,150	2,400	4,300	2,460
Tripoli and Western	150	2,000	300	2,300
Eastern	1,000	400	2,800	160
Central	1,000	-	1,200	-

Tripoli and Western Province produced 80.5% of Tripolitania's total cabila wheat in 1954/5 and 65.7% in 1955/6. On azienda land, which includes Italian concession and demographic farms and Libyan hawāza farms, Tripoli and Western Province produced only 7% of the dry wheat but 83.4% of the irrigated wheat in 1954/5, and 7% and 93.5% respectively in the following year. Of the wheat produced on the Jefara Plain in 1955/6 therefore 73% (9,600 tons)

came from cabila land (shifting cultivation), 24% from irrigated azienda land, and only 3% from dry azienda land. Of the 39,550 metric tons of barley harvested on the Jefara in the same year, 87.6% was from areas of shifting cultivation, 6.75% from dry azienda land and 5.65% from irrigated azienda land. Although the larger part of the wheat harvest still comes from cabila land, a significant amount is also produced on irrigated azienda land. In 1955/6 the production of irrigated wheat and barley on the Jefara Plain was roughly the same. Of the wheat grown on the azienda farms in 1955/6 in Tripoli and Western Province, 88.8% was irrigated, compared with only 47.2% of the barley.

Wheat production is concentrated more in the areas of sedentary cultivation than barley. Table 14.3 shows that the main areas are: Suk el Jiumaa and Tripoli oasis, Gasr Ben Gashir, Suani Ben Adem, Zawia and Azzahra.

Appendix IXd gives the production and areas of wheat on the INPS demographic farms in the period 1952/3 - 1956/7. From studying this, it appears that there has been a shift in emphasis from dry to irrigated wheat, although there has been no expansion of the area of land devoted to irrigated wheat. Less wheat is being grown under dry cultivation. In 1952/3 Bianchi, Micca and Corradini grew dryland wheat but in 1956/7 Corradini remained the only producer (Castelverde only has a few farms occupied and does not concern us here).

Yields of dryland wheat are usually much the same as those for dryland barley. Averages for the whole of Tripolitania are 2.76 qts./ha. for a wet year (1956/7), 3.43 qts./ha. for an

average year (1944/5) and 1.275 qts./ha. for a bad year (1946/7). Provincial yields for the year 1956/7 show that Tripoli and Western Province has the highest with 4.175 qts./ha., Central Province next with 4.05 qts./ha. and Eastern Province last with 0.89 qts./ha. Lewis discovered that there was little difference between yields for dryland wheat on Arab and Italian farms on the Jefara Plain, but for irrigated wheat yields on Italian farms were higher, 11.32 qts./ha. compared with 9.1 qts./ha. on Arab farms. Theodorou found that, in the Zawia area, none of the 70 Libyan farmers grew irrigated wheat, and that yields for dryland wheat on these farms were very low, 0.99 qts./ha. He also found that the Italian farmers, none of whom grew dry wheat, had two yields for irrigated wheat; if land was under wheat alone it yielded on average 14.33 qts./ha., but if the wheat was grown between trees or interplanted with any other crop, then yields averaged 10.39 qts./ha. 13-15 qts./ha. would appear about the average yield for the Jefara Plain.

Yields of irrigated wheat on the INPS farms, which are given in Appendix IX, range from 13.03 qts./ha. to 15.66 qts./ha. at Oliveti, 11.46 to 14.4 at Bianchi, 11.83 to 15.5 at Hashian, 15.22 to 20.75 at Giordani, and 13.46 to 16.78 at Micca. In contrast, yields of dryland wheat range from 0.964 qts./ha. to 4.8 qts./ha. Yields on a Concession farm at Zawia (study no. 4) are 25 qts./ha. for irrigated wheat and 5 qts./ha. for dryland wheat. The best growing conditions for wheat are to be found at the Government Experimental farm at Sidi Mesri, and here yields for irrigated wheat are 40 qts./ha. and for dryland wheat 6 qts./ha.

There is obviously room for an improvement of cultivation methods on most of the private farms.

Although most of the varieties of wheat which are grown at the moment, were introduced by the Italians, many of them are not well suited to local conditions. A very hardy, early maturing, hard wheat is needed for dry cultivation, and a vigorous high yielding wheat, capable of withstanding heat, is needed for irrigated cultivation. Some Italian varieties such as Florence Aurora, Mentana and Quaderna, adapted themselves well to Libyan conditions, but F.A.O. continues to experiment with new varieties. The Italian varieties of Mara and Fortunato, the Moroccan B.T. 2306, and the Egyptian Giza 13a, all offer promise of being good, short strawed, soft wheat suitable for irrigation in Tripolitania. Early maturing North African varieties such as D.77, Syndiouch Mahmoudi and B.D.3225 may well be suitable for dryland cultivation (4).

D. Other Cereals.

The other cereals are not very important. Maize and millet, for instance, only amount to about 3.5% of the total value of production on Libyan farms and 0.5% on Italian farms. Nearly all maize, millet and oats are confined to Tripoli and Western Province, although a little is grown in Eastern Province.

Oats are only grown on a few Italian concessions on the Jefara Plain, where they are usually cut green and fed to animals. The largest acreage of this crop is on a concession south of Gasr Ben Gashir, which has the only large dairy herd in Tripolitania. The total production of oats each year in Tripolitania is only

2-400 tons, and there is not likely to be an increase in the future, because no expansion of the dairy industry is anticipated.* The local varieties of oats are poor being susceptible to rust and having little resistance to drought. Three new varieties have been tried at Sidi Mesri - Palestina, Clinton and Nemaha; the first an early maturer, the second a medium early-maturer and the third a late maturer. Under dry cultivation at Sidi Mesri these varieties have given green forage for two months.

On the Jefara about 60% of the maize crop is grown on Libyan sanīya farms (plate 29) although small quantities are grown on some of the Italian farms. There is little trade in maize, for on the swani (sing. sanīya) it is usually a subsistence crop, and on most of the larger Italian farms it is only grown for home consumption. The maize seed is usually planted from the middle of March to the end of April and the crop is harvested 115-120 days later --middle of June to the end of July. It is therefore grown during the first half of the summer and needs full irrigation. The annual production of maize is only about 400-800 metric tons and as long as the crop continues to be grown for home consumption only there is not likely to be an expansion. The maize gives good yields and grows quite well in the oases. At Sidi Mesri, with a sowing of 15-20 kgs. of seed, and an application of 8 qts. of superphosphate, 2 qts. of ammonium sulphate and 1.5 qts. of potassium sulphate, plus 200 qts. of manure, yields of 40-50 qts./ha. are being obtained. This is better than

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* For information on the dairy industry see Vieira, B/94.

the yields from any of the small grains at present grown in Tripolitania. New varieties such as Wisconsin and Fungus G. are being studied by Government experts.

Millet is hardier than maize, in that it will stand higher temperatures and also tolerate infrequent irrigation with inferior quality water. It is quite common in the oases of the south-west Jefara: Shakshiuk, Tiji and Jaush. The two main types of millet grown are known in Arabic as Gseb and Ghafouli. Total yields for the whole Jafara do not exceed 1,000 metric tons per annum. In habits, the millet plant is very similar to maize.

E. Cereals and Water Needs.

It is now an accepted fact that some of the winter cereals are given supplementary irrigation. The Arabs have probably been irrigating small areas of wheat and barley on the sanīya farms of the coastal oasis zone for many years. When the Italians arrived in Tripolitania, they decided, that unlike olives, part of the cereal crop should be irrigated. Graiff (1 p.5) gives us an idea of how much land was set aside by the Italians for cereal cultivation.

Table 14.6 Percentage of developed Italian land in Tripolitania set aside for cereals.

Owner of land	Total area developed	Irrigated cereals	Dry cereals
Private and State	126,580 ha.	1.4%	6.79%
ENTE	89,871 ha.	1.9%	5.42%
INPS	45,325 ha.	2.27%	9.38%

Several of the Italian agriculturalists working at Sidi Mesri before the last war advocated the increased irrigation of cereals.

Vivoli (8) 'favorire l'estendersi delle coltivazione irrigue', as the only way to achieve yields of 30 qts./ha.

Irrigation gives high and stable yields, and the amount of water needed for the irrigation of winter cereals is small compared with that given to groundnuts or citrus. Lewis quotes the average number of irrigations on Italian farms on the Jefara Plain as 4, each being 363 m3/ha. and together making a total of 1,452 m3/ha.; on Libyan farms there is an average of 5 irrigations giving a total of 1,150 m3/ha. With a winter crop the amount of water needed depends on the rainfall in any particular year; in some years only one watering may be required, in other years 4-6 waterings may be necessary. It would appear that if high yields are demanded, then wheat and barley must be irrigated with 1,500 - 2,500 m3/ha. over and above rainfall. At Sidi Mesri winter cereals receive a total of 2,400 m3/ha. of water in addition to rainfall; this is given in six irrigations which are at intervals of 20-30 days. Whenever possible, irrigation in November, December and January is avoided and in years of good rainfall only 3-4 irrigations of 350-400 m3/ha. are given.

