CROP PRODUCTION

By now, the physical and human background of agriculture has been studied and some major problems surveyed in both West Punjab and Barbary. In the light of these conditions, a study of the distribution and production of different crops may now be undertaken. It is intended in this chapter to give the relative importance of various crops, to trace the development of the varieties cultivated and to portray the evolution of each crop during recent years. The detailed geographical distribution of crops as well as the manner of their cultivation will stand out more conspicuously in the chapters on Agricultural Regions.

Land Utilization

The extent of land available for cultivation according to physical factors was discussed briefly earlier and also shown on a map. Some of the critical limits imposed by relief, climate and soils were similarly stated and portrayed. The actual use of land is dependent in addition on human traditions and initiative, the possibilities of irrigation or dry farming in drier tract and the methods practised. The details of land use must be left to the subsequent account of different regions but the broad facts may now be discussed.

Barbary

The following table gives figures of areas in the three territories according to their present use:—
In 1,000 Hectares

<table>
<thead>
<tr>
<th></th>
<th>Morocco Area</th>
<th>Algeria Area</th>
<th>Tunisia Area</th>
<th>Total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cultivated incl. fallow</td>
<td>7,370 19</td>
<td>4,651 23</td>
<td>2,946 23.6</td>
<td>14,917 21</td>
</tr>
<tr>
<td>Orchards, vineyards &amp; gardens</td>
<td>350 1</td>
<td>526 2.6</td>
<td>797 6.4</td>
<td>1,673 2.4</td>
</tr>
<tr>
<td>Pastures &amp; wastelands</td>
<td>7,740 20.6</td>
<td>5,714 28.6</td>
<td>4,246 34</td>
<td>17,700 24.9</td>
</tr>
<tr>
<td>Woods &amp; Forests</td>
<td>3,960 10.8</td>
<td>3,835 19.2</td>
<td>1,011 8</td>
<td>8,806 12.4</td>
</tr>
<tr>
<td>Unproductive</td>
<td>18,240 48.4</td>
<td>7,237 36.2</td>
<td>3,500 28</td>
<td>29,977 42.2</td>
</tr>
<tr>
<td></td>
<td>37,660</td>
<td>20,963</td>
<td>12,500</td>
<td>71,123</td>
</tr>
</tbody>
</table>

The proportion of the area at present cultivated is very low and as just over 42% of the total area is unproductive, there is apparently great room for expansion. The utilization of further areas for cultivation is bound to be determined fundamentally by the availability of water so that while the soil over large areas may be excellent and the lands accessible, their utility from the agricultural point of view must be viewed in the light of this factor. Hydrographical data on Barbary is most inadequate, however, and nothing more than the broadest generalisations can be attempted.

The percentage of unproductive land for Barbary as a whole is pretty high and can be attributed to the prevalence of mountainous topography on one hand and desert conditions on the Saharan fringe on the other. Thus in Tunisia wherein lowland relief is dominant, only 28% of the land is unproductive.
The Moroccan percentage - 48.4% - is very high because not only is a large proportion of the country's area occupied by the Atlas ranges but the southern and eastern part is completely arid for the most part. The percentage of unproductive land for Algeria is intermediate between its two neighbours. It is higher than in Tunisia on account of the dominance of mountains in its relief as well as the fact that large areas in the High Plateau are saline. It is lower than in Morocco because the desert fringe has been excluded from this account which treats only the area north of the Saharan Atlas.

The percentage of cultivated lands is lowest in Morocco even though the total figure is higher than in the other two areas. For this, the reason stated above is responsible though the higher actual area despite lower percentage is due to the larger area of Morocco. Orchards and gardens occupy a relatively high proportion of the total area in Tunisia on account of the large areas devoted to olives. The Algerian percentage comes next but the area includes over 350,000 hectares of vines so that with vines occupying smaller areas in the other two territories, the relative extent of fruit and olive orchards in Algeria must be considered inferior to both Morocco and Tunisia.

Forests and wastelands occupy the highest percentage in Algeria due to the predominance of mountains wherein the forests occur in the more humid sections, while pastures and wastelands occur in the drier mountains and plateaux.
The percentage of forested land is lowest in Tunisia because the area of humid mountains is limited but that of pastures and wastelands is the highest of all the three territories. This can be attributed to the prevalence of semi-arid and arid conditions over the large part of the Tunisian steppes.

**West Punjab**

The total area of West Punjab (1) is over 37,137,000 acres of which 19,637,000 or 52.6% was cultivated in 1944-45. Figures for 1931-32 give 46% of the area as cultivated and 32.4% as fallow or culturable waste. This leaves only 21.6% uncultivable or forested. The higher percentage of cultivable land in the province is due to the fact that more than 4/5ths of the province consists of an alluvial plain while even in the Potwar plateau and its bordering hills, an appreciable percentage of the area is cultivable.

As districtwise details of the types of cultivated land are available, an analysis of these figures in relation to the natural conditions can be undertaken. The following classification of land is applied by the Land Revenue Department and although adopted primarily for assessment purposes, its basis is essentially geographical i.e. fertility as related to soil and water-supply:

- **Barani** - lands dependent upon rainfall
- **Chabi** - lands irrigated by wells and other means of water-lift

(1) According to Land Revenue Reports for 1931-32 in the District Gazetteers, part B

(ii) See table at the end.
Nahri - lands irrigated by canals

Sailab - lands flooded periodically by streams or which by proximity of water are naturally moist

Abi - lands irrigated by springs, or otherwise than by wells or canals.

The statistical details will be found in Table 4 at the end and have been plotted on Map 83. The districts of the Potwar Plateau consist of land cultivated by rainfall. The sub-montane tracts also show a high percentage of their area as thus cultivated although canal irrigation is important in Gujrat and well irrigation in Sialkot and Gujranwala. The districts of Central Punjab are cultivated mostly under canal irrigation while in the districts of Jhang and Multan, irrigation by wells also plays a leading role. The districts which benefit most from periodic floods or the proximity of rivers are Mianwali, Muzaffargarh and Dera Ghazi Khan, all of them along the Indus. Well-irrigation land is again prominent in the two south-western districts.

The statistics that form the basis for these calculations are for 1931-32 and since then the total cultivated area has increased from 46% to over 52% of the total area by 1944-45 while irrigated area increased from 61% of the cultivated area to 63%. The relative importance of canals as a source of irrigation has increased as is evident from Map 79 and the account of Irrigation.
METHODS OF CULTIVATION

It is impossible to grasp the significance of relative yields among the different classes of cultivators without reference to their methods. In Barbary there is a gulf of centuries between the modes of cultivation of the native fellah and the European colonist. In West Punjab once again there is a greater uniformity of methods but these conform rather to those prevailing among the native Muslim cultivators in Barbary although the fact that here the peasants have not lost their best lands due to foreign colonisation must never be lost sight of. Comparative improvement has also been secured through the planning of canal colonies and a greater effort on the part of the administration to improve cultivation by small peasants. A counterpart to the larger modern farms of Muslim landlords in Barbary is present in the large estates of privileged owners.

Along with the consideration of methods and means, we shall also take into account the character of the cultivator.

Barbary

Two civilizations exist side by side in Barbary, one native to it, adapted to its harsh climate, living simply and poorly off the soil, without the will and the means to rise up against the environment; the other transplanted from Europe, dynamic and industrialised with both the initiative and the equipment to overcome adverse conditions. The fellah tills the land for mere subsistence and can hardly attempt more than that; the colonist plans and produces crops for profit and
has commercialised his farm. Lately a small section of the native Muslim landlords have introduced the modern methods of cultivation practised on European farms.

The Fellah: The greater bulk of the Muslim cultivators (fellaheen) are small-holders as has already been shown. The area of their holdings is inadequate to provide them with a reasonable standard of living. The fellah is usually poor and ignorant. He cannot save enough money to improve his land or his implements consequently he finds himself all the more at the mercy of the elements. His traditional plough has too often been criticised but it has its advantages. Among its merits noted specially in Barbary is its lightness so that when sowing stony land, it can just be picked up or swerved sideways where the heavy iron plough will get stuck. The only motive power he has for his plough is his pair of bullocks or mules. They cannot till the hardened soil at the end of the summer drought so that the peasant must wait for the first autumn rains to soften the ground. On the heavier soil of some low-lying plains the plough and the draft power are not adequate. The other implements used for harrowing and harvesting are similarly rudimentary.

Apart from the lack of modern implements, the fellah suffers from the shortcoming typical of the small-holder - lack of understanding of market conditions, and of technical advances in cultivation. This can again be attributed to his poverty. The influence of a subsistence level production and the
ignorance of market requirements is reflected in his choice of crops that are restricted mainly to cereals.

Some advantages have usually been associated with small-holdings - that even though lacking in equipment, they can be brought under intensive cultivation with a judicious choice of paying crops making the utmost use of the activity and industry of manual labour. Furthermore small-holders can take up some extra vocation outside their agricultural activity or combine with other small-holders to launch some joint enterprise, like a cottage industry. But to achieve this certain conditions are necessary among these being "credit distributed on rational lines, co-operation, vocational training and an adequate marketing organisation"(i) These conditions do not exist in any large measure in Barbary although beginnings have been made with the foundation of the S.I.P.S.(ii) intended to distribute improved seeds on credit, assist peasants in years of difficulty and arrange for the sale of the produce from small-holdings. These organisations have a perfectly laudable purpose but they have so far tended to concentrate on the purchase and sale of grain and have not applied enough energy to the problem of modernising the fellah. The scope of these and similar organisation will be discussed in the concluding chapter when we consider future prospects.


(ii) Sociétés Indigènes de Prévoyance - Native Provident Societies.
Just as to why the fellah is steeped in age-old traditions and methods of agriculture, taking almost the minimum reward for his toil on the land is a question that is usually brushed aside with a brief comment on his fatalism and his ignorance. Ignorance can be explained in terms of poverty and they both are at the root of fatalism bred by an unfavourable environment and the seeming futility of personal endeavour against a capricious climate. The real cause for the use of extensive methods and the insistence on maintaining large numbers of cattle so noticeable among the fellahen is that culturally, most of them are still living the life before colonisation when land was abundant for the smaller population of that time and grain for subsistence was obtained easily enough by scratching the soil with the plough and throwing a little seed. Since then, the introduction of western medicine has reduced the death rate and the native population has increased. That would have increased the pressure on the land by itself but the great majority of fertile lands have been acquired by Europeans and the fellah finds himself compelled to till the marginal sloping land. He has thus been impoverished and confined to small parcels of land without having had time to adjust himself to the new situation. His present plight all the more pathetic as it is compared all the time with the modern colonist's prosperity is simply a case of events being faster than adjustments among a community long since adapted to the local
It may be emphasised here that this general description of the Barbary peasant does not take into account the considerable variations in agricultural efficiency that are noticed from region to region. Pastoral tribes in general grow indifferent crops for subsistence while the long-established sedentary tribes practise a more systematic and careful husbandry of the soil. This factor may be related to Map 72 showing the distribution of nomadic and sedentary population. Several groups such as the inhabitants of Kabylie, the olive growers of Sfax and the scattered Andalous give such care to their lands which they bring largely under fruit trees that they are more of gardeners than cultivators.

The Modern Cultivators We have adopted this heading rather than "the colonists" because although mechanised agriculture is practised mostly by the European settlers, a fair number of Muslim landlords have modernised their farms. They all have one feature in common - the large size of their holdings. On these they possess all the advantages the fellah does not. Not only is their own farming capital always considerable but also the credits available to them are very much larger due to the better organisation of banking and co-operation. In the case of the colonists in particular, the government has helped them organise regional banks for agricultural credit which along with the commercial banks make short, medium and long term credits on easy terms. The details
of this organisation and its development are a large subject that is beyond the scope of this general study of agricultural methods. With the help of these abundant funds, the modern cultivators have been able to keep abreast of the rest of the world in mechanisation. Tractors and harvester-combines are being imported in increasing numbers. In Algeria alone, after the reduced supplies during the war, 2,092 tractors and 231 harvesters were imported in 1948.(i) Mechanisation started as far back as 1920 but did not get into its stride till 1936. Mechanical ploughs driven by tractors give deep ploughing to the heaviest soils with ease. Other farm implements such as sowers, harrows etc. are also mechanised. Machines unlike the fellah’s cattle are capable of ploughing the land at the right time even if the rains are delayed and the ground is still hard after the summer drought. Mechanical cultivation has thus enabled the practise of preparatory tillage to be extended in areas receiving less than 20" of rainfall so that moisture can be conserved and evaporation and run-off reduced to a minimum. The extension of the dry-farming technique has similarly been facilitated.

The degree of technical skill available to the large holders is much greater than in the case of the fellah. Modern experimental farms evolve methods and varieties that could not be tried easily on a small subsistence farm. The large holder can afford to set aside some land for trying improved varieties

(i) "Exposé de la Situation Générale de l'Agriculture en Algérie en 1948" p.6
or some new method of treating the soil etc. With the help of capital, he also uses chemical fertilizers that are so large a factor in the improved yield of his crops. These and machinery are naturally utilised more efficiently on the bigger fields of the large holding and even if the fellah were given these means, he would find his small parcelled fields a handicap. The large holder can also afford to apply improved rotations of crops not possible on a small holding.

Finally, the most marked feature of the modern farm is that it is organised on sound business lines to make profit and has much better storage and marketing facilities than the fellah can ever hope for. Grain elevators are widely in use. The production is always being oriented so as to obtain the best prices in foreign or domestic markets. The growth of vine cultivation and citrus plantations - both with an eye on exports have been a great factor in the present prosperity of the modernised cultivators.

The West Punjab Peasant In terms of the efficiency as a cultivator, the West Punjab peasant is closer to the fellah than to the colonist. The two fundamental reasons for this are that he is a small-holder with all the disadvantages of that status and also that his cultural background and consequently his methods and attitude are similar to those of the fellah. His plough resembles the traditional plough in Barbary. He generally sows his fields broadcast, harvests with a scythe
and is not too well off for marketing organisation although better transport over the Punjab plains is an advantage. He possesses, however, several advantages over the fellah. Most of his lands are irrigated and consequently more productive and secure. This is the greatest single factor for his higher yields. Furthermore all the care and organisation behind the planning of canal colonies that we have already considered have raised his status above that of being a subsistence farmer for he grows cash crops like cotton, sugar-cane and oil seeds apart from cereals for his own consumption and sale. The spirit of enterprise has resulted in the greater propagation of improved seed varieties than in Barbary. On the other hand the West Punjab peasant is given to burning valuable supplies of manure from cattle-dung in the shape of fuel in the deforested plains.

The cultivators of West Punjab are divisible into several classes (1) carrying tribal names although they do not exist in compact groups.

(1) The Jats are the cultivators of the province "par excellence" and are unrivalled for their sturdy independence and their diligence and perseverance in work. They are strongly attached to the soil.

(2) The Rajputs, as their name indicates, claim descent from princely ancestors and are less inclined to hard work although they are the largest proprietors in the province particularly in the central and north-western tracts.

(1) A. Khan "The Punjab Cultivator" in "Sons of the Soil" editor W. Burns 1941
(3) The Arains claim a Semitic origin and do in fact resemble the Andalous in that they are specialists in market-gardening while in cultivating general crops they come after the Jats. They are by nature thrifty and hard-working.

(4) The Janglis were described before under colonisation and like many a tribe in Barbary have only recently taken to settled agriculture and still like horses better than bullocks.

In addition there is the large group of Gujars who have pastoral traditions and are often professional graziers. As cultivators they come after most of the above categories.

THE CROPS AND THEIR DISTRIBUTION

The distribution of principal crops according to statistics, in Barbary and West Punjab is illustrated in Maps 9S-00. It may be added that the map of dominant crops according to statistical divisions for Barbary gives no really useful indication of the detailed distribution due to the largeness of the divisions for Morocco and Tunisia. Hence although the year selected for the analysis of statistics - 1945-46 - was an abnormal one(i) it has not affected the delimitation of agricultural regions. Indeed, on comparing the regional percentages for 1938 and 1945 for Morocco, it was established that the actual position of dominant crops remained the same. The detailed distribution of principal crops according to field observations and documentary material has been plotted

(i) See Appendix on the Crop Statistics of Barbary.
on Map 84 and illustrates the scheme of agricultural regions adopted although in adopting this scheme, other factors besides the distribution of crops were also considered.

The following figures of the percentage of total cultivated area show the relative position of principal crops in Barbary and West Punjab

<table>
<thead>
<tr>
<th></th>
<th>Barbary (1945-46)</th>
<th>West Punjab (1944-45)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Barley</td>
<td>27.9</td>
<td>Bajra 7.8</td>
</tr>
<tr>
<td>Maize &amp; Sorghum</td>
<td>8.9</td>
<td>Gram 11</td>
</tr>
<tr>
<td>Vines</td>
<td>5</td>
<td>Cotton 10.2</td>
</tr>
<tr>
<td>Olives</td>
<td>9.1</td>
<td>Fodder 15.8</td>
</tr>
</tbody>
</table>

Wheat is thus seen to occupy the leading position in both regions. As regard the other crops grown in Barbary, West Punjab had 2.7% of its area under barley and 2.3% under maize. The reason for these low percentages is discussed later on. The commercial crops in the two regions are entirely different. The importance of orchard or plantation crops in Barbary is typical of Mediterranean lands and while the vine and early vegetables have been extended by Europeans, the other main crops, fruits and olives have long been grown on account of their adaptation to the climatic conditions. The main commercial crops of West Punjab are grown almost entirely under irrigation.

It is now proposed to deal first with the cereal crops and then in the next chapter, with the commercial crops.
CEREALS

The regions under review form parts of two of the great cereal-growing areas of the world - the Mediterranean Basin and the sub-continent of India. Cereals are the most important crop both in Barbary where they cover over 90% of the lands(1) sown every year, as well as in West Punjab where they occupy 70% of the cropped area. They are the basis of the food economy of the regions and also constitute the cash crops for a majority of the local cultivators.

The relative importance of different cereals in the two regions will be discussed in the following paragraphs. It should be noted that wheat is the dominant cereal crop in both the areas. But whereas the distinction between hard wheat (Triticum durum) and soft wheat (Triticum vulgare) is made clearly in Barbary in the compilation of statistics as well as in the various accounts of regional distribution, the different varieties sown in West Punjab are not differentiated in any way in these respects. Consequently it is not possible to make the finer comparisons of yields and distribution of the several varieties in the case of the latter.

Cereals in Barbary

Cereals cover 97% of the area devoted to annual crops

(1) Figures in the following account have been calculated from the following unless otherwise indicated:
Annuaire Statistique de la Tunisie - 1947
Renseignements Statistiques Agricole - Algerie 1946
Annuaire Statistique du Maroc - 1945-46
Season and Crop Report of the Punjab - 1945
Also see note on statistics in Appendix 4.
Acreage Ratio Reflecting Effect of Precipitation on the Relative Importance of Wheat & Barley in Tunisia.

Barley acreage in percentage of wheat acreage.

N. Fanny, "Competition among Grains."
in Tunisia and 95% in Morocco. In Algeria where colonisation is much more advanced and exotic cultures have been introduced, they still occupy 92%. Wheat and barley take up 96% of the area devoted to cereals in Tunisia, 88% in Morocco and 92% in Algeria. Maize, insignificant in Tunisia and Algeria, occupies 11% of the total area under cereals in Morocco. Barley comes a close second to wheat in Tunisia and Algeria, but occupies the first position among cereals in Morocco, accounting for almost 47% of the area under cereals as compared to 41% for wheat.

The special importance of barley among cereals in Barbary is usually explained in terms of the backwardness of the cultivators who continue to sow it out of habits dating back to their pastoral days. This certainly is a factor but the real explanation is a climatic one. Barbary is among the few countries of the world where unirrigated cereal cultivation extends almost to the desert. Under semi-arid and arid conditions, barley was proved to give 39% higher yield than wheat according to experiments conducted in California. (1) It also flourishes better on the light sandy soils that characterise the drier parts. Hence the continued importance of barley in Barbary is due to its hardiness and higher productivity under semi-arid conditions. Its area in relation to wheat increases in an inverse ratio to that of rainfall as will be seen on map showing barley acreage in Tunisia

(1) N. Jasny "Competition Among Grains" Food Research Institute California p.272
as percentage of the wheat area. From only 30% in the humid north it increases to 246% in the arid south.

The effect of economic and cultural factors on the relative percentage of different cereals may be best studied in the case of Algeria. Here are the percentage figures for the four principal cereals in 1919 and 1939. (1)

<table>
<thead>
<tr>
<th>Cereal</th>
<th>1919 Percentage</th>
<th>1939 Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Wheat</td>
<td>37%</td>
<td>38%</td>
</tr>
<tr>
<td>Soft Wheat</td>
<td>10 1/2%</td>
<td>14%</td>
</tr>
<tr>
<td>Barley</td>
<td>44%</td>
<td>40%</td>
</tr>
<tr>
<td>Oats</td>
<td>8%</td>
<td>6 1/2%</td>
</tr>
</tbody>
</table>

The proportion of area under hard wheat increased very slightly. This was due to the continued importance of this variety as the staple food of the native inhabitants whose population had increased. Soft wheat grown chiefly by Europeans gained appreciably primarily because of its commercial value and also because of its higher productivity. Barley receded, to make place for the increased in the first two crops and so did oats. The absolute area did not decrease for the last two, only the increase of area under wheat was much greater.

Map 86 shows the detailed distribution of the four principal cereals in Algeria. As the statistical and field data used in the preparation of the map of Dominant Crops is

(1) From: E.C.M. "Algerie" p.286
not adequate, this official map of Algeria will serve as a guide to the main features of the distribution of these cereals in relation to physical and cultural factors.

It may be noted that hard wheat dominates in the more humid parts of Eastern Algeria, especially in the High Plains of Setif and Constantine. The drier zone to their south as well as the coastal Massifs west of Algiers which receive less than 16" of rainfall on the whole are mostly under barley. This cereal also extends over a large part of the Kabylie Massifs and the Bihan chain over whose mountainous surface and high altitudes it is preferred to the more exacting hard wheat crop. South of the barley-growing zone fringing the steppes, the rainier and partly irrigated Aures Massif is again largely under hard wheat. The distribution of soft wheat coincides with the intensity of colonization which is highest over cereal-growing lands in western Algeria, notably the Shelif Valley, the plateau of Sersou (around Tiaret) and the southern parts of the plains of Mascara and Sidi bel Abbes. Oats, grown chiefly for fodder by Europeans, are confined to colonised coastal areas.

While accompanying graphs of cereal production in Algeria show a progressive increase in their production, there have been significant changes in the distribution of cereals. Those of the lands planted with vines over the past century that were cultivated earlier were presumably devoted to cereals. While the expansion of vineyards is reaching its limit in the light of geographical and economic factors, other crops have
recently been extended. In most newly irrigated areas, cereals are being replaced by fruits and vegetables. This tendency was noticed by studying the changes in the proportion of different crops to the total cultivated area in some Algerian irrigated tracts. In unirrigated but comparatively humid areas, other commercially important crops such as flax and sunflower are being grown over increasing areas. These trends are obvious from the account of recent developments in type farms studied in the different agricultural regions (see subsequent chapters). This competition from more lucrative and on the whole more intensively cultivated crops has confined cereals largely to unirrigated lands getting less than 24" of rainfall. From the viewpoint of a balance between commercial and subsistence crops as well as the general intensification of production, this trend is welcome.

WHEAT

Wheat is the leading crop in both West Punjab and Barbary. It is the staple food of the population and has attained its dominant position because of particularly favourable climatic conditions for its growth.

Of the two types of wheat grown in Barbary hard has long been grown by the local population while soft wheat was popularised by Europeans. According to Professor Boeuf, however, only soft wheat appears to have been grown in Barbary in ancient times. The Arabs introduced hard wheat and the crop prospered
so well that it eliminated the first one. (1) The "introduction" of soft wheat was therefore only a return of the variety grown in the distant past. It has flourished remarkably well so that its area has been extended considerably. Hard wheat is valued principally for its semolina which constitutes the basis of the diet of the local population. Soft wheat on the other hand is grown for its flour, chiefly for export so that it may be regarded as a commercial crop.

In both regions, wheat is a winter crop, sown at the beginning of the autumn and harvested in spring although the harvest in Barbary is usually a month later. Because of its importance in the agriculture of both areas, its production and distribution may be examined in detail.

Requirements

Wheat can withstand fairly high temperatures provided that they are not accompanied by high humidity at the same time. The germinating period should be cool and moist and frequent showers help tillering. The growing season of the crop is limited up to the commencement of summer heat and drought during which it is apt to suffer damage. While the varieties grown in West Punjab are usually harvested by the end of April, an important problem of wheat cultivation in Barbary has been to evolve varieties sufficiently precocious to avoid the extremely dry heat of the Mediterranean summer.

The moisture requirements of the crop are not heavy and in fact if properly distributed, even a rainfall of 10" can mature crops. Wheat flourishes better, however, where total

(1) F. Boeuf, "Le Bler'en Tunisie" cited by Despois, Op.Cit.369
amount is nearer 20" and more. More significant for the cultivation and yield of wheat is the distribution of rainfall. Under Variability of Rainfall in the chapter on Climate, certain important conclusions were reached by comparing the monthly rainfall statistics for Tunis with the Tunisian hard wheat areas and yields from 1911 to 1930. The area sown varied with the autumn (September to November) rainfall while the yields were closely related to the rainfall in March and April. Dr. Ahmad analysed the wheat production figures for the Punjab in the lights of the distribution of rainfall over a period of 35 years (1901-2 to 1935-36) and came to the following conclusions:

(1) That the most important rainfall is that of September. A positive departure from the normal during this month has almost always been associated with an increase in wheat acreage. A negative departure is associated with a decrease.

(2) A defect of rainfall from the normal in each of the four months September-December has been invariably followed by a decreased acreage.

(3) Frequent light showers between December and January enhance the yields. A prolongation of wet, humid and cloudy weather after that brings about rust and smut. (i)

Thus it may be noticed that autumn rains bring about an increase in acreage in both the regions. The effect of mid-winter (December-January) rains is decidedly beneficial in West Punjab but does not show a constant relationship to yield in Barbary. Excessively high temperatures during growing

(i) Op.Cit. 407-412
period lead to a reduction in yields while severe cold and frost retard the growth. Rising temperatures after January help to mature the crop and continuance of cold weather has always been accompanied by lower yields.

Making an allowance for exceptional climatic conditions that are bound to occur occasionally, the normal climatic regime in both Barbary and West Punjab is very well suited to the requirements of wheat in areas where rainfall exceeds 12\". The characteristic rainfall graphs are seen to conform to the seasonal distribution favourable for wheat. It may be noted that wheat does equally well at low and medium altitudes provided temperature and moisture conditions are suitable. In Algeria, most of the wheat producing lands lie between 2000 and 2,500 feet.

Wheat grows on a wide variety of soils but has certain specific requirements to give good yields. It grows best in loamy soils with good drainage and water-holding capacity. Extremely sandy soils are unsuitable. A fair percentage of clay in the soil is advantageous as it supports the stalks heavy with grain. The crop can withstand a moderate amount of salts but does not flourish under strongly saline or alkaline conditions.

Distribution of Wheat Producing Areas

As both Barbary and West Punjab present generally favourable conditions for the growth of wheat, it is cultivated almost everywhere as will be seen from the distribution maps.
Barbary

Certain areas stand out in this region as being specially important for the production of wheat:

1. Northern Tunisia,
2. The High Plains of Setif and Constantine,
3. The Plateau of Sersou and the southern plains of Western Algeria - the regions of Mascara and Sidi bel Abbes,
4. The Atlantic Lowlands in Morocco.

Within these, both hard and soft wheat is grown and their distribution varies with the intensity of European colonization as was pointed out earlier. Further details of distribution and production will be provided in a subsequent chapter. The average area under wheat for 1940-44 is given in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Morocco</th>
<th>Algeria</th>
<th>Tunisia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940-44</td>
<td>1297</td>
<td>1649</td>
<td>707</td>
</tr>
</tbody>
</table>

The following table gives the total areas under hard and soft wheat in the three territories for 1945-46. (1)

<table>
<thead>
<tr>
<th></th>
<th>Morocco</th>
<th>Algeria</th>
<th>Tunisia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Wheat</td>
<td>603</td>
<td>916</td>
<td>512</td>
</tr>
<tr>
<td>Soft Wheat</td>
<td>374</td>
<td>514</td>
<td>131</td>
</tr>
</tbody>
</table>

The area cultivated by the colonists represents 20% of the total wheat acreage in Barbary (28% in Tunisia, 27% in

(1) See note in appendix 2 about the agricultural year 1945-46
Algeria and 10% in Morocco, the low percentage in the last named being due to the smaller proportion of its area being colonized.

The total area under wheat as well as the production shows violent fluctuations from year to year. Graph related these ups and downs in Tunisia from 1911 to 1930 to the annual rainfall and a broad correspondence was found between low rainfall and low production. Graph 37 for Algeria shows the production of the two types of wheat over a comparable period. Production from European farms tends to be steadier on the whole.

This is reflected in the production of soft wheat which is grown principally by colonists. The magnitude of fluctuations in Algeria before 1940 is comparatively less than for hard wheat and a consistent increase is noticed in area.

After that year, the war-time difficulties of getting petrol and spares for agricultural machinery had their effect so that the ups and downs in production are as violent as for hard wheat.

Yields in Barbary

Yields vary as much as the total production according to the rainfall. Looked at from the standards of other Mediterranean countries they are generally low as the following table (i) will indicate.

(i) Source:—International Yearbook of Agricultural Statistics 1941-42 to 1944-45.
Quintals per hectare, averages for 1939-43 with figures for 1934-38 in brackets

<table>
<thead>
<tr>
<th>Country</th>
<th>1939-43</th>
<th>1934-38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morocco</td>
<td>5.5</td>
<td>(4.9)</td>
</tr>
<tr>
<td>Algeria</td>
<td>5.3</td>
<td>(5.6)</td>
</tr>
<tr>
<td>Tunisia</td>
<td>4.3</td>
<td>(5.1)</td>
</tr>
<tr>
<td>France</td>
<td>13.7</td>
<td>(15.8)</td>
</tr>
<tr>
<td>Italy</td>
<td>13.6</td>
<td>(14.4)</td>
</tr>
<tr>
<td>Spain</td>
<td>7.2</td>
<td>(9.6)</td>
</tr>
</tbody>
</table>

The pre-war figures have been given so that a comparison can be made and the effects of the war noticed. Except for Morocco, every country has shown a decrease in the yield. Other factors may have also been responsible for the fall in production but there is no doubt that the war itself was the most important factor during the period 1939-43.

The yields of soft wheat are generally much higher than those for hard wheat:

Yields in quintals per hectare. (1)

<table>
<thead>
<tr>
<th></th>
<th>Hard wheat</th>
<th>Soft wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>5</td>
<td>3.5</td>
</tr>
<tr>
<td>Tunisia</td>
<td>3.5</td>
<td>11.6</td>
</tr>
<tr>
<td>Morocco</td>
<td>5.9</td>
<td>7.2</td>
</tr>
</tbody>
</table>

The higher yields of soft wheat in Tunisia can be attributed partly to the early spread of the Florence-Aurore variety which gives the best yields under the climatic conditions that characterize Barbary.