Fertilizers must be applied to irrigated land under winter cereals, otherwise the soil is soon exhausted. At Sidi Mesri, 2 qts. of Triplex (12:24:12) and 1 qt. of Sulphate of Potash are given per ha. Irrigated winter cereals therefore are costly to grow on the Jefara Plain, because they have to bear the expense of water and fertilizer costs. However with fertilizers and irrigation, yields are boosted enormously. At Sidi Mesri dryland wheat gives 6 qts./ha, irrigated wheat 25 qts./ha, irrigated and

fertilized wheat 40 qts./ha. Many of the Libyan sanīya farms over-irrigate and give too little fertilizers; on farm no. 41 of the studies, 2 jiabia of wheat are given a total of 900 m3 of water -- equivalent to 3,600 m3/ha. Wheat does not need this quantity of water in the Tripoli area.

No estimates are available for the amount of water given by the local farmers to maize and millet, but at Sidi Mesri, maize is given a total of 4,800 to 5,600 m3/ha. consisting of 12-14 irrigations of 400 m3/ha. Summer cereals need two to three times more water than winter cereals.

F. The role of cereals in the country's economy.

1. Prices and costs of winter cereals. In the years 1957 and 1958, the average price of wheat per metric ton in Tripoli was £L30-35 and for barley £L25. With information supplied by Khairi Sghaier at Sidi Mesri it is possible to estimate the cost of growing irrigated wheat or barley on one hectare of land. The irrigated crop is given a mixture of Nitrogen, Phosphorous and Potash, -- about 3-4 qts./ha. -- at a cost of £L3.9 per qt. Wheat seed is about £L3.5 per qt. and barley seed £L3 per qt.

With one hectare of irrigated barley costs are:-

Fertilizers	£L4
Seed	£L3.6
Water	£L6
Labour	£L5
Total	£L18.6

If the yield of barley is taken as 30 qts./ha. then at a price of £L2.5 per qt. the income is £L75. The difference

between income and costs is approximately £L55 per ha. According to Rowland (5 p.131) the estimated cost of producing one hectare of dryland barley is approximately £L3.65; with a yield of 3 qts./ha., the cost of producing 1 qt. is approximately £L1. If we take a yield of 5 qts./ha., which is high for most of the Jefara, then the income with a price of £L2.5 per qt. is £L12.5. When production costs are subtracted, the profit on one hectare of dryland barley is £L8.85 compared with £L55 for one hectare of irrigated barley. However, the return on each quintal is very similar, £L1.77 for dry and £L1.83 for irrigated.

Returns from one hectare of irrigated winter cereals are far superior to those from one hectare of dryland crop, and whenever water is available it is more profitable to irrigate.

Broc* however believes that an income can be derived from the cultivation of wheat in the Inner Jefara, as long as there is water-spreading from the wadis. He puts forward a hypothetical example of 500 ha. of water-spread land along the Wadi el Hira. He argues that in a five-year period, there will be one good year with a yield of 15 qts./ha., 3 average years with 8 qts./ha. and one bad year with no yield. With wheat at £L25 per metric ton, the total income for 5 years would be £L48,750 i.e. £L9,750 per year. Even allowing for production costs this would seem profitable, but it is necessary to point out that his yields are optimistic.

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* B/94.

2. Export of cereals ? At one time Libya used to be an exporter of cereals but today they have to be imported. In 1945 for example 20,217 metric tons of barley were exported, but in 1955 and 1956 there were no exports, and in 1957 there was only one small export of wheat valued at £L33, and in 1958 a small barley export of 703 metric tons. In 1956 wheat imports were 702 metric tons and barley imports 3,397 metric tons. At present something like 25,000 metric tons of wheat are imported annually, plus any gift wheat and flour. Occasionally a little millet is exported from Tripolitania. More wheat and barley are needed to supply the home market.

G. Summary and Conclusions.

The Jefara Plain is now the most important producing area for winter cereals, which are still predominantly a dryland crop; there has, however, been a shift towards irrigation in the last few years. The other cereals are insignificant.

The area of land suitable for dryland wheat and barley is very limited (see fig. 11d), and even in the most favourable areas yields are low and unreliable. Irrigated land is seven times more profitable to cultivate.

With the increasing home demand for cereals, Tripolitania is now forced to import. What should the Government's policy be ? Should there be a large expansion of irrigated cultivation to obviate the need for imports; or should the irrigation of winter cereals be discouraged ? Some writers, especially Rascovitch,*

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* Rascovitch, E.M. 1953. B/93.

consider that further work needs to be carried out on the cost of production, yields and profits of irrigated winter cereals, so as to compare them with other crops of higher economic yields, such as linseed, sesame and sugar beet. Should not irrigated wheat be abandoned in favour of another irrigated winter crop, and all the demands for cereals satisfied by an expanded dryland production, and if this is deficient for a few years, by importing supplies from abroad ?

The present Government policy seems to be one of protection. It intends to encourage cereal production at home. In 1956/7 it purchased the entire cereal harvest at a fixed price through the Agricultural Bank, and subsequent to this it has increased the duty on imported flour from £L2.5 to £L7. Such protective measures can only lead to an expansion of home production, and since only by irrigating his winter cereals, can the farmer make an effective profit, the expansion is likely to be in this direction. Fortunately winter cereals only need a small supplementary type of irrigation, so that demands on the underground water reserve for this purpose are small. With water-spreading, there are opportunities for a big expansion of winter cereal cultivation in the Inner Jefara. Any development along these lines can only come from the Government.

CHAPTER 15

Other Field Crops.

Of the remaining field crops to be studied, tobacco and potatoes are the most important; tobacco because it is a subsidy crop, and potatoes because they are being exported to the Western European markets in increasing quantities. Other crops account for a very small percentage of the farmers' income and most of them are grown for family consumption or for sale in the local markets.

A. Tobacco.

There are two tobaccos grown in Tripolitania: the 'Plain' type and the 'Hills' type. The former, of which there are many varieties, is irrigated and has a luxuriant growth (see plate 32) but the quality of its leaf is poor; the latter, which is a rain crop and spurns watering, is small in size but gives a good quality oriental leaf. Some tobacco was grown in Tripolitania even before the Italians arrived but only in small amounts on a few of the coastal saniya farms, and it was only in the 1920's that the cultivation of tobacco was in any sense organised. Today the industry is controlled by the State Tobacco Monopoly which has power to buy and manufacture all tobacco produced in Tripolitania.

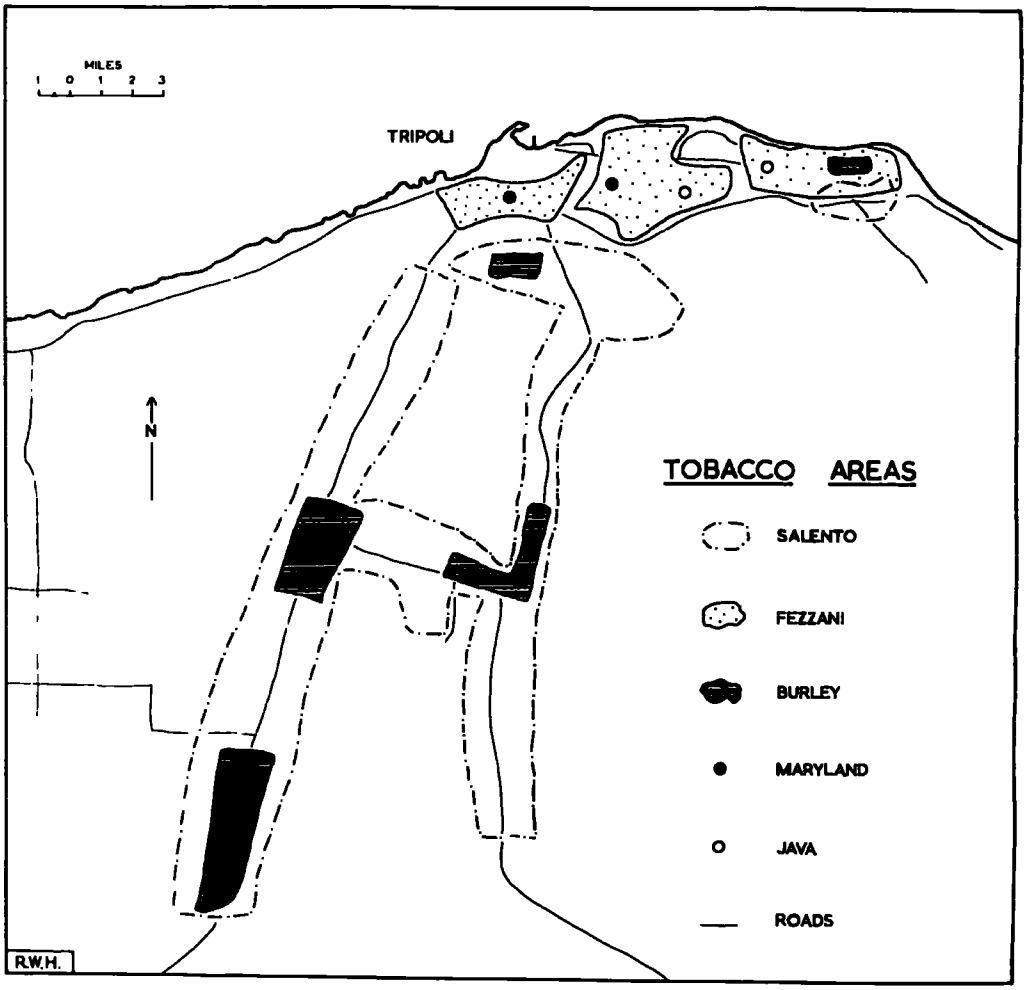
The growing of the oriental tobacco in the Jebel is centred on Tigrina near Gharian, where it was introduced by A.T.I., an Italian colonising agency which developed farms in the Jebel specifically for tobacco production. At present, A.T.I's

buildings and warehouses are in the process of being taken over by the Government Monopoly.

The S.T.M. now rigidly controls the area of tobacco grown on private farms by issuing permits, and as a result statistics for this crop are the best organised and the most accurate of any which are available for crops in Tripolitania. However, not all tobacco that is grown under licence reaches the Government factory, because a certain quantity is being smuggled to Egypt. Appendix X which gives the Monopoly's buying figures since 1925 illustrates the large number of varieties that are grown, or have been grown. In the period 1935-57 Perustitza, Samsoun, Near Eastern, Eritrean and Akhisar Jebel tobaccos have been grown, but only Perustitza has been retained. The remaining tobaccos, which are the 'plains' type, are nearly all confined to the Tripoli, Tajiura, Gasr Ben Gashir, Suani Ben Adem and Azizia regions (see fig. 26), although some grown on the Valdagno Concession near Khoms (not on the Jefara) and in recent years in the Rabta oasis.

1. Varieties of 'Plains' tobaccos: their characteristics, distribution and production.

Of the varieties included in Appendix X , only Salento, Fezzani (Tombac when sun-cured), Burley and Brazile Beneventano are grown on private farms at the moment; Dumbarai, Java, WAF and GF are still at the experimental stage; Erzegovina, Spadone and others have been discontinued. The production and areas of the various varieties during four recent years are


MILES
0 1 2 3
TRIPOLI
N
TOBACCO AREAS
SALENTO
FEZZANI
BURLEY
MARYLAND
JAVA
ROADS
R.W.H.

given in the following table:-

Table 15.1 Production and Areas of Tobacco Varieties 1955-58

Variety	1955		1956		1957		1958	
	ha.	m.t.	ha.	m.t.	ha.	m.t.	ha.	m.t.
Salento	144	360	153	400	125	326	40	104
Brazile Benev.	25	56	13	39	-	-	40	104
Fezzani	163	432	160	397	111	280	80	200
Tombac	9	28	17	59	-	-	10	25
Burley	36	108	55	164	80	210	80	200
Maryland	-	-	-	-	¼	4	5	12
Dumbara	-	-	-	-	¼	1	5	12
Java N.	-	-	-	-	¼	1	5	12

In 1958 the varieties in order of importance were Fezzani and Burley, Salento and Brazile, Tombac, Maryland and Java and Dumbara.

(a) Fezzani. This variety was introduced into Tripolitania so long ago that it is now often regarded as indigenous. Its distribution is shown in fig. 26 and in 1958 licences were issued as follows:-

Tripoli	107	licences	11.42 ha.
Suq el Jiumaa	33	"	29.51 "
Tajiura	616	"	62.78 "
Rabta	129	"	5.16 "

Most Fezzani tobacco is grown on the saniya farms in the Tajiura oases. The plant has an average height of 27" and usually produces 12 graded leaves and 4 lower leaves, which are strong and rubbery, have a high moisture content and yield a very strong tobacco. Seed is planted in beds in January and by April the young plants which are then a few inches high, and ready for transplanting at the rate of 44,000 per ha. Harvesting is usually between July and October and average yields are 2,500 kgs. of dry leaf at

23% moisture content. After the leaf has been air cured by the farmer, it is taken to Monopoly warehouses and fermented and matured in stacks of 18,000 kgs. Because of its poor and strong quality, Fezzani is mainly sold as a chewing tobacco to the Cyrenaicans, although some is used in Tripolitania for snuff and cattle dip, and also for strengthening the taste of cigarette blends.

Torbac tobacco, which is much lighter and is derived from the sun-cured leaves of untopped Fezzani, is used exclusively for smoking in the 'arghilla' water pipes.

(b) Burley. This variety was introduced from Italy in 1947 for the purpose of replacing Fezzani and also to preclude the need to import flue-cured tobaccos. In distribution it is confined to the Tajiura, Suani Ben Adem, Azizia and Gasr Ben Gashir regions (see plate 32 and fig. 26). The plant is very tall and grows to an average height of 78", usually bearing 35 graded leaves and 5 lower leaves. The leaves, which are lighter than those of Fezzani are either sun or air cured and then fermented and matured in stacks of 18,000 kgs. Seed, which is imported annually from Italy, is sown in seed beds laid down in January and later young plants are subsequently transplanted at the rate of about 20,000 per ha. (half the density for Fezzani). Harvest time is from July to October and average yields are 2,600 kgs per ha. at a 17% moisture content. Burley is used mainly as a filler tobacco because it has no

special taste. It will not replace Mezzani because its flavour is not strong enough for the local population.

(c) Salento. This Italian variety was introduced in 1928 and seed is still imported annually from Italy. It is found on only a few farms in the area delimited in fig. 26. The plant, which usually bears 14 graded leaves and 4 lower leaves, grows to an average height of 40". The leaf is heavy, dark and slightly ovate and when harvested is silo-cured and then matured in stocks of 20,000 kgs. The average density of plants per ha. is 16,000 and the average yield per ha. is 2,600 kgs. of dry leaf at a 19% moisture content. All tobacco from this variety is used for making the dark, strong cigarettes.

(d) Brazile Benevento. This tobacco is planted and harvested about the same time as Burley and Salento. Except for its slighter appearance, Brazile resembles Salento in most respects and it has the same distribution.

2. Cultivation and Irrigation. For tobacco, land is ploughed once or twice during the period January to March in preparation for transplanting which occurs in April, and since about 90 days have to elapse between sowing and transplanting, seed beds have to be paid out in January. At the time of harvest the leaves are picked individually and then most of them are strung together in groups, to be air-cured in the shade of trees.

Throughout its growth tobacco needs irrigating, but it must be given good quality water of not more than 25 p.p.m.

sodium chloride, otherwise the leaf will be less combustible (38). Judging by the jungle-like character of much of the plains tobacco crop, it must be receiving large quantities of water. Lewis* estimates that the Italians are giving their tobacco crop a total of 13,312 m3/ha., consisting of 32 irrigations of 416 m3, whereas the Libyans are only applying 5,500 m3/ha. in 20 irrigations of 275 m3. The number of irrigations and the total amount of water given seem rather high. Prinzi and Negretti (25) consider that tobacco only needs 2,300 m3/ha., given in 4-5 waterings of 400 m3 from May to September; Trigona only suggests an irrigation every 20 days (34 pp.83-86) and the instructions given to farmers in 1929 (10) recommend that Salento be given only 5-6 irrigations between the third week in April and the first week in September. Rands (26) estimates that Fezzani, after an initial irrigation at transplanting and a 20-30 day dry period, should be watered every 5-6 days, and even every three days if it is abnormally hot in mid-June at the time of topping; Burley needs irrigating about every 8 days. Rands, however, decided that most of the farmers were over-irrigating, with the result that tobacco plants were too large and luxuriant. To prove this he carefully measured the quantity of water that was given to his experimental plots of Java and Maryland at Sidi Mesri. The results communicated to the writer (28) are given in the following table:-

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* Lewis, R.H.: 'Irrigated Land-Use and Irrigation Report', L.A.T.A.S. (Point IV), Libya.

Table 15.2 Irrigation of 1958 Experimental Tobacco Plots at Sidi Lesri.