There is a striking contrast between the yields from

---

(1) From Mr. Gorsse, "Cerealiculture en Afrique du Nord", unpublished M.S. 1949
European and Muslim lands as the following figures for Algeria will illustrate: (i)

<table>
<thead>
<tr>
<th></th>
<th>European</th>
<th>Muslim</th>
<th>Percentage of (1) to (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Wheat</td>
<td>8.7</td>
<td>4.1</td>
<td>209</td>
</tr>
<tr>
<td>Soft Wheat</td>
<td>8.6</td>
<td>5.1</td>
<td>170</td>
</tr>
</tbody>
</table>

The higher European yields are due to the following factors:

(1) Better quality lands.
(2) Superior methods and implements. As stated in a previous chapter, a greater percentage of European lands receive preparatory tillage than in the case of Muslim lands.
(3) Use of better crop varieties

There are also considerable variations in yields from region to region as will be noticed in the study of Agricultural Regions. On the whole, the rainier parts of Barbary give higher yields.

**Distribution and Yields in West Punjab**

In no district does wheat occupy less than 20% of the cultivated area. (ii) Its proportion generally exceeds 30% except in the trans-Indus district of Dera Ghazi Khan which is the most arid part of the province and only partially irrigated while Lahore has 27% of its area under wheat, the slightly lower percentage being due to an equal percentage being under fodder crops. In the unirrigated north-western districts, the

---

(i) Ibid
(ii) All these figures are for 1944-45
percentage of total area under wheat exceeds 40%, reaching 57% in the Attock District. One reason for the preponderance of wheat in this region is the comparatively greater amount of winter rain which is so favourable for the crop. Also, in the absence of irrigation, no commercial crop such as cotton or sugar-cane competes with wheat.

The total production in 1944-45 was 7,124,000 acres or 38% of the total cropped area. About two-thirds of the Punjab wheat is irrigated so that the crop does not depend heavily on rains. The variations in the yearly production are not therefore as great as in Barbary although total production does react to the general rainfall conditions.

Yields of wheat in the province average 820 lbs. to the acre (9.2 Qx per hectare) Yields on barani (unirrigated) land range from 410 to 574 lbs. per acre (3.5 to 6.4 Qx per hectare) and on irrigated land from 900 lbs. to 1066 lbs. per acre (10.2 to 12 Qx per hectare) Under intensive cultivation as much as 4640 lbs. per acre (51 Qx per hectare) have been obtained during experiments at Lyallpur. This shows the enormous scope for improvement.

Influence of cultural practices

As in Barbary, preliminary cultivation of the fields before sowing helps to increase the yield.

On irrigated lands, one watering is given before sowing (wahn) and two to three after sowing (rauni) and excellent

(i) Yields based on Roberts and Kartar Singh Op.Cit. p.224
yields are thus obtained. But if the waterings after sowing are delayed, an additional watering may later become necessary. The total irrigation water required for wheat is estimated to be 12".

Howard has called attention to the dangers of over-irrigation which is often a result of the assessment of water duty on the basis of area and crop rather than the amount of water. (1) Not only is valuable irrigation water wasted but also water-logging and loss of texture result. He advises long rests between irrigations and also volumetric distribution of irrigation water.

The type of rotation practised also has an important influence on the yields. The crop is usually grown on lands that have been fallow during the preceding summer; it may also follow fodders grown in the early part of the summer. On unirrigated land, wheat either follows a previous winter crop or the summer crop of the previous year. The intensity of rotations depends upon local conditions of soil and water and the amount of manure available. During experiments wheat has responded much better to three or four year rotations than to one or two year ones as it is an exhausting crop.

Comparison of Yields in Barbary and West Punjab

The average West Punjab yield of 9.2 Quintals per hectare exceeds greatly the average yields of about 5 Quintals in the three countries of Barbary. This is due primarily to

---

the fact that a major part of the area under wheat in West Punjab is irrigated while the crop is grown largely unirrigated in Barbary. Irrigated wheat yields 12 to 13 Quintals in the plain of Beni Amir in Morocco with the traditional methods of cultivation. This figure is slightly above the yields of irrigated wheat in West Punjab (10 to 12 Qx) but can be attributed to the use of fertilizer which is enforced officially in this area. Unirrigated wheat in West Punjab yields 3.5 to 6.4 quintals and is comparable to hard wheat yields in Barbary while soft wheat in the latter yeilds 7 to 11 hectares. Since the major proportion of wheat cultivated in West Punjab consists of varieties similar to those of soft wheat in Barbary, West Punjab appears to have a lower standard of production. Again other factors have to be considered such as the extensive use of agricultural machinery and fertilizer in Barbary among the cultivators of soft wheat who are either European colonists or enlightened Muslim notables. The yields of unirrigated soft wheat grown by the Muslim cultivators in Algeria does amount to the same figure as that for West Punjab and this similarity should hold good for the rest of Barbary.

In conclusion, yields of wheat cultivated by Muslim cultivators are comparable in the two regions both for irrigated and unirrigated land.

**Improvement of Varieties**

While the improvement of agricultural methods is one
way of increasing production, the cultivation of more prolific and better adapted varieties is an equally important measure towards the same end. In fact, experience has shown so far that it is easier to propagate improved varieties of crops than to change the outlook and methods of the illiterate peasant because the sale and distribution of seed is well within the powers of an administration while it cannot always revolutionize traditional methods over a short period of time.

Up till recently the peasants both of Barbary and West Punjab used to cultivate a mixture of varieties. In Barbary, native types were grown together with foreign strains imported during years of drought. The various organisations set up after the French conquest to conduct experiments in improving varieties have tried to develop types that are precocious, resistant to drought, lodging and rust and at the same time give high yields. The most significant contribution has been made by the Service Botanique et Agronomique of Tunisia under the direction of Prof. Boeuf. Some of the varieties developed here have become dominant all over Barbary because of their hardiness and high yields.

In West Punjab, the results of the Central Agricultural Research Institute at Pusa as well as the local experiments conducted at Lyallpur have similarly been applied and several improved strains propagated.

**Improved varieties of Barbary**

New Varieties of Hard Wheat: The problem in developing new varieties was to find species suitable for the
great variety of conditions from the mountains and rainy regions to the semi-arid plains and valleys stretching far to the south. Several hundred varieties were isolated and then multiplied in order to get the few varieties most suitable for all conditions. The principal varieties developed in Tunisia are:

1. Mahmoudi 552 - suitable mainly for the northern wetter regions. Liable to lodging.
2. Biskri - A variety suitable for all areas on account of its resistance to drought.
3. Roussia 752 - Suitable for the humid regions in the north as resistant to black rust.

Other varieties have been developed in Algeria and some notable successes include Hedba grown in the wetter Departments of Constantine and Algiers, Langlois, found in many parts of the Tell, Hadjini etc.

Of all these varieties, the three developed in Tunisia have become most popular. It must be noted, however, that "the improvement of hard wheats has not given as important results as those obtained with soft wheat" and great progress still needs to be made.

Improvement of Soft Wheats: The vulgare wheats, introduced by the Europeans, have given much higher yields than hard wheats mainly through the introduction of early maturing varieties.

(1) F. Boeuf, "Improvement in Cereal Production in Tunisia", I.R.A., 1937
(2) L. Ducellier, "Improvement of Cereals in Algeria", I.R.A. 1935 No. 12, p. 533-534
Among the first varieties to be tried in Barbary was Mahon from southern France. This variety yields very high quantities of wheat per unit area but since its heads are heavy and it matures late it is liable to both lodging and rust. Other French varieties too did not succeed very well. The two primary qualities to be sought for in the soft wheats being early maturity and resistance to drought, efforts were directed towards introducing foreign varieties.

Richelle Hative 110 was obtained from Australia and was found to mature ten to twelve days before Mahon. Its resistance to black rust and lodging as well as its high flour yields were certainly advantageous but it succumbed to weeds and cold easily. It was replaced in 1920 by Baroota of Australian origin. Other varieties introduced included Florence, Irakie from Irak and Pusa 4 of India. The earliness of the latter two was a great advantage and they proved to be good yielders.

Hybridisation was begun in 1923 and two notable varieties emerged - Florence Aurore and Pusa Florence both strong wheats conforming to the highest Canadian standards, resistant to lodging and very early maturing. Of these Florence Aurore has spread all over Barbary because of its various qualities.

Pusa wheats have also been used for hybridisation in Algeria and have, in combination with some Algerian and
Australian varieties yielded excellent new strains. Florence Aurore is, however, gradually replacing most other strains.

**Improved Varieties in West Punjab**

Three species of wheat are grown in West Punjab:

(i) *Triticum durum* - the "hard wheat" of Barbary but locally known as "Wadanak". It is grown chiefly in the sub-montane districts and is prized for its semolina. The area under this type is limited.

(ii) *Triticum compactum* or dwarf wheat - was cultivated extensively in the south-western districts on account of its resistance to drought. It is not popular since the coming of irrigation.

(iii) *Triticum vulgare* - the "soft wheat" of Barbary is the most important species grown in West Punjab and accounts for the bulk of the output.

The improved varieties developed so far have been mostly of this last type. One of the first was the Punjab II, introduced in 1919 in the Canal Colonies. It was replaced soon however by the 8A which gave up to 165 lbs per acre (1.9 qx per hectare) more than the previous variety. This type is deep-rooted and can grow as well in barani tracts as in irrigated lands. From the consumers' as well as the farmers' point of view it has highly desirable qualities and has become established as a popular variety.

---

Other strains developed later on include C.518 and C.591, the latter being perhaps the finest variety yet evolved on account of its excellent colour, bread-making quality and high yields. It outyields 8-A by over 80 lbs. per acre (1 quintal per hectare). It is resistant to rust but susceptible to smut. 9D is a new variety that has been found suitable for poor land.

The exact area under improved varieties is difficult to calculate, especially after the Partition of the province but a reliable estimate could be the minimum figure of 50%. Of these varieties, 8-A occupies almost three-fourths of the area under improved types.

BARLEY (Hordeum Vulgare).

It was noticed how prominently the crop figures among the cereals in Barbary on account of its high productivity in semi-arid conditions. This is accounted for by the fact that it matures in a shorter season than any other cereal crop. This has won it the reputation of being drought-resistant. "This" observes Klages "is not exactly the case; the crop is drought-escaping rather than drought-resistant" (1) During its short period of growth it demands a fairly abundant supply of moisture.

Requirements

Barley is able to withstand low temperatures during its period of growth and can endure high temperatures once the heads have grown. This gives it a fairly wide range of altitude for it is not damaged by the winter temperatures of the higher

(1) K.H.W.Klages, "Ecological Crop Geography", P.363
altitudes in Barbary where it flourishes well on mountain slopes and on the drier parts of the high plains. Like wheat, however, it cannot withstand a combination of high humidity and high temperature and is consequently not grown widely in coastal lowlands. The requirements of malting and ordinary barley differ insofar as the malting varieties require a longer growing period and cannot grow on the desert fringe.

The climatic requirements of barley are similar to those of wheat and their areas overlap in many parts of the world, barley being grown under less favourable conditions. This holds true equally in Barbary and West Punjab. In the latter, the crop has only a secondary importance now that most of the area is irrigated. The soil requirements of barley are very specific however, as it does not grow well on heavy clay soils and is less tolerant of soil acidity than wheat. On the other hand it can stand a fair amount of alkalinity in the soil.

**Production and Distribution in Barbary**

Barley dominates the drier parts of Barbary where wheat does not give good yields. It is found mainly along the southern fringe of wheat-growing areas although considerable areas within the wheat-growing regions such as the High Plains of Constantine and Setif are also devoted to it. In addition the crop is dominant in areas of rugged topography or high altitude such as the Kabylie and Dahra Massifs and the cultivated parts of the Atlas ranges in Morocco. The following table gives the total area under barley in the three territories:
Morocco is the most important producer. Here, barley is concentrated in the drier parts, i.e. in the southern part of Western Morocco in the regions of Marrakesh and Agadir. It also occupies a leading place in the eastern part of the country. The relative position of the crop in Algeria and Tunisia has already been discussed.

Barley is grown mostly by the Muslim population and the European share of the crop is a minor one. Thus in 1945-46 the proportion of the barley area in European hands was only 12% in Algeria and 65% in Morocco. They grow mainly brewing varieties such as 14 j developed in Tunisia or two-rowed varieties like No. 43 in Algeria. (1)

Yields in Barbary

The following table gives the yields of barley in the three countries of Barbary along with the yields for three other Mediterranean countries:

<table>
<thead>
<tr>
<th></th>
<th>In Quintals per hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morocco</td>
<td>6.4 (8.7)</td>
</tr>
<tr>
<td>Algeria</td>
<td>5.7 (5.7)</td>
</tr>
</tbody>
</table>

(1) Ducellier Op.Cit. p.334 T
Tunisia 2.5 (3.7)
France 12.8 (14.5)
Italy 10.3 (10.9)
Spain 9.9 (12.6)

The lower war-time yields are noticeable in Tunisia. From these figures, it is evident that the general standard of yields in Barbary is much below that in the other Mediterranean countries. There is in addition, the large discrepancy in yields obtained by the colonists and the Muslim peasants as may be noted from the following table:-(1)

<table>
<thead>
<tr>
<th></th>
<th>Europeans</th>
<th>Muslims</th>
<th>Percentage of Europeans to Muslims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>9.4</td>
<td>5.4</td>
<td>180</td>
</tr>
</tbody>
</table>

Trends in Production

The relative importance of barley has been decreasing in proportion to wheat over the past few decades and in Algeria alone, a recession of 425,000 acres was noticed between 1901 and 1939.(ii) The higher and more dependable prices of wheat have been the primary reason for this. But in many cases, wheat has been extended into regions of frosts and intense heat at the expense of barley and the restoration of this crop would certainly be conducive to better production.

Barley in West Punjab

Barley occupied only 528,456 acres or 2.7 of the total cropped area in 1944-45. In no district does it occupy more than 5% of the total cultivated area and is comparatively

(ii) E.C.M. "Algerie", p.286
more important in the unirrigated parts of Attock, Shahpur, Mianwali and Muzaffargarh. In those parts of the province where only small quantities are grown, it is sown chiefly on areas which are too late to be sown with wheat.

The crop receives much less care than wheat, is usually grown without manure and often mixed with gram. The average out-turn is 600 lbs. per acre (6.6 Quintals per hectare) which is better than the average yields in Barbary. Variations in yield are considerable from year to year.

The crop is principally used for cattle feeding, human consumption and mixing with wheat. Improved varieties developed for mixing with wheat are Nos. 4 and 5, both of them excellent for malting and brewing.

MAIZE.

Unlike wheat and barley, maize is a summer crop ("kharif" in West Punjab, "mazouzia" in Morocco) It is cultivated in both West Punjab and Barbary either under irrigation or in comparatively humid areas. Introduced into Barbary, by the immigrating Moors from Spain, it became established as an important crop in Morocco due to exceptionally favourable conditions in the Atlantic lowlands. Elsewhere, its cultivation has undergone great vicissitudes. In Algeria, for example, it was grown widely by the colonists in the second part of the 19th century and occupied 34,000 hectares in 1878. It fell in favour
rapidly and the area was reduced to 12,500 hectares by 1886. (1)
Since then the downward trend has persisted and in 1946 only 10,000
hectares were cultivated. This tendency may be attributed to
the great expansion of vineyards. The area under maize in
Tunisia is as insignificant as in Algeria so that the crop
may be said to be restricted to the Atlantic littoral of
Barbary.

This distribution can be explained partly in terms of
its requirements. It needs a fairly high precipitation and
although rainfall in the Atlantic lowlands is below 26" it is
supplemented by the high atmospheric humidity caused by the
effects of the Canaries Current. The clayey tirs ("dark") soils
of the region are also well-suited to the crop which is
shallow-rooted. Over 496,960 hectares were cultivated in 1946,
the chief growing areas being in the regions of Shawia, Abda
and Dukkala. Over 9/10ths of the crop is grown by the Muslim
peasants. Yields for Morocco and Algeria are given below along
with the figures for other Mediterranean countries for
comparison:

<table>
<thead>
<tr>
<th>Country</th>
<th>Quintals per hectare 1939-43</th>
<th>1934-38 in brackets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morocco</td>
<td>5.2</td>
<td>(4.9)</td>
</tr>
<tr>
<td>Algeria</td>
<td>7.1</td>
<td>(6.9)</td>
</tr>
<tr>
<td>France</td>
<td>12.6</td>
<td>(15.8)</td>
</tr>
<tr>
<td>Italy</td>
<td>17.7</td>
<td>(20.4)</td>
</tr>
<tr>
<td>Spain</td>
<td>14.8</td>
<td>(16.3)</td>
</tr>
</tbody>
</table>

Algerian yields are higher than those in Morocco because most of the crop in Algeria is grown under irrigation.

Maize in West Punjab

The crop occupied 437,098 acres in West Punjab in 1944-45 or 2.3% of the sown area. It grows very little on the arid south-western districts and occupied the highest percentage of the total cultivated area in 1944-45 in Rawalpindi - 11%. Here it is irrigated by wells. Although grown in small quantities in the canal colonies, it has not expanded its area despite being a profitable crop on account of competition with cotton. There are two main varieties of maize, yellow and white and of these, the yellow type of more popular in the Canal colonies whereas the white variety is grown in the north and north-west. The crop is commonly rotated with sugar-cane or wheat.

Yields average 750 lbs. per acre (8.6 quintals per hectare) which is higher than either in Morocco or Algeria. With heavy manuring and an abundant water supply as much as 3280 lbs. per acre (37 Quintals per hectare) may be obtained. The crop is grown mainly for its grain which is consumed as bread. When green, it is used as fodder as well although in this case, the crop is sown earlier.

LEGUMINOUS CROPS

These include a wide range of crops including various types of peas (chick-peas in particular), beans and lentiles in Barbary and gram and pulses in West Punjab. In the former, they
are grown mainly in the more humid cereal-producing areas in rotation with wheat. Apart from providing a valuable food they enrich the soil greatly by their property of restoring nitrogen in the soil. In 1945-46, they occupied the following areas in the three territories: (for peas, chick peas, beans, lentil)

In thousands of hectares

- Morocco: 241
- Algeria: 61
- Tunisia: 37

Their cultivation is being expanded to provide better crop rotations. The relative importance of individual crops may be judged from the following figures for Algeria - (Average of 1929-1938)

In 1,000 hectares

- Beans: 32
- Peas: 9
- Chick peas: 20
- Lentil: 1.8

**Leguminous Crops in West Punjab**

Of these gram is the most important single crop and covered 2,187,000 acres in 1944-45 or 11% of the total cultivated area. It is a winter ("rabi") crop and therefore competes with wheat for space. Grown all over the province, it is a leading crop only in Mianwali and Shahpura where it occupied 33% and 20% of the cultivated area respectively in 1944-45 and stood second to wheat. Most of the gram area is unirrigated and depends upon timely rains i.e. in September at sowing time.
failing which, the gram area is reduced. Gram has increased its area over the past several years at the expense of barley. The main varieties grown are the large type (Kabuli) which approximates to the chick-peas in Barbary and the several smaller types of different colours - black, brown and yellow. Several improved varieties have been developed and the main object of research has been to isolate varieties resistant to gram-blight which causes great damage. Yields of gram range from 450 to 1640 lbs. per acre (4.7 to 18.5 Quintals per hectare) depending upon the amount of rainfall, cultural practices and pests etc. Average yield comes to about 492 lbs. per acre (5.5 Qx per hectare). About half the crop is used for human consumption and the rest for stock-feeding.

**Pulses** for an important article of diet and are known as the poor man's meat. More important among these are Mung, Mash, Moth and Massar (lentil) They are grown in all districts mostly without irrigation. In 1944-45, they occupied 725,000 acres or 3.7% of the total cultivated area.

**Cereals Special in Barbary**

**Oats**

Oats are grown primarily by Europeans as feed for their livestock. They require a higher precipitation than either wheat or barley and are less resistant to winter cold. Consequently they are not grown at high altitudes. They grow on a variety of soils and do best on soils retentive of moisture. They cover a considerable area in Algeria - over 120,000 hectares - in 1946. Their area is limited in Tunisia and
Morocco, being 74,000 acres in the former and 72,000 acres in the latter.

Small quantities of sorghum and rye are also grown in various parts of Barbary but their area is unimportant.

Cereal Crops Special to West Punjab:

BAJRA (Bulrush millet, Pennisetum Typhoideum)

This is the second most important cereal in the province and covers 1,424,642 acres for 7.3% of the total area sown. It is grown as a kharif crop in the same areas as wheat, on lands that are not suitable for wheat in the following rabi season. It is a staple food of the poorer classes and some of it is also used as fodder when green.

It is a deep-rooted drought-resisting crop quite suitable for the poorer sandy soils. It is an important crop in the Potwar plateau where it occupies more than 30% of the cultivated area. It is least grown in the canal colony areas where it does not occupy more than 5% of the area sown.

The yield of the crop varies from 330 lbs. to 410 lbs. per acre (3.5 to 4.6 quintals per hectare) on unirrigated lands while on irrigated lands up to 820 lbs. (9.2 Qx per hectare) may be obtained. Two main varieties are cultivated in the Province - small seeded or bajri and bold seeded or bajra. The former is considered to be of a better quality while the yields of the latter are higher.

We may also consider Jowar here, another millet which is sown primarily for fodder. Only 492,533 acres were sown
with this crop in 1944-45. This is a kharif crop. In Dera Ghazi Khan, the arid trans-Indus district it occupies more than 20% of the total area sown and is used as human food. The crop is injured by drought more easily than bajra and is therefore grown on better lands. Given good growing conditions, it gives a good yield - from 400-600 lbs. on irrigated land to 200-472 lbs. on unirrigated lands.

Rice

Rice acreage has been extended in West Punjab during recent years because of the development of irrigation. It occupied 330,767 acres or 4.3% of the total cultivated area in 1944-45. It is mostly irrigated (over 80%) but when unirrigated it is grown in the Sailab (flooded) lands. The districts of Gujranwala and Sheikhupura are the most important producers of rice in the province and over 10% of their areas is devoted to its cultivation. It is grown fairly extensively in the sub-montane districts of Gujrat and Sialkot as well as in the district of Dera Ghazi Khan. It is a kharif crop being sown in May and June and harvested in September and October.

Rice is a product of hot humid climates and heavy soils. The alluvial soils of the wetter West Punjab districts have proved to be especially suitable. It is not grown under well-irrigation because supplies of water from a well would not be adequate. Because of its ability to grow on heavy clay soils and also its great demand for water, it has been found ideal for reclaiming alkaline and water-logged lands.
The cultivation of rice makes heavy demands on labour because on irrigated lands it is first grown in nurseries and then transplanted. It can also be sown broadcast but the former method pays ample dividends for the labour employed through higher yields.

**Varieties and Yields**

The varieties grown range from fine rices like Basmati to medium and coarse rices, the last including the unirrigated Jhona. Some improved varieties have been evolved that suit local conditions better and give better yields. These are mostly based on the existing varieties.

Yields average 1150 lbs. per acre (3 Quintals per hectare) being over 1300 lbs. (14.8 Quintals per hectare) for irrigated lands and only 570 lbs. (6.4 Quintals per hectare) for unirrigated areas. The highest yield obtained during experiments was 3200 lbs. so that there is a great scope for the improvement of yields.
The Commercial Crops of Barbary

The Vine

The vine was grown in Barbary long before the French conquest in small quantities for consumption as table grapes. Its area was very limited and in 1830 it covered only some 3,000 Hectares in Algeria. (1) No recorded figures are available for that time in Tunisia and Morocco but they must have been low. Since then the growth in its acreage and importance has been continuous so that it has formed the basis of the Algerian commerce for several decades.

History of Development

The growth of the area under the vine has been linked up with the growth of colonization. The Muslims have made no contribution to the process, wine being forbidden by Islam.

The first colonists did not grow vines on any large scale till a law permitting the export of wine to France was passed in 1851. The real wine boom started in 1875 after the French vineyards had been ruined by the Phylloxera and from 15,000 Hectares in 1873, the area under vines increased to over 155,000 Hectares in 1900. The Algerian vineyards were themselves threatened by the disease and for a time the area declined, but by the commencement of the First World War, the vine recovered enough with the help of imported American varieties to cover

(1) H.Fontanelle - E.C.M. "Algerie" p.297
over 365,000 acres. It continued to expand its area rapidly until the maximum figure of 400,000 Hectares was attained in 1936. Meanwhile, overproduction had become a serious danger to the prosperity of the crop and in 1931, restrictions were imposed on the extent to which new plantations could be established - the individual quota being 10 hectares. The increase continued despite this and by subsequent legislative measures, the government called a halt to the uneconomic tendency to plant vines even if the market was glutted. The decrees of 1933 and 1940 called for a reduction in the area of the large vineyards. During the Second World War, the lack of insecticides and other chemicals against diseases as well as the effects of the war itself reduced the area considerably and since then a revival has been in progress.

The vine figures less conspicuously among the agricultural crops of Tunisia and Morocco largely because colonization has not made the same headway as in Algeria. Vines for table grapes occupied 1100 hectare in Tunisia in 1881. The Europeans had planted 3,000 by 1883 which had increased to over 50,000 by 1933. After this a slight recession set in. Morocco had a considerable are under table vines before the French conquest, mostly in the region of Dukkala, the Atlas and the Zerhou, the total number of vines being 5,500,000. This has since increased to 16 million in 1935. (1) They have

(1) G. Lebault, E.C.M. "Maroc" p.240
to be reckoned in number rather than area because they are not
grown in regular plantations. European plantations started in
1918, amounted to 200 Hectares in 1920 and to 3,000 Hectares
in 1933.

Requirements of the Vine

Vines require a long mild to hot summer and cool
winters for their best development. They are not adapted to
humid summers because of their susceptibility to certain fungus
diseases, particularly mildew; nor do they survive very cold
winters in which temperatures may go below 0°F. Frosts after
spring are disastrous and a long, sunny growing period is needed
to mature them.

The vine has deep roots and does not need abundant
moisture. Spring rains are undesirable as mildew sets in and
it is mostly during the autumn and the winter that the plant
builds up its reserves of moisture.

From these considerations, it will be obvious that
the Mediterranean climate is ideal for the growth of this crop
and it is only natural that the regions of the world with
this climate should have developed it as a principal culture.
It is grown in the littoral zone where temperature conditions
are equitable.

Production and Distribution

The area under vines in the three territories was
as follows in 1943-46. Comparison with the 1934-38 average will
show the diminution that took place during the war due to the
blocking of exports and difficulties of obtaining chemicals for use against pests.

<table>
<thead>
<tr>
<th></th>
<th>1934-35</th>
<th>1945-46</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morocco</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Algeria</td>
<td>394</td>
<td>351</td>
</tr>
<tr>
<td>Tunisia</td>
<td>43</td>
<td>28</td>
</tr>
</tbody>
</table>

The areal distribution is closely associated with colonisation. In Tunisia the region around Tunis and the Cap Bon peninsula share the Tunisian vineyards almost half and half.

In **Algeria**, there are three principal zones under vines:

1. The littoral plains - notably the plains of Mitija, Isser, Shelif, Oran and Arzeu as well as the eastern Algerian plains of Bone, Safsaf and Summam.

2. The hill-side plantations of the Algerian Sahel, Philippeville, the coastal slopes of western Algeria and the regions of Mostaganem and Ain Temouchent - west of Oran.

3. The mountain vineyards between 2,500 and 3,300 feet in the regions of Miliana, Medea, the Dahra Massif and south of the Jurjura range as well as the well-known plantations of Tlemcen and Mascara.

The **Moroccan** vineyards are in the Fez-Meknes plain and in the Gharb plain near the coast.

---

(i) The Moroccan figures do not include 271,000 scattered vines grown by the Muslims as table grapes.
Varieties

The principal varieties for red wines are Carignan, Cinsault, Alicante-Bouchet, the Grand Noir and Calmette while Clairette, white Ugni, Faranah and Macchabes are grown for white vine. They are mostly grafted with American varieties Lot and 41B against the phylloxera.

The red and rose vines are grown mostly in the lowlands and yield high quantities of ordinary wine. The hill-side and mountain plantations yield lower quantities but the vines have a higher alcoholic content and make juicy, perfumed wine so that lower production is counterbalanced by higher prices.

The prosperity of vine cultivation is dependent upon foreign markets, principally France herself.

The Olive

The olive is the Mediterranean plant par excellence and the extent of its distribution has often been used to delimit the boundaries of this climate. It has been called the tree of peace, and indeed the history of its vicissitudes in Barbary testifies to the truth of the statement. Introduced and extended by the Phoenicians, the olive plantations covered large areas during Roman times when, according to some estimates, it covered 2,500,000 acres in Tunisia alone. (1) Remains of countless oil-presses in the arid south bear witness

(i) 'Olives', Encyclopaedia Britannica, 1947.
to its former luxuriance in those regions. The turbulent times that set in with the Vandal invasions and later the period of instability following the Arab migrations reduced the area considerably.

At the time of the French conquest the plantations in Tunisia consisted of about 8 million trees, most of them very old. The establishment of peaceful conditions and the stimulus given to olive plantations by foreign commerce have since raised the number to over 19 million in 1940. Progress has also been recorded in Algeria and Morocco but the tree does not play the same important role in their economies as it does in Tunisia where it formed the second leading export before the Second World War. (i) Tunisia is the fifth largest producer of olives in the world, following Spain, Italy, Greece and Portugal.

The olive has long been the leading plantation tree in Barbary and most of its production is in the hands of the native Muslim cultivators who own 92% of the trees in Tunisia, 2/3rds of the plantations and most of the scattered trees in Algeria and 90% of the trees in Morocco.

**Requirements**

In general it may be said that the olive grows under typical Mediterranean conditions i.e. a hot dry summer and a cool and moist winter. Within these conditions, it is quite adaptable. It rarely suffers from excessive heat if the moisture

---

(i) E.C.M. "Tunisie!"
reserves of the soil are adequate. In Tunisia and elsewhere, it extends up to the edge of the desert.

Rainfall in the olive zone is usually low and the tree can live in regions where the annual rainfall does not exceed 8". On the other hand, the olive tree is very sensitive to excessive rain and specially to stagnant water. Its density per acre is dependent upon the amount of rainfall.

The tree flourishes on a variety of soils except clayey ones from which it has difficulty in obtaining moisture. Light soils like those of southern Tunisia are particularly favourable. The range of altitude is considerable for it can be grown up to heights of 5,000 feet in some parts of Barbary. The best yields are obtained at altitudes of between 1,000 and 1,600 feet and the oil content diminishes with greater heights. (1)

Violent winds do a lot of damage to the tree. It grows better on slightly inclined ground because it is well drained.

Area and Distribution

Tunisia is the most important producing country in Barbary. The larger plantations lie along the coast which provides the best environment for the crop even if the rainfall is light. The insular climate is more favourable than the continental because temperatures are equitable and the moist atmosphere prevents rapid evaporation of soil moisture. The principal producing areas are as follows:

(1) Olives and Olive Products - International Institute of Agriculture, Rome, 1940, p.2
(1) The **North**: In this zone, the rainfall exceeds 16" while the soils vary a good deal. The tree prospers on the lighter soils but on heavy compact soils, irrigation is sometimes necessary as the tree itself cannot obtain its moisture from clayey soils easily. The density of thees to the acre varies from 40 to 120 planted at distances of 20 to 27 feet for old trees and 35 feet for young ones. The region is one of little expansion and between 1926 and 1936 only 125,000 new trees were planted. (1)

(2) The **Sahel** olive groves extend into the interior for 60 miles with over a width of 40 miles and is centred on Sousse and Mahdia. The soils are lighter here and more suitable for olives than in the north. The muskat system of terracing and irrigation is used. This is a region of expansion of plantations. The number of trees per acre is 32 though in some parts it rises to 40. The interior regions of Thala and Kairwan have little importance as olive producers although some expansion has taken place in the latter

(3) **Sfax and the South**: The Sfax region consists of a veritable forest of olives that extends for 25 miles to the north of Sfax, 40 miles to the west and 32 miles to the south. (ii) The sandy and calcareous soils absorb the moisture readily and the planting is done with great care by the Sfaxians who are well-known olive growers. Isolated groups of plantations occur further to the south at the oases of Safsa, Gabes and the

---

(1) Ibid p.207
(ii) A.M.Barbier & R.Margarit "Voyage d'Etudes Agricole en Tunisie" 1936
regions of Matmeta and Maknassy. Extensive groves are found at Zarzis and Jerba. The number of trees per acre varies from 6 to 8 as the rainfall is low and variable and the tree must be surrounded by enough soil to keep it alive during periods of drought. The greatest expansion of groves has taken place in the Sfax region.

The following figures show the progress of olive plantations made in various regions from 1882 to 1938.

<table>
<thead>
<tr>
<th>Regions</th>
<th>No. of trees 1882</th>
<th>No. of trees 1938</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>2,400,000</td>
<td>4,200,000</td>
<td>1,800,000</td>
</tr>
<tr>
<td>Sahel and Centre</td>
<td>4,500,000</td>
<td>7,200,000</td>
<td>2,700,000</td>
</tr>
<tr>
<td>Sfax and the South</td>
<td>1,240,000</td>
<td>7,600,000</td>
<td>6,360,000</td>
</tr>
<tr>
<td></td>
<td>8,140,000</td>
<td>19,000,000</td>
<td>10,860,000</td>
</tr>
</tbody>
</table>

Varieties and Yields

The number of varieties cultivated is considerable. Taking the size of the fruit as the basis, these can be divided into three classes: i.e. (1) Large fruits (2) Medium fruits (3) Small fruits. (ii) The varieties with small fruits are those used for oil extraction while the large fruits are used for table consumption.

The two principal varieties grown for oil are the Shemlali which accounts for 60% of the total and occurs in the

(ii) A. Pascal, "Olive-growing in Various Countries" (4) I.R.A. 1935, p.175 T
Sahel and Sfax regions and Shetwi, constituting 20% of the total production and growing in the north. The best varieties of table olives are Zanazi, Meski and Baruni.

A characteristic of the olive plant is the irregularity of its yields despite all the care that can be given to it and years of good, moderate and low yields follow each other in a cycle. This is one reason why the olive is often associated with other crops in order to ensure some return from the land.

**Algeria**: Olives grow everywhere in the Tell, principally between altitudes of 1500 feet and 3,000 feet. There are also some isolated plantations south of the High Plateau. According to the figures for 1948 (1) there are over 8,800,000 olive trees in production. These are mostly found in the regions of Tlemcen, Sidi bel Abbes, Kabylie, Bougie and Guelma. They are sometimes grown mixed with cereals or other fruits but generally occupy secondary lands of marly or limestone character.

The principal varieties grown are Shemlal; Rougette Azeraj, Limli and Aberkan, the last a table olive. Some European varieties have been introduced into the Department of Oran. In addition to the regular plantations there are 5½ million wild olive trees scattered all over the country.

**Morocco** has 9,400,000 olive trees, 70% of which are concentrated in the regions of Fez and Marrakesh. (ii) Expansion in the Fez region has chiefly been towards the north in the

---

(1) G.G.de l'Algerie, "Renseignements Statistiques Agricoles" 1948
direction of the Sebu and olives are often grown together with vines. Olives grow up to heights of 3,000 feet. The Marrakesh region grows olives largely with irrigation because of its dry continental climate. Olives occur up to heights of 4,500 feet. The Meknes region also has some orchards, principally on the Zerhoun Massif.

The most important varieties are Soussia, Meslala and Zitoun in Marrakesh and Bot Shwika, Meslala and Zitoun in the Fez area.

Citrus Fruits

Citrus fruits have long been grown in Barbary. They were first introduced into the region by the Arabs during the 8th century when they brought with them the bitter orange and the lemon. But the sweet orange did not enter the region till the 14th century. During the time of Muslim domination, several areas possessed renowned orange orchards. When the French landed in Algeria in 1830 they were struck by the "forest of oranges" around Blida in the Mitija plain. A flourishing export trade developed and several colonists planted orange gardens. The total number of citrus trees in 1905 was estimated at 1,247,610 covering 7,500 acres of which over a million belonged to Europeans. No progress was recorded between 1910 and 1935. At this time, the construction of several dams was being taken in hand and the government decided to send missions abroad to find out the best use of irrigation water. Opinion was already

turning in favour of extending citrus plantations when the Spanish Civil War in 1936 interrupted Spanish orange exports and created an immense demand in France. This was the turning point for citrus fruit plantations which have since increased phenomenally in area.

Tunisia and Morocco both have traditions of citrus cultivation. In the former it was the thrifty Andalous who developed their gardens in the Cap Bon regions under irrigation. In Morocco, there were several renowned varieties of oranges grown in the regions of Zegzel, in eastern Morocco, south of the Rif Mountains around Wezzane and also in the region of Dukkala and Marrakesh. Since 1936, these territories too have experienced a great boom in the expansion of citrus plantations. The following figures show the progress made during 8 years from 1938 to 1946:

<table>
<thead>
<tr>
<th></th>
<th>Algeria in hectares</th>
<th>Morocco and Tunisia 1000 trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1938</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td>1,547</td>
<td>3,970</td>
</tr>
<tr>
<td>Algeria</td>
<td>10,734</td>
<td>24,061</td>
</tr>
<tr>
<td>Tunisia(1)</td>
<td>300</td>
<td>797</td>
</tr>
</tbody>
</table>

Requirements

Citrus does best between temperatures ranging from 56°F to 104°F. Sudden falls of temperatures below freezing point are harmful to its growth and it does not stand persistent frost. Consequently it is seldom grown above 2,000 feet altitude.

(1) Only oranges.
Citrus fruits grow more or less continuously all the year round and need a constant supply of moisture. The optimum rainfall for the trees is 35 to 45" which should be distributed fairly evenly through the year. Hence even in comparatively humid areas, irrigation of citrus plantations become necessary during the dry intervals.

The force and frequency of winds play an important role in the growth of citrus because they have an injurious effect on the fruit as well as the trees. Hence windbreaks are used commonly because they enhance the quantity of produce and increase yield by as much as 20%.

The soil requirements of citrus trees are not so exacting, as the crop grows on a great variety of soils. Most deep and permeable soils are suitable hence the special importance of alluvial deposits. Soils that are too light or too heavy are both useless for the planting of citrus. About the best soils are well drained and light soils. An excess of clay is harmful to the growth of fruit trees. As already indicated in a previous chapter, citrus trees cannot withstand salinity or alkalinity of the soil.

**Distribution**

Because of their specific requirements, citrus fruits grow only in restricted areas in Barbary. As map will show, the principal groves are found in low-lying areas. Almost everywhere, even if the annual rainfall is sufficient in quantity,
irrigation is a necessity. In most areas irrigated by the new dams, citrus fruits are grown. The important citrus-growing regions may now be described in brief:

**Tunisia** - Unlike Morocco and Algeria, the majority of the citrus trees belong to the native Muslims who own 80% of the total. Sixty per cent of the plantations are situated in the Cap Bon region, 24.6% in the Tunis district. The increase of citrus plantations is limited in Tunisia by the shortage of water for irrigation. Over 80% of the fruit produced consists of oranges.

**Algeria**: Europeans own the major proportion of the citrus trees in Algeria. Among these, oranges again the dominant variety accounting for 61% of the total area under citrus plantations. P. Robert has grouped the citrus-growing areas as follows: (figures indicate percentage of Algerian area).

1. The Plains of the Department of Oran - including the plains of Tafna, Sig and Habra and the regions of Oran and Mostaganem - 26%
2. The Shelif Valley including the valley of the Mina - 9.3%
3. The Mitija Plain and the Sahel of Algiers - 40%
4. The Valleys of the Isser and Sebaou - 2.7%
5. The Sumam Valley and the Bougie Plain - 2.2%
6. The Philippeville-Bone region - 17%

**Morocco**: Europeans own 77% of the citrus plantations in Morocco. More than half of those are in the Gharb plain.

---

(i) A. Pascual "Citrus in Morocco and Tunisia" I.R.A., Vol. XXXI, 1940
(ii) Op. Cit. 389 20 Percentages calculated for 1941 figures
Other important growing areas are centred on Meknes (13%) and Marrakesh. Of the varieties grown, early maturing types occupy 2/3rds of the area, consisting mostly of oranges.

Varieties and Yields

The varieties planted in Barbary are primarily those which can compete with other producing countries in the foreign markets. Hence the emphasis is on early-maturing or late-season fruits. Tunisia alone concentrates mainly on mid-season varieties. Oranges are by far the most important species and are followed by clementines, mandarines, lemons and grape fruit.

Oranges: Early maturing varieties:

Washington Navel: An excellent fruit with good colour and resistance to adverse conditions. It is the most popular variety on new plantations everywhere.

Thompson Navel: Matures one to two weeks earlier but is more fragile.

Robertson Navel and Hamlin are other more recent varieties from U.S.A.

Mid-season oranges include Cadenera from Spain and the Portuguese sanguine, the latter being marked by its excellent colour and absence of pips.

Late-maturing varieties are Valencia Late, Vernia and Jaffa. The first-mentioned is specially popular on account of the fact that its fruit can stay long on the tree without deterioration. It also gives a high yield.
Tunisia also grows Maltese oranges in considerable quantities.

The leading mandarin varieties are Blidah and Satsuma and King of Siam.

The average yields from different types of citrus fruits have been calculated as follows:— (i)

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oranges</td>
<td>150 to 220 lbs.</td>
</tr>
<tr>
<td>Mandarines</td>
<td>175 to 220 lbs. (once in two years)</td>
</tr>
<tr>
<td>Lemons</td>
<td>105 to 175 lbs.</td>
</tr>
<tr>
<td>Grape-fruit</td>
<td>150 to 220 lbs.</td>
</tr>
<tr>
<td>Clementines</td>
<td>Similar to oranges but very irregular.</td>
</tr>
</tbody>
</table>

It may be added that in terms of the existing prices citrus fruits yield more than twenty times the income per acre from cereals and more than twice that from vines. (ii) As the demand for citrus fruits is far from satisfied in the not too distant European countries, there is still a great scope for the expansion of plantations.

EARLY VEGETABLES

The cultivation of early vegetables in Barbary has developed over the past thirty years due to a number of factors. Vegetables mature in Barbary several weeks ahead of those in

(i) M.Briand, G.Castets, R.Tecourt "La Culture des Agrumes au Maroc" p.32
Europe. Thus Algerian potatoes come on the market early in March against the Spanish ones, among the earliest in Europe, which are not harvested till the middle of April. Moroccan potatoes are ready even earlier and those grown in the south are on sale by the end of January. Other vegetables such as tomatoes, artichokes, carrots, haricot-beans and peas can also be matured earlier than in Europe. This advantage secures them very high prices in the European market (especially in France and Britain) so that despite the additional expense of transport, high profits are made. Quick transport across the Mediterranean has yet been another factor in the expansion of this crop. Ships from Algerian ports can now cross to Marseilles in 24 hours and vegetables can be put on the market at Paris on the third day from dispatch. The time taken with Moroccan vegetables is now 4 to 5 days. The natural advantages of growth in Barbary have thus combined with accessible and profitable markets to make early vegetables a leading commercial crop. In 1938, it occupied the third place in value among the Algerian exports following wine, and cereals and exceeded in value the exports of animal products and minerals.\(^{(1)}\)

**Requirements**

While early vegetables give high returns, their requirements are so exacting that they can be grown only in limited areas. They require abundant moisture and under the

\(^{(1)}\) E.C.M. "Algerie" p.323
capricious rainfall regime in Barbary, have almost always to be irrigated. They flourish best on light well-aerated soils and the use of manure and fertilizer is necessary for intensive production. The crop is highly susceptible to hail and frost so that it needs to be protected against these hazards. Strong wind is equally harmful and windbreaks of reeds have to be erected at short intervals wherever strong winds are common, e.g. on the Sahel of Algiers. In addition to these natural requirements, the cultivation of early vegetables needs close and continuous attention and a large labour force is required. Finally as the crop is grown primarily for export, it has to be grown in locations from where the produce can be speedily transported to the port of embarkation.

There are two maturing seasons in Barbary, one in spring and the other at the beginning of autumn. Of these the first one is more important.

**Production**

Vegetables for local consumption have long been grown in Barbary. Among these fresh vegetables occupied a negligible proportion. Thus in Morocco only 5,300 Hectares were under vegetable crops in 1913.\(^{(1)}\) The areas in the other two territories were negligible. About 1920 the Algerian production of early vegetables began to expand as the advantages of the precocious local crop began to be realised. For a stretch, Algerian produce enjoyed very high prices as it was the earliest on the market. In 1926, the Moroccan government

\(^{(1)}\) E.C.M. "Maroc" p.236.
yielded to the pressing demand of Moroccan growers to help in the marketing of its produce and the Algerian producers found themselves faced with serious competition as the Moroccan crop matured two to four weeks earlier. Subsequently the two territories came to an agreement and the prospect of a disastrous rivalry was averted. In 1936, the export of market-gardening produce from the three territories was as follows:

- **Algeria** 139,000 tons
- **Morocco** 26,000 tons
- **Tunisia** 5,400 tons

From these figures it is apparent that Tunisia does not compare with the other two territories as a producer of early vegetables. This is due to the fact that humid coastal lowlands that constitute the most suitable areas for this crop are limited. With Algeria having an early start, Tunisian produce could not have presented the same challenge to her supremacy in the European market as the more precocious Moroccan crop. In 1946 the total areas under vegetables were as follows:

<table>
<thead>
<tr>
<th>Territory</th>
<th>Area (thousands of hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morocco</td>
<td>33</td>
</tr>
<tr>
<td>Algeria</td>
<td>40 (ii)</td>
</tr>
<tr>
<td>Tunisia</td>
<td>19</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>92</strong></td>
</tr>
</tbody>
</table>

From these figures, Tunisia's share in the total area would appear to be not inconsiderable. Official statistics

(ii) The Algerian figure is not for 1946 but for 1936 as no figures of total area are available in the 1946 issue of the agricultural statistics. The recent figure is more likely to be in excess.
do not make any distinction between early and normal season vegetables. Most of the area is, however, under the former as growers find them more profitable. It is not possible to be precise on this point.

Yields

No indication is given in published statistics of the yields of principal vegetables with the exception of potatoes in Algeria which in 1946, yielded 65 quintals per hectare.

Distribution

The cultivation of early vegetables is concentrated in parts of the humid coastal lowlands of Barbary in a narrow fringe along the shore. These areas not only benefit from the high coastal humidity, especially in Morocco, but they also have the sandy soils which are ideal for this crop. The maritime influence is also salutary in that frosts are rare. The advantage of easy access is manifest. The cultivation of early vegetables does not extend far inland as climatic conditions become more extreme and the distance a handicap.

Morocco

The coastal fringe extending from Fedala to Casablanca is one continuous strip of vegetable gardens. Further south another narrow vegetable zone occurs between Mazagan and Azzemour. This area accounts for 2/3rds of the Moroccan
production of early vegetables and among these potatoes and tomatoes are dominant. These are irrigated by means of tube-wells. Another notable zone of early-vegetables is in the lower part of the Triffas plain along the Muluya. Interior areas around large towns such as Fez and Meknes cater mainly to local needs. Potatoes covered about half the total area under vegetables before 1938.

**Algeria:**

More than 4/5ths of the Algerian early vegetables are grown in the Sahel of Algiers in a narrow strip 3 to 6 miles extending from Tipasa to Ain Taya. In this zone potatoes, tomatoes, artichokes, haricot beans and peas occupy the leading place. Potatoes are also grown further inland in the Mitija plain. Other areas growing early vegetables are the Sahel of Oran, the coast around Mostaganem, the lower Summam valley and the plains of Philippeville and Bone among coastal areas while inland the valley of the Tafna, the Sig plain, the Shelif Valley, the Miliana region, the Mitija plain and the valley of the Sebaq.

**Tunisia:**

Certain zones specialize in individual crops. Thus potatoes are grown chiefly around Bizerta, tomatoes in the Cap Bon region while artichokes are prominent in the lower Mejarda valley.

**Prospects**

Market-gardening and specially early vegetables depend upon the intensive exploitation of land and require a
large amount of labour. Their expansion promises hope of providing for the increasing population. Guernier estimated that the 40,000 Hectares under vegetables in Algeria in 1938 supported 250,000 people. There are still some possibilities of expanding the market in Britain and France and internal consumption can be increased manifold to provide a more balanced food to the population.

The Commercial Crops of West Punjab

These include cotton, sugar-cane, fruits, oil seeds, etc. As will be noticed these do not correspond with the main commercial crops of Barbary. Herein factors of physical environment are not the only ones to be considered; the human factors are quite as significant. Sugar-cane and oil seeds have long been planted for local consumption, the latter often supplying the fat content in the poor man's food. The development of the cotton acreage has followed its success on the West Punjab soil under irrigation where it has given a higher yield than most other areas in the Indian sub-continent. It may be added that just as cotton has been grown sporadically in Barbary, olive has flourished in a wild state in the Potwar plateau and could be made to grow if there was enough economic stimulus.

As for citrus and other fruits, there has been a steady expansion in the area under fruit plantations in the irrigated areas and oranges in particular have been a great success.

(1) E.C.M. "Algerie"
Cotton

Cotton is the leading cash crop of the province and also the principal crop of the kharif season. Its two varieties desi (indigenous) and American occupied 2,000,651 acres in 1944-45, and accounted for 10.7% of the total area sown. The crop is grown mostly under irrigation and the highest percentage of cultivated area is devoted to it in the Canal colonies. Thus Montgomery has over 20% of its area under cotton while Lyallpur, Lahore, Sheikhupura, Jhang, Shahpur and Multan devote between 10 and 20% of their areas to it. It is grown unirrigated mainly in the sub-montance districts and is least important in the Potwar Plateau where it occupies less than 1 per cent of the total area.

Requirements:

Cotton grows on all except the lightest soils and does best on medium to heavy loams. American cotton requires heavier soils than desi. This explains the greater suitability of the districts of Montgomery and Multan which are further away from the mountains and therefore have finer alluvial deposits. A factor of considerable importance is the moisture-retention capacity of the soil in a semi-arid region like West Punjab. It may be added that the coarser desi cotton gives better yields on poorer soils than the American variety which has more exacting requirements.

A good water supply is essential whether it comes from rainfall or irrigation. But even though grown mostly under irrigation its yield is affected to a great extent by the
distribution and incidence of rainfall. Heavy showers are injurious and the quality tends to be better in drier conditions. Thus the cotton of Multan is the best in the province. (i) Desi cottons are more drought-resisting. A light rainfall in the initial stages of growth during April and May helps the growth. In barani areas, sowing is delayed till the monsoon starts and if the monsoon is sometimes late, the unirrigated area is reduced. Heavy and frequent rains between June and September generally reduce the yield, particularly if they occur towards the last stages of its ripening and picking period, i.e. from the end of August. Comparatively dry weather with moderately high temperature reduces the menace of pests and insects.

The limits of cotton cultivation are determined by the duration of the frost-free period which should have a length of 200 days. This hazard does not exist in West Punjab except in the Potwar plateau. Abnormal frosts occurring during the late pickings in November reduce the yield and injure the quality of American cotton. Hot winds during the summer damage the crop so that it is not uncommon to see the crop being grown in the shelter of a taller crop like sugar-cane.

On the whole conditions in West Punjab are favourable for the growth of cotton under irrigation.

Varieties and Yields

Of the two principal varieties mentioned above, the

(i) Report of Indian Cotton Committee, 1919, p.13,
American one demands better conditions of soil and water-supply and is therefore confined almost entirely to the canal colonies. It has a longer staple and a better texture than the desi variety.

The introduction of medium-stapled American cotton first was tried in the new canal colonies. Unfortunately boll-worm had disastrous effects on its development. After 1905, when the organisation of agriculture had been improved, attempts were made again. Since then it has made continuous progress and now covers more than 80% of the area under cotton. The principal varieties of American cotton are 4-F, the first one to be introduced on a large scale which has held its own till today, 285-F early maturing and drought resisting, 289-F with a higher yield than 285-F but later maturing and hence subject to damage by frost. The latest variety to be introduced on a large scale is 43-F which has an all-round superiority over the other strains in its staple, time of maturing and yield. Most of these varieties have been developed from American upland varieties.

The desi cottons in West Punjab consist of a mixture. Improved strains have recently been developed of which Mollisoni is the best and covers most of the area under desi cotton now.

Yields are higher on irrigated lands for both American and desi varieties. The yield per acre of irrigated cotton is about 650 lbs (with seed) per acre. It is about
50 lbs. more for the American varieties. This yield is the highest obtained in the sub-continent of India but is one-third that in Egypt and only two-thirds of the American yields. The maximum yields obtained during experiments have been 6 to 7 times higher. (i)

Influence of Cultural Practices

Cotton cannot be sown after wheat because of the late wheat harvest. It does best when following a leguminous crop such as gram. In the canal colonies therefore, wheat lands cannot be good cotton producing lands. Cotton sometimes follows cotton after a fallow.

Manuring is not required after a fallow because cotton is not an exhausting crop. Nitrogenous manures are useful for enhancing the yields of American cotton.

Cotton requires about twice the amount of water as wheat (24") A good part of it is obtained from the monsoon but generally, one irrigation is applied every three or four weeks after sowing. A watering preparatory to sowing (rauni) is usually given a month earlier and produces a good sub-soil reserve. Harrowing after sowing is very useful as it breaks up the crust which is sometimes formed at the soil surface at this time of the year. Sowing itself is done in regular lines in the canal colonies and gives better yields than sowing broadcast.

SUGAR CANE

Sugar cane occupied only 251,879 acres in West Punjab

(i) Roberts and Kartar Singh Op.Cit.413
in 1944-45 or 1.3% of the total sown area but its real importance is much greater than this would suggest because of its higher yields and greater demands of labour, manure and water than most other crops. Unlike cotton which is grown mainly for sale sugar-cane is grown for consumption within the province. It is grown mostly under irrigation in the eastern districts of the province i.e. Sialkot, Gujrat, Gujranwala, Sheikhupura, Lahore, Lyallpur and Montgomery.

The water requirements of sugar cane are fairly heavy which is one reason for its importance in the better watered part of the province. It is sown in March and is harvested from December to February. Good rainfall at sowing time is helpful. Frequent showers during the summer are favourable when loss of moisture by evaporation is the highest. Rains during the ripening period as well as after it have an injurious effect on the yield and the preparation of sugar (the native variety called gur).

Sugar cane is sensitive to abnormally low temperatures, being strictly speaking, a tropical plant. Winter frosts may kill standing crops which is why the crop is not grown in the Potwar Plateau.

Sugar cane can be grown on a variety of soils provided that they are naturally fertile or have been liberally manured. Good sugar cane soils are relatively heavy soils with an ability to retain moisture. The crop is tolerant of moderately alkaline conditions.
The human factor is most important in the production of sugar cane for it exacts a great amount of labour, careful cultivation and management. It leaves the soil in poor tilth so that the preparation for the next crop is laborious. Before it can be sown, the land has to be prepared and manured well in advance. Its annual water requirements amount to 50 to 60" and the greater number of irrigations, the higher the yield. Its cultivation therefore entails intensive effort on the part of the cultivator combined with an abundant water-supply.

Varieties and Yields

Three main classes of cane are grown in West Punjab:

(1) "Ponda" - (for chewing)

(2) "Desi" consisting of several varieties such as katha, kahu etc.

(3) Improved Coimbatore varieties.

The last named have become increasingly popular while the cultivation of desi varieties has practically ceased. This is because Coimbatore varieties give about 80% greater yield than the desi varieties.

Yield per acre is 9 tons of cane which is pitifully low compared with 15 tons for the rest of India, 54 tons in Java and 62 tons in Hawaii. This is due to the fact that West Punjab lies at the northern fringe of the cane-growing regions and also because of inefficient practices. The record yield obtained in West Punjab during experiments was 63 tons at Risalewala near Lyallpur.

(i) K.S. Ahmad, Op.Cit. p. 536


(iii) Ibid 307
1 ton of gur or coarse brown sugar made by concentrating the juice almost without purification. Nearly 70% of the total cane is used for making gur, and only 3% into white sugar. The rest is used for feeding cattle, chewing, seed etc.

FODDER CROPS

Strictly speaking, the different crops grown for fodder are not meant primarily for commerce but are meant to feed the large numbers of cattle maintained by the cultivators. Considerable quantities are, however, sold and the crops also influence commerce in that they support large numbers of milch cattle whose products - milk and purified butter ("ghee") - enter the rural markets in large quantities. In 1944-45, 3,094,000 acres under these crops and accounted for 15.8% of the cultivated area. The main producing districts are Lahore, Montgomery, Lyallpur, Shahpur, Jhang, Muzaffargarh and Multan all of which devote over 16% of their cultivated area to the crop. In Lahore, they occupy the same proportion of the cultivated area as wheat (27%) and this leading position among crops is due to the large fodder requirements of the city of Lahore. About 13 different types of fodder crops are grown in the province of which the most important are juar (great millet), Guara (a leguminous crop), turnips and Indian clover. Berseem or Egyptian clover is becoming popular.
Chapter 17

AGRICULTURAL REGIONS I

The account so far of the agricultural geography of Barbary and West Punjab has of necessity been general. Physical and human factors, agricultural problems and finally agricultural production have all been treated in their various aspects. It now remains to integrate these facts, to work out a geographical distribution of crops, methods and problems as well as to bring out the interaction of man and environment as expressed in the actual rural landscape.

The regions studied are vast in area and one is faced with the "geographers' dilemma of trying to comprehend large regions while seeing at once only a small area". On the other hand, generalisations based on physical and statistical facts are not sufficient. The following account presents intimate details of farms and regions visited during a study tour in Barbary. The units of agricultural activity chosen were those representing characteristic conditions, especially of semi-arid areas.

Procedure in the Selection of Typical Farms: As the following classification of Barbary into agricultural regions

(1) R.S. Platt - Latin America "Countrysides and United Regions" p-2
NOTE: Field work in Barbary was carried out with the help both of the administration and of private farmers. In each territory i.e. Tunisia, Algeria and Morocco, the writer would contact the central agricultural authorities. They sent out instructions to regional officers to guide me in accordance with my needs. The regional officers then furnished information and took the writer round to typical farms. Apart from these "official" visits, several farms of Muslim notables and colonists were visited through personal introductions. From the latter, one could also obtain opinions and facts to supplement, correct and indeed sometimes contradict official information. Some of this data was used in earlier chapters.
derives largely from the details of "typical" farms, it is necessary to establish that these farms were indeed typical of the conditions they illustrate.

Before the study tour was undertaken, the writer carried out intensive work on the literature and maps available in Edinburgh, London and Paris for over a year. (1) On the basis of these studies, the writer formulated a rough plan of the itinerary in Barbary and the type of farms to be visited. This itinerary was, of course, modified as a result of experience in the field.

In several regions, notably those that were considered to afford a close parallel to conditions in West Punjab, several farms were visited within the same region. In addition details of agricultural features as well as statistics of entire regions have also been furnished in some regions i.e. the Gharb Plain, the Fez-Meknes region and the Atlantic Lowlands in Morocco and the Affreville plain (part of Shelif valley) in Algeria. This should help to establish how far some of the farms chosen as samples accord with the general picture.

Map 108 shows the journeys undertaken, the location of farms and regions studied in detail as well as the duration of stay at important centres.

Altogether twenty-four farms were visited, distributed as follows:—

<table>
<thead>
<tr>
<th>Region</th>
<th>Farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunisia</td>
<td>6</td>
</tr>
<tr>
<td>Algeria</td>
<td>8</td>
</tr>
<tr>
<td>Morocco</td>
<td>10</td>
</tr>
</tbody>
</table>

(1) See Bibliography
This was intended to be in proportion to the actual and potential productivity of the respective territories, Morocco being of special importance on account of the resemblance of several areas to West Punjab as also its own intrinsic interest. The farms can be classified as follows according to ownership:

Native: Muslim Fellahs (small holdings) 2
       Muslim Landlords 13
European: Colonists 9

Considering that the great majority of the cultivators of Barbary are small-holders, this selection of farms would appear to be disproportionate. As was observed earlier, however, the fellah's mode of cultivation is more or less uniform over the larger part of Barbary and lends itself to no sub-division of type beyond the distinction between the cereal-cultivator and the fruit-farmer. The same methods and almost identical rotations are practised by this great mass of cultivators from Tunis to Agadir.

The farms of local Muslim notables combine the native agricultural traditions with the advanced technique of the west so that whereas the choice of crops accords with the spirit of indigenous agriculture, their methods and the yields obtained reveal the possibilities of the different regions in terms of their physical and human make-up.

European colonists form an important class by themselves. Their modern methods are applied to the production
mainly of commercial crops, many of them introduced from abroad. While the fellah represents tradition and a centuries old adaptation to the environment, the colonist has been the spearhead of agricultural progress and has brought to bear the influence of western scientific research and technique on the land. His methods, his crop varieties and his rotations are often copied and adopted by the native landlords and peasants, because they are designed to make profit. Except for vine for wine-making which is anathema to Muslims, many recent developments pioneered by European colonists have been adopted by the local population. Notable among these are the extension of improved varieties of citrus and other fruits all over Barbary and the expansion of industrial crops such as flax and sunflower.

Classification of farms: Full descriptions of farm-types in each agricultural region would be repetitive. It is proposed, therefore, to classify the farms into several categories, each having certain characteristic features. Departures from type will be indicated where they have been observed. The following categories are being adopted:

Cereal-growing small-holding (A): The fellah's small holding of 10 hectares (25 acres) of arable land or less. Traditional methods described in Chapter 15 in vogue. Devoted mainly to cereals. Occasionally, some fruit trees may also be maintained.
Small fruit-growing holding (B): This is usually an irrigated holding cultivated with fruits under traditional methods which are, however, more intensive for fruit-growing. Their average area is generally less than the cereal growing small-holdings, but much higher returns are obtained. Fruits include olives and dates.

Cereal Farms (C): Modern medium (20-25 hectares) to large (over 50 hectares) farm owned by European or Muslim landlords and devoted to cereals. Cultivation with tractors and other farm machinery; use of chemical fertilizer and improved seed varieties. A number of native labourers employed.

Mixed Farms (D): Modern medium to large farms with mechanised cultivation but with a mixture of cereal and fruit crops, the former usually occupying a major part of the area.

Vine-growing Farms (E): Modern medium to large farm devoted to vines. Almost exclusively European.

Fruit Farms (F): Modern large farm, fully mechanised and devoted mostly to fruits.

Apart from these main categories, small farms outside larger towns are devoted largely to market gardening and form a category by themselves. Excepting limited coastal regions and the outskirts of large towns, farms devoted exclusively to vegetables are few and market gardening is generally combined
with the production of fruits, vines or even cereals on large farms.