Spacing of Plants	Variety	No.of irrigations.	Quant. per irrig.	Vol.of Water per 500 sq.m.	Vol.of Water in m3/ha	Remarks	Yields
1 m. x 1 m.	Maryland (1st.Gen.)	19	3 m^3	57 m^3	1,140	untopped	623 kgs.green leaf
1 m. x 1 m.	Maryland (Orig.)	18	3 m^3	54 m^3	1,080	untopped	715 " " "
1 m. x 1 m.	Java (1st.Gen.)	17	3 m^3	51 m^3	1,020	untopped	447.5" " "
1 m. x 1 m.	Java (Orig.)	16	3 m^3	48 m^3	960	topped	647.5" " "
80 x 80 cms.	Maryland (1st.Gen.)	15	3 m^3	45 m^3	900	topped	850 " " "
80 x 80 cms.	Maryland (Orig.)	14	3 m^3	42 m^3	840	topped	1,258.5" " "
80 x 80 cms.	Java (1st.Gen.)	18	3 m^3	54 m^3	1,080	topped	525 " " "
80 x 80 cms.	Java (Orig.)	11	3 m^3	48 m^3	960	untopped	627.5" " "

The volume of water required varies from 840-1140 m3/ha., representing minimum figures because the 1958 summer was cool. Irrigations were made at intervals of 6-15 days, depending on the local weather and soil conditions. Rands agrees that away from the coastal belt more frequent irrigations will be required and he quotes a farmer at Azizia who states that Salento needs from 2,000 - 5,000 m3/ha. during the normal summer, given in plus or minus 24 irrigations. Even in a summer with a high incidence of Ghiblis, when it may be necessary to irrigate for the sole purpose of cooling the soil surface to prevent the tobacco leaves from becoming burnt, it is doubtful if more than 3,000 m3/ha. would be applied at Sidi Lesri. However, it does appear that rates of irrigation are necessarily higher in the Azizia region than along

the coast where humid northerly winds are experienced during many summer days.

3. Limitations of the present varieties of tobacco and the search for suitable new varieties.

Most leaves from the 'Plains' tobaccos are strong and rubbery, and have poor burning qualities, furthermore, they arrive at the factory and warehouse in a filthy condition. Few irrigated tobaccos produce good leaf, and it seems unlikely that with the climatic and soil conditions prevailing in Tripolitania, that a tobacco will be produced that is of sufficiently high quality to break into the world market. Salento is the best tobacco grown on the Jefara Plain, but although it is liked by the local population, it is of inferior quality compared with that grown abroad. Exports of Burley and Fezzani are out of the question and their consumption at home is very limited.

Attempts have been made to eradicate the bad burning qualities of local tobaccos by the application of fertilizers, but without success. The S.T.M. therefore decided to search for foreign air-cured varieties which could replace the local varieties and furnish its factory with a better quality leaf. In 1957 trials were carried out on the following varieties (27):-

Dumbara)		Java Country
G.F.)	Indian	Maryland
W.A.F.)		Siam

The results of the trials showed that Java and Maryland had better quality, taste and burning characteristics than any of the local varieties and at the same time appeared to grow well under local conditions. Java and Maryland were grown in 1958 (28) to produce

seeds for distribution to farms in 1959.

5. S.T.[illegible]'s Policy 1958. Before the war the Italians were hoping to develop tobacco into the leading summer cash crop, but today it has been overshadowed completely by groundnuts. The Monopoly realises that there is no prospect of a permanent export of tobacco even if new varieties adapt themselves well to local conditions; the Sefara will never produce a good leaf. Two batches of Fezzani tobacco were exported to Algeria and Egypt respectively in 1957, but this was only a chance export due to unsettled conditions in those countries.

On the 1st January 1958 the stocks in the Monopoly's warehouses, at the present rate of consumption, amounted to 50 months supply of Fezzani, 37 months supply of Burley and 32 months supply of Salento. It is clear that with the very limited demand for Burley and Fezzani, the production of these two tobaccos ought to be drastically reduced. There was a small export of Salento tobacco to Italy in 1948 and 1949, but it is normally of poorer quality than the Italian leaf and a reduction in acreage is therefore advisable. Despite this surplus of tobacco, production has been maintained at a high level for the last few years and some prices have even been increased as indicated by the following table:-

Table 15.3 Average prices paid to farmers for all grades of tobacco leaves, rms./kg.

	1956	1957
Fezzani	120	120
Burley	120	134
Salento	121	125

In 1958 nearly 1,500 farmers benefited from what can be considered an indirect form of Government subsidy. With the above prices and average yields, the farmer's income from 1 ha. of Fezzani is approximately £L300, from 1 ha. of Burley £L370 and from 1 ha. of Salento £L325. These represent guaranteed incomes that are not related to the vagaries of a foreign market. Tobacco is the most profitable crop grown on the Jefara Plain.

The State Tobacco Monopoly, which is a social rather than an economic industry, has an enormous surplus of poor quality tobacco stacked in its warehouses. With the maintenance of present prices and acreages the only solution is to find a leaf that is more suitable for local manufacture, hence the Monopoly's experiments with Maryland and Java. Since these varieties will take several years to prove themselves, production of 'plains' tobacco will continue to be based on Fezzani, Tombac, Salento (silo-cured), Brazile Beneventano and Burley. The area of land devoted to tobacco is likely to remain constant for the next few years.

B. Potatoes.

Both for internal and external market 'la coltivazione delle patata deviene sempre più importante in Libia'. (7). The production of potatoes in Tripolitania was 657 metric tons in 1935, 4,000 metric tons in 1950, and 17,000 metric tons in 1956/7. Production is almost entirely confined to the Jefara Plain, there this shallow rooting tuber finds the good quality irrigation water to its liking. Each year there is an export which starts in December and finishes

in May; in 1956/7 2,282 metric tons of potatoes were sent abroad and in 1957/8 698 metric tons (lower because production was only 7,600 metric tons). Production costs are high, but good quality potatoes command excellent prices abroad if marketed at the right time. Gargour, one of Tripoli's leading exporters, considers that early potatoes will eventually replace groundnuts as the major cash crop.

The potato industry is now well established and imports and exports are closely controlled by the Nazir of Finance and Economics. Only the following varieties are permitted for export to Europe: Bintje (Dutch), Eclipse (British) Sieglinde (German) and Etoile dm Leon (French), The varieties that may be grown for local consumption and for export to Mediterranean countries are: Up-to-date, Arran Banner, Majestic and Bianconna di Napoli. Seed potatoes have to conform to certain standards and must be imported from certain specified countries; they are brought into Tripolitania from August to September and again in February to April, and are sold at about £L33 per metric ton.

1. Cultivation (see plates 20 and 31). On the better farmed irrigated lands of the Jefara Plain the potato is grown in a three year rotation with groundnuts, maize (or another summer crop) and autumn sown cereals or peas. There appear to be three main times of sowing: to take best advantage of the winter rains tubers must be planted at the end of September and in October; for an export crop tubers must be sown between the middle of November and the middle of December so that they are ready for

marketing in the early part of the new year (these run the risk of frost damage); spring sown potatoes which need more irrigation have to be put into the ground from mid-February to mid-March. Potatoes are usually in the ground from 90-100 days depending on the date of sowing.

Many farmers are growing potatoes, and irrigation is now an accepted part of their cultivation. The need for irrigation is evident in table 4.14, and the number of irrigations recommended by the Department of Agriculture (7) is:-

Autumn sown - about three irrigations depending on rainfall.

Spring sown - about six irrigations.

At Sidi Mesri the autumn crop is usually given 4-5 irrigations of 400 m3/ha. so that the maximum amount applied is 2,000 m3/ha.; the spring crop receives a maximum total of 4,200 m3/ha., consisting of 9-12 irrigations of 350 m3/ha. The former crop yields 100-150 qts./ha. and the latter crop 150-200 qts./ha. Yields on private farms are lower, probably about 50 qts./ha. and reflect insufficient application of fertilizers rather than under-irrigation. Few farmers use as much fertilizer as the Government farm, which applies 20 metric tons of organic manure, 6 qts. superphosphate, 2 qts. sulphate of potash and 4 qts. of sulphate of ammonia, to each hectare of crop.

2. Potatoes on a Commercial Farm. In 1958 Mitchell Cotts, (Farm Study no. 1) grew 80 ha. of early potatoes for the United Kingdom market. All the seed tubers which were Bintje, were planted in several sowings from September until the end of

November and the first potatoes were ready for lifting in December. Cultivation methods on this farm are good, and the well manured land gives average yields of 100 qts./ha. Growing potatoes is considered a gamble because cold spells in early spring can retard the crop sufficiently for it to meet competition from the Canary Islands, Algeria and Sicily, and in the 1956/7 season Mitchell Cotts lost £L20,000 on early potatoes.

3. Prospects for Potatoes. The united Kingdom is the main market for potatoes. The 1957 exports were valued at £L76,000; £L69,000 to the United Kingdom, £L7,037 to France and £L451 to Italy. The light sandy soils yielding a clean and attractive tuber, the favourable winter temperatures and the proximity of Europe, make the Jefara Plain an ideal area for the production of early potatoes. The best market is undoubtedly London and it is not surprising that the entry of Tripolitania into the early potato trade is the result of the initiative of British firms. One of them, A.I.T.I.C., has found the Libyan potatoes so popular in London, that it has invested in a grading plant in Tripoli and now exports grade potatoes in 20 kgs. baskets.*

It is essential that the export of potatoes should be in the hands of highly specialised and capitalised firms, and fortunately several are operating in Tripoli at the moment. Potatoes must arrive in London in February and March, when they can command 9d lb., missing this market means selling in competition with Canary Islands and other potato producers, and prices drop to about 3d lb. As long as producers give

* Sunday Ghibli, 2nd March, 1958.

sufficient irrigation, use the best quality water (see table 3.6), practise a rotation and apply adequate fertilizers, and lift the potatoes when they are small and soft-skinned, sales will increase on the London market and the potato could well replace the groundnut as the leading cash crop.