The Basis of Division into Agricultural Regions:

The following differentiation between regions has been worked out according to the principal crops grown and the methods of crop-production in relation to the physical background with special reference to irrigation or dry-farming in semi-arid regions. Special emphasis is laid on the fact that agriculture not only produces certain quantities of crops but is also associated with ways of life. The different aspects of the physical and cultural background, the problems of agriculture and the main features of the production of different crops as summarised in previous chapters have been grouped into regions.

A briefer description of West Punjab has been given due firstly to the greater uniformity and the smaller size of the province but more because no personal field enquiries have been made specifically for the purposes of this study. Although published economic surveys of certain villages have been consulted and made use of, they have been considered inadequate to allow a full-scale analysis of different regions. More even than earlier chapters, emphasis has been placed on Barbary, West Punjab being treated only generally along the same lines.
The Relation of Agricultural Regions to Physical Regions: That there should be a broad similarity between the schemes of physical and agricultural regions is natural in Barbary where relief features have such a far-reaching influence on climate, soils and water resources on one hand and human activity on the other. In Chapter 6 it was noted that the biotic response to the natural environment as expressed in the types of natural vegetation accorded with the basic physical divisions of Barbary. In the study of the modes of life, it was observed that the broad physical regions approximate broadly to the broad human ones. The Tell is thus a zone of sedentary cultivators, the steppes of the High Plateaux are mainly the domain of semi-nomads while the Sahara to the south of the Atlas Ranges forms the habitat for a nomadic population. These broader similarities are reflected within smaller regions so that although this classification derives its basis fundamentally from the nature of agricultural activity, it has been found that regions of similar crops and rural landscape are often the physical units treated earlier very briefly in Chapter 2.

A comparison of the two schemes of regions will show that the apparent similarity of agricultural and physical regions is illusory. Many of the physical units of Chapter 7 have been sub-divided on account of their agricultural diversity. The Sebu Basin has been split into two parts, the Gharb Plain and the Fez-Meknes Region. The Moroccan Meseta
has been divided into the Central Massifs and the Sub-Atlas High Plains on account of the degree of dependence on agriculture and the development of irrigated cultivation especially of fruits. The coastal massif in Western Algeria has been divided into the Mostaganem Region which is mainly European owned and wine producing and the Dahra Massif, cultivated with cereals by native peasants. Those physical regions that have been retained as agricultural regions too are areas within which sufficient diversity in crops and rural life does not exist to warrant a sub-division. The Atlantic Lowlands of Morocco, the Sheif Valley and the Mitija Plain are among such regions.

Not everywhere have larger physical regions been subdivided. Wherever conditions of agricultural production are fairly uniform over a number of physical regions differentiated in Chapter 2 they have been described under a single agricultural region. The Northern Tunisian wheatlands embrace the Northern Tell, the Mejerda Valley, the Beja Region, the Mateur plain and a part of the High Tell region. The High Plains of Eastern Algeria similarly combine the Constantine-Guelma Region and the Mejana and Setif High Plains. Both these agricultural regions are mainly cereal-producing with large farms and smallholdings occurring side by side everywhere.

For West Punjab the impression of agricultural and physical regions being identical does not arise as several sub-
divisions of a largely uniform plain obviously derive their basis from the nature of crops and the role of irrigation, among other factors.

The Amount of Regional Detail:

Certain regions in the following account have been described in great detail with illustrations of regional activity in the shape of type farms. Other regions have been treated very briefly. This has resulted naturally from the selective study of the agricultural landscape in Barbary. As the title of this enquiry indicates, this is an agricultural geography of semi-arid regions. Such regions notably the Atlantic Lowlands and the Sub-Atlas High Plains in Morocco, and the Shelif valley in Algeria, the Sahel and Kairwan regions in Tunisia have been treated at length. In supplying the amount of detail, points of resemblance to West Punjab have been kept in view in accordance with the second part/the title of this study. Other regions described in some detail are those that have an important place in the agricultural economy of Barbary such as the Gharb and Mitija plains or those that typify conditions in several different tracts, i.e. the Dahra Massif, which is not only semi-arid but also stands for the extensive elevated regions cultivated largely by native cultivators with cereals.

Some regions, especially elevated and rainy mountain regions, have been described in the barest outline. The Saharan fringe has similarly been treated. An endeavour has been made on the whole to maintain a balance in the regional analyses between the point of view of local regional interest and the
comparison with West Punjab. Regions in which important agricultural developments have taken place i.e. development of large-scale irrigation projects or extension of special crops like citrus fruits have received close attention. Those tracts that are potentially productive as West Punjab was before the great development of canal irrigation have also been pointed out. Among these are the Tadla plain, the southern part of the Atlantic Lowlands (the Abda region) In both, great irrigation projects are in hand.

Apart from the considerations outlined above, the amount of regional detail that could possibly be given was also limited by the vast areas involved in Barbary, and only restricted areas could be studied intimately.

The Method of Regional Description:

As the Introductory Chapter indicated, the chapter on Structure and Relief was designed to provide only the barest framework for studying the other factors, physical and human, as well as the problems of agriculture. In the micro-geographical studies within selected regions, it has been considered necessary to give those details of relief that were observed in the field or studied from large-scale maps. Naturally, the description of topographical features has not been considered to be an end in itself but has been related to the soil, water resources and crop-production. After details of land use and farm types, an analysis of types of rural habitation and settlement has been
given, as they form an integral part of the rural landscape and express the human response to physical as well as agricultural features.

THE AGRICULTURAL REGIONS OF BARBARY

MOROCCO

THE RIF SLOPES:— To the north of the valley of Sebu, these cordillera-type mountains rise to 8,000 feet marked by steep slopes and crowned with bare limestone ridges. Rainfall is generally abundant but decreases from 33" at Wezzan in the west to less than 16" towards the Muluya valley. At altitudes higher than 6,000 feet snow may lie for 70-80 days and the winters are generally rigorous.

This west to east diminution in rainfall is reflected in the life of the inhabitants. The western section is inhabited by tribes practising sedentary cultivation and the density of population is high, i.e. over a 100 to the sq. mile which is considerable if the rocky and forested areas are taken into account. The rugged countryside is spotted with hamlets inhabited by groups cultivating small holdings with cereals or olives—types A and B. Two types of favoured agricultural land may be distinguished:

1. The alluvial valleys of streams.
2. Lands around springs on gentler slopes.

The tribes in the eastern part are mainly pastoral.

The mountains cannot support as high a density of population as occurs in the Jebala and consequently large numbers of the tribesmen migrate temporarily to the rich plain to the south to work as agricultural labourers.
THE GHARB PLAIN

The lower Sebu Basin is agriculturally one of the most productive regions in Barbary. Although noted primarily as a cereal-growing area, it has grown to be a leading producer of citrus fruits through the initiative of the European settlers and a combination of favourable factors of environment that will be analysed below.

The name Gharb ("western") belongs by tradition to only the northern part of the lower Sebu plain, the southern part being known as the plain of Beni Ahsen after the dominant tribe. It is proposed to call the entire plain the Gharb plain to simplify the nomenclature of what is obviously a geographical unit without any marked physical or cultural differences to warrant a sub-division. The Mamora upland to the south, almost entirely forested with an open forest of cork, holm and zeen oaks has been included as it has always figured so prominently in the life of the nomadic population. Furthermore, by virtue of its low elevation which does not exceed 1200 feet and its gentle slopes, the upland tract is intermediate between the plain and the central Moroccan massifs to the south and south-east.

The Gharb plain is a triangular region with its base, some 50 miles broad, towards the Atlantic Ocean. It is over 60 miles long in the centre. It commences where the Sebu and its tributaries leave their valleys in the hilly regions to the north, east and south-east. The Sebu and its northern tributaries - Rdat and Wargha - flow through broad graded valleys.
before entering their lower course. Hence there is no sudden arresting of velocity and no formation of any considerable alluvial cones. Consequently the steeper slope of the lower Rif hills is in evidence till 60 feet above sea level below which the flat plain surface sets in. On the other hand the principal southern tributaries, the Rdom and the Beth, enter the plain after mountainous upper courses with steep gradients, the Rdom breaking through the pre-Rif massif of Jebel Watita in a gorge above Petitjean (see photo). Alluvial deposition in the shape of their coalescing fans has given rise to an intermediate slope between the steep sides of the mountainous tract above 160 feet and the relatively flat plain surface below 60 feet. This has an important bearing on the soil types and agricultural settlements which will be discussed later. To this greater deposition from the southern tributaries may also be ascribed the northerly position of the river Sebu in the centre of the Gharb plain.

Lying entirely below 300 feet and most of it below 100 feet, the plain has the aspect of a closed basin as even the coast is fringed by a belt of dunes that rise steeply from the seaward side and attain to a height of over 300 feet. They provide only two outlets to the sea - the mouth of the Sebu and the opening of Merja Zerga in the north. This is one main reason for the imperfect drainage and the formation of extensive seasonal marshes (merjas) whose origin was discussed in the account of Hydrography. Many of the tributaries of the Sebu
lose themselves in these marshes which occupy the centre of the plain and lie from 20 to 50 feet above sea level. One series of merjas lie behind the coastal dunes the most important of these being Merja Zerga and Merja Daoura. Others lie on either side of the Sebu, the largest of these being Merja Mektane on the right bank and the Merja Kbira on the left. Large areas have been reclaimed on the right bank of the river north of Sidi Allal Tazi.

The Sebu and the Beth have built up high natural levees in the plain and their banks lie 6 - 8 feet above the level of the plain on either side. This results in periodic inundations when the rivers are in flood and is yet another reason for the existence of the merjas. In the north-west of the Gharb plain is a miniature plain of similar features - low, marshy and flat - between the isolated hill of Sefian (elevation just over 300 feet) and the lower heights of the southern Rif. This is drained by Wadi Tihili which flows into Merja Zerga.

The general relief of the Gharb plain is for the most part monotonous and the great factor in the diversity of agricultural land use is the soil. The rivers have deposited light loamy alluvial soils along their courses. These form the best agricultural lands and are known as dehs. Further below in the centre of the plain occur the dark coloured, heavy clay soils which like all other darkish soils have been called "tirs" by the native population. These compact soils have been
Cross-section in the Gharb Plain showing natural levees

Horizontal Scale 1:50000

Vertical Scale 1:200

Above Sea Level

Sebu

Error

39
Section of Wadi Fez Showing Alluvial Terraces.

Scale 1: 50,000
Heights in metres.

(After J. Deneck, Harper's, 1934)

A NORIA
in the Atlantic Lowlands

(After J. Colen and G. Hardy)
slightly decomposed by the action of the water and are impermeable. Consequently over a larger part of the plain sub-soil reserves of water are negligible and irrigation water for citrus plantation has to be obtained directly from the river by pumping or by means of canals from the el-Kansera dam fifteen miles south of the plain on River Beth. This as well as the occurrence of the lighter de§soils along the rivers is responsible for the concentration of citrus groves along the Sebu and its main tributaries. The coastal soils are sandy (remel) having been formed by marine deposition and are relatively infertile.

Climatic conditions in the Gharb plain are everywhere favourable, for nowhere is annual rainfall below 20" which combined with the high humidity provides abundant moisture for most crops.

Land use and Farm types:

Three principal types of land-use can be distinguished on the basis of the soil types. The belts of de§soils along the Sebu and its tributaries are devoted mostly to citrus groves as has already been stated. European farms dominate in this zone and the total area in possession of colonists exceeds 500,000 (200,000 Ha) acres. The rich de§soils around Sidi Slimane along the Beth river have an especially marked concentration of large orange plantations for over 20,000 acres are irrigated from the El-Kansera dam. Further plantations are being made as the supply of water from the dam is extended to larger areas.
Panorama from road bridge showing Sebu river in early June when water was fairly abundant. On right bank an orange orchard with cypress hedges as windbreaks. The two sheds house agricultural machinery. The line marked X indicates the pipe by means of which water is pumped out to irrigate the orchard. Notice the flatness of distant horizon.

The Tisra gorge by which River Rdom breaks through and pre-Rif Massif of Jebel Watita on to the Gharb plain. Picture looks west to the opening of the gorge, the settlement faintly seen being Petitjean. The gorge carries the road and the electrified railway from Fez to Rabat. The scrub pasture on the sides is grazed by cattle and sheep.
A young orange plantation on the bank of the Sebu. The soil is sandy loam with a clayey crust whose bits are seen in the foreground. The trees are planted in a hexagonal pattern and are of the Washington Navel variety (photos taken in June 1949).

Tobacco field west of Suk-elArba, being part of farm 1. In the background two dwarfs close to each other - circular arrangement of nwalas may be noted. In the distance a part of the Ferian hill.
Citrus plantations are, however, a comparatively recent development. The greater part of the plain is under cereals. The continuously high relative humidity of the air does not favour extensive cultivation of barley. Wheat, both hard and soft, is grown on the heavier "tirs" soils in a triennial rotation with peas and sorghum, the latter being especially important. This is because its sowing season extends throughout the spring during what would otherwise be an idle period for owner and tenant alike between the maturing and harvesting of the wheat crop. Flax has been introduced in recent years and is gaining rapidly in favour. The cultivation of cereals is carried on mainly in two zones - between rivers Rdom and Beth to the south of the Sebu and over a larger part of the northern plain. These are the zones of the tirs soils which are not suitable for citrus but when adequately tilled by means of heavy ploughs or tractors give excellent yields of cereals.

The agricultural landscape of the Gharb plain is diversified by the occurrence over extensive areas of grasslands devoted to grazing. These cover continuously the sandy coastal zone. The very light sandy soils are not suitable for most crops but they have the advantage of developing grassy vegetation at the first fall of rain in autumn. Hence they are admirably suited as pasturelands as also are the merjas which provide abundant grasses during the hot dry summer when the shallow water accumulated during the winter dries up.
Three main farm types are found in the Gharb plain. The eastern part of the plain has a dominance of small peasant holdings (A type) with a few large cereal growing farms. The western part has in addition the large, mainly citrus-growing farms of Europeans with a general sprinkling of type D (cereal and citrus growing) farms belonging to Muslim notables. In general it may be said that at the fringes of the plain where agriculture has been practised for a long time, smaller holdings are the rule whereas in the colonised regions, as well as the newly cultivated areas towards the centre, larger holdings prevail.

Farm (1) 24 miles south of Suk-el-Arba combines in itself the several features of the agriculture of the Gharb plain. The property consists of 1235 acres/scattered in three sections, all to the north of the Sebu and belongs to a Muslim notable of Arab stock. His village lies 3 miles to the north of the Sebu and apart from himself and a related notable, the 60 families of the same tribe in the village live in nwalas or small mud houses according to their resources. Most of them are tenants and workers while some own small holdings of about 25 acres on the average. Of the total area, the greater part lies near the village and consists of "tirs" soils. They were planted as follows this year: (1949)

Cereals - 494 acres/(370 under hard wheat, Mahmoudi variety, rest under barley and oats for the animals)

Flax - 494 acres/(This crop was adopted after war and has been increasing in area. Grown for the oil.

Chick-peas 150 acres/ Grown in rotation with cereals.
The owner has mechanised the farm and possesses two tractors and two combine-harvesters. The yields usually obtained are high and compare favourably with those obtained on European farms:

Wheat 890 lbs to the acre, or 10 Quintals per hectare
Barley 1060 to 1330 lbs to the acre, or 12 to 15 Qs. per Ha
Flax 445 to 890 lbs to the acre, or 5 to 10 Qs. per Ha.
Super-phosphate fertilizer is used.

One parcel of the property is situated four miles west of Suk-el-Arba, and of its total area, 75 acres is under vine and 18 acres under tobacco. The area cultivated with vine was formerly owned by a colonist. Wine-making varieties are now being replaced by those yielding table grapes. There is a tobacco-drying establishment on the farm.

The third parcel of land lies along the Sebu and occupies 75 acres. It has been brought under orange-orchards during the last five years. It is irrigated by means of two pumps from the river. The main varieties planted are Washington Naval and Valencia Late.

Apart from the lands devoted to cultivation, the owner also has over 1200 acres of sandy land along the coast devoted entirely to the grazing of 300 cattle and 500 sheep. On the cultivated farm there are 30 cows, 150 sheep and 10 mules, the latter doing sundry work on the farm which is fully mechanised.

Some sixty families work on the lands and are paid in cash. The wages are generally satisfactory by local standards (3-4 shillings a day). Since the end of the war sunflower has
been grown for its oil on 50 acres.

**Farm (2)** is situated to the east of Sulcel-Arba and may be taken to be a typical larger holding of the type A. Of its 50 acres, 32 acres were under wheat (yield 700 lbs on the average) 13 under flax (yield 530 lbs) and 5 acres under barley. It is worked by three khammes with three ploughs of the traditional type drawn by bullocks and mules. About 30 sheep are maintained on the farm. A biennial rotation is practised, wheat being grown one year, chick peas and sorghum in the following year.

The Gharb plain is one of the most important agricultural regions of Morocco as indeed of Barbary. The following figures give an idea of its importance in the production of some of the main crops of the country.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Moroccans</th>
<th>Europeans</th>
<th>Whole of Morocco (for comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Wheat</td>
<td>222 (90)</td>
<td>25 (10)</td>
<td>2220 (900)</td>
</tr>
<tr>
<td>Soft Wheat</td>
<td>17 (7)</td>
<td>44 (19)</td>
<td>1235 (500)</td>
</tr>
<tr>
<td>Barley</td>
<td>149 (60)</td>
<td>12 (5)</td>
<td>4942 (2000)</td>
</tr>
<tr>
<td>Oats</td>
<td>10 (4)</td>
<td></td>
<td>86 (35)</td>
</tr>
<tr>
<td>Alpist</td>
<td>25 (10)</td>
<td></td>
<td>30 (12)</td>
</tr>
<tr>
<td>Sorghum</td>
<td>172 (70)</td>
<td>12 (5)</td>
<td>320 (130)</td>
</tr>
<tr>
<td>Chick peas</td>
<td>37 (15)</td>
<td>10 (4)</td>
<td>123 (50)</td>
</tr>
<tr>
<td>Peas</td>
<td></td>
<td>20 (8)</td>
<td>100 (40)</td>
</tr>
<tr>
<td>Flax</td>
<td></td>
<td>10 (4)</td>
<td>100 (40)</td>
</tr>
</tbody>
</table>

Apart from these, the Gharb plain accounts for more than half of the citrus orchards in Morocco.

---

(1) Calculated by R. Tringtinia for lower Sebu Basin which also includes the pre-Rif Hills. Their production of the crops is however not considerable so that these figures are fairly accurate for the Gharb plain. Years are not indicated.

(E.C.M. Maroc.) Comparison with figures published in the I.I.A. Yearbook 1941-45 indicate that they are averages for 1941-44
Rural Settlements:

The three principal soil types associated with different types of crops are the basis for the main types of farms and settlements in the Gharb plain. Thus the light deh soils are characterised by the occurrence of scattered European farms each with large modern buildings with red-tiled roofs, surrounded by the poorer habitations (nwalas principally) of the labourers. The upper part of the deh-soil areas notably along the Beth, Sebu and Wargha have large numbers of Muslim hamlets (diwar) consisting mostly of "dar" type houses indicating the antiquity of sedentary cultivation in these areas. The fan slopes between 60 and 160 feet have an especially high concentration of these permanent settlements. The largest and the most prosperous ones are those centred around the tomb of a saint, for example Sidi Kacem which lies close to Petitjean and forms part of it. The reason for the importance of such shrines as nuclei for permanent settlements has been given in the chapter on modes of life and settlement.

Sedentary settlements in the central Gharb plain avoid the marshes and are found either where the higher "deh" belt provides safety from the inundations or on the slopes to the north and south of the depressed central part. The number of settlements is smaller as compared to the alluvial fans of the Rdom and Beth.

Everywhere, the sedentary settlement consists of several mud houses and nwalas. The houses are sometimes made of stone walls at the foot of the hills but everywhere crude
mud-bricks are in general use. The roof consists of wooden logs overlain by thatch which is then covered with mud. Nwalas in the settlements in eastern part of the plain (in the deh zone) are rectangular structures with sloping thatched roofs. They are inhabited by the poorer land-owners, tenants, workers or craftsmen. Out in the open plain the fixation of habitation has in many cases been recent so that nwalas outnumber the houses. There are two reasons for this:

(1) The influence of large proprietors. When, following colonisation, the pastoral tribes found their grazing lands restricted, they began to cultivate parts of the communal lands. Certain notables either by reason of their influence or because of French support appropriated large parts of the newly cultivated lands. Most of the settlements thus show a large house or two built with bricks and cement surrounded by nwalas inhabited by the tenants and workers as well as the few smaller proprietors.

(2) The fixation of tribes having been recent, the nwala has succeeded the tent. In general, however, the nwala is the habitation of the poor peasant.

Most dwar are named after the family which lives in them and it is not rare to find two dwarfs on the opposite side of a river having identical names - this being due to different branches of the same clan living in them. Such for instance is the case with many settlements in the Zirara, one of the sub-divisions of the Sherarda. (1)

(1) T. Hochelol "Dar Zrari" L'Habitat Rural Au Maroc, R.G.Maroc 1931, P.123
The low-lying parts of the Gharb plain with their excellent pastures had in the past not only their local pastoral population but also used to act as magnets for transhuming tribes in the Massifs to the south and south-east. Although the migrations from other regions have become restricted, large sections of the population of the merjas and their fringes still rear cattle and sheep in large numbers, the Beni Ahsen being the chief pastoral tribe. They still live in tents although the old arrangement in large dwars is not so common and isolated groups of two or three tents are often in evidence. Map B shows the emplacement of many permanent encampments of these pastoral groups. They are centred round the merjas mainly to the south of the Sebu and also behind the dunes.

The larger settlements of the Gharb plain are to be found north of the Sebu River. This region was agriculturally important before cultivation was extended in the southern section. The largest rural centre of the plain is Sbeitel-Arba du Gharb which, as the name indicates, has developed on the site of an important suq.

The larger settlements shown on the map of the Gharb plain are the only ones in which European colonists are found in larger agglomerations. These show planned roads and streets unlike the native dwarf and larger villages which consist of a number of houses and nwalas grouped together in a haphazard mass, streets being narrow and crooked.
THE FEZ-MEKNES REGION

Agriculturally, the upper part of the Sebu Basin centred on the cities of Fez and Meknes is unparalleled in Morocco for the richness of its fields and the variety of its products. As the table at the end of this account will show, its share in the total Moroccan production of the principal crops is out of all proportion to its relative extent as shown on the map of agricultural regions. The dominant crops over a larger part of the region are similar to those in the Gharb plain although vines and olives cover considerable areas. Physically, however, the area differs greatly from the lower Sebu plain, having none of its marshes or its extremes of clayey and sandy soils. Relief is more varied with heights ranging from 200 feet in the lower valleys of the Wargha and the Sebu to over 3000 feet in the case of the Pre-Rif Massifs. Hence its influence on the soils and on agriculture is considerable as will be noted when details of relief are correlated to the details of agricultural production and settlement.

Physical Background: The greater part of the Fez-Meknes region consists of late Tertiary and Recent sediments deposited in the gulf which occupied the Sebu Basin in Pliocene times. The rocky Pre-Rif Massifs emerge out of these sediments to diversify a surface which is dissected by the valleys of the Sebu and its numerous tributaries. Other geological features of agricultural significance are that the central part of the region
is a lacustrine plain while the volcanic flows following the upheaving of the Middle Atlas have been responsible for some of the richest soils of Barbary in the regions of Tifrit and Sebaa Aiyoon.

Commencing in the east at the Taza Gap, the region is high here and less than two miles wide between the Rif slopes to the north and the Middle Atlas to the south. A transverse profile of the gap shows a notable dissymmetry as the slope on the southern side towards the Middle Atlas rises steeply to a height of 6000 feet above it, while the ascent towards the Rif range is more gradual. Westwards, the two ranges recede away from the depression which is occupied by a relief dissected considerably by the headwaters of the Innawene, an upper tributary of the Sebu. Their valleys show youthful features, the Innawene itself traversing a deep gorge below Taza.

Approaching Fez, the general height diminishes to 1200-1500 feet. This region constitutes the plateau of Beni Sadden. The Sebu enters here from its mountainous course in the Middle Atlas and meanders in a mature valley with a flood plain over a mile in width. To its east, a basin between 1000 and 1,500 feet lies surrounded by steeper slopes and suggests the former existence of a lake similar to the one occupied by the plain around Fez and Meknes. There is a similar basin between 1000 and 1300 feet to the west of Jebel Zalagh, the pre-Rif Massif north of Fez.
The Zalagh Massif rises 1,500 feet above the Sais plain at the northern fringe of which lies city of Fez. The Massif has comparatively gentle slopes below the altitude of 800 feet but rises precipitously above that height. North-westwards the height diminishes though the upper slopes are everywhere steep and much dissected.

The Sais plain south and south-west of Fez has a gently undulating surface between 1300 and 1400 feet above the sea. It is dissected by the valleys of the Fez river and its tributaries. These flow between alluvial terraces 50-100 feet below the general level of the plain. Diagram gives a cross section of the Fez river. The course of the river is marked by the existence of marshes near the city.

South of the plain, a higher surface is attained to by a steep ascent to its general level of 2200-2400 feet. This tract has numerous depressions occupied by dayas (seasonal lakes). The edge of the region is marked by a prevalence of discontinuous streams which suggests an outcrop of limestone strata. Above 2500 feet, the steeper slopes of the plateau of Sefrou herald the approach to the Middle Atlas itself.

The region of Sebaa Aiyoon between Fez and Meknes lies between 1700 and 2000 feet and has a surface similar to that of the Sais plain. Southwards, the plateau of El Hajeb rises to its height of over 3000 feet by a steep escarpment. The Maknes plain is attained by crossing the 100 foot deep valley
of Wislam, one of the many streams that flow in the neighbourhood of Sebaa Aiyoon (literally seven springs).

The Meknes region presents a surface that is more diversified than that of the Sais plain. To the south, the plateau of Tifrit lies beyond several low hills. North of Meknes, the altitude varies from 1000 to 1200 feet till we reach the pre-Rif Massif of Zerhun. The same features which characterise the Zalagh Massif are found here, the lower slopes being comparatively gentle but those above 1500 feet rising steeply till the altitude of 3400 is reached. Numerous streams flow from the Massif through young steep-sided valleys on the slopes which are much eroded. At the foot of the Massif which consists of limestone strata is a spring-line. North of the Zerhun Massif is the lower Massif of Marcab (altitude 2500 feet).

The Dkhissa region west and north-west of Meknes is characterised by young valleys dissecting a surface undulating between 2000 and 3000 feet. Wadi Kell, a tributary of the Beth has carved out a valley which is 500 feet deep. The pre-Rif Massifs of the Kefs and Watita mark the western termination of the Fez Meknes region.

The southern tributaries of the Sebu, notably the Rdom and the Mikhes flow in young valleys as they flow in a region marked by outcrops of limestone strata, though they both have marked alluvial terraces. The Sebu and the Wargha have, however, carved out broad mature valleys for themselves on account of the abundance of water in them and small resistance of the sedimentary deposits. They are both liable to floods. This has
an important effect on settlement.

Apart from its distinctive pattern of relief, the Fez-Meknes region also differs greatly from the Gharb plain by its abundance of underground water-supplies. Almost everywhere, the light top soil is underlain by limestone strata. To the north and south lie mountains in which permeable limestones are prominent as indeed they are in the pre-Rif Massifs described above. Consequently, not only are sub-soil reserves present everywhere but there are also very numerous springs, especially at the foot of the limestone massifs and plateaux.

With this may be combined the advantage of an adequate rainfall which is nowhere less than 20". The other climatic conditions are favourable and the region is distinguished from the Gharb plain by a lower atmospheric humidity in which barley grows much better.

Soils and agricultural land-use:

The greater part of the Fez-Meknes region consists of productive agricultural lands on which all the main crops of Barbary flourish very well. Diversity in production has been brought about by the nature of the soil and by relief and water-supply. The two predominant soil types are dark-coloured heavy soils (tirs) and the reddish decalcified soils (hamri).

A distinction must be made between the tirs of the Fez-Meknes region and the heavy impermeable soils of the Gharb plain which bear the same name. The tirs of the former region are richer and lighter than those of the latter and have been formed principally in the hills and massifs of the Pre-Rif zone.
68 Interior of farm / Berber mare and foal.

69 Jebel Zalagh north of Fez. The gentle lower slopes are cultivated with wheat and barley. Scattered olive trees at its foot. Fields in the foreground covered with grass and being on the outskirts of Fez, probably ready for extension of houses.
Meknes region. Citrus plantation in the valley of the Rdom. Undulating hills to the south are devoted mostly to cereals. Whiter patches are barley which is ripe for harvesting; darker ones - wheat.
on the exposed Tertiary marls which are responsible for the clay content. (1) The dark-coloured volcanic soils of the plateau of Tifrit and Sebaa Aiyoon have also been named tirs by the local population (this name being applied to all dark-coloured soils in Morocco). The hamri soils are sometimes sedentary soils, formed in situ but are often associated with alluvial deposition. They are found chiefly in the area formerly occupied by the late large Tertiary lake in the plain of Sais and around Meknes.

As in most rich and well-watered parts of Barbary, colonisation has been widespread particularly around Meknes and a total of about 520,000 acres has been brought under European possession.

Travelling from east to west, several distinct agricultural zones are noticed. From the Taza gap westwards, the plateau of Beni Sadden has dark tirs soils except for the patches of hamri soils wherever the calcareous strata are exposed, particularly in the south. The surface is undulating and water is not available for irrigation, hence there has been no development of citrus and other fruit plantations. The olive does, however, flourish and occurs extensively in scattered trees as well as small orchards. Cereals, especially wheat and barley are the main crops.

North of Fez, the region known as Dwyet, is remarkably fertile with its tirs soils which are comparatively heavier than

(1) R. Trintigniac Op. Cit. p. 262
those in the Beni Sadden tract. The relief being hilly particularly due to the presence of the pre-Rif Massifs, cereals are again the principal crops, olive plantations occurring on the steeper slopes which cannot be cultivated. In both the Beni Sadden and Dwiyet regions small native cereal-growing or cereal and olive-growing holdings dominate. Large European holdings occur principally along the road from Taza to Fez.

The Sais plain has deep "hamri" soils everywhere underlain by a chalky crust that holds supplies of water but does not interfere with the agricultural quality of the land. There are numerous large springs notably Ain Shqef, Ain Sheggag and Bu Rkeiss which are utilised to irrigate plantations of oranges and other fruits as well as vines, olives and vegetables. The fruit plantations are especially important on either side of Fez river on the alluvial terraces. Cereals and leguminous crops are also grown. European colonisation has acquired a large proportion of the cultivable lands. Holdings of type A and D dominate. The larger holdings grow mostly soft wheat.

The tract around Sebaa Aiyoon, further to the west is among the richest in the Fez-Meknes region. It extends southwards up to the plateau of El Hajeb and is covered with deep hamri soils. With irrigation from a large number of springs most of the deeper soils have been planted with orchards of oranges, apricots and olives. These are owned by Europeans in large holdings of the type F. The shallower soils are devoted to cereals and where they do not form parts of European farms are
held in small holdings of type A.

South of Meknes the plateau of Tifrit is a highly productive region where the heavier soils are under cereals while the lighter ones are devoted to vines. European holdings of types C and E dominate. The undulating and much dissected Dkhissa region to the west and north-west of Meknes is mostly under cereals but along the principal streams, notably the Rdom, occur plantations of citrus and other fruits. The cereal growing lands on the hill slopes belong mainly to the local population in holdings of type A although even here scattered groves of fruit trees are not rare especially near springs. The fruit plantations are owned by Europeans in farms of type $z$.