C. Forage Crops.

In the areas of sedentary cultivation most animals are kept for work, although a limited number of cows produce milk for Tripoli; it is in the Dune Jefara that the majority of sheep and goats are reared. The working animals are mainly fed on lucerne and this crop is grown widely in the coastal zone. It will tolerate both high temperatures and poor quality water, but it is a high water consumer and its rapid growth and numerous cuttings calls for frequent irrigation. It takes about 800 m3 of water to produce 10 qts. of lucerne (32).

Safsfa, which is the local name for lucerne, is the major fodder crop on the saniya farms, and without it the cattle, camels and donkeys that operate the dalu would have very little to eat. In preparing his land for safsfa the Libyan farmer applies animal manure at the rate of 50 metric tons per ha., and after this has been ploughed-in, he sub-divides his land into jedawl. The local seed is either the Khobbesi variety, which has a large leaf and gives heavy yields, or Nefeli, which is a smaller variety and gives lower yields. If a farmer is growing his safsfa in an area of sweet water he goes to Tajiura for his seed, but if he is growing it in an area of saline water he goes to El Menshia.

Seed is usually sown in the spring from March to the middle of April and after 40-45 days it begins to form flower buds; two days later the farmer makes his first cutting, and then subsequent cuttings at intervals of 20-25 days in the summer and 30-40 days in the winter. This continues for 3-4 years and then the crop is ploughed-in. A good crop of local lucerne will give an average of 8-10 and sometimes even 12 cuttings, with a production ranging from 2,000-3,000 qts./ha.

Lucerne requires water throughout most of the year. Prinzi and Negretti calculated that it needs a total of 10,800 m3/ha., given in 36 irrigations of 300 m3; table 4.14 suggests a total requirement of 17,300 m3/ha. with jedula irrigation. Lewis estimated that Libyan farmers were giving an average amount of 8,908 m3/ha. and the Italian farmers 14,756 m3/ha.

Forage crops are grown on all the Government farms,* primarily to feed the animals at Sidi Mesri and Garabulli; they include mixed vetches, oats, peas, carrots, barley, trifolium and lucerne. Nearly all of them are sown between September and October. Lucerne may be sown any time from October to March, although better results are obtained from the autumn sowings because the roots are more fully established by the advent of summer. All crops are heavily manured, and they are usually irrigated once a week with 500 m3/ha. during the summer although every four days if the weather is very hot.

Lucerne is by far the most important forage crop and will

* Information supplied by L. Garuccio, 29.10.57.

remain so in the future because of its tolerance of brackish water (see table 3.6). As yet the local varieties have proved themselves superior to any exotic varieties. Most of the saniya farms grow ¼-1 ha. and the hawāza up to 3 ha. The production of Lucerne will remain stable at the present level. The big disadvantage of the crop is its high water needs, and this has led workers in Israel to experiment with the mangold* They have shown that with only half the water requirements of lucerne, the mangold can produce up to 500 qts./ha., which is considered a far more efficient use of water. Mangolds are planted in autumn and harvested between April and August. The search for a high yielding winter forage crop should be intensified, because there is no reason why fodder could not be grown in the winter and stored for consumption in the summer, thus avoiding the use of large quantities of precious water in the hot season.

D. Tomatoes.

The tomato is the next most important vegetable to the potato and it is grown as a commercial crop on quite a number of farms, although never covering more than a few hectares. Some tomatoes are grown all the year round but the main sowings are in winter and spring. The spring crop, which is the most important, has a growing season of 3-4 months and is ready for harvest in June. On well managed Italian farms with a density of 30,000 plants per ha., yields average 300-400 qts./ha., but average yields on Libyan farms are only 50-80 qts./ha. The main varieties that are

* Israel's Wonder Crop - Mangold. World Crops, April, 1959.

grown on Italian farms are Costoluto which is ready in February, and Marmande, Comet and San Marzano which are harvested in April, May and June.

The crop needs irrigating all the year round; 10,000 m3/ha. for the autumn-sown crop from October to May, and 14,400 m3/ha. for the spring crop from March to June/July.

No recent production figures are available, but since production averaged 9,200 metric tons per annum between 1946 and 1949, it is not unreasonable to assume that the present production in Tripolitania exceeds 10,000 metric tons. Most of the tomatoes are grown for local consumption but an increasing quantity is being exported. Exports, which go mainly to Malta and Italy, start in February and finish in June or July :-

Table 15.4 Monthly Exports of Tomatoes in 1958

Month	Quantity (metric tons)
February	11.2
March	6.4
May	39.5
June	0.9
July	1.4
Total	58.4

Because most of the tomatoes produced are subject to splitting and many of them are very large they can only be used for culinary purposes. Reference to table 3.6 shows that the tomato is high on the list of moderate salt tolerant crops, and with the introduction of improved varieties and the construction of a canning factory in Tripoli the production of tomatoes should expand. A few of the farm studies already indicate a small increase in the

acreage of tomatoes in the last few years, and the same trend is evident on E.P.S farms, although very slight:-

Table 15.5 Area of Tomatoes on E.P.S farms.

Settlement	1953/4	1956/7
Oliveti	-	-
Bianchi	23.72	19
Hashian	0.1	1
Giordani	20.97	22
Licca	12.72	18
Total	57.58	60

E. Other Vegetables.

A large collection of vegetables are grown for family consumption and to sell on the local markets. The most important are: peppers, melons, broad beans, onions, cabbage, cauliflower, carrots, celery, cucumbers, egg-plants, artichokes (see plate 30), asparagus and garlic. On the saniya farms the vegetables are all interplanted in a jumbled fashion, but on the larger farms each crop is found in well defined patches that together cover a small area of up to 1 ha., somewhere near the farm house.

Rascovich, the F.A.O. marketing expert, is convinced that the Jefara Plain could be a large scale producer of very early and very late crops of carrots, peas, asparagus and cauliflower. Early vegetables are a high income crop that is ready for shipment from Tripoli up to 30 days earlier than most other producing regions in the northern hemisphere. The export of early vegetables, like that of potatoes, requires highly specialised trading companies with large financial resources. Produce must be marketed exactly when planned and this is very difficult with the infrequent visits

of refrigerator ships.

By searching through the statistics available in Tripoli it was possible to trace exports of carrots, peas and asparagus. Mitchell Cotts Ltd. seems to be the only pioneer trying to market early vegetables. Asparagus (variety Argenteuil Hâtil from the Seine-Oise region of France) was first grown in post war years at Sidi Mesri, but in 1957/8 Mitchell Cotts Ltd. grew 6 ha. of the green type of asparagus that is found in southern France, and then exported it from the middle of December to the end of February. In early 1959, 159 kgs. were exported by the company, probably by air for when questioned in 1958, the management stated that this method of transport would have to be used in order to overcome the shipping difficulties. Mitchell Cotts is also growing early carrots. On the Jefara this crop is sown in October and is available for export from January to May; in this period in 1957 232.43 metric tons were shipped to foreign markets. Broad beans are quite an important crop on some farms (see farm studies) but there is no export and much of the crop is fed to animals.

F. Miscellaneous Crops.

1. Henna. Before the war, the leaves of this dye-producing plant were exported to the Middle East, to Marseilles, and to other North African countries, but today few farmers grow this crop and exports are insignificant. There has been a serious deterioration in the quality of leaves exported in recent years and this accounts for the fall in demand for Libyan henna. The value of exports was £L3,841 in 1954, £L142 in 1955, and £L234

in 1956. With the general contraction of world demand for henna the crop will probably disappear from the coastal oases in a few years time, except for a few very small areas which will supply local demand.

2. Strawberries. Small quantities are produced from the end of November until March, but the fruit is small and very sandy. Sand is an excellent medium in which to grow the strawberry and much of the English crop is grown on light soil, but in Tripolitania sand is constantly being blown about and it clings to the fruit. If the varieties are changed, and if the plant is protected from sand, mulched, sprinkler irrigated and altogether given constant and skilled attention, a fruit suitable for the London Christmas market could be produced, but it would have to be transported by aeroplane. There are so many difficulties and pit-falls in the production of a high-class strawberry, that it would need a very brave trading company to attempt commercial export, and for this reason there is not likely to be an expansion of the area under this crop.

3. Flowers. These offer better prospects for the exporter than the strawberry. While the flowers in Europe are condemned to a hot-house existence, with all the cost that this involves, those on the Jefara Plain grow freely in the open throughout the winter and therefore can compete with forced flowers on the European markets. At the moment Libya is a flower importing country but Rascovich is certain that gladioli, in the period March-June, and poinsettias at Christmas, would

sell well at Covent Garden.

4. Experimental Crops. Every country is searching for new varieties or new crops which will give better returns. In the introduction, the possibility of increased exports of agricultural crops and the reduced import of food goods was emphasised as a means of destroying the permanent adverse trade balance.

One of the country's largest food imports is sugar, currently running at about 2,000 metric tons, and this has encouraged several experts to advocate the introduction of sugar beet. The crop has much in its favour if it is grown during the winter half of the year, and its adaptation to hot and arid conditions is borne out by the fact that 60% of all refined sugar produced in the U.S.A. comes from irrigated beet (8). In the Imperial Valley of south California it is planted in August and harvested in the following June; in this area its transpiration rates are only half those for lucerne and two-thirds those of potatoes. The most valuable attribute of the sugar beet is its tolerance of salt water and it heads the list in table 3.6. There is no possibility of growing this crop for export because of high production costs, but it could be grown by farmers to supply a local sugar monopoly. This would eliminate the need for importing sugar, and at the same time would provide the farmers with another cash crop, which unlike groundnuts and tobacco, would only need supplementary irrigation. It could become another subsidy crop.

Rascovich considers that more attention should be paid

to linseed. He points out that the cost of production and the yields of this crop, are very much the same as for wheat, but it commands a much higher price on the world markets. Linseed has a very deep rooting system and under dry cultivation will yield 10 qts./ha. in an average year and 20 qts./ha. in a favourable year; in contrast wheat yields rarely exceed 5 qts./ha under similar conditions. Furthermore, linseed is more drought resistant than wheat and since it ripens three weeks earlier, it misses many of the spring Ghiblis. It has been grown on a few private farms, and also at Sidi Mesri, where the Altamurra variety has yielded 20 qts./ha. under dry cultivation and 30 qts./ha. under irrigation.

Sesame, which could supply a cheaper edible oil than olive oil, could be developed as a profitable summer crop. Experiments have been carried out at Sidi Mesri on rape, and sunflower, but no results have been published to indicate whether these two are suitable for introducing as summer cash crops. Cotton has been tried, mainly because of its tolerance of salty irrigation water, but its quality was very poor and wholly unsuitable for export.

SECTION VI

EPILOGUE

CHAPTER 16

Summary and Conclusions

A. Summary.

In order to fully appreciate the changing conditions of agriculture on the Jefara Plain it is necessary to review some of the more important observations made in the text.

The possibilities of a region are determined in part by its people and with sequent occupance different types of economies develop. At the turn of the century Northern Tripolitania was little developed and Bernet, writing in 1912, aptly describes the coastal areas 'Au pied de la mer les oasis se succèdent de Lebda à la frontière tunisienne, mais en arrière, le pays est souvent semblable à un désert, désert en petit, mais qui en a tout l'aspect et le caractère'. Thus was the Jefara Plain when the Italians arrived; a few coastal irrigated oases and inland a vast sandy area with grazing animals and a few barley patches.

Like the Israelis in the Negev in more recent years, the Italians soon initiated an energetic colonisation programme, and transformed large areas of the Dune Jefara and some of the unirrigated lands bordering the coastal oases. In the earlier stages most of the development was by concession farmers, but later the Italian state was directly responsible. It was a planned agricultural economy based on the dry cultivation of tree crops such as olives, almonds and vines, and few holdings had more than 1 ha. of irrigated land. During the period of intense colonisation life on the saniya farms in the coastal oases

changed very little.

After the war the shortcomings of dry farming were revealed as more of the trees coming into production gave disappointing yields. Interest in the possibilities of irrigation increased, and as a result there has been a significant expansion of the area of irrigated land during the last ten years. One of the aims of this study was to establish that there had in fact been an increase in irrigation. Results showed that more irrigation is practised than was anticipated, sufficient in fact for groundnuts to become the major export. It is worthwhile to summarise the main evidence for the increase in irrigation:-

1. Sales of irrigation equipment have been at a high level for the past five years.
2. More electricity has been sold to agricultural consumers in recent years.
3. Many loans have been made for the purpose of irrigation development
4. Before the war the olive was considered a dryland crop, but today an increasing number of trees are irrigated.
5. Citrus cultivation is steadily expanding.
6. Vines and almonds, dryland crops, which together with olives formed the basis of pre-war agriculture, are now declining in numbers.
7. Groundnuts have developed as the leading cash crop since 1945.
8. Wheat and barley are given supplementary irrigation by

many farmers in the area of sedentary cultivation.

9. Most of the other field crops are irrigated; the area devoted to tobacco remains steady, but that under potatoes and tomatoes expands.

The expansion of irrigation has been largely the result of private enterprise, because after the war there was no rigid control of agriculture by a central government. Some of the factors operating to encourage the shift to irrigation are:-

1. The climate is unsuitable for profitable dryland cultivation.
2. With dryland cultivation the light, sandy soils, which predominate in the area, are easily eroded by the wind.
3. Within the area of the Tyrrhenian deposits good reserves of high quality underground water are to be found.
4. Crop yields are much higher and more reliable with irrigation, and at the same time plants and trees often mature earlier.
5. With irrigation the farmer has flexibility because he has more control over production factors. He can grow high income crops that give quick returns. Irrigation is the only way the small farmer can make money; this applies to other countries besides Libya and Gottman (8) writes 'post-war experience in Palestine has proved that only by irrigation can a farmer be assured of an income enabling him to live on a European standard'.
6. It is much easier to obtain loans for irrigation development, because bankers consider dry farming a 'risky business'.
7. Cheap power is available to the farmer. He can use electricity at a low tariff and buy customs free diesel oil.

8. The desire to expand irrigation on the Jefara Plain coincided with the widespread appearance of sprinkler irrigation throughout the world. Today about 80% of Israel's citrus groves are sprinkler irrigated (20). Sprinklers are ideally suited to the Jefara permeable soils and the need to irrigate field crops that are growing between trees.

The expansion of irrigation is now steadying. It is impossible to summarise all the reasons for this, but the following are probably the most important:-

1. Falling water-tables and salt-water intrusion are evidence of overpumping. Cary in his study of the agriculture of Saudi Arabia (4) remarks: 'the critical and most frightening factor is the relationship between mechanical power and potential water supply'. Such is the case on the Jefara where a large number of pumps have been installed and the water reserves have been overpumped in some areas. This problem of a falling water-table is common in most regions which rely on underground sources for the supply of irrigation water. One sixth of the U.S.A.'s irrigation water comes from underground and the most important area where it is utilised is California. Here there are many examples of falling water-tables. In the Oxnard area of Ventura county, 50 miles N.W. of Los Angeles, the irrigated cultivation of lucerne, citrus, walnuts, sugar beet, vegetables, and lima beans has been expended considerably in recent years, and now the water-table is below sea-level in most localities and seawater

is moving slowly inland. The position is not as critical on the Sefare Plain, and it is only in localised areas that the water-table has fallen. There is no real danger of an exhaustion of underground reserves because recharge is continually taking place, but care must be exercised in coastal areas to ensure that no sea-water is allowed to infiltrate inland.

2. Many farmers however have lost the initial enthusiasm for irrigation, not because of a falling water-table, but because of falling yields, especially on groundnuts. This is the logical result one would expect from the monoculture of an irrigated crop. The lack of a rotation and insignificant applications of fertilizers, two essentials that go with irrigation, have given low yields and encouraged the development of a deficiency disease.

3. Markets abroad have hardened and at the same time the quality of some of the agricultural exports has declined; the farmer therefore receives less money for his crop.

B. Conclusions.

Having thus established the nature of the post-war agricultural trends, it now remains to suggest possible lines of future development. Many writers advocate an expansion of irrigation because they agree with Cederstrom's dictum 'underground water is the key to a real vigorous economic life!. It is quite clear that irrigation has many advantages and that, if left alone, the private farmer will continue to expand his irrigated area.

bearing in mind that the Jefara Plain is the most important agricultural region in Libya, what policy should be adopted for its development ? Should the irrigated area be reduced and future crop production concentrated on dryland tree crops ? Or should the irrigated area be expanded ? There are two requisites of a development policy: agriculture must be expanded so as to rid Libya of its adverse trade balance, and the standard of living of the smaller Libyan farmer must be raised.

With these conditions in mind, the present field crops must be retained and their area also expanded. The groundnut acreage needs to remain static, perhaps reduced in areas of seriously falling water-tables and extended elsewhere. The greatest emphasis should be placed on winter field crops, because they only need supplementary irrigation, particular attention being paid to wheat and sugar beet. Linseed could be introduced as another field crop. However the continued cultivation of irrigated field crops can only be maintained if farming practices are improved. Throughout this study there has been no real reference to animals in the areas of sedentary cultivation. This is because at present the animal has no place in the economy of the individual farmer with the result that the soils, which are already low in organic matter, are given very little manure. This deficiency is common in other countries and Dumont writes (6 p.383) 'The mistake common to all those irrigated sectors, is that lucrative cash crops are being grown before the conservation of soil can be assured by a proper development of animal

husbandry'. More fodder crops and animals are a necessity, and with these and the following rotation, field crops can be grown with continued success:

a) Commercial crop - groundnuts, potatoes, tobacco, tomatoes and vegetables.

b) Cereals

c) Legumes

d) Legumes

Tree crops will continue to have a place in Jefara agriculture and the numbers of olives, almonds and citrus should be expanded, so that ultimately most farms will have a combination of irrigated field and tree crops, and some dryland tree crops. The writer does not consider that a return to the Italian system, which relied on dryland tree crops, will in any way solve the problem of a low standard of living or an adverse trade balance.