Farm 3 in the Meknes region belongs to a European colonist and consists of two parts, totalling 4200 acres (1700 hectares). One of these is in the plateau of Tifrit while the other is to the east near Ain Taujdat. Excepting 1235 acres (500 Ha) that are stony, the rest of the area is all cultivated with the help of agricultural machinery. Most of it is under cereals but 185 acres (75 Ha) are planted with vines in the Tifrit region, 37 acres (15 Ha) with olives under irrigation and only 6 acres under oranges. The cereals are grown in a biennial rotation with one year under wheat and one year under peas. In the richer Tifrit part of the farm, a triennial rotation has been adopted being pease wheat - oats. The proprietor has a spring on his property east of Meknes which irrigates the olives and oranges. Formerly the farm used to have 150 cows
and 1000 sheep but these have largely been dispensed with recently. The yields of wheat average 12 quintals per hectare but the Tifrit region gives 15-20 Qx. per hectare. Use of superphosphate fertilizer increases yields by 50%.

The eastern section of the property is mainly cultivated with soft wheat. Yields of cereals depend upon the distribution of rainfall and the colonist observed that the best yields were obtained when there were rains in October and November followed by a break, then showers in February and again during the later half of March and early April. Yields of peas average 900 lbs. to the acre, (10 Qx. per Ha) The vines are susceptible to mildew and copper-sulphate spraying is used against it. Yields in grapes vary from 60 to 90 quintals per hectare.

The owner stays in a bungalow in Meknes and goes out in his car to supervise the working of the eastern part of the farm. The section in the Tifrit region is managed by his son. The farm employs 62 workers on the average but the number swells to 150 during the grape-picking season.

The Zerhun Massif has a veritable forest of olives on its steep dissected slopes with orchards as well as scattered trees of oranges, apricots and table grapes interspersed among them. The land is owned mainly in holdings of type B.

North of the Zerhun Massif the broad valleys of the Sebu and Wargha have been planted with citrus orchards here and there cereals and olives are the principal cultures on the valley sides.
and over the hilly topography that prevails. Farms of types A and C prevail with an occasional type D.

Farm 4 east of the Wenza river is owned by the President of the Moroccan Chamber of Agriculture at Fez where he permanently resides. Consequently the farm embodies in it all the features typical of progressive European agriculture. Of its 1580 acres (640 Ha) 1235 (500 Ha) are under cereals, mostly hard and soft wheat, 198 acres (80 Ha) are under orange groves and 147 (60 Ha) under forage crops. The orange orchards are irrigated by means of a tube-well drawing water directly from the river. The entire cultivation is done by means of tractors and other machinery which was introduced as early as 1920. Good yields of wheat are obtained without fertilizer - 10 Quintals per hectare. This is doubled when super-phosphate is used. The proprietor considered November rains to be the most important determining the yields of wheat and years of deficiency in that month had lower yields than normal. The oranges planted include Washington Navel, Valencia Late and Portuguese Blood-Red types. Yields of 100 Hx per hectare are obtained in good years. Some local varieties give twice that yield though the quality is not so good.

The farm has 100 cows and the owner has developed some cross-breeds between Moroccan cows and Hollandaise bulls. Experiments of crossing local cows with Indian bulls (principally Sindhi type) have also been successful. The farm employs 50 workers
on wages. They are increased to 100 during harvests.

The following figures give the area under principal crops in the Fez-Meknes region in relation to the total for Morocco.

Areas under principal crops in the Fez-Meknes Region

In thousands of hectares (averages worked out by R. Trintigniac (1)

<table>
<thead>
<tr>
<th></th>
<th>Moroccans</th>
<th>Europeans</th>
<th>Whole of Morocco</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard wheat</td>
<td>150</td>
<td>8</td>
<td>900</td>
</tr>
<tr>
<td>Soft wheat</td>
<td>15</td>
<td>40</td>
<td>500</td>
</tr>
<tr>
<td>Barley</td>
<td>130</td>
<td>8</td>
<td>2000</td>
</tr>
<tr>
<td>Oats</td>
<td>15</td>
<td></td>
<td>35</td>
</tr>
<tr>
<td>Maize</td>
<td>20</td>
<td>2</td>
<td>500</td>
</tr>
<tr>
<td>Sorghum</td>
<td>60</td>
<td></td>
<td>130</td>
</tr>
<tr>
<td>Beans</td>
<td>12</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>Chick peas</td>
<td>15</td>
<td>2</td>
<td>50</td>
</tr>
<tr>
<td>Green peas</td>
<td>20</td>
<td></td>
<td>45</td>
</tr>
</tbody>
</table>

RURAL SETTLEMENTS:

Security, safety from floods, water-supply and agricultural fertility are among the notable factors which have to be considered in varying degrees in order to understand the location and distribution of rural settlements in the Fez-Meknes region. At the same time, several tribal groups that originally

(1) Unfortunately, Trintigniac has not indicated the years for which the averages were taken. By a study of the statistics of several past years, it has been established that the averages approximate to those of 1940-44.
migrated from a Saharan environment have maintained their tradition of dwelling in tents, among these, as referred to in the chapter on Modes of Life and Settlement, being the Gueruan to the south and south-west of Meknes. Finally, a close scrutiny of the names of the villages and hamlets will show the considerable importance of the religious factor for the majority of rural settlements are named after saints and marabouts and are often grouped round their tombs. Many tribes trace back their installation in their present location to the direction of the venerated Idrissid Dynasty - over a thousand years ago.

Starting from the east again, the town of Taza lies at a strategic point along what has always been the principal land route from Morocco to the east. It is now an important administrative and military centre. Westwards, the deep young valleys of the numerous streams are avoided by settlements that lie in groups of hamlets at the top of the slopes. The commonest habitations are mud houses. Tribes on the southern and northern fringes of the main region still make periodic use of tents owing to the seasonal movements of small sections along with sheep and goats. Most of them are, however, sedentary and live in permanent villages. These are often located around large springs or at points where small streams emerge from a steep upper course.

East of Fez, the flood plain of the Sebu is avoided by settlements, due, no doubt, to the periodic occurrence of floods and the shifting course of the river. Villages are
located on either side on the valley slopes and consist of a mixture of houses and huts, the former being predominant. West of the Sebu and to the north of Fez, hill-top settlements are conspicuous, notably on the Zalagh Massif where they are surrounded by orchards of olives and other fruits. Large hill-top settlements also characterise the other Pre-Rif Massifs. This is the universal response in Barbary to the cultivation of fruit trees which is the principal agricultural produce of these Massifs. Some of the house types associated with the Rif mountains extend into these, especially in the Zerhun Massif. The two-storeyed house with the upper storey serving as a grain-store and topped by a thatched roof is observed widely. The Zerhun Massif has a number of very large rural agglomerations.

Within the Sais plain south of Fez, the larger native villages are centred around the springs mentioned earlier on. The terraces of the Fez and other rivers have scattered large farms with the usual concentration of the huts and houses of the farm workers. Such farms, mostly European, become more and more numerous towards Meknes and extend southwards to the plateaux of Tifrit and El Hajeb. West of Meknes, they lie on the alluvial terraces of the Rdom in a continuous ribbon.

As a result of security, numerous small hamlets are found in the Meknes region. They are usually located above the deep valleys of the various streams. In the Sebaa Aiyoun area, they are grouped around the numerous springs emerging below the
escarpment of the plateau of El Hajeb. West of Meknes, the hilly country north and south of the Rdém has villages located at the break of the steep upper slopes between 1500 and 2000 feet or where the streams enter a broader valley. Between the Wargha and the Sebu, settlements are particularly dense along springs and streams, some being found close to the larger rivers in their flood plains. Hill-top villages are quite numerous.

Fez and Meknes, the two large urban centres, were founded by former Sultans of Morocco. Their role in the agricultural set-up of the region is exerted principally on their immediate neighbourhood by their large requirements of vegetables, milk, fruit etc. Apart from housing many European colonists and the larger Muslim proprietors they do not figure as agglomerations of the rural population in any sense and have since their foundation constituted a world apart as was outlined in Chapter 10.

THE ATLANTIC LOWLANDS

This agricultural region coincides with the physical region described briefly in the chapter on Structure and Relief. The lack of agricultural diversity on a scale large enough to justify further sub-divisions is the outcome of the uniformity of the natural environment and especially climate which varies very little despite the fact that the region extends over three degrees of latitude. Due to the favourable physical conditions and even more important, the continued
security this region has enjoyed over considerable periods, it has long been the agricultural backbone of Morocco and even today accounts for more than a third of the production of the principal cereals, growing 4/5ths of the maize grown in the country.

Relief, Climate and Soils:

The region is delimited in the west by the coast from Rabat to Mogador and is fringed by an almost continuous belt of dunes. Inland, it is the Central Massifs, the elevated parts of the Moroccan Meseta, which bound them to the east. Except in the north, they rise steeply with a scarped slope above 1000' giving the lowlands a well-defined entity. The width of the lowland depends upon how close the Massifs approach to the coast. Thus at the two north and south extremities they are very narrow as the Zaer-Zayan and Jebel Hadid Massifs respectively lie close to the coast. The maximum width exceeds 40 miles in the Shawia and Dukkala regions in the centre. Within the lowlands, relief is diversified but little. Except for the stretch between Rabat and Casablanca, there are few valleys apart from the lower courses of the Um-er-Rbia and Tensift. The monotony of a flat and very gently sloping surface is broken only by the existence of numerous depressions in certain areas, ascribed by Celerier to local decalcification and by the rare outcropping of the primary peneplain.

The main diversifying factor from the agricultural point of view is the soil. As in the Gharb plain, the three

---

(i) E.C.M. "Maroc" p.113
principal types, \textit{remel} (coastal sandy soils), \textit{tirs} (dark-coloured heavy clay soils) and \textit{hamri} (reddish light loams intermediate between the first two) occur in different areas in varying thickness. The description of the main sub-divisions of the lowlands as recognised by the local population will therefore emphasise the soil as much as the local relief features. These traditional divisions of the lowlands have been adopted because they correspond with gradations in land-use, and settlements.

South of Rabat, the narrow coastal lowland is fringed by the steeper slopes of the Zair-Zayan plateau and is traversed by the deep valleys of numerous streams. Chief among these are Wadis Yquem, Sheerat, Nefifikh and Mellah which flow 100-200 feet below the level of the countryside. The degree of incision increases with altitude. Numerous small local depressions are encountered close to the coast, especially between Wadis Yquem and Mellah. The steeper edge of the massif begins at about 500 feet. The southern part of this narrow coastal strip is known as Zenata. Soils are everywhere light and sandy except in the narrow valleys where they are alluvial and in the depressions where they tend to be heavier and approximate to the tirs.

Southwards, the plain broadens out in the Shawia and Dukkala regions lying north and south of the Um-er-Rbia respectively. The coast is fringed with dunes behind which extends a zone of ancient dunes fixed by vegetation and converted very often into sandstone hills. Here the relief is much varied with undulations of 50-100 feet. South-west of Casablanca, there is a continuous
break of slope at 300 feet, 5 to 6 miles from the coast and a low hill over 100 feet high lies parallel to the coast for about 20 miles. South of Mazagan, in the Dukkala region, the coastal dunes exceed 300 feet in height and are marked by the presence of lagoons behind them. The soils of the coastal region are everywhere sandy. They vary however from the whiter sands of the fresh dunes to the darker and reddish soils of the interior marking the gradual passage to tirs and hamri soils as well as an increasing humic content.

The larger part of the Atlantic lowlands is the region of tirs soils par excellence in Morocco. The origin of these dark heavy soils exceptionally rich in humus is still a matter of controversy. Probably the decalcification of the parent rock accompanied by the decomposition in situ of the rich vegetation under prevailing high humidity was responsible for their formation. They extend between the Bu Regreg and Tensift but not in a continuous stretch. They do not commence till about 6-10 miles from the coast in the Shawia region and reach their greatest width south of Ber-Reshid in the Shawia region and in the Dukkala region further south. Here they extend up to over 57 miles inland. Their thickness is variable and from a shallow top layer of less than 16" over most of the Shawia plain, they attain a depth of over 3 feet everywhere in the Dukkala plain, exceeding in some areas a depth of 20 feet. (i) The plain of tirs to the south of Ber-Reshid forms one of the richest cereal-growing tracts in Barbary.

(i) Ibid p.112
(ii) V. Piquet "Le Maroc" Paris 1917, p.36-38
Further south, in the Abda region they vary in depth from 20" to 3 feet.

The hamri soils usually occur at the fringe of the tirs soils and may be taken to be intermediate between them and the coastal remel. They are invariably light to medium loams.

Relief inland from the undulating coastal zone is less diversified and the slope too is much gentler. Thus whereas we ascend to an altitude of over 600 feet within the first fifteen miles from the coast, the next 30 miles and more to the edge of the escarpment of the Meseta record an elevation of only about 400 feet. Within this area, relief is fairly monotonous, diversified mainly by shallow depressions south and west of Bu Reshid as well as to the east of Safi. These are filled with water during the rainy season but form pastures during the summer. The ancient peneplana is exposed in the shape of stony low heights mainly south-east of Casablanca.

The valley of the Um-er-Rbia is incised deeply into the lowlands. Its sides are everywhere steep and dissected by small local tributaries that flow only during the winter. The river flows through a gorge 500' keep below Meshra Abbas only 18 miles from the coast as the crow flies but with itself still having some 50 miles to flow. It emerges from it 25 miles below. Fifteen miles from its estuary-like mouth (due no doubt to slight depression of the coast) it enters a broad flood-plain where it has deposited its rich alluvial soils. The Tensift emerges from
a steep-sided valley in the Rehamna Massif to flow in a broader flood-plain in the narrow Chiadma plain north of Mogador. It is marked, however, by steep banks. The rest of the plain south of Casablanca is remarkable for the absence of perennial streams.

Over this extensive region with a large degree of uniformity in relief and soils, the climatic conditions are singularly unvarying. As was pointed out in the chapter on Climate, the summer and winter isotherms run parallel to the coast. In this the influence of the Canaries current is fundamentally important. There is a gradual diminution of rainfall from over 21" at Rabat to 16" at Casablanca and less than 12" at Mogador. But the prevalent high humidity due to the oceanic breezes as well as the current mentioned above gives a large measure of climatic unity to the region. It is only in the interior and specially in the interior of the Abda region in the south that the parsimony of rainfall is not compensated sufficiently by oceanic breezes, and vegetation and crops approximate to those of typically semi-arid regions.

Land-use and farm types:

Agriculture in the Atlantic lowlands is greatly influenced by two factors:

(a) The existence in this region of some of the largest towns in the country. These are from north to south, Rabat, Fedala, Casablanca, Safi, Mazagan and Mogador, all on the coast. Their total population numbers over a million in proportion to the 600,000 that live in the countryside. Hence market gardening occupies considerable
areas notably between Rabat and Casablanca.

(b) The conditions of high humidity that prevail throughout the year enable the growth of summer crops locally known as *mazouzia* which are not grown in other parts of Morocco without irrigation. Chief among these is maize. The acreage of summer crops decreases as humidity becomes less and less away from the coast.

From north to south, the various sub-regions as described before show their own special features within a generally uniform pattern. The coastal fringe with its lighter soils has become as fine a market-gardening area as any other in Barbary. Cereals dominate inland with maize occupying an important position but diminishing in area as the distance from the coast increases. Other crops, notably leguminous crops, are secondary, grown in rotation with the main cereals. The narrow coastal plain south of Rabat consists mainly of large farms of type C and D maize being the principal crop with vegetables, sunflower seed and vines occupying appreciable areas. European farms are numerous. The forested uplands bordering the coastal lowland are devoted to grazing. Market-gardening becomes the predominant culture in the region of Zenata around Fedala and to its south. Here, an area of 1500 acres is irrigated from a small dam on Wadi Mellah and European farms dominate the landscape.

The Shawia region has its lighter coastal soils under early vegetables for the most part. Inland, in the tirs soils,
Cereals are cultivated on a large scale. A major part of the region is cultivated by large Muslim proprietors with the help of khammes (farms of type C) or by small-holders (A type farms). As water table lies within easy reach, well-irrigation is practised with norias worked by mules and bullocks. The irrigated fields are usually planted with little orchards of fruits or with vegetables. European colonists have acquired over 320,000 acres in this rich region and their modern farms are dotted all over the lowland, conspicuous by their red-tiled roofs or the high aeromotors. Two large Muslim farms were visited in the Shawia region to determine the exact nature of land-use and the methods practised.

Farm 5 near Bu-Rashid lies 40 miles to the south-east of Casablanca and consists of 1600 acres (650 Hectares) This was cultivated in 1948-49 as follows:

<table>
<thead>
<tr>
<th>Crop</th>
<th>Acres (Hectares)</th>
<th>Yield (Qx per hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard wheat</td>
<td>320 (130)</td>
<td>8 to 10</td>
</tr>
<tr>
<td>Soft wheat</td>
<td>296 (120)</td>
<td>10 to 12</td>
</tr>
<tr>
<td>Barley</td>
<td>296 (120)</td>
<td>15</td>
</tr>
<tr>
<td>Maize</td>
<td>345 (140)</td>
<td>10</td>
</tr>
<tr>
<td>Flax</td>
<td>150 (60)</td>
<td>6</td>
</tr>
<tr>
<td>Fallow</td>
<td>The rest</td>
<td></td>
</tr>
</tbody>
</table>

About 10 acres are under oranges and figs and are irrigated by means of a well. The farm is worked with the help of modern agricultural machinery by only 16 workers working on the khamessat contract. In the opinion of the proprietor the
system works very well as the tenants know that harder work will increase their share. In the present writer's opinion this is hardly feasible as the workers would realise that 4/5ths of any increase affected by their labour would be taken by the proprietor. If they work hard, it is probably for fear of losing their jobs. Tractors and other machinery were introduced only after the recent world war. Prior to that, the number of workers on the farm was no greater, only half of the land had to be left in fallow. Some mules and 15 mules are maintained on the farm, some of the latter crossed with European breeds. The farm also keeps 60 sheep. The number of workers is doubled at harvest time.

The farm forms a small hamlet by itself and the nwalas of the khammes surround the large white-washed mansion of the owner with its large courtyard (see photo 7/1) The fields nearest to the house are cultivated with maize. Flax has been introduced only this year. A biennial rotation is applied in a number of variations such as wheat-maize or barley-flax. The proprietor proposes to cultivate sunflowers next year. Because of the great demand for hay at Casablanca, the ripe cereal crop is harvested by means of the harvester-thresher so that tall stubble is not left standing for grazing as in most other cases.

Farm 6 lies 15 miles away at the eastern extremity of the Shawia region within sight of the plateau-escarpment bordering the Atlantic lowlands. This is a large farm consisting of 2710 acres (1100 Hectares) The distribution of crops is as follows
The hamlet housing the proprietor of farm 5. Nwalas of the workers all round. Route by the settlement is used by peasants riding donkeys, a common form of rural transport. Large dark mass is the store of hay covered with thatch.

Field of maize in the Shawia plain. Gentle undulation visible in the distance.
Outer part of Casablanca, the largest city in Barbary. Note well planned roads lined with palms, modern concrete buildings.
(Yields are not indicated as they approximate closely to those on Farm 5):

Cereals 1480 acres (600 Ha) (divided equally among soft wheat hard wheat and barley)
Peas 500 acres (200 Ha)
Maize 250 acres (100 Ha)
Forage 250 acres (100 Ha)
Rest 250 acres (100 Ha) Fallow

The smaller proportion of maize as compared to farm 5 may be noted on account of reduced rainfall due to the inland position. Some 30 cows and 150 sheep are maintained. The rotations adopted are the same as on farm 5. A notable feature of this farm is that the proprietor has constructed modern quarters for his workers (khamessat). They work on the khamessat contract but probably work better because of the improved living conditions. They number only 15 for such a large farm but then agricultural machinery is used for ploughing and harvesting. Fertilizer is not applied as the shallow soil is not suited for it. An air pump on the farm provides water for the use of workers and animals. The proprietors live in Rabat (they also own farm 7) and manage the farm through a representative in the Zaer plateau.

Rural Settlement:

The Atlantic lowlands present features of rural settlement that are altogether special to the region. The entire area has enjoyed prolonged security under the effective rule of the Sultans. This, combined with conditions favourable for cultivation has led to sedentary agriculture becoming the
prevalent mode of life. At the same time, the uniform excellence of soils over most of the region, the absence of important routes along which settlements might tend to group have prevented the growth of large villages. The few large rivers, as has already been indicated, flow in deep valleys whose steep sides are avoided by settlements. Most of the larger settlements like Bu-Reshid and Mediouna in Shawia have grown into prominence in recent years as administrative centres. The most typical settlement in the Atlantic lowlands consists of either a dwarf of nwalas or of tents or more often, of the tents and nwalas of the tenants grouped round the house (dar) of a large proprietor which stands out by its height and its white-washed walls. The density of population in the region is high (over 100 to the square mile) everywhere but variations are recorded in the distance between the settlements. They lie close together in the Dukkala plain where the density of rural population often exceeds 200 but lie at greater distances apart in the eastern extremity of the region where the decrease of rainfall and of humidity makes cultivation more risky.

The use of tents need not indicate an appreciable element of nomadic pastoralists in the rural population. In most cases, the tent is the habitation of seasonal farm labourers who have to move about looking for work. In restricted areas, however, grazing is combined with cultivation as will be indicated in the regional description of rural settlement and tents do
indicate pastoral activity. The influence of large urban agglomerations, notably Casablanca and Rabat is considerable. On one hand, they attract large numbers of landless labourers and impoverished peasants to their docks, factories, and other fields of paid service. At the same time, their expansion has enriched the countryside in the immediate neighbourhood which provides vegetables, grain and fodder to them at good prices. Here more prosperous habitations are the rule - brick houses using cement and iron girders etc. as against the mud houses of the prosperous peasant further away.

Taking rural settlement regionally, settlement on the coastal fringe south of Rabat takes the form of small hamlets grouped together. Large European and Morrocan properties have the typical aspect - a modern building surrounded by the nwalas of the labourers. Settlements avoid the steep-sided valleys of the numerous streams in this area. The stretch up to 25 miles south of Rabat has fairly dense settlement after which there is an almost uninhabited stretch up till Fedala. Here the forests approach close to the coast; among these recent eucalyptus plantations are numerous. South of Fedala, all along the coast European farms surrounded by the huts of farm labour predominate up to Casablanca.

South of Casablanca, coastal rural settlement is fairly dense on account of the large labour requirements of European and Muslim farms devoted to market-gardening. In the
low hills fringing the coastal zone, rural settlement is sparse again and tent dwars are numerous, indicating the importance of grazing. Up to thirty miles south of Mazagan, however, the coast is dotted with hamlets of nwalas and houses and European farms. Further south the lagooned coast has few permanent settlements and tent encampments are prominent. Approaching Safi, settlements in the zone of remel soils are again fairly dense. A review of the distribution of rural settlements in the coastal belt of light sandy soils would indicate that wherever ancient dunes have a varied topography and are thus not suited to the development of market-gardening and also wherever the very sandy soils of recent dunes are in evidence, settlements are sparse otherwise they tend to be very dense indeed.

In the interior the general aspect of rural settlement follows the pattern indicated at the beginning of this section. There is a falling away of the density of settlements in the interior. As the edge of the Central Massifs is approached, dwars of tents become more numerous and are associated with the increasing dependence on grazing. The tracts with local depressions (dayas) have quite naturally a sparser rural population so that settlements are fewer. Also grazing the use of tent associated with it enter into the picture. Over the Shawia plain, agglomerated settlements are fewer than in other parts of the Atlantic lowlands as the extensive use of wells necessitates residence close to the orchards and gardens thus irrigated.
The Atlantic Lowlands and the West Punjab Plain:

The Atlantic Lowlands were compared to the West Punjab plain in the chapter on Structure and Relief. Points of similarity between the two certainly exist both physically - in that they have lowland relief and a low rainfall, and agriculturally in that they are both predominantly cereal-growing. On closer analysis, however, there are differences between them that are more significant still. Whereas the Atlantic lowlands are of tectonic origin and their surface relief is affected by the Primary peneplain underneath, the West Punjab plain has been formed by deep alluvial deposits in which the slight changes in configuration are determined almost entirely by the rivers. Rivers have played a minor role in the present agricultural set-up of the Atlantic lowlands in which the variation in the nature of the soil have been occasioned by the nature of surface decomposition or by marine deposition near the coast. As set out in the chapter on soil types the West Punjab soils vary according to the process of alluvial deposition. Finally the climate of the Atlantic lowlands is essentially maritime under the influence of the cold Canaries Current in contrast to the extremely continental nature of seasonal weather conditions in West Punjab. Consequently irrigation does not play the same vital role in agriculture. The great importance of maize and other summer crops near the coast in this Moroccan region has no counterpart in West Punjab where maize and vegetables are grown mainly under irrigation.
For a real and far-reaching parallel to conditions in West Punjab the region must lie further inland where extreme continentality and semi-aridity combine with an alluvial soil, and irrigation is the mainstay of agriculture. Only two such regions occur in Barbary - the Sub-Atlas High Plains in Morocco and the Shelif Valley in Algeria.
THE CENTRAL MASSIFS:

This region extends south of the lower Sebu basin down to the foot of the High Atlas and consists of the plateaux of Zemmour and Zaer-Zayan, the limestone plateau of Settat and the Massifs of Jebilet and Rehamna. Between the fertile Atlantic lowlands to the west and the rich alluvial Sub-Atlas high plains to the east, it forms a largely negative region from the agricultural point of view as the ancient crystalline peneplain is exposed everywhere, over whose rocky surface grazing is more important than cultivation. This mercynian peneplain in fact constitutes the unifying trait of these regions which differ greatly from each other in altitude and topographic features. For these contrasts, varying degrees of rejuvenation as well as the different degrees of resistance of the exposed rocks are responsible. It would be no exaggeration to state that over the greater part of the Central Massifs, land use is directly related to geological structure, as not only the soils, slopes and water-supply but even the climate varies with the nature of relief as will be evident from the account of different sections that follows.

Physical Background:

According to their physical traits, the Central Massifs may be considered in three principal sub-divisions:

1. The Zaer-Zayan region in the north has the greatest contrasts in relief, the highest rainfall and some of the richest agricultural lands in the Central Massifs. This region underwent
considerable elevation during late Tertiary movements, the erosional processes were intensified as a consequence so that the thin sedimentary veneer was removed. The degree of rejuvenation can be measured from the depth of the upper valleys of the Bu Regreg and its tributaries, one of these Wadi Agennour lying in a gorge 1600' deep. The contrasts between the monotonous plateau surface and the deep valleys are most striking. The general height diminishes from 4500 feet in the east to less than 2500 feet in the west, the fringe of the Zaer plateau facing the ocean being below 2000 feet. Within this general framework, variety in the landscape is produced by the degree of resistance of the exposed rocks. Granites reveal their presence by eroding into rounded features - spherical basins as in the region of Oulmes and Christian. Quartzites constitute some of the most prominent heights some exceeding 5000 feet. Schists on the other hand give rise to basins and valleys with gentler slopes.

The relation of the direction of flow of the rivers to the strike of geological strata needs specially to be noted. The SE to NW direction of the rivers cuts across the NE to SW alignment of Hercynian folds in the peneplain. Every outcrop of quartzite is marked by a gorge while schists have broader valleys within which rivers meander. These latter valleys are locally known as tirzas.

Soils are thin and poor over the crystalline surface. Volcanic outflows in certain regions notably the plateaux of Ment
and Culmes and the lower Zaer slopes have given rise to deep black soils which are again termed tirs by the local population. The limited plains in the areas of schist outcrops have alluvial soils along the rivers. These soils occupy greater areas as the rivers emerge from their deep valleys towards the coastal lowlands.

Rainfall in the Zaer-Zayan region is fairly high everywhere and exceeds 28-32" in the eastern more elevated part. There is an orographic increase in the case of the prominent heights which is reflected in a more luxuriant vegetation of oaks - cork-oaks, and holm-oaks dominating. But rain-shadows are found wherever deep-valleys occur running north to south. Much of the region is forested, lower slopes with a bushy vegetation forming a rich maquis while oak, thuya and juniper forests occur above 3300 feet.

Owing to the impermeability of the bed-rock and the thinness of soils, sub-soil water reserves are conspicuous by their absence.

2. The Plateau of Settat between the Shawia region and the Tadla plain marks a section of the Central Massifs within which rejuvenation of relief has not been considerable so that the surface is monotonous over the greater part. The altitude diminishes from over 3300 feet in the north to 2000 feet and less in the south along the Um-er-Rbia. The central part from Khouribgha to Wadi Zem is warped into a gentle fold. In a region consisting of cretaceous and eocene strata among which limestones dominate
large streams are markedly absent. The prominent escarpment towards the Shawia region west of a line joining Ben Ahmed and Settat is dissected by numerous dry valleys especially in the north. North-eastwards the relief is varied with steep slopes and prominent hill features as the Zaer-Zayan region is reached. In contrast to the scarped ascent from the Shawia lowland, the eastern slope is gentle and merges imperceptibly into the alluvial Tadla plain. The southern limit along the Um-er-Rbia is however marked by steep, almost precipitous slopes to the gorge-like valley.

Over the monotonous relief of this region, the depth and nature of soils vary with slope. Lower parts of local valleys and depressions have deeper soil while the heights have their cover removed. Hamri soils occur in several parts owing to decalcification in situ. Arable soils do not occur as a continuous cover and their agricultural utility is related to the existence of springs and wells in a region where they occur in several localities due to the permeable limestone strata that dominate. Regions especially rich in such springs and sub-soil reserves are between Khouribgha and Wadi Zem, particularly around the latter, and around El Borouj a little to the north of the Um-er-Rbia.

Rainfall in the Settat plateau varies from 16" to the northern part to about 12" towards the south and east.
Temperature conditions are continental with marked seasonal extremes. Under these conditions only a poor steppe vegetation can develop as may be noticed on the map of the vegetation of Barbary.

3. The Massifs of Jebilet and Rehamna to the south of the Um-er-Rbia have a low relief seldom exceeding 2,000 feet but local elevation has resulted in slight rejuvenation and the disappearance of the top sedimentary layers. The northern Massif - that of Rehamna is dominated by several crystalline ridges that rise above the general surface. Of these Sehour (2,250 feet) is the highest. As in the Zaer-Zayan region, areas of schist and granite outcrops form relatively monotonous lowland expanses as in the case of the region around Ben Guerir. Jebilet (literally "small mountains") consists of an east-west chain much dissected due to rejuvenation which rises to a height exceeding 3,300 feet. The south-western part of the Rehamna Massif may be called the Plateau of Louis Gentil and consists of a much-dissected surface lying at an average height of 1,500'.

Soils are everywhere thin and poor in this region and sub-soil water reserves more or less absent. This combined with a rainfall that is below 12" everywhere gives the region a desert aspect with a poor vegetal cover.

**Land-use and Farm Types**

The richest part of the entire region is that in the north - the Zaer-Zayan plateau. Grazing takes precedence over cultivation over the greater part despite the high rainfall.
Temperate conditions are continental with marked seasonal extremes. Under these conditions only a poor steppe vegetation can develop as may be noticed on the map of the vegetation of Barbary.