Development must proceed in areas beyond the present limits of sedentary cultivation and this can only be achieved by direct government action. Since as Rowland[x] remarked 'agriculture in the fullest sense of the word starts where forestry ends, so dependent is agriculture on those things which trees and bushes can provide', much of the Eastern Jefara needs afforesting so that the many thousands of hectares of dunes can be stabilised, before small areas can be developed for agriculture. In certain districts however, where the dunes are not extensive and the moisture conditions are more favourable, slow growing tree crops which are

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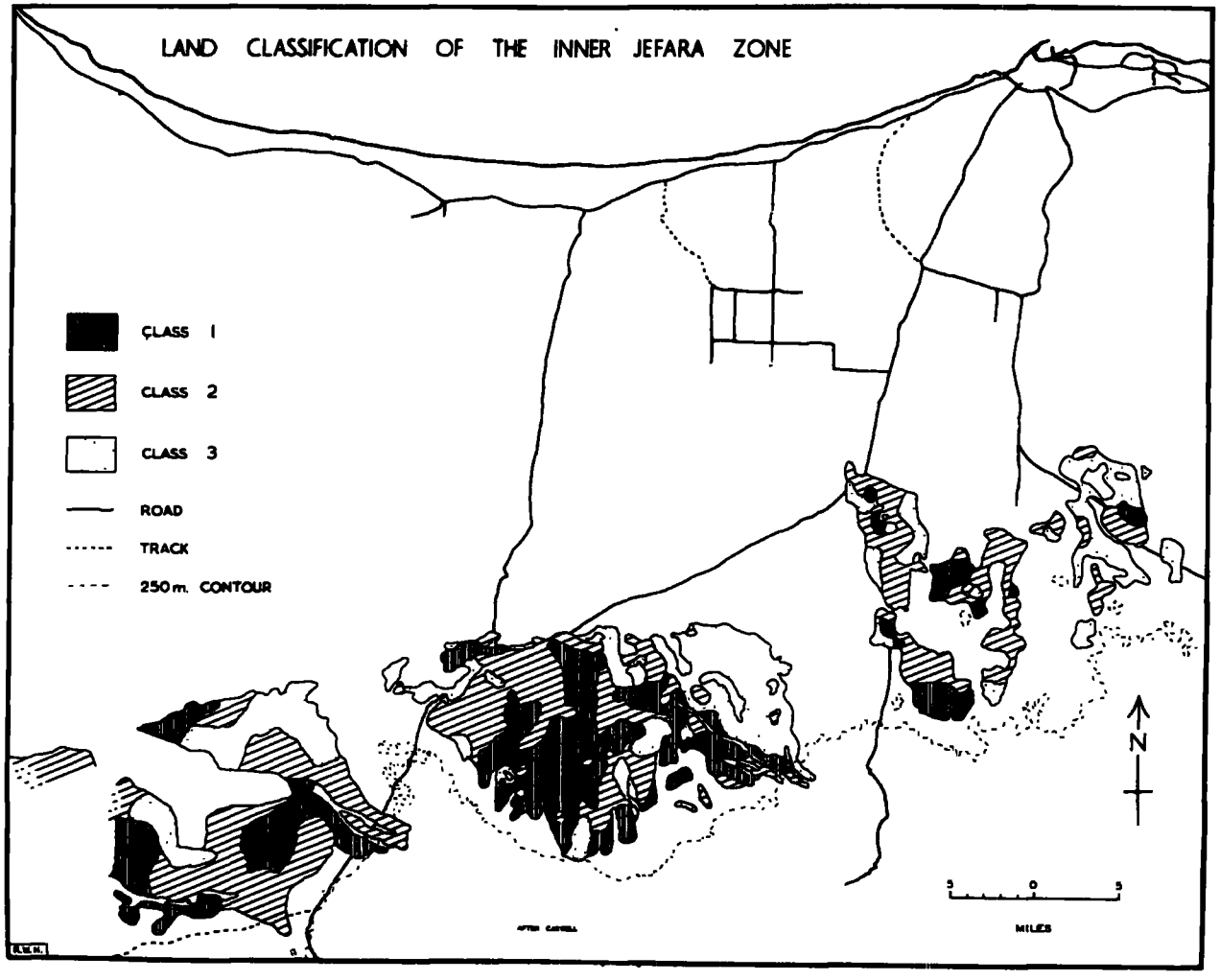
LAND CLASSIFICATION OF THE INNER JEFARA ZONE
CLASS 1
CLASS 2
CLASS 3
ROAD
TRACK
250 m. CONTOUR
N
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MILES

ecologically suited to local conditions - carobs, pistachia and cactus - should be planted and shifting cultivation abandoned. The Inner Jefara offers scope for development in areas where water-spreading is possible. Fig. 27 shows the most favourable districts and it is in class 1 and 2 areas that the cultivation of apricots and peaches, and winter cereals, should be possible if water-spreading is practised.

The Jefara lying west of the El Kenshar hills is a very difficult area and for the moment the only policy is to dig more wells in an endeavour to reduce overgrazing and thereby facilitate better range management, and then wait and see how successful are Dr. Boyko's attempts in Israel at irrigating grazing plants with brackish water.

Finally there are certain areas in the Dune Jefara, some of which are state owned (3) that are at present under shifting cultivation but could be developed for irrigated farming. The most favourable area is to the south and west of Bianchi where the underground water reserves are substantial. It was to this area that Ahmed envisaged an extension of the electricity grid for the development of irrigated farming (see fig. 19). The Mazara of Agriculture has selected an area known as Saadiya, which lies between Azizia and Kicca. This will be developed similarly to Maamoura, and it is hoped will set the pattern for all future development on the Jefara Plain. It is proposed that 115 farms of 4 ha. each should be developed. Water is available in the first aquifer at 30-35 metres below the surface and in the second

aquifer 60-80 metres below the surface. It is intended that each well will have a capacity of 40 m3/hr. and will be fitted with four 5 h.p. electric pumps which will supply water for four farms. Irrigation will probably be by gravity means although sprinklers are being considered. Each farm will be completely irrigable and will be divided into two parts; one for the cultivation of wheat and barley in the winter and the other for groundnuts and other crops in the summer. Trees mainly olives, citrus, soft-shelled variety almonds, and palms will be planted but will not exceed 200 per farm.

This project is envisaged as the proto-type of future settlement schemes which it is hoped will help in some small measure to improve the living conditions of the rural population. The new farms will be based on a mixed type of economy which includes trees and field crops, all depending heavily on irrigation. Irrigation is the most satisfactory method of making the dry land smile and is now an integral part of Jefaran agriculture.

Plate 21

Typical Italian Congession Land

The land is sub-divided into large rectangular blocks each with many olive trees and occasionally almonds; the dark grey patches indicate areas of groundnut cultivation. A mature citrus orchard is evident near the farm in the right foreground and in the centre of the photograph young citrus trees can be seen to the right of another farm. Note the tall eucalyptus along the roads and tracks, and the sandy nature of the land, particularly in the distance.

Plate 22

Approaching Idris Airport from the South

A good example of dry cultivation. Several rows of vines can be seen growing between the widely spaced, mature olive trees and in the distance is the building where the wine is actually made. The vine is a hardy plant which is well suited to the heat and aridity experienced on the Jefara Plain, but unfortunately the local demand for wine is declining and many farmers are destroying their vines.