3. The Massifs of Jebilet and Rehamna to the south of the Um-er-Rbia have a low relief seldom exceeding 2000 feet but local elevation has resulted in slight rejuvenation and the disappearance of the top sedimentary layers. The northern Massif - that of Rehamna is dominated by several crystalline ridges that rise above the general surface of which Sehour (2250 feet) is the highest. As in the Zaer-Zayan region, areas of schist and granite outcrops form relatively monotonous lowland expanses as in the case of the region around Ben Guerir. Jebilet (literally "small mountain") consists of an east-west chain much dissected due to rejuvenation which rises to a height exceeding 3300 feet. The south-western part of the Rehamna Massif may be called the Plateau of Louis Gentil and consists of a much dissected surface lying at an average height of 1500'.

Soils are everywhere thin and poor in this region and sub-soil water reserves more or less absent. This combined with a rainfall that is below 12" everywhere gives the region a desert aspect with a poor vegetal cover.

**Land Use and Farm Types:**

The richest part of the entire region is that in the north - the Zaer-Zayan plateau. Grazing takes precedence over cultivation over the greater part despite the high rainfall.
This is a natural adaptation to a region of skeletal soils covered by a luxuriant vegetation. In fact from the pastoral point of view the area possesses advantages unparalleled in any other largely pastoral region in Barbary. High rainfall in those parts of the mountainous regions that are devoted to grazing (i.e. Middle Atlas and Aures) is accompanied by heavy falls of snow in winter that necessitate a downward migration. In the Zaer-Zayan plateau, snow occurs only very occasionally during the colder months and never persists beyond a few days so that transhumance is unnecessary. In spring, the entire area sprouts with a rich herbaceous growth that supplements the abundant resources of the forests. Not only the animals of the local tribes but also those of tribes descending from the Middle Atlas find rich pastures. No wonder that this area has developed some well-known cattle breed of its own, the red cattle of Oulmes and the fawn coloured breed of Christian. Large numbers of sheep and goats are also grazed. Several European colonists have large holdings of grazing land around Oulmes over which they carry on grazing of animals on organised and scientific lines.

Within a dominantly pastoral region, several areas devoted to cultivation stand out. The tracts with black volcanic soils are especially productive and yield excellent harvests of cereals year after year without fallowing. Some of these occur towards the northern periphery in the Zemmour region bordering the Meknes plain, notably around Tedders Maziz and Dayet Roumi. Farms of type A and C prevail, some of the latter belonging to
Europeans.

The plateaux of Marchand south east of Rabat has some of the most productive cereal-lands in Morocco. This region which lies at an altitude of 1200-1500 feet extends eastwards up to Tiflet and Khemisset. Cultivation is carried on in conjunction with grazing over the steeper slopes of the valleys and the bordering forests. Erosion has been less intense here and extensive areas are covered with rich soils which vary from hamri in calcareous tracts to a deep and fertile black soil in areas of volcanic rocks. Rainfall in this region is moderate—between 20" and 24" but such is the moisture-retaining capacity of the soil that crops have not been known to fail even in years of drought. In 1945, a year of widespread distress due to the failure of rains, this area gave average yields of cereals.

This tract forming a part of the Zaer region, is characterised by the existence of large estates and has been colonised extensively. One large estate (Farm 7) belonging to a family of Moroccan notables was visited and the following particulars obtained:

The estate, scattered in several places, consists of 5430 acres (2200 Hectares) and is owned by five brothers who, although possessing individual titles to different parts, co-operate with each other in sharing labour, machinery and general supervision. The land was sown as follows this year (1948-49):
Fields of soft wheat (Florence Aurore) in the Zaer plateau. Cereals stretch far out on the gently undulating surface dissected by deep valleys. These lands form part of farm 7.

Part of the property of farm 7 devoted to grazing of cattle.
Habitations of workers on farm 7 - nwalas. On the right two tents visible in the distance. These house those of the workers who tend the cattle and move with them over the pastureland. In the foreground uncultivated grass. White patch towards the tents is flax.
Cereals: Soft wheat - Florence Aurore and hard wheat - 2470 acres (1000 Ha)
Barley  124 acres (50 Ha), Flax  740 acres (300 Ha)
Chick peas  250 " (100 Ha), Peas  740 " (300 Ha)
Sunflower  370 " (150 Ha), Fallow  740 " (300 Ha)

Yields are double those indicated for other large farms previously i.e. wheat 3000 lbs per acre and so on. About two-thirds of the land is worked by modern machinery and the rest by animals. The latter include 15 camels apart from bullocks and mules.

In addition, the proprietors graze a herd of 400 cattle as well as some 500 sheep of the Brobi (native Moroccan) breed. Because of the susceptibility of sheep to disease they fluctuate in numbers from 200 to 1200. A part of the land - over 600 acres, is always reserved for the cattle. The landlords also rent parts of the government forests in the vicinity as grazing lands. They purchase young calves at the neighbouring suq, bring them up on their pastures and sell them when they are grown up.

A leading feature of this farm was observed to be the special relationship between the workers and landlords. The average number of workers maintained is 350. Of these, a considerable number are employed in looking after the animals, move about with them living in tents. The rest who work on cultivated land live in nwalas but the landlords are endeavouring to improve their housing as they did for the workers on their
farm in the Shawia region (Farm 6). Apart from the wages of 3 shillings per day for men and 2½ shillings per day for women which are in keeping with the prevailing standard, the labourers get free food and get a substantial share of the annual charitable dues (zakat) which amounts to 2½% of the proprietors' income. Some of the workers with a long standing on the farm have been given small pieces of land of 2-5 acres to cultivate on their own.

The farm uses a biennial rotation, cereals alternating with leguminous crops. Super-phosphate is used as fertilizer. Sunflowers have been introduced since the last war and the estate grows some of the finest sun-flowers in Morocco. Flax is another crop of recent introduction. The extension of these crops is evidence of increasing commercialization.

Over the plateau of Settat sedentary agriculture is restricted to certain favourable tracts with deep soils and with local springs for irrigation. Thus the domain of the tribe Oulad Said around Settat which has rich tirs soils is devoted largely to maize and farms of type A and C are numerous. As one proceeds towards the east, maize loses its importance till in the fertile and well-watered region around Wadi Zem, it is grown only under irrigation while over the rest of the area, barley is dominant over other cereals. Here as well as around El Borouj, the other notable tract of sedentary cultivation, farms of type A and C are prevalent. The rest of the region is the domain of semi-nomadic tribes which cultivate barley here and there.
The Massifs of Jebilet and Rehamna are devoted largely to grazing of sheep and goats. Wherever deeper soils or springs enable cultivation as in the west around Louis Gentil, cereals, especially barley are grown. Consequently, cereal growing farms are the rule.

**Rural Settlements:**

In a region devoted for its greater part to pastoral grazing, permanent settlements are not dense and the mode of habitation most in use is the tent. This, though habitually arranged in dwars is today often found occurring in small isolated groups of two or three under conditions of security.

In the Zaer-Zayan region, sedentary settlements are naturally concentrated in the cultivated parts. Within these they usually occur as small hamlets above the steep edge of a deep valley. Probably a desire to utilise as much of the level arable land as possible as well as the advantage of water-supply are the two factors considered in this emplacement. The familiar agglomeration of the nwalas and tents of workers around the large farms is again to be seen frequently. Several larger centres have grown into prominence near local suqs and serve as administrative centres as well as market-towns. The European population has tended to agglomerate in them. These are Marchand, Tiflet, Khemisset, Oulmes etc.

In the plateau of Settat, a distinction has again to be made between the sedentary settlements concentrated in cultivated areas and the ever-mobile tents of the pastoral tribes the best-known of whom are the Beni Meskin. Houses and nwalas
are used in sedentary villages according to the economic status of the cultivators. Settat, El Borouj and Wadi Zem are the largest settlements and figure prominently as administrative centres. The last named is also the regional wool market. Villages are most commonly placed near large springs and in the south they avoid the deep valley of the Um-er-Rbia.

Sedentary rural settlements in the Jebilet and Rehamna Massifs are few and far between, most of them occurring towards the west where springs are again focal points for settlements. They may also occur perched on low heights above the cultivated fields. The greater part of the territory is the domain of the tent.

THE SUB-ATLAS HIGH PLAINS:

The Sub-Atlas High Plains of Tadla and Haouz are not only regions of great intrinsic interest from the point of agriculture but also merit special attention on account of their close resemblance to conditions in West Punjab. Physically, about the only notable difference between them is in altitude, the Sub-Atlas plains lying between 1200 and 2000 feet in contrast to the 500-1000 feet of West Punjab. This does not affect agriculture to any considerable extent for the associated climatic conditions are not very different from those in West Punjab. Aridity maps drawn according to de Martonne's formula bring out this climatic similarity to advantage as most of the two regions have an index of 5 to 15. The annual maximum and minimum temperatures
of 117°F and 27°F respectively at Marrakesh find their counterpart in Lahore, Montgomery, Multan and other centres in West Punjab where maxima are around 115°F and minima range from 30° to 35°. Rainfall which ranges from 9" at Marrakesh to 15" at Kasba Tadla and over 20" in the Atlas fringe is comparable to amounts recorded in West Punjab that vary from 7" at Multan to 20" at Lahore and 31" at Sialkot. This close similarity reflects the extreme continentality of climate in both regions consequent upon their distance from the sea.

Like West Punjab again, the Tadla and Haouz plains combine excellent alluvial soils and gentle slopes with these semi-arid conditions so that wherever irrigation has been developed, agriculture has reached fairly high standards of productivity. And indeed without irrigation, cultivation is a gamble on a capricious and low rainfall so that ingenious devices for irrigation have been in existence in both regions.

Relief, Soils and Climate:

The basic physical features of the Tadla and Haouz plains have been outlined above. They occupy the synclinal depressions that were formed in front of the Atlas ranges and were filled in by alluvial deposition from a large number of streams emerging from the Middle and High Atlas. The hydrographical system is now integrated into the two principal

(1) Figures for Marrakesh from Geographical Handbook, Naval Intelligence Division "Morocco" and for West Punjab from Indian Weather Review 1938-42
(ii) These are not the lowest and highest figures for the respective regions but the amounts prevailing over the greater part - see Rainfall maps.
rivers - the Um'er-Rbia which flows through the Tadla plain and the Tensift river draining the Haouz plain. Within the two plains slopes have been determined by the nature of alluvial deposition. The two plains are separated by an off-shoot of the Jebilet Massif but are linked together by a break in this ridge near Kelaa es-Seraghna.

In both the plains, the rivers have been pushed by greater alluvial deposition from the Atlas streams towards the Central Massifs so that the large part of the plains lies towards the Atlas ranges. This feature is most remarkable in the Haouz plain where the numerous tributaries of the Tensift from the south have driven the river to the flank of the Jebilet Massif so that the plain lies almost entirely to the south of the river. The relief of the two plains may now be analysed one after the other.

The Tadla plain begins where the Um'er-Rbia emerges from a mountainous course in the Middle Atlas above Kasba Tadla at an elevation of just over 1500 feet. In the eastern part of the plain the river flows between deep banks and the Massif to the north rises steeply above it. There is no marked alluvial cone and several tributaries from the Middle Atlas have probably covered it with their own deposits. Further west the river flows in the centre of the plain and divides it into two parts, the plain of Beni Amir to the north and that of Beni
Moussa to the south. The slope in the plain of Beni Amir is very gentle and there are no notable tributaries traversing this region. To the south of the river however, the abundant alluvial deposits from several Middle Atlas streams have given rise to a comparatively steeper slope. The Middle Atlas rises precipitously above it as the contact between the plain surface and the range is marked by faults. The streams come through deep valleys in the Middle Atlas. The more important of these are Wadis Derna, Day, Rebat, El Abid and Tessaout. The last two are rivers of considerable size. Of these, the Tessaout has been captured by the Um-er-Rbia and previously flowed into the Tensift. These rivers have marked alluvial fans especially in the case of the Tessaout. The coalescing fans have given rise to an intermediate slope between 1600 and 1800 feet east of Beni Mellal. Copious percolation in the coarser deposits here gives rise to a high water table in the plain of Beni Moussa where numerous wells tap this supply.

The Tadla plain which is inclined north-east to south-east descends to 1000 feet in its west. It is prolonged towards the foot of Jebilet by the plain of Bahira which is so flat that it forms an extensive marsh during the rainy season.

The Haouz Plain south of the Jebilet Massif presents a singularly monotonous surface diversified very rarely by the stony crystalline hills such as that of Gueliz near Marrakesh.
which represent the projecting peaks of a rugged landscape now covered by alluvial deposits. The plain is about 120 miles long and varies in width from 30 to 60 miles. The level of its central part descends from 2000 feet above the sea level at the eastern extremity to less than 1000 feet west of Shishawwa (Chichaoua). For all practical purposes, the Tensift which drains the region may be taken to form its northern boundary for as explained earlier, it flows close to the Jebilet Massif whose steep rocky slopes commence within a mile or two. South of the river, there is a very gentle slope up to 2000 feet above which the ascent is less gradual in the "dir" mountain-foot zone extending up to 3000 feet. There is no line of demarcation between the two surfaces which merge into each other imperceptibly. The general surface is flat but is diversified by the valleys of numerous streams incised into the fan deposits.

The physiography of the plain has been determined largely by deposition from the numerous tributaries of the Tensift. There are few streams in the extreme east and the largest of them, the Tessaout is now tributary to the Um-er-Rbia. Approaching Marrakesh, however, an increasing number emerge from the High Atlas whose snows maintain a copious though variable water supply. These streams have formed alluvial fans which merge into each other where streams lie close to each other. The main streams are from east to west Wadis Rdat, Wrika, Reraya, Nfis and Shishawwa. Not only are they themselves utilized for irrigation but the
copious percolation in their cones is tapped ingeniously by the use of khattaras which were described in detail in the chapter on Irrigation. The fan slopes away from the rivers are used by canals (seguias) as will be noticed from Map 4.27. The largest of the tributaries of the Tensift, the Nfis, has a large and constant supply of water which has been utilized for large-scale irrigation by means of a dam.

Soils vary in texture and compactness according to their distance from the mountains, becoming progressively finer and heavier as the distance increases. The climatic conditions have already been set out briefly. The basic features from the agricultural point of view are the paucity and great variability of rainfall. With this may be combined the extremes of temperature and the high evaporation during the dry summer leading to an intensification of arid conditions.

**Land Use and Farm Types:**

The climatic regime enforced a semi-pastoral regime of land exploitation wherever irrigation facilities were not developed. Thus, the Tadla plain has long been the poorer region of the two despite a comparatively higher rainfall. It has already been explained in an earlier chapter how the dir zone became the centre of dense settlement as there alone did a moderately high rainfall combine with the generally favourable relief and soils.

Present-day land use varies considerably in each region over short distances according to irrigation supplies as well as according
to the type of agriculture practised i.e. traditional or modern.

Within the Tadla plain, the rainfall decreases from north to south. Three zones of decreasing productivity are recognised - the Semguett in the north, the Beni Madane tract and the plain of Beni Moussa. Most of the tribes of the plain have an accepted partition of the plain in parallel bands of a width of some 25 miles perpendicular to the mountain so that each bank includes territory of different productive capacities. The lower part is largely grazed with some scattered cultivation of barley while the upper and rainier tracts are cultivated with annual crops as well as fruit trees, chiefly olives and almonds. This unique arrangement has been disturbed by the installation of French colonists who now own over 60,000 acres and by the launching of large-scale irrigation schemes. The colonists have established some citrus plantations. The larger part of the plain held by the local population was owned collectively by tribes but since the introduction of irrigation in the Beni Amir plain, there has been a tendency towards partitioning among individuals. In the foothill zone properties of type A and B dominate. Lower down, large European holdings are interspersed among the A type holdings in the eastern part of the plain. Towards the west, the waters of the Tessaout are utilised by means of several indigenous canals to irrigate fields of cereals - barley and hard wheat. Irrigation by means of wells is practised along the river on both sides though the areas thus cultivated are restricted. The larger part of the plain of Beni Moussa
is still cultivated under the capricious rainfall regime by a population which depends greatly on grazing. How the entire aspect of agricultural land use can be changed by irrigation has been described under "Irrigation".

The Haouz Plain despite its greater aridity has long been exploited intensively over large areas through irrigation from wells, seguias and khettaras. Marrakesh itself has the appearance of a large oasis town with its date-palm plantation surrounding it on the south and the east. Westwards, large orchards of olives are irrigated with the help of khettaras. Further away on all sides stretch the cereal fields and fruit plantations irrigated by seguias. The irrigated land is by no means continuous and is concentrated mainly on the alluvial cones formed by the rivers on which irrigation water can be conducted by gravity. Here and there occur the bare parched lands that bear a crop once in several years when rains are abundant.

The eastern and higher part of the plain is comparatively poorer for here the streams emerging from the Atlas are less numerous. Approaching Marrakesh however irrigated lands with their rich fields of barley and wheat and the orchards of olives, apricots and pomegranates change the aspect. The date palms around Marrakesh combine with the ground-crops and the lower fruit trees to give rise to the three tier exploitation of land. The principal means of irrigation in the immediate neighbourhood of
A part of the irrigated sector of the Beni Amir plain. The modern buildings in the centre are the headquarters of the local seed-selection farm. The fields around are ploughed and ready for sowing. Over the horizon can be seen plantations of olives and other fruits trees. Notice the flatness of the surface.

A part of farm 8 outside Marrakesh. The photograph illustrates three-storeyed cultivation. In the foreground vegetables, principally tomatoes. The lower trees are apricots and pomegranates. The tallest canopy is that of date-palms. The men in the picture are preparing a field for cultivating vegetables.
The tube-well which irrigates farm 9 in the Haouz plain. In the background can be seen citrus trees. The three poles signify recent boring operations on the well.

The reservoir in which water from the khettara irrigating farm 10 in the Haouz Plain accumulates. Building seen clearly on the right is built of mud and accommodates the farm-animals and machinery. In the centre a corner of the colonists' house. The trees around the house are part of the farmhouse garden.
Marrakesh are khettaras. West of Marrakesh, irrigated cultivation is carried on mainly by means of seguias, now integrated into unified systems by the government and by means of water from the Nfis dam. Native holdings of type A and B dominate, particularly the latter. Large farms of types D and F are by no means uncommon. European colonisation has made headway even in this hot region, 120,000 acres being in the possession of settlers.

The following three farms visited in the Haouz region should furnish the details of crops and methods in vogue. Property 8 is a part of the date-palm plantation consisting of 74 acres (30 Hectares) and belongs to a Muslim owner. It is irrigated by means of a khettara. The land is cultivated in three storeys (see picture):

1. Ground crops of maize, barley and vegetables, particularly of tomatoes. The latter due to the proximity of the town.

2. On the same areas at intervals - fruit trees consisting mostly of olives, apricots and pomegranates.

3. The tall canopy of scattered date palms.

The date palms and olive trees are old established and arranged irregularly but modern plantation methods have been used for the apricots and pomegranates which are evenly spaced. The area is worked intensively with the application of super-phosphate and high yields are obtained. Thus maize yields average
Dr Rossi's Farm
(Farm 9)
North-West of Marrakesh
Scale approx. 1:4000

- Oranges
- Olives
- Apricots
- Forage crops
- Vegetables
- Wind-breaks

Unshaded - cereals with scattered almond trees.

Canal Distribution

43
1355 lbs. to the acre (15.2 Qx per hectare) Truck crops are being extended. The date palms are of a very mediocre quality locally known as "khalt" - mixed. Due to its scattered trees, the farm cannot be worked by machinery and a varying number of workers is employed averaging six.

Farm 9 eight miles to the north-west of Marrakesh belongs to a European colonist whose modern bungalow with its well-laid out gardens is surrounded by 93 acres (40 Hectares) of fruit orchards and other crops. The land is cultivated as follows:

Citrus fruits  - 30 acres (12 Ha) Olives 15 acres (6 Ha)
Almonds  - 5 " (2 Ha) Apricots 6 " (2½ Ha)
Forage crops (lucerne and berseem) 15 acres (6 Ha)

The rest under wheat and barley except 6 acres under vegetables and tomatoes.

The distribution of these crops on the farm is indicated in figure 43. The farm draws its water for irrigation partly from a tube-well and partly from a seguia - from the pooled sources of the wadis west of Marrakesh. The fruit trees each receive 10-20 lbs. of manure each year as well as smaller quantities of composite fertilizer and give excellent yields. Thus the oranges although still young, yield 10 tons of oranges per acre. They are Washington Navels and Valencia Late and protected by windbreaks consisting of cypresses.

The farm is worked by 15 permanent workers resident on the premises. Agricultural machinery is used. The owner
The khettara modernised by the owner of farm 10. The proprietors of farms 9 and 10 are seen on the left and right respectively; two young agricultural officers in the centre. On the right, fallow field; in the distance the citrus plantation. To the left is low brush on uncultivated land.

Place Jama Afna in Marrakesh which serves as the local market in the morning and a centre of amusement in the afternoon. The tower is the famous Kotobbia.
Cultivation in the dir zone. White patches to the left are salt-incrusted land. Dark zones signify valleys. The High Atlas in the background. Notice the snow; picture was taken in mid-June.

Terraced cultivation under irrigation along Wadi Amizmiz in the dir zone of the Haouz plain. Fields are under maize and wheat; those in the foreground have recently been sown. The village is seen rising along the valley slope on the opposite bank. Most of the trees seen in picture are olives. Lower and gentler slopes of the mountain are cultivated without irrigation with barley. Upper bare slopes are grazed.
maintains 8 cows, cross-bred with European Montbeliards which give 75% higher yield of milk than local breeds. Other animals kept are two horses and a pair of bullocks for sundry work on the farm. Yields of wheat (1070 lbs. per acre or 12 Qx per hectare) and barley (890 lbs or 10 Qx per hectare) are high.

Farm 10 to the west lies on the bank of the Tensift and covers 390 acres (160 Ha). It is also owned by a European colonist. Irrigation water is obtained from two hktteras one of which was previously in disuse and has now been modernised (it was mentioned under irrigation). The proportion of different crops compares with farm 9 except that half the land is under cereals or fallow and only half is under fruits, forage crops and vegetables. This is because the supply of irrigation water is less secure than on farm 9. A biennial rotation is applied on cereal lands with every alternate year under a cultivated fallow.

The dir zone is cultivated with barley and some wheat in holdings of type A without irrigation. Where streams emerge from their mountain course they have been utilised to irrigate terraced fields. Here maize can be grown and fruit orchards are also maintained. At Amizmiz, Wadi Amizmiz has thus been used to irrigate over 12,000 acres devoted to maize, vegetables and fruit and the terraced fields can be observed in a photograph. The yields obtained from irrigated crops are three to four times the yields obtained from unirrigated crops.

Rural Settlements:

Agricultural settlements in the Sub-Atlas high plains are determined primarily by water-supply. Apart from the natural
concentration in the irrigated sectors consequent upon greater productivity, even the Tadla plain has the settlements hugging the banks of the Um-er-Rbia in an almost continuous ribbon.

What constitutes a remarkable contrast between the Tadla and Haouz plains is the fact that the Tensift in the latter has not exercised the same attraction for settlements. This is due to the population of this tract being agglomerated firstly in that gigantic village - Marrakesh, and secondly among the irrigated areas whereas until recently, irrigation was hardly developed in the Tadla plain and the population, depending considerably on cattle in a region poorer in large streams, concentrated along the main river.

Another contrast between the two plains is in the greater use of tents and nwalas in the Tadla region, and natural outcome of the greater dependence on grazing and comparative poverty, while the sedentary population of the Haouz plain lives mostly in houses.

Large settlements in the Tadla plain are few. Kasba Tadla situated at the debouchment of the Um-er-Rbia is the regional centre but the town of Beni Mellal at the foot of the Middle Atlas plays an equally important role as a centre of exchange with the mountain tribes. Fqih ben Salah is the growing centre of the irrigated plain of Beni Amir but is largely a European settlement. Within the irrigated sector, several sedentary villages have been established though they have mostly grown up at the points where semi-permanent settlements consisting
of nwalas already existed. Houses are replacing nwalas now.

The nature of rural settlements in relation to irrigation in the Haouz plain may be studied from map 2. Within the irrigated areas, isolated native farms and small hamlets are quite common. Further south as one travels towards the Dir zone, larger villages become numerous and occasionally fortified granaries are noticed though their incidence in this zone is unusual. The dominant house-type is the mud house with flat roofs. In the dir zone, settlement is exceptionally dense. Most villages consisting of several hamlets are located along permanent water-courses. At the debouchment of the larger streams from the High Atlas are situated some of the largest villages of the Haouz plain namely Imintanout, Amizmiz (see photo) and Tahanout. Within the Haouz Plain, there are no large towns apart from Marrakesh.

THE MIDDLE ATLAS:

Bounded in the north by the Taza Gap, on the east by the Muluya Valley, on the west by the Tadla plain and on the south by the depression south of Khenifra, the Middle Atlas has a plateau-like surface above its steep sides characterised by the predominance of pastoralism and of forest-exploitation. In the northern sector, rainfall often exceeds 30" on the Atlantic-facing slopes. It decreases southwards and eastwards. The advantage of high precipitation is in most cases discounted by high altitudes and severe winters so that large areas are either
grazed seasonally or under forests. Some of the pastoral migrations were briefly described in the chapter on Modes of Life.

Agriculture is confined to the valleys situated between 2500 and 4000 feet which are rainy without being too cold. Soils are mainly red decalcified (hamri) in limestone areas or tirs over areas covered with volcanic lava. As water is abundant in the shape of numerous rivers and their tributaries as well as springs from the predominantly calcareous rocks, irrigation is widely practised. At present considerable areas are under cereals - maize, hard wheat and barley but there is scope for the extension of fruit cultivation on such good soils with the abundant facilities for irrigation. Some European colonists have established orchards of cherries and apples in the valley of Tigrigra south of Meknes as well as on the plateau of Immouzer. Scattered fruit trees also exist round sedentary Moroccan villages which rise in tiers of flat-roofed mud and stone houses in the valleys. Larger regional settlements are Azrou in the north and Khenifra in the south. Over the major part of the Middle Atlas, however, the tent is used periodically by all tribes which apart from practising irrigated agriculture, send their flocks of sheep and goats to the higher pastures in summer. (see p. 35).

**THE HIGH ATLAS:**

This, the highest range in Barbary, is marked by very steep slopes and deep narrow valleys, both longitudinal and transverse. It receives less rainfall than the Middle Atlas and its southern slopes have a Saharan aspect. In the extreme east
where conditions approximate to those in the Algæro-Moroccan steppes of the High Plateaux, semi-nomadic pastoralism prevails. In the west rainfall is appreciably higher and the Shleuh lead sedentary lives amidst their orchards of almonds, walnuts, figs, and pomegranates cultivating some of the valley-sides with barley and rye. The argan tree whose fruit resembles the olive, yields an edible oil and its extensive wild forests help to support the dense population. Conditions in central High Atlas are intermediate between the two sectors. The water resources of the High Atlas do not compare with those of the Middle Atlas because of the smaller precipitation and a prevalence of impermeable rocks. Although snow lies for as many as nine months on the higher peaks its quantity is small and does not influence the water regime of streams that are usually torrential. Settlements tend to concentrate where transverse and longitudinal valleys coalesce so that a small alluvial plain is formed. The multiple-storeyed mud and stone habitation of the Shleuh in the west gives place to single storeyed houses in the central sector while the tent is used in the extreme east. Among the sedentary and semi-nomadic tribes of the centre and the west, fortified store-houses (tighremt and agadir) are a marked feature.

THE SOUS:

This depression between the High Atlas and the Anti-Atlas is about a hundred miles long and increases in width towards the ocean. Its alluvial soils have formed a sub-soil
calcereous crust due to the arid climate. Except for some limestone ridges here and there, the greater part of the region presents a plain surface well suited to cultivation if water were available. But while on one hand rainfall is less than 12", the principal rivers have a very irregular regime, the Sous river and the Wadi Massat being almost dry in summer. Certain limited sectors benefit from perennial springs and the subterranean flow of rivers. Here the water has been utilised for irrigation. In winter, numerous rustic dams of mud or stone also tap the river waters.

The Sous region is devoted mostly to barley in holdings of type A. A little maize is grown in the coastal sector where coastal humidity makes up to some extent for climatic aridity. Some European settlers have been installed in this area. Early vegetables are grown around Agadir as by its warm winters the region matures tomatoes, haricot-beans and new potatoes several weeks ahead of other regions of Barbary. Some irrigated citrus orchards have also been established. The Moroccan population also maintains a large number of almond trees, principally around their sedentary settlements while olive trees also occur in smaller numbers.

Most of the Sous region is inhabited by a sedentary population living in single storeyed mud houses agglomerated in villages. Fortified store-houses (agadir) are common at the foot of the mountains where a part of the population practises seasonal transhumance.
EASTERN MOROCCO:

East of the Middle Atlas, landscape resembles that in western Algeria and two of the Algerian zones, the Tell and the High Plateaux are easily distinguishable. With its slightly higher rainfall i.e. 12" or so, the Tell Zone constitutes the main agricultural sector. The much-dissected folded Massif of Beni Snassen is forested at the upper heights but some of its valleys have become renowned for the production of oranges with the help of irrigation from perennial springs and streams. In the west, the plain of Triffas with a total area of about 120,000 acres (50,000 Ha) is a rich tract with reddish alluvial soils (hamri). Half of the total area has been colonised by Europeans. Rainfall does not exceed 12" in the plain and, although this provides for the production of cereals, especially barley, irrigation by tube-wells has been developed to grow citrus fruits and vegetables. At present an area varying from 15,000 to 20,000 acres (6,000 to 8,000 Ha) is devoted to vegetables every year. Much of it is situated in the slightly depressed part of the plain known as Madagh. Irrigation on a large scale will provide security and facilitate intensive cultivation over 75,000 acres (30,000 Ha) when a dam on the Muluya and the associated canal system are completed. Work is already in hand. Farms of the type D and F predominate in the Triffas plain.

In the interior, cereals especially barley are sown over extensive plains between Taza and Oujda of which the plain of Angad south of the latter is the largest. Once in several
years excellent harvests are obtained following abundant and well-distributed rainfall. Further to the south, sheep rearing is the dominant occupation of a nomadic population. Cultivation is confined to oases. The Muluya valley itself is agriculturally of use only at three points where the junction of important tributaries has provided an oasis-like abundance of water in the middle of an arid steppe.

Settlements in the Tell zone are fixed and consist of villages of mud houses. In the interior the tent is increasingly used with greater dependence on pastoralism though large agglomerations of sedentary houses do occur where conditions favour fixed cultivation. Taorirt and Guercif are large settlements of this type apart from Oujda the eastern outpost and regional centre of Morocco.
Chapter 18

AGRICULTURAL REGIONS - II

ALGERIA

The physical distinction that was made between eastern and western Algeria is reflected in the agriculture of the country. Eastern Algeria is humid and generally elevated. Western Algeria is semi-arid in the real sense of the word, rainfall being below 20" over the larger part. This combined with the extremes of temperatures and higher variability of rainfall gives this region a character analogous to West Punjab (cf Chapter 1). With its alluvial valleys and plains brought under the plough by irrigation, the higher plains and plateaux under dryland cultivation, Western Algeria constitutes a zone of real interest for this enquiry. Within its bounds are present the many problems of agriculture we discussed in earlier chapters. The writer concentrated his attention on certain parts of this region, notably the Shelif valley for irrigated cultivation and the plateau of Mostaganem and the Dahra Massif for dryland crop-production. The rest of the region was studied in the field in a general manner without specific sample studies.