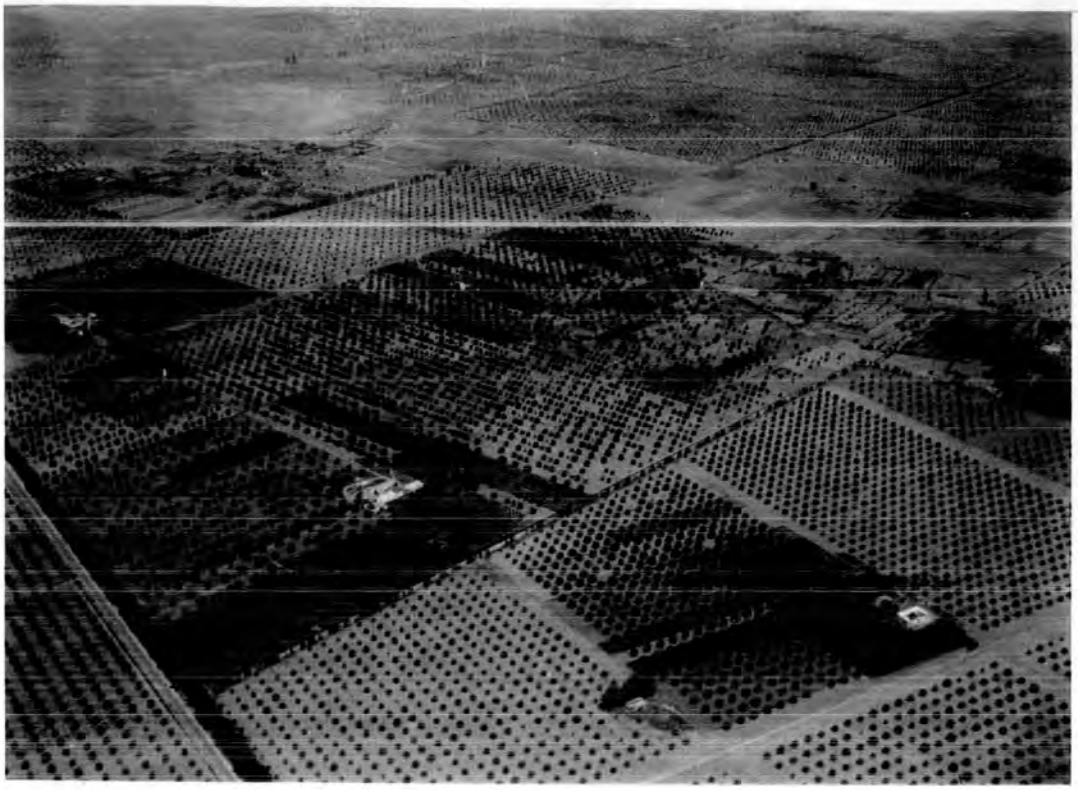

Plate 23

Dry Cultivation of Olives

The olive has been grown in Tripolitania for many years and was an important tree crop in Roman times. When the Italians started colonising they brought their olives with them and planted them on their concession and demographic farms. The mature trees in the photograph were planted in the middle 1930's; they are widely spaced and the land between remains fallow although ploughed several times a year. Today there are few large farms on the Jefara Plain which rely entirely on the dry cultivation of olives.

Plate 24

Grafted Italian Olives near Gurji

Of the large numbers of Italian olives planted prior to the 1939/45 war, many are now giving disappointing yields; since the Jefara has a drier and hotter climate than Sicily and southern Italy this is not surprising. Answers to questionnaires reveal that in the immediate vicinity of Tripoli and round Garabulli in the east, areas of over 300 mms. of rainfall, Italian olives give fair returns under dry cultivation; elsewhere many farmers have decided either to irrigate or graft with Tunisian varieties.

Plate 25

Castor Bushes in the Inner Jefara

Castor plants need careful handling with occasional watering when young, but when mature they are hardy, need little attention and can be used as dune-fixers. In many parts of the Jefara the castor is growing wild almost like a weed, and is seeding itself. Since castor oil is still in high demand on the world market for medicinal and lubricating purposes, there is no reason why the export of castor seed should not be increased. Further agronomical research is needed however.

Plate 26

The Pistachio Tree (Pistachia Vera)

This is a nut tree which grows widely in the Mediterranean and the Middle East, and like the almond is a useful source of food; there are however only two small plantations of this tree on the Jefara Plain. According to G.B. Mazzocchi, the F.A.O. horticulturalist seen in the photograph collecting grafting material, the pistachio is more resistent to dry conditions than the olive, but since it takes longer to mature and needs protection from winds, it has not attained the same economic importance. The tree in the photograph was grown from seed planted 26 years ago.

Plate 27

Groundnut Extension Trials at Sorman

The groundnut is now the major cash crop in Tripolitania and experiments have been carried out at Sidi Mesri to compare the yields of local varieties with those from abroad, especially U.S.A. In 1957 the American extension officer at Zawia planted North Carolina, Virginia Runner and Virginia Bunch varieties on a Libyan farm just west of Sorman. Such extension work shows the local farmer the correct way to grow groundnuts and it also gives an indication of the likely results to be obtained from foreign groundnuts in areas away from Sidi Mesri. In the photograph the crop is being inspected by a Palestinian extension worker.

Plate 28

The Barley Harvest in the Inner Jefara

Barley, which is grown in the Inner Jefara by the Libyans, is entirely dependant on rainfall and as this photograph shows, yields are very low. A small area has already been cut and is seen stacked in the top right hand corner of the photograph; in the foreground the barley awaits harvest. The Jebel can just be seen on the horizon and castor bushes are evident in the Middle distance.

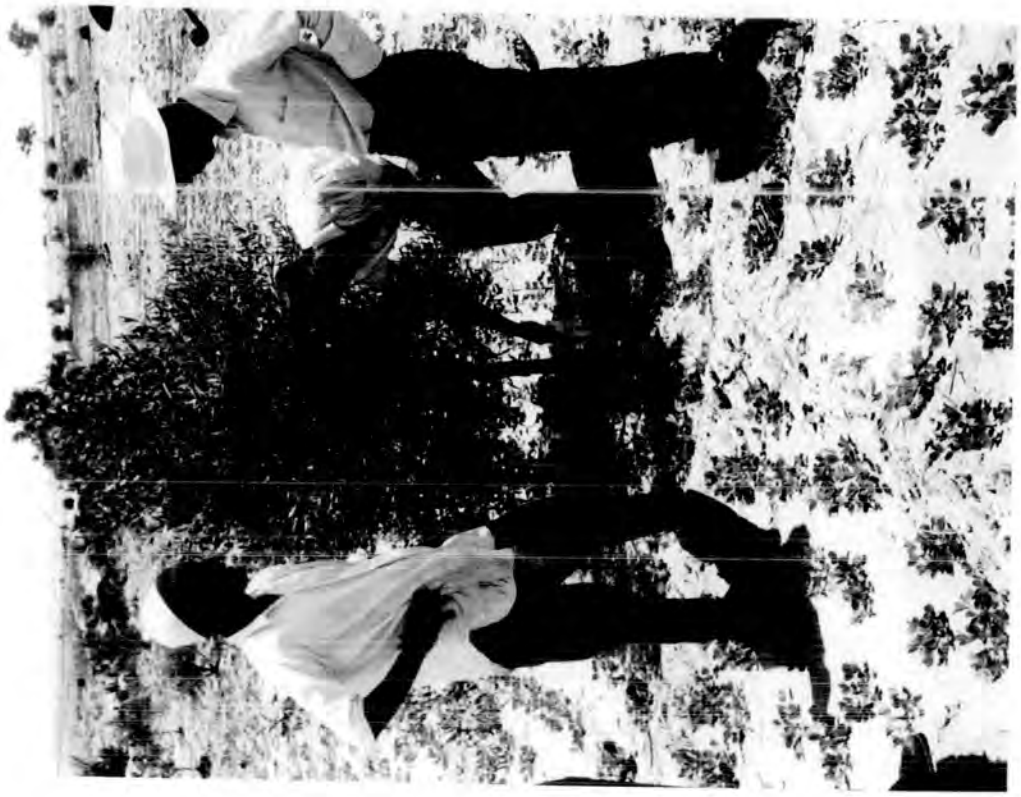

Plate 29

Young Maize Plants

In inland areas, where the first water-table is readily accessible, small farms have been started by Libyans, water being raised either by a small petrol pump or wind pump. This photograph, taken in early summer, shows part of one of these farms. The tree in the left foreground is a lemon, that to the right of centre a tangerine, and those in the background are olives; the maize growing in the irrigation squares is a subsistence crop.

Plate 30

Irrigating Artichokes in the Ain Zara district

Although this crop is limited in distribution to a few private Italian farms, this photograph is important because it emphasises two significant facts: firstly there is scope for the development of early winter vegetables for the Western European market; secondly such vegetables must be given supplementary irrigation. In the photograph the artichokes are being irrigated by the furrow method and the Libyan labourer is plugging an earth channel in order to divert the flow of water.

Plate 31

Inspecting Autumn-sown Potatoes

The increased popularity of potatoes, of which Dutch and English varieties are favoured, is due partly to the fact that two crops can be grown during the winter rainy season. This photograph summarises the cropping trends on an Italian Concession farm which is now owned by a Libyan. In the right background are mature olive trees which were originally planted under dry cultivation; in the left background is a citrus orchard planted just before the last war; and in the middle foreground and background potatoes are growing between immature orange trees. The sprinkler piping is evidence that the potatoes have recently been irrigated.

Plate 32

Burley Tobacco

There is more accurate information available on tobacco than any other crop because acreages are rigidly controlled by the State Tobacco Monopoly. All "plains" tobacco has to be irrigated and as a result grows rapidly and gives high yield, but its quality is poor. The main varieties grown are Burley, Salento and Fezzani, although efforts are being made to introduce Maryland and Java. The total area of land devoted to the crop is small.