Eastern Algeria has not come in for detailed field studies except in the Mitija plain and the Sahel of Algiers. Apart from being representative of comparatively humid conditions in Algeria, this area is of special intrinsic interest by reason of the many facets of its agriculture and also because this is perhaps the most intensively cultivated part of Barbary.

Finally although beyond the real compass of this enquiry, a visit was made to the Biskra oasis to study conditions
of oasis cultivation with special reference to the date-palm which is grown in large numbers in the south-western districts of West Punjab.

The plan followed is to work inland taking each zone of lowlands or highlands in sequence.

Western Algeria

The conformity of agricultural zones with physical ones is a broad one and in the following account we shall see how variations occur in zones of similar rainfall and physical character due to the human factor. The basic variant in the cultural influences is the extent and intensity of European colonisation.

1. THE VINELANDS OF NORTH-WESTERN ALGERIA

This coastal region extends from the western boundary of Algeria to Mostaganem and except for the mountainous part, is characterised by the predominance of vineyards. Most of the land is in the possession of colonists. The influence of colonisation has combined with the natural advantages of the soil and climate for vines, fruits and truck crops to give the agricultural landscape a "European" appearance. This refers as much to the intensity of cultivation as to the nature of rural settlements.

Physical Background

The region consists of parts of the two northernmost zones of Tell Atlas of Western Algeria - the coastal highlands and the northern plains. The coastal highlands consist of the
Sahel of Oran rising precipitously from the coast and the plateau of Mostaganem, the two being separated by the depression occupied by the Macta marshes. South of these extend the low-lying plains of Mleta and Habra characterised by alluvial but waterlogged soils. They lie generally below 200 feet.

The plateau of Mostaganem was studied in some detail as a colonised region lying in close proximity to the Dahra Massif which was also studied intensively as a region typical of native agriculture. The plateau lies south of the Shelif gorge and is bounded on the south and west by low lying plains above which it rises with a steep slope. The ascent from the coast is similarly abrupt. Most of the plateau surface lies between 600 and 800 feet and is marked by gentle undulations. South-eastwards, the plateau is bordered by the Ben Hachel range rising to a height of 1600 feet. It is wooded for the most part and dissected by numerous deep narrow valleys sloping towards the Mina river. Rainfall in the coastal sector seldom exceeds 20" and is usually about 16". Depressed regions receive less, i.e. Arzeu near the Macta marshes receives a bare 13". Mostaganem has a rainfall of 15". High coastal humidity makes up for the deficiency of precipitation to some extent and cultivation of vines and vegetables is possible without irrigation. Rainfall in the lowlands to the south is less than 16", Pemegaux receiving 13.5". Here irrigation is necessary for non-cereal crops.

Soils in the coastal region and in the plateau of Mostaganem are light and sandy and are thus well-suited for
vines and vegetables. The alluvial soils of the low-lying plains are heavier and often salty and waterlogged. Drainage has to be provided for artificially and the extension of fruit culture has been hindered because of salinity over considerable areas.

Land-use and Farm Types Most of the cultivated land is under vines that are grown almost exclusively by Europeans. Market-gardening is carried on around Oran and Mostaganem in small holdings of 10 to 20 acres and tomatoes are the most important crop grown as an early vegetable. Steep hill slopes are under barley. Over 45,000 acres are irrigated around Perregaux and St. Denis du Sig from the Bu Hanifia and Sheurfas dams respectively. Here citrus has been extended on drained lands and early vegetables occupy a high percentage of the land. But the dominant crop in the region as a whole is the vine. Among the colonists, those of Spanish descent form an appreciable percentage.

In the Mostaganem plateau market gardening dominates in the vicinity of the town. Further away it is vines that occupy almost all the land. Southwards, with increasing distance from Mostaganem, cereals begin to figure.

Farm 11 lies 16 miles to the south of Mostaganem at Bouguerrat and consists of 550 acres (230 Ha). It is managed by the widow of its European owner who lives in Mostaganem with the help of a foreman resident on the farm. It was cultivated as follows this year: (1949)
220 acres (90 Ha) under vines
12 " (5 Ha) " vegetables
75 " (30 Ha) are salty and the rest are under barley, oats and lucerne

Of the vines 130 acres (55 Ha) have been planted only this year being renewals of the old plantation which suffered damage during the war. They are not expected to yield till after four years.

Barley and oats are cultivated in a biennial rotation with cultivated fallow each alternate year. Lucerne covers only a small area - 25 acres and is a prized forage crop yielding seven cuttings a year. The vines, vegetables and lucerne are irrigated by means of a number of wells, two of them worked by electric motors and five by oil engines. The vine yields are consequently high - 4450 lbs of grapes per acre (50 Qx per hectare) and the farm has its own wine-making cellar capable of storing 10,000 hecto-litres.

Of the 40 permanent wage-workers on the land, three are European, these being the foreman, the mechanic and the distillery expert. Agricultural operations are conducted by means of machinery but 30 mules and horses and 12 cows are also maintained on the farm, the latter for milk. The farm buildings consists of a walled enclosure with the houses of the European workers in one corner and animal stalls and rooms for tractors etc. all round. The wine-cellar is housed in a separate building.

Around the farm stretches an undulating expanse where as many fields are planted with vines as with cereals. Scattered
native mud huts appear here and there even among vineyards. These may as often be owners as workers for realising the profitable nature of vine-cultivation, many Muslim peasants grow vines although they scrupulously abstain from making wine on their own properties and sell the grapes to distilleries.

**Rural Settlement** The vinelands are characterised by the prevalence of European farms and villages outside the large towns like Oran and Mostaganem in which a large proportion of the European landowners live. As in the case of Farm 11, landholders prefer to enjoy the amenities of town life, exercising supervision over the farms by frequent car trips and through the services of resident managers. The Algerian local population lives mostly in huts in their villages and hamlets amidst cereal lands. Those who can afford it have, however, adopted the European type of habitation with gabled roofs and brick and cement walls. Marshes and waterlogged areas are avoided by sedentary settlements as also are the numerous salty depressions that occur around Oran.

In the Mostaganem plateau, European villages are located at the edges immediately above the steep slopes or at their foot. Thus Belle Cote and Ain Tedles are two large villages above the Shelif gorge while in the south Noisy-les-Bains, Ain Sid Sherif and Abukir lie at the foot of the southern edge. The mixture of French and Arabic names of settlements recalls the fact that while many of the European settlements were founded anew, others occupy the sites of earlier Algerian settlements.
THE DAHRA MASSIF

East of the vinelands described above extends a region of mountainous relief which is cultivated mostly by the native population. It constitutes a zone of interest because of its low precipitation and because it typifies the conditions under which the great mass of the peasants of Algeria cultivate their lands. Colonists are present, of course, on the richer lands along the coast and in some parts of the Massif but the proportion of land held by them is small. From this region has been chosen the holding of a fellah for a detailed and close study and side by side, within a short distance of his land, the farm of a colonist has been described. The position of the two farms in relation to relief has been indicated on map drawn on the basis of field observations but with the principal heights and other significant features drawn from a 1:50,000 map.

The Physical Background: The Dahra Massif extends from the gorge of the Shelif eastwards along the coast, bounded on the south by the Shelif valley and on the east by the Damous river. Its relief consists of two main surfaces. The plateau surface between 1800 and 2000 feet occurs in the central part of the region and is characterised by gentle slopes. The limestones stand out as crests between basins consisting mainly of marls. This type of landscape is illustrated by photograph. On the coastal fringe, a mountainous surface dominates with peaks in the eastern part exceeding 2500 feet. The mountains
rise steeply from the coast and are capped by precipitous scarps. Valleys are deep and narrow and transverse to the coastal range. There is almost no coastal plain, the stretch of a few hundred yards width being the light sedimentary deposits from the erosion of the mountains. The mountainous topography with steep slopes and deep narrow valleys again becomes apparent at the southern periphery of the Massif although the general elevation does not exceed 2000 feet. There is, in other words, no range of hills bordering the plateau surface on this side but mountainous relief prevails because of the abrupt descent to the Shelif depression. Some of the larger tributaries of the Shelif have carved out valleys with a gentler relief which provide the principal means of access to the plateau. Such, for instance, is the valley of Wahrane north of Orleansville along which the writer journeyed into the central region. Topography in the Paul Robert area which may be taken as being typical of the plateau surface is not rich in the contrasts that characterise the mountainous fringe. There are the limestone ridges which rise with concave slopes and lie at 1800-2000 feet while between them lie basins 200-300 feet deep sloping towards the exterior of the Massif. It is these basins which provide deep and rich soils for cultivation and as photo/illustrates, the steep upper slopes with thinner soils are under cereals while the deeper soils at the bottom are devoted to vines.

Eastwards, the topography is rounded and slopes are convex along the road from Orleansville to Tenes. Here as in
other parts of the Massif, the slopes are deeply gullied by erosion and untrenched fields present a much scarred surface. Approaching the coast at Tenes, the scarp-faced coastal heights rise impressively, the ridge east of Tenes dominating the surrounding landscape with its rocky escarpment exceeding 3000 feet. Soils are generally skeletal and on the higher slopes, non-existent.

The coast from Tenes westwards presents a uniform aspect of an extremely narrow coastal lowland never more than a quarter of a mile wide lying at the foot of forested hills rising steeply to heights of 1500 to 2500 feet.

Mean annual rainfall varies from about 22" at Tenes to about 16" in the west on the coast while the Massif itself gets an amount varying from 19" at Casaigne in the west to 15" at Paul Robert in the heart of the region.

There are no streams of considerable magnitude within the Massif and the peripheral rivers are not susceptible to being utilized for irrigation especially when the terrain itself is unfavourable.

**Land-use and farm types** The coastal strip is everywhere planted with vines by European colonists who are spread at intervals all along the shore and cultivate the slopes above with cereals. The steeper slopes of the main coastal range are cultivated by Muslim peasants who also maintain considerable herds of sheep and goats as the soil is poor and suitable mainly for pastures. Two farms were visited in this coastal zone which from the point of view of rainfall, should
be regarded as distinctly semi-arid.

Farm 12 lies on the coast 55 miles to the east of Mostaganem and consists of 450 acres (180 Ha) belonging to a European colonist. Of this only 170 acres/are under the plough, 75 acres (30 Ha) being under vines and the rest under cereals. The vines do not give as high a yield as those in the humid east Algerian vineyards but their quality is much higher so that one makes up in price what one loses in quantity. The main varieties grown are Carignon, Claret and Cot, their alcoholic content being 13°. They are subject to mildew, the pest that is found almost everywhere in lands subject to humid breezes. Another disease of the vine here is oidium for which the treatment is sulphur sprays. Wheat and barley are grown in a biennial rotation with cultivated fallow over half the land and leguminous plants over the rest. Yields approximate 900 lbs to the acre (10 Qx per hectare)

The farm has one tractor but also uses mule-driven modern French ploughs on steeper land which is terraced. There are 12 permanent workers who live near the farm but during the grape-picking season the number is trebled. Among the farm animals are 6 mules, 10 bullocks, 4 cows for milk and 80 sheep which graze on the uncultivable slopes. The fallow lands are manured before a crop is sown and one third of the vine-lands receive composite nitrogenous fertilizer each year in rotation.
View of the coast from the lower settlement on Farm 7 (height 500'). Note the narrow coastal plain which is planted with vines. Buildings of a European farm are also seen. The slopes between the coastal strip and the camera are given over to grazing. Scattered trees are the remnants of a once abundant vegetation. Part of a conifer (a pine) is seen to the left.

This photograph contrasts the unbroken land covered with dwarf palms on the left of the wadi with the cultivated land to the right. The former is part of Farm while the latter belongs to a European settler. The crop is barley. The position of this photograph is indicated on map.
This photograph shows the two types of plough used on Farm 7. In the foreground the second son of the head of the family holds a French iron plough. Behind, the wooden plough which is the traditional implement used everywhere in Barbary with only an iron point at the end of the ploughs have to scratch the ground. The background is cactus. Hut on the right houses farm implements.

The cultivators of farm 7. The aged owner is second from left. This photograph illustrates two principal articles of dress worn by the fellahs - the long "burnous" or flowing robe coming down to the ankles and the shirt and baggy trousers that are worn underneath.
The owner hopes to extend the area of his farm utilised by one fourth by planting figs and carob trees and also by terracing the forest covered slopes. He was the most liberal-minded colonist the writer encountered anywhere in Barbary and was immensely popular among the Muslim cultivators around his farm to whom his advice and assistance was always available. Unlike most Europeans who tend to blame the fellah for his backward methods, he accepted them as the traditionally established mode adapted to the environment and felt that the standard of cultivation could not be raised unless the standard of living also rose among the small peasants. This can best be achieved in his opinion by allowing the Muslim peasantry a greater degree of freedom from the control of official improvement organisations on one hand and the native landlords on the other both of whom exploit the peasant under a facade of wordy sympathy. The fellah's need was for the safeguarding of his property against encroaching hands as well as for helpful guidance. The colonist in question has given parcels of 2\frac{1}{2} to 5 acres of land to some of his permanent workers in addition to their wages.

Farm 13 is a fellah's holding 3 miles to the south-east of Farm 12. Its position is indicated on contour-sketch and it lies on a broad spur above the narrow coastal fringe of lowlands at a height of 200 to 300 feet, the higher forested part of the farm being up to nearly 300 feet high. The total area of the holding is 250 acres (100 Ha) and it belongs to a joint family consisting of half a dozen households. The area cultivated
covers only 62 acres (25 Ha) most of it in sloping, unterraced fields in which gullies were already making headway. The entire cultivated area is under cereals, mainly wheat, mostly the hard variety, and barley. On the remaining lands are grazed 3 cows, 25 goats and 15 sheep. In addition 6 donkeys and 3 mules are kept for ploughing etc.

The owning group is headed by an eighty-year old man who still leads the farming operations. He has cleared most of the land with his own hands during a lifetime, having obtained the hill-side entirely covered with pines. He has two traditional ploughs and one iron French plough. (see photograph) The latter does very well but when in use all the three mules have to be yoked to it so that less work gets done. The outlying lands are cultivated under a biennial rotation with alternate fallow but the lands near the huts get night-soil and animal manure and are cultivated every year. Yields per acre are 180 to 270 lbs. (2 to 3 Qx per hectare) on the outlying lands and twice that much on the well-manured lands near the settlement. In years of good rainfall (both in quantity and distribution) the yields are easily doubled.

The group's settlement consists of half a dozen thatched huts (gourbi) whose construction can be noticed on photograph. There are two groups of huts, one 300 feet higher than the other. The higher group is open and exposed to the sea breeze and is used in summer. The lower group is protected by trees and also has a number of huts for animals and farm implements. These are used during the winter.
The head of the group has in recent years introduced some new varieties of wheat - Florence Aurore and Mahmoudi. He also proposes to grow beans in rotation with cereals. He complained that high taxation prevented him accumulating any savings for improving the farm and in fact put him to great hardship in years of drought.

This is a typical peasant-holding in Barbary and its description should facilitate an understanding of the petty fellahs who are the backbone of the agriculture of the region and with whose progress is linked up the whole future of crop-production in Barbary. The comparison of the two neighbouring farms should also illustrate the difference of centuries between the mechanised agriculture on the colonist's holding and the rudimentary tillage practised by the fellah. This juxtaposition of the ancient with the modern is characteristic of Barbary and constitutes a real problem for the administration which has to provide advanced modern facilities of experimental research and improved machinery to the large landowners, mostly European and at the same time attempt to uplift the great mass of smallholders who barely make a living in favourable years and starve under those of drought.

Most of the Dahra Massif is cultivated in holdings of Type A but over many parts of the plateau section notably around Rabelais, Paul Robert and Renault many villages of colonists have
been founded and vines have been planted over large areas surrounding them. Thus Paul Robert, 35 miles north-west of Orleansville, has about 90 colonists each having 150-180 acres cultivated mostly with vines. The village has its own co-operative wine cellar. On native lands cereals are grown for the most part on unvegetated fields. Barley occupies a higher proportion of these lands than hard wheat.

**Rural Settlement**

Three main types of settlement can be distinguished in the Dahra Massif. On the coastal lands occur isolated farms of vine-growing colonists with an occasional small agglomeration such as La Guelta, Point Rouge and El Mersa. On the steep slopes of the mountain surface, small native hamlets occur on spurs or even on tops of hills consisting mostly of gourbis of the type shown in photographs and Hill-top settlements are rare along the coast because of scarped or rocky upper slopes but many of them occur above the Shelif Valley. Finally, on the plateau surface, larger agglomerations are to be found. These may consist of colonists' villages with modern stone and cement houses with tiled and gabled roofs such as Rabelais, Paul Robert, Renault or native villages consisting mainly of gourbis. Both the types are found either on the limestone crests or on spurs above the valleys of streams.

**THE SHELIF VALLEY**

As was established in earlier chapters, the Shelif Valley presents many points of resemblance to the West Punjab plain.
Its relief and rich alluvial soils are great assets from the agricultural point of view. So great, however, are the extremes of temperatures and so low and variable the rainfall that the region has been called "a corner of the Sahara lost in the Tell" (1) These conditions are especially remarkable as the region lies within 30 to 40 miles of the sea and are due to its being in the rain shadow of the coastal Massifs on the one hand and the Moroccan Atlas ranges on the other. The agricultural development of the region, long since retarded by the inadequate water resources of the Shelif, is now proceeding apace as the waters of some of its tributaries are being stored by means of dams and a constant supply for irrigation maintained. Herein lies another close parallel to West Punjab as also in the existence of considerable areas of salt-impregnated land in the lower part of the valley.

Relief, Climate and Hydrography The Shelif Valley occupies a structural depression between the Dahra and Zaccar Massifs in the north and the Warsenis Massif in the South. As described briefly in chapter II, the valley is divided into three parts by the encroachment of mountainous topography at two points, the three sub-divisions being the plains of Affreville, Altafs and Orleansville.

The plain of Affreville is 24 miles long and attains a maximum width of 8 miles in the centre. Commencing below Lavigerie at an elevation of 1000 feet it descends to a height

(i) M.Barbut "Les Régions Agricoles" E.C.M. Algerie, p.278
of 825 feet in the west. Above Lavigerie, however, there is a narrow basin centred on Dolfusville. The plain of Affreville is traversed by the meandering course of the Shelif in the middle. A cross-section of the valley reveals an increasing slope away from the river. The steep slopes of the massifs do not commence till 1200' in the east and 900' in the west. Few important tributaries join the Shelif in this part of the valley and the larger affluents are those from the south so that the steeper fan slopes approach closer to the river. A notable feature of hydrography is that some of the tributaries flow parallel to the Shelif for long distances before finally flowing into it. Wadi Taane meanders in this fashion for 15 miles, sometime lying less than half a mile from the river. It flows, however, between high banks. The Shelif Valley narrows down to less than a mile as a hill projects northwards from the Massif of Warsenis.

The **plain of Aktafs** below this constriction is of roughly the same dimensions as the plain of Affreville, its length being 25 miles and the breadth 5 to 6 miles on the average. In this section the Shelif descends from over 800 feet to about 450 feet so that the gradient is steeper than in the plain described above. There is the same sequence of a gentle plain slope towards the river above which lies the intermediate slope for another 200 to 300 feet before the steep slopes of the Massifs set in. This intermediate slope is of importance from the point of view of native agriculture and settlements. The
river meanders greatly in the plain of Altafs flowing in the eastern half close to the southern side of the valley and shifting to the northern side towards the west. Occasionally a low hill approaches close to it. Several tributaries join the river in this region and their valleys extend the plain surface northwards or southwards according to their direction of origin. The larger affluents from the north include Wadis Ebda, El Argh, Kremis, Boukalli and Taria while the principal ones from the south are Rivina and El Had. Their fans are occupied by the larger rural settlements. This part of the Shelif Valley terminates below the confluence with Wadi Fodda.

The plain of Orleansville is the largest in dimensions being about 60 miles long and 5 to 8 miles wide. Unlike the above two sections which lie approximately east-west, the valley is aligned ENE to WSW for its large part and descends from 340 feet above Ponteba to 140 feet at its confluence with the Mina. North of Orleansville lies another plain which extends eastwards for 15 miles and is separated from the main valley by a low ridge known as Montagnes Rouge which barely exceeds 750 feet in elevation. This plain is drained by the Wahrane whose valley converging with the Orleansville plain gives it is maximum width of 12 miles north of Malakoff.

The Orleansville plain has an almost flat surface, there being no extensive intermediate slopes towards the Massifs. Except for a hill which rises 300 feet above the plain in the
middle below Charon, the surface is singularly uniform in aspect. In the west, the alluvial soils which characterise the entire Shelif valley are impregnated with salt so that the plain is sterile and unproductive over large areas. It is separated from the Relizane plain by a slightly elevated tract occupied towards its south by the Sebkra of ben Ziane. Within the valley itself, several small depressions occur locally in this section. One of these, a little to the east of Inkerman is occupied by a marsh (Merja of Sidi Abed)

In this part of the Shelif Valley enter some of the largest tributaries of the river, those from the north including Wadis Wahrane, Ras, Tarhia and Razzal, considerably larger Wadis from the south being Tsirhaoul, Sli, Tafelout, Riou and Jidiwia.

The soils in the Shelif Valley are everywhere alluvial and they differ only in texture from the lighter and coarser soils of the alluvial cones of the wadis to the heavier and sometimes impermeable soils near the river. The saline soils of the lower Orleansville plain were described in Chapter 13.

Attention was drawn to the extreme continentality of climate of the Shelif Valley in the chapter on climate. Rainfall decreases from about 19" (473 mm) at Affreville to 17" in the plain of Altafs, 16" (400 mm) at Orleansville and only 13" at the western extremity of the valley. This is extremely variable in total amount and even the average departures from normal exceed 20% as will be seen on map 3 showing variability of

rainfall in Algeria. Orleansville received about 10" of rainfall in the agricultural year 1919-20 and the lower part of the valley even less. In 1927-28, the agricultural year had a total rainfall exceeding 20" everywhere in the valley with the western part receiving over 30". (1) There is also the accompanying variability of the season of incidence which renders agriculture even more insecure.

Temperatures in the Shelif Valley reach some of the greatest extremes in Barbary. At Orleansville, the mean minima and maxima are 41°F (in January) and 101°F (in July) respectively but the extreme minimum recorded was 28°F while the extreme maximum was 117°F. At Les Altafs in the Altafs plain not only are the mean minimum and maximum temperatures more extreme - 37°F and 102°F respectively but the lowest and highest recorded temperatures also shown a more marked continentality being 17°F and 119°F.

The water resources of the Shelif Valley itself are much smaller than might be imagined from the large number of tributaries that enter what is the longest river in Barbary. The great variations in the flow of the Shelif were pointed out in Chapters 4 and 12 and shown graphically as well. Wadi Fodda one of the largest tributaries on which a dam has been constructed, had a total flow of 916 million cubic feet in 1926 but two years later it exceeded 8700 million cubic feet.

(1) Ibid, Maps 51 and 52 between pages 148 and 149.
View of Affreville Plain below Lavigerie. Soft wheat fields extend from the foreground into the distance. Notice the "line of the Miliana Massif on horizon.

Photograph of the northern slopes above the Affreville plain. They are cultivated with hard wheat. Scattered olive trees. Notice the lower limit of scrub vegetation.
View of Affreville Plain below Lavigerie. Soft wheat fields extend from the foreground into the distance. Notice the outline of the Miliana Massif on the horizon.

Photograph of the northern slopes above the Affreville plain. They are cultivated with hard wheat. Scattered olive trees. Notice the lower limit of scrub vegetation.
Another view of the Affreville plain from the northern slope showing cultivation of vines. Scattered olive trees can be noticed among the vine.

Fruit packing factory at Orleansville established only a year ago. It also has facilities for storing fruit in refrigerated chambers.
Irrigation directly from the rivers although practised till recently has been so insecure that huge dams storing several years flow have had to be constructed. The underground water-supplies are limited owing to the depth of the alluvium and the fact that the Shelif flowing in the lowest part of the valley acts as a drain. Only in the plain of Orleansville where the valley is flat and there are clay strata in the alluvium does the water-table rise to within 16-20 feet of the surface around Inkerman.

**Land-use and Farm types**

Most of the valley bed has been colonised and on these lands cereals are grown in large holdings replaced by orchards of citrus and other fruits wherever irrigation facilities exist. The Muslim peasants are confined for the most part to the steeper valley sides and grow cereals principally although small olive groves are maintained here and there. These traits constitute the agricultural unity of the valley as a whole. In the three sub-divisions, however, there are local traits and peculiarities of distribution which can be brought out on closer analysis.

**The plain of Affreville** receives over 16" of rainfall everywhere so that most of it is already cultivated without irrigation. Local irrigation supplies i.e. from springs, have resulted in the planting of citrus plantations in one part of the plain towards the south. Vines are also grown without irrigation. Diagram gives an idea of the distribution of
various cultures. It does not show the small Dolfusville basin which is almost entirely under vines.

Most of the plain is cultivated by European holdings of 300 to 600 hectares. Soft wheat is the main crop, barley occupying only 10% of the area. Flax has been extended greatly in recent years. Cereals are cultivated on a biennial rotation with one year under ploughed fallow. Larger quantities of superphosphate are applied than is usual elsewhere (6 Qs per hectare as compared to 3 or 4) because the soil is lighter. Green-manuring is also resorted to with beans and lentils. The average holding of Muslim peasants on surrounding slopes consists of 25 acres (10 Ha) and is cultivated with wheat and barley in equal proportions. The average yields obtained by the Europeans and native cultivators may be contrasted in the following figures:

<table>
<thead>
<tr>
<th></th>
<th>1947-48</th>
<th>1947-48</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wheat</strong></td>
<td>Europeans</td>
<td>Muslims</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td><strong>Barley</strong></td>
<td>20-22</td>
<td>13</td>
</tr>
</tbody>
</table>

It may be added that the Europeans possess the richer lands, use fertilizers and agricultural machinery. They also practise dry-farming and plough the fallow lands in July after the harvest, again in December and January during the rainy season to destroy weeds and finally before sowing in October.

(1) Supplied by the Regional Agricultural officer at Miliana.
Schematic Diagram of the Petticure Plain Showing Distribution of Principal Crops
Sketch of Affreville Plain showing method and accuracy of field study.

Rivers, settlements traced from 1:200,000 map; details plotted from field observations and from 1:50,000 map.

--- Route of main water

Limit of plain
Drainage channel
Railway track

Limit of steep upper slope where observed

Dense vegetation
Countryside settlements

Deep valleys
Galleries observed

Contours roughly plotted from 1:50,000 map
Significant heights
Canyon-like valleys

Red deca clay soil (hams) where observed
Alunial soil with clay substrata; subject to waterlogging; observed

Far slopes

MAP No

47

For distribution of crops in the Affreville Plain, see diagram.
Vines give average yields of good quality wine, the usual amount obtained per acre being 16 hectolitres. Carignon is the main variety grown. As for fruits, figs and olives do very well on the slopes but citrus fruits do not flourish because there is a heavy fall of fruit after the sudden rise of temperature in June. A few orchards of Washington Navels and Valencia Late have been established.

The region of Affreville has possibilities of becoming a centre of dairy industry but the larger towns are too far away to allow any great expansion. The total areas under the main crops in the Affreville plain and its environs are (for 1947-48)

<table>
<thead>
<tr>
<th></th>
<th>Natives</th>
<th>Europeans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>50,000 acres (21,000 Ha)</td>
<td>37,000 acres (1,500 Ha)</td>
</tr>
<tr>
<td>Vines</td>
<td>-</td>
<td>11,500 &quot; (4,650 Ha)</td>
</tr>
<tr>
<td>Citrus fruits</td>
<td>875 acres (355 Ha)</td>
<td>1,100 &quot; (450 Ha)</td>
</tr>
</tbody>
</table>

The northern part of the plain is subject to water-logging and is drained artificially. The problem is not very serious however as on either side of the draining ditches, crops are now flourishing. There are two co-operative olive oil mills and three co-operative wine cellars in the region. About 75000 acres in this region are going to be irrigated by the Ghrib dam in a few years. Irrigation water is already being supplied to the eastern part of the plain below Lavigerie.

The Plain of Attafs is mainly under cereals again though vineyards are interspersed fairly extensively among the
cereal lands. Holdings of the type C (large cereal-growing farms) and D (large mixed farms with fruits, vines) predominate in the centre of the valley which is mostly colonised. The slopes higher above are cultivated in holdings of type A (small cereal-growing farms) by native cultivators. As in the plain of Affreville, groves of figs and olives are scattering among native lands. The Attafs plain is at present the poorer part of the Shelif valley where irrigation has not been developed considerably. A local dam at Carnot provides irrigation water during the rainy season. There is no scope of large-scale developments similar to those in the other two sections in the immediate future. The western extremity of the plain is partially irrigated from the Wadi Fodda dam.

The plain of Orleansville was among the first interior parts of Algeria to be colonised on a large scale. Irrigation has long been practised by means of local barrages at Ponteba, Malakoff and Charon. The supplies were neither constant nor secure however and perennial irrigation became possible only when the Wadi Fodda Dam was completed. The total area irrigated at present from this source as well as the percentage under different crops was indicated in the chapter on Irrigation. Map 75 shows the areas irrigated and the areas whose irrigation is projected when the supply from the dam is fully developed. The table in the chapter on Irrigation showing the proportion of irrigated area under various crops indicated a high percentage of it as ploughed fallow - 46.76%. This is the area which is at present being prepared for citrus and other fruits. The
Plan of the "Vergers de l'Oued Fodda".
low percentage indicated for olives is due to the fact that the Orleansville plain is planned to become one of the main centres of the citrus industry in Barbary. Extensive areas on either side of the river are being planted with oranges, clementines, grape-fruit and apricots. A fruit-conserving and packing plant has already been installed and is shown on photo

Among the farms and plantations visited in the Orleansville plain was the "Vergers de l'Oued Fodda", a citrus plantation 12 miles east of Orleansville belonging to a European company. All but five of its 243 acres have been planted with oranges, mandarines, grape-fruit and apricots. The distribution of these fruits on the plantation is indicated on diagram along with the windbreaks. All the fruit trees planted consist of modern early maturing or late varieties already mentioned under crop-production. The plantation receives irrigation from the Wadi Fodda Dam and also has two tube-wells of its own. It is run as an organised commercial estate with a resident manager; meteorological observations are made regularly and the whole work is done by modern agricultural machinery. High yields are obtained averaging 325 lbs. per tree for the citrus fruits. According to the observations made at the plantation during the past 12 years, rainfall has averaged 17.6" with considerable variations in defect and in excess as well as in the period of incidence. The extreme minimum temperature was 17°F while the highest recorded temperature reached 118°F. The plantation has a permanent establishment of 60 workers which is augmented to over 100 when the collection of fruit is in progress.
Two plantations of a European colonist consisting of 540 acres (221 Ha) are similarly almost entirely under fruits. A difference between the lighter soils to the north of the river and the heavy soils with a sub-soil crust of impermeable clay to the south on its bank is reflected in the yields which are lower for the latter. The crust has either to be mechanically broken up at great expense or trees specially grafted to spread their roots. In this zone, some cereals and forage crops are also grown. To the writer this appeared to be a case where plantation of citrus had been carried into a zone where it is no longer feasible.

Farm 16 belongs to the leading Muslim notable of the plain and consists of two main parcels, one of over 2200 acres (900 Ha) to the north of the Shelif bordering the Dahra, the other along the river to its south and covering 250 acres (100 Ha). The former represents the unirrigated section of the region and 1975 (800 Ha) of it is under cereals, the rest being reserved for pastures. The other section along the river has largely been planted with citrus and other fruits.

The larger section of the farm lies in a zone where relief is already undulating. Some of the slopes cultivated by fellahs having type A holdings are subject to gully erosion and yield miserable crops. The larger fields of the landlord in question are worked by tractors and mechanical ploughs and with the help of fertilizers (super-phosphate), they yield 1070 lbs per acre (12 Qx per hectare) of soft wheat (mostly
Florence Aurore) and up to 900 lbs (10 Qx) of hard wheat. A biennial rotation is applied with cultivated fallow. Apart from 25 mules and horses, 12 cows are maintained for milk. Despite its huge area only 25 permanent workers are required. The landlord is a hereditary religious dignitary and the workers are descended from his followers so that they are long since established on his estate. It may be indicated that this is the only large Muslim estate in the plain of Orleansville and has survived the inroads of European acquisition because of the religious following of the owner.

The second part of the farm resembles the other citrus and orchards, is irrigated from the Wadi Fodda dam. It may be noted that although it is smaller in area, it requires 50 permanent workers because of the intensity of the work required in taking constant care of the trees. Yields from the oranges compares with those obtained from European farms, i.e. 300 lbs per tree compared to 325 in the "Vergers de l'Oued Fodda" from younger trees. At present only 150 acres are under fruits but further irrigable areas are being prepared.

Below Orleansville, the citrus orchards continue for some 15 miles along the Shelif. Then we come to the lower plain of the Shelif where the rainfall is less, the irrigation by ordinary weirs less secure, consequently citrus orchards are less important. European colonisation is still dominant however marked by big modern farm buildings surrounded by extensive
orchards of olives and occasionally, also fruits. As we approach Relizane and the plain of the Mina, extensive sterile zones covered with sparse grass begin to appear. These are the salt-impregnated areas. Passing by the large Sebkra of Ben Ziary we come to the flourishing irrigated region of Relizane.

Slopes to the north of the Orleansville plain are gentler than those to the south and have largely been denuded of their vegetation by the native peasants driven off their land by European colonization. How the unprotected slopes have been ravaged by erosion and deprived of their fertile soil was indicated in the chapter on Soil Erosion. These slopes as well as a large part of the secondary plain east of Wadi Wahrane are cultivated by native small-holders with cereals, principally hard wheat and barley. The steeper and rockier slopes of the massif of Warsenis are partly wooded, partly cultivated but the pastoral activity here takes precedence over the agricultural one.

Rural Settlement: The primary distinction made in describing land use between the colonised low-lying part of the valley and the native-owned lands on the higher slopes determines the nature of settlements. Most of the larger settlements in the valley are European villages with orderly streets and modern cement and brick houses. They lie along the principal roads and the railway line which traverses the Shelif Valley. Their geographical location, however, presents points of great interest.

Most of the European settlements lie along the northern or southern fringe of the valley and the majority of them are
located on the alluvial cones of the larger tributaries of the Shelif. In the plain of Affreville, there is no stream of any size joining the river so that no large alluvial cone is formed. Here the principal colonization villages are situated to the north of the Shelif at the foot of the Massif of Miliana. They are from east to west Lavigerie, Affreville (which is also the regional administrative centre) Lavarande and Littre. Scattered European farms also occur especially to the south of the river. In the plain of Attafs, settlements lie on the alluvial cones of the principal tributaries where they emerge from the Massifs. Kherba and Carnot lie on Wadi El Argh and Boukali respectively to the north of the river while the southern settlements are Duperre, Rouina and Les Attafs. The same principal applies to the Orleansville plain where most of the larger settlements are to the south of the plain as it is from the Massif of Warsenis that the larger tributaries emerge. Settlements on the southern cones are from east to west Ponteba, Orleansville on Wadi Tsinhaoul, Malakoff on Wadi Sli, Charon on Wadi Tafelout, Inkerman on Wadi Riou and St.Aime on Wadi Jidiwia. The most notable European settlement to the north of the river is Warnier on the cone of Wadi Wahrane. In addition isolated modern farms are scattered in the irrigated regions marked by the usual concentrations of the gourbis of their workers which are more often located some distance away as small hamlets.
Native settlement in the Shelif valley is concentrated on the higher slopes where most of their lands are. Here they lie as small hamlets on the spurs above the valleys. On the slopes of the Massif of Miliana north of the Affreville plain, mud houses are prevalent. Westward gourbis are as common as houses and most villages are a mixture of the two. The gourbi is the dominant habitation in the western part of the Shelif valley. Native villages in the low-lying part of the valley avoid the river in the Affreville and Attafs plains but lie close to it in the Orleansville plain. They become more numerous wherever hilly topography approaches close to the river. Thus the Zekakra hill on the Attafs plain, the Montagnes Rouge north of Orleansville have dense native settlements. Large native villages lie east of the Wadi Wahrane close to the irrigating wells. It must be added, however, that the basic fact of the concentration of native villages on the slopes fringing the valley populated by Europeans is essentially true for most of the Shelif Valley.

THE PLAIN OF RELIZANE:

The plain of Relizane is separated from the lower part of the Shelif Valley by the slightly elevated basin occupied by the Sebkra of ben Ziane. It is almost entirely irrigated and largely colonised. The percentage of principal crops in this area as well as the influence of salinity were indicated in earlier chapters. The distribution of main crops and settlements will now be described in the plain itself as well as in the
surrounding area.

The plain of Relizane consists of the alluvial deposits of the Mina, one of the principal tributaries of the Shelif. The upper and somewhat steeper slopes above 200' mark the alluvial cone formed by the river. The plain itself lies below this height and slopes very gently towards the north. It is surrounded by higher ground on all sides except for the narrow valley of the river in the north. This feature combined with the almost flat surface of the plain has resulted in insufficient drainage particularly at the periphery where the influence of the river as a draining agent is not felt. This area is saline. The main section around Relizane is prolonged westwards in the plain of Negma between 400 and 600 feet and southwards in the plains of Khurara and Twila lying between 300 and 500 feet.

Rainfall in the plain of Relizane is less than 16", Relizane itself receiving 13". The alluvial soils are fertile, hence the early development of irrigation in this region.

Land-use and Farm Types

Cultivation in the plain is almost entirely dependent upon irrigation from the Bakhadda Dam. About 20,000/(8000 Ha) were irrigated in 1947 but it is planned ultimately to increase this area to 33,000 acres (13500 Ha) Of this area cereals and pastures account for almost half, vegetables occupy about 17% citrus fruits 10% and olives about 5%. Holdings of type D and F dominate and 69% of the area is in the possession of European
settlers. The high percentage under vegetables is significant and a large proportion of the produce is exported as early vegetables to France. These have grown in importance in recent years because of the suitability of the light alluvial soils for intensive cultivation under irrigation as well as the relative proximity of the region to the ports of Mostaganem and Oran. High temperatures prevailing in the plain lead to early maturing. The main vegetables grown are tomatoes, potatoes and haricot beans. The fruit plantations are found mainly in the southern half of the irrigated sector as the gently sloping land is well drained and the reddish light soils are especially well-suited for fruit trees. Map 76 shows the irrigated area in the plain as well as the areas to be irrigated in future.

The higher plains west and south of Relizane are largely under cereals grown on holdings of type A and C. The slopes to the north-west have extensive olive orchards.

**Rural Settlement** Settlement within the plain is concentrated in the largely European town of Relizane lying at the centre of the irrigated sector. Two smaller European settlements lie at the eastern and western extremity of the plain at the foot of the southern slopes, these being Ferry and Clinchant. Scattered farms are few and a few smaller settlements occur along the Mina. Hamlets of gourbis are the characteristic settlements on surrounding slopes and plains. The influence of saline lands on settlements may be noted in that while the hamlets of the local population occur fairly closely to the west
of the Mina, they are few and far between to the east.

The Interior High Plains of Marnia, Sidi Bel Abbes and Mascara may be taken together with their fringing chains to the north and south. The Thessala range which approaches 3000 feet in height is largely devoted to hard wheat grown on holdings of type A. The northern slopes fringing the coast constitute a rich vine-growing region cultivated by Europeans in large holdings. The Sidi Bel Abbes plain is colonised largely by Spanish settlers whose holdings are smaller than the normal European ones being often less than 50 acres. Vines are grown and also cereals and olives. Dry-farming is practised. The Marnia plain further west has a similar character but citrus plantation will be expanded when irrigation water becomes available from the Beni Bahdel dam. The Mascara plain to the east also resembles the Sidi Bel Abbes region. The altitudinal arrangement of crops on both sides of the Mekerra shows the relative utilization of land. The lands immediately next to the river are under truck crops. Further up on the sloping ground are the vines while cereals are found on the ordinary lands at the general level of the plain.

Dry farming has long been practised in the Sidi Bel Abbes region. It is also the basis of agriculture in the plateau of Sersou which has been colonised by Europeans during the last thirty years and cultivated with cereals mainly with the help of this technique. Rainfall in this area is everywhere below 16″. Huge properties of 2500 to 10,000 acres (1,000 to
4,000 Ha) are found on which soft-wheat (Florence Aurore and Mahon) and barley are grown with cultivated fallow in alternate years. The cycle of ploughing is the same as described in the chapter on Dry Farming for Tunisia. Labour is entirely native. The great enemy of cultivation is winter frost but on the average high yields are obtained - averaging 1300 to 1780 lbs per acre (15 to 20 Qx per hectare). In actuality one excellent harvest is obtained in five years due to the variability of rainfall while in other years the crop may be mediocre to bad. Sheep and cattle rearing is carried on on a large scale by Europeans who have dug deep wells to provide watering points.

The mountains of Saida and Frenda at the southern edge of the western Algerian Tell and the Massif of Warsenis are devoted to grazing and so are the high plateaux with their extensive alfalfa grasslands.

EASTERN ALGERIA

THE SAHEL OF ALGIERS

Both in the nature of crops produced and the methods used in agriculture as well as the type of settlements, the region is entirely European in aspect. This is because this was the first part of Barbary to be colonised from which all traces of native culture have been completely eliminated and replaced by that of the settlers. The landscape with its larger regular fields, its network of modern roads, and its red-roofed villages could well belong to any recently reclaimed portion of the Mediterranean littoral of Europe.

Relief, Soils and Climate

The Sahel of Algiers extends from Algiers westwards to
Tipasa. It is split into two parts by the gorge of the Mazafaran and the eastern or main section is a compact and roughly circular plateau lying between 400-600 feet but exceeding 1300 feet at Bouzarea in the north-east. The western section consists of an elongated strip resembling the larger tract in its relief in the east but narrowing down to a ridge further west. The northern slopes towards the sea are generally steep. The main block shows a marked contrast between its eastern slopes behind Algiers which are precipitous and the western slopes that descent gently towards the coast. The Sahel is dissected by numerous streams so that the surface has an undulating aspect. The southern slopes facing the Mitija plain mark a descent of 400 to 500 feet in half a mile or so and are consequently steep.

Both relief and soils are influenced considerably by the outcrop of pliocene clays from beneath the sandstone-topped limestones which characterise most of the region. These marly clays erode into low rounded hills and give rise to heavy soils on which vines do not grow. The coastal belt consists of sandy soils formed from consolidated dunes which have given rise to terraces on the western coast of the Sahel - an indication of the recession of the sea as the region was elevated in sub-Recent times. It is only in this part of the Sahel that there is a narrow coastal plain.

With a rainfall of 24-32" moderate temperatures and high humidity due to its coastal location, the well-drained and rich soils of the region support excellent crops. Exceptionally high yields are obtained through the use of modern methods and
Cultivated land below Paul Robert. The slopes are under cereals—those that are terraced to the right are fallow. Lower land is under vines. White patch in the middle is ripened barley. Note the gently undulating plateau surface. The higher surface is rocky as can be observed from the abrupt termination of the slope towards the top.

The old city of Tenes lies two miles away from modern Tenes developed by the French on the coast. Avoidance of the coast by the builders of the original city was presumably for safety from raiding ships. Building in the foreground is administrative most houses flat-roofed. Beyond the wooded hills in the background, the top of the rocky coastal escarpement is seen.
The general aspect of the landscape in the Sahel. Photograph shows dissected plateau surface sloping towards the Mitija Plain (south-east of Algérie) planted with vines and with scattered European farms such as the one to the right. Picture looks towards south-east and faintly shows the mountains fringing the Mitija plain.

The other aspect of the Sahel where the pliocene clays are exposed. Rounded slopes devoted mostly to cereals and fodder crops. There are few farms and villages. A small village is seen to the left.
application of fertilizers by the European cultivators.

Land-use and Farm Types

The western section of mostly wooded in the west but the gentler northern slopes in the east are planted with vines. The coastal sandy soils are cultivated intensively and devoted mainly to early vegetables. All the land is held by Europeans in small to medium holdings.

Agriculture in the larger eastern part is much diversified. The area consists of prosperous fields of vines over the lighter sandy soils of the sandstone areas and cereals over the heavier soils that cover the pliocene clays. This difference in aspect is very striking and is illustrated by means of two photographs taken in the area. Fruit orchards consisting of plums and medlars are numerous. Dairy-farming is often practised side by side with cultivation to cater to the necessity of the town of Algiers with over half a million population. Three agricultural zones can be distinguished:

The zone along the coast is formed of light sandy soils that are easily worked. It is devoted almost entirely to the intensive cultivation of vegetables notably tomatoes, carrots, potatoes etc. grown on small European-owned holdings of 5 to 15 acres (2 to 6 Ha). The landscape is characterised by small fields of vegetables protected against the wind by little hedges of reeds or of casuarinas and cypresses. Irrigation from wells is practised and the density of agricultural population exceeds 1000 to the square mile.
The second zone consists of vines which in this elevated region are of a high quality. A farm studied at close quarters will be described later.

The zone of cereals mainly to the south is exposed to the cold winds from the Blida Atlas.

The second and third zones are characterised by medium-sized holdings of 100 to 250 acres (40 to 100 Ha).

Farm 17 in the second zone belongs to a European colonist and represents a typical farm of the type E. Of its 250 acres (100 Ha), 200 (80 Ha) are under vines, 25 under barley and 25 under forage crops for dairy-farming is a part of the business of the farm. The vines consist of red varieties, namely Carignan, Cinsault and Alicante-Bouchet and yields of 32 hectolitres per acre are obtained. The farm has its own private cellar. Barley is grown as feed for the cattle. The farm has 8 cows crossed with European breeds and ten calves. There are also 10 horses for work on the farm. About 50 workers are employed on the average and paid regular wages. Ploughing etc. is done by tractors. The farmer also maintains a large number of poultry and rabbits which are valuable due to the proximity of Algiers. Mildew is a serious menace to the vines due to high spring humidity and preventive measures consist of drastic cutting of lower branches and copper-sulphate sprays.
Rural Settlements

The most outstanding feature of the region is the wholly European aspect of houses and settlements. Most villages are well-planned with metalled roads and modern houses. Tents or gourbis that are the integral part of rural landscape in Barbary are absent. Apart from several villages, most of them established officially during the earliest colonization endeavours, scattered farms are quite common.

The coast is a zone of dense settlement, mostly in the shape of isolated groups of farms. Larger settlements are from east to west Guyotville, Sidi Feroush, Zeralda, Fouka, Tefeshoun, Berard and Tipasa. Another conspicuous zone of settlements lies at the top of the Mitija-facing slopes, where occur many of the larger villages notably Kolea, Maelma, Douera and Crescia. Other settlements occur on the tops of hills between the valleys of the principal streams Saoula and Cheraga belong to this category. Several villages lie on the higher eminences, of these Bouzarea lies at the highest point in the Sahel. Several settlements lie on the gentler western slopes.

Algiers, as the largest town and port of Algeria, the seat of its administration and the centre of commercial as well as industrial enterprises exerts a great influence on the neighbourhood by its requirements of vegetables and dairy produce. Apart from that it is essentially an urban agglomeration.

THE MITIJA PLAIN

Of all the agricultural regions of Barbary, this is
the most productive and has been largely colonised. A considerable proportion of its rich vineyards have been developed on what were formerly marshes. This constitutes one of the outstanding benefits of French occupation. At the same time this is among those regions from which the native population has mostly been driven away so that as in the Sahel of Algiers, the cultural landscape has a European aspect.

**Physical background**

The plain has been formed by alluvial deposition from numerous streams emerging from the Blida Atlas in the south. Their deposits have given rise to two surfaces:

1. The upper fan-surface above 200 feet consisting of the coalescing fans of the streams and constituting in effect a piedmont plain. The alluvial deposits here are coarser and lighter.

2. The lower plain where the finer alluvial deposits have formed the impermeable clay soils which give rise to extensive marshes. This zone extends to the foot of the Sahel region. In the east it reaches up to the coast.

The higher mountain slopes begin at 600-700 feet south of Blida but they extend down to 400 feet in the east and west. The large fan of the Wadi el Kabir on which Blida is situated is noticeable even on the 1:500,000 map of the Mitija plain. 

Rainfall exceeds 30" everywhere and at Blida which receives the highest rainfall among observed stations, it
averages 38". The problem of the region, unlike the greater part of Barbary, has been an excess of water especially due to the prevalence of marshy conditions in the lower part of the plain. Most of the numerous streams drain into the Mazafran entering the sea through the Kolea gorge or into the Harach which empties its contents into the Mediterranean east of Algiers. The Hamiz further to the east is an independent river with a high discharge and has been dammed for irrigation south of Pondouk. Water which percolates through the fan deposits of the rivers provides a high water-table and is utilized during the summer drought to irrigate fruit plantations.

Land-use and Farm types

The greater part of the lower plain has been drained of its marshes and Boufarik stands in the middle of what was once an unhealthy swamp. Lake Halloula towards the west and the marshes at the foot of the Sahel of Algiers still remain to be drained. Most of these reclaimed lands are under vines and indeed with 125,000 acres of its total area of 370,000 acres under vine, the Mitija plain is the vine-growing region par excellence in Barbary. Medium to large European holdings dominate in this part of the plain.

In the upper part of the plain citrus and other fruit plantations take pride of place. Blida was renowned for its oranges even before the French conquest and is surrounded by large orchards that stand out at once by their wind-breaks. Vines still figure prominently but olives, cereals and tobacco
are also grown. Medium to large European holdings again dominate although native large holdings also occur here and there.

Over, 12,500 acres (5,000 Ha) in the eastern part of the plain are irrigated from the Hamiz Dam and the total area ultimately to be irrigated will be 45,400 acres (18,000 Ha). Most of the irrigation supplies are being devoted to the extension of fruit plantations and at present no other crops may be watered. Farm 18 within the irrigated zone lies to the west of Fondouk and belongs to a family of Muslim cultivators who bought it from a colonist after the First World War. Its 345 acres (140 Ha) are cultivated as follows at present (1949):

<table>
<thead>
<tr>
<th>Crop</th>
<th>Acres (Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>50 (20)</td>
</tr>
<tr>
<td>Apricots</td>
<td>30 (12)</td>
</tr>
<tr>
<td>Vines</td>
<td>168 (70)</td>
</tr>
<tr>
<td>Tobacco</td>
<td>47 (19)</td>
</tr>
<tr>
<td>Pears</td>
<td>40 (16)</td>
</tr>
</tbody>
</table>

The vines go back to the days when the farm was managed by a European. They yield 20 hectolitres per acre which are fermented and bottled at a cellar on the farm itself. Barley is grown for farm animals which include 15 cows as well as 12 mules and horses for farm-work. Machinery is used for agricultural operations. The fruit plantations were established only after the Second World War and are still too young to come into full production. They are irrigated from the Hamiz dam. Manures and chemical fertilizers are applied to the fruit trees in well regulated quantities. A biennial rotation is used on lands under annual crops. About 40 wage-workers are employed constantly though the number increases to 100 during the grape-
picking season. The farm combines in itself the various features of the agriculture of the upper Mitija plain - production of vines, fruits, tobacco and cereals.

The northern part of the Mitija plain also grows forage crops like berseem oats and lucerne. A crop which occupies limited areas and yet constitutes a source of worldwide importance is the geranium for perfumes. Half of the world's production comes from the Mitija plain.

Rural Settlements

The most striking feature in rural settlement in the Mitija plain is the line of large villages situated on the alluvial cones at the foot of the Atlas. To name only the important ones, they are from west to east Marengo on Wadi Meurad, Bourakika on Wadi Gherdba, El Affroun on Wadi Roumi, Chiffa on Wadi Chiffa, Blida on Wadi el Kabir, Rovigo on the Harrach, Arba on Wadi Jemaa and Fondouk on the Hamiz river. Within these settlements most of which are fairly old - pre-French - there is a mixture of Europeans and the native population, with the latter mostly in the status of farm-labour or domestic servants. The villages have consequently a European aspect. Scattered isolated farms are common but without the usual concentration of farm labourers' huts for the labourers often live on the slopes above or in the villages. Blida is a town of considerable size. The triangular alignment of its principal roads and the residential quarters radiating in expanse from an apex are a consequence of their location on a large alluvial cone.

On the slopes
The lower Mitija plain is seen in its most characteristic aspect with the regular lines of vines. Marshes are visible at the foot of the slope above which rises the Sahel. Picture taken on a rainy day in May when the sky was heavily clouded. The ground between rows of vines is harrowed. Notice the gentle slopes above the marshes marking a terrace from which the sea receded in sub-recent times. Further in the distance rise the steeper slopes of the Sahel.
Photograph of a European farm in the Setif region. Notice the bare limestone hills in the background. The harvested wheat crop lies in stacks (picture was taken in mid-May when only the soft wheat crop is ready for harvesting).

The Biskra Oasis. A part of the town is seen showing mud houses with enclosed courtyards. Dak palms extend on all sides. Lower hills below the Aures Massif seen in the distance.
above the cones are located small hamlets consisting mostly of flat-roofed houses surrounded by terraced fields.

On the lower plain surface, rural settlements are sparse in the western part of the plain and at the foot of the Sahel because of the unhealthy marshes. East of Boufarik which is almost entirely European and a centre of the wine industry isolated farms as well as villages are numerous. Many of the villages are those that were founded officially for early European settlers. With its orderly vineyards and large co-operative wine cellars, its red-roofed farms and villages and finally its network of metalled road the plain is now presented to the foreign visitor as a showpiece of French colonization. When the early accounts of its malarial swamps and sparsely settled pastures are taken into account, this is indeed a transformation that does credit to the settlers. At the same time the general absence of traces of the native culture makes one wonder if this foundation of a corner of the new France has been not a transformation but a wholesale replacement through the "refoulement" of the native population from a region colonised officially during the more violent early phases of settlement.

The valleys of Isser and Summam are humid lowlands largely under vine cultivation. European farms of type E. The cultivation of tobacco and the plantations of citrus fruits and olives provide the variety in the agricultural landscape.
The **Kabylie Massifs** have an agriculture peculiar to themselves. Rainfall is in excess of 30" almost everywhere. The density of agricultural population is very high - about 300 to the square mile and the peasants practice a garden type of cultivation with olives and fig groves near their settlements and at the crests of ridges with cereals, mainly barley, on the gentler slopes below. The size of holdings is very small. Settlements were described in an earlier chapter.

The **High Plains of Setif and Constantine** are devoted largely to hard wheat and barley, the latter occurring mostly towards the drier southern part where rainfall is less than 16". The northern part is extensively colonised, particularly in the Setif region where large holdings of type C are common. The small peasants dominate on the rough slopes as well as towards the south where they combine grazing with cultivation. Here holdings of type A are dominant.

The **Bône Plain** resembles the Mitija in its being pre-dominantly European and in the importance of vine cultivation. The plantations of vine are being extended over the newly reclaimed marshy areas. Holdings of type E prevail.

The **Biskra Oasis** This large plantation of date palms occurs to the south of the Saharan Atlas and derives its previous water supplies from artesian wells at Shetma to the east and Tolga to the west as well as from several springs at the oasis itself. Tube-wells have recently been installed at a point above a subterranean ridge north of Biskra which holds
up sub-soil water. The soils are sandy loams accumulated by Wadis Abiod and Biskra which flow as large torrents in the rainy season but are completely dry in summer. The oasis along with neighbouring date-palm plantations of Sidi Okba and Tolga contains 600,000 date trees. These are owned in very small parcels of 100 to 200 providing a meagre living. Many of the trees belong to tribes living in the Aures or to nomads. Each parcel of date palm trees is surrounded by a mud wall within Biskra and underneath the trees, vegetables, fruits and cereals are grown. A dam on Wadi Abiod at Fum el Gherza will be 165 feet high and irrigate 30,000 acres north of Sidi Okba. It is proposed to devote most of the irrigated land to cereals.

An agricultural research station at Ain ben Nwi, six miles from Biskra, develops improved varieties of date-palms and other crops suitable for desert conditions. Settlements consist of flat-roofed mud houses agglomerated in large villages like Sidi Okba or Tolga. Biskra itself derives some of its living by virtue of being a tourist centre.
Muslim Tunisian population is again concentrated sides and lives in tents. Older Tunisian centres such as Miliana and Siliana also exist although large European minorities occur in these as well. Scattered European farms are common in the plains and basins of the lower Tell.

**THE TUNIS REGION**

Within a radius of thirty to forty miles of the city of Tunis extends a rich agricultural region in which a great variety of crops is grown. A glance at Map 24 showing Dominant Crops will bring out the individuality of this area, most of it consisting of fertile lowlands, wherein vines, olives, citrus fruits and vegetables figure as prominently as cereals. Close to Tunis, cereals, principally soft wheat occupy small areas and most of the land is under various fruits, vegetables and vines. Further away, cereals become dominant with olive groves and vineyards occurring in limited patches. With increasing distance from the city, this mixed-farming region merges into the Wheatlands to the north and west and the Cap Bon Fruit Growing Region in the south-east.

**Physical Background**

The Tunis Region includes sections of several physical regions. In the north it extends over the delta of the Mejerda below Jedeida. This is a marshy lowland lying below 50 feet for
South of the Mejerda Valley, the plains that are largely colonised have regional centres of recent origin such as Bu Arada, and Pont du Fahs. These are largely European. The Muslim Tunisian population is again concentrated on the hill-sides and lives in tents. Older Tunisian centres such as Miliana and Siliana also exist although large European minorities occur in these as well. Scattered European farms are common in the plains and basins of the lower Tell.

THE TUNIS REGION

Within a radius of thirty to forty miles of the city of Tunis extends a rich agricultural region in which a great variety of crops is grown. A glance at Map 94 showing Dominant Crops will bring out the individuality of this area, most of it consisting of fertile lowlands, wherein vines, olives, citrus fruits and vegetables figure as prominently as cereals. Close to Tunis, cereals, principally soft wheat occupy small areas and most of the land is under various fruits, vegetables and vines. Further away, cereals become dominant with olive groves and vineyards occurring in limited patches. With increasing distance from the city, this mixed-farming region merges into the Wheatlands to the north and west and the Cap Bon Fruit Growing Region in the south-east.

Physical Background

The Tunis Region includes sections of several physical regions. In the north it extends over the delta of the Mejerda below Jedeida. This is a marshy lowland lying below 50 feet for
Typical garden outside Sfax

Scale approx. 1:800.

Tabia (mud wall
with reeds)

Fruit trees (divers)

51
the most part and consisting of recent alluvial deposits. Three small islands that once lay out in the sea have been incorporated into the mainland and stand out by their relatively greater height. These are Galaat el Andeless, Shawat and Mabtuha.

South-eastwards of the delta, the dune fringed coast is bordered by higher land rising to 300 feet but with gentle cultivable slopes. Tunis and its environs area situated in a region of submergence and alluvial deposits from the rivers Mejerda and Miliana have isolated Sebkrat-el-Riana and the Lake of Tunis. West of this lowlying plain, the landscape is diversified by isolated low hills rising 200 to 300 feet above the general level of the surrounding plain. Their slopes are also cultivable. Beyond ten miles of Tunis to the south and south-east, hills of the low Tell rise steeply from the plain. They gain in height and the hills of Bu Kournine and Ressas to the west of the Cap Bon peninsular mark the highest points in a compact area of mountainous topography with heights of 1870' and 2608' respectively. To the east of these hills lies the alluvial plain of Grombalia which does not exceed 200' in height and presents a flat plain surface.

South-west of Tunis, this agricultural region extends to the plain of Mornag lying along Wadi Miliana between 400 and 500' while westwards, it stretches to Mejaz-el-Bab over a low-lying but very gently undulating region of deep fertile red soils (hamri).

The annual rainfall over most of the Tunis region exceeds 16", Tunis itself receiving about 19". Although
A field of peas. Beyond the wheat-lands in the middle distance, above a slight slope, is a small hamlet of about a dozen houses with mud walls and thatched roofs.

View of the buildings housing farm machinery on Farm 22. Behind the building stretches an extensive olive plantation. Bare hills in the background.
Another facet of the varied agriculture of the Tunis Region. A vineyard with the colonist's house in the middle distance. This lies about 20 miles from Tunis on the way to Mateur. Some scattered fruit trees are seen among vines. Notice gentle undulations.

Aerial photograph taken by the writer with an ordinary camera. It shows the coastal area northwest of Tunis with regular fruit plantations. Surrounding lands are under cereals. The isolated white buildings are European farms.
irrigation has been practised for intensive cultivation in several areas notably the plain of Grombalia and the Tebourba region this is fairly adequate but for those years when it varies to a serious defect of the average.

Land-use and Farm Types

The several crops mentioned earlier occur side by side almost everywhere but certain crops dominate in certain areas as has been indicated in Map 94. Olives preponderate immediately to the north of Tunis while to the west and south it is the vines that occupy most of the land. Along the coast citrus fruits are grown to the north-east of Tunis but olives are dominant over most of this tract. Patches of olives occur here and there, the most important of these being the large plantation north of the Mejerda around Tebourba. Over 2 million olive trees lie within the administrative region of Tunis which embraces most of the area included in this agricultural region. Important vine-growing areas lie in the delta of the Mejerda and east of Mejez-el-Bab. Vegetables occupy considerable proportion of the lands in the immediate vicinity of Tunis, some of these being grown to meet the requirements of the large town with a population approaching half a million including suburbs while early vegetables are grown chiefly for export.

Considerable areas have been colonised by Europeans. A multitude of small holdings devoted to market-gardening and fruits occur immediately in the neighbourhood of Tunis. Large French farms of the type E (vineyards) lie within small
distances of the town while smaller medium-sized Italian holdings, also devoted to vines occur further away in the south and north. Many of these were expropriated during the recent War and have been given to French settlers. The Grombalia plain has been largely colonised and is under vines over most of its area.

Small holdings of the type A and B are relatively less numerous in the Tunis region and a high proportion of the cultivated land in local hands is held by large Muslim proprietors although no published statistics are available to allow a detailed account. The small holdings are confined to the hilly land south of Tunis and the coastal olive-orchards. Some celebrated citrus gardens lie to the south of Tunis. They have existed for generations and grow local varieties of oranges as well as imported ones developed in recent years.

Farm 22 lies within three miles of Jedeida north of Tunis and consists of 1,250 acres (500 Ha). It is owned by the President of the Tunisian Chamber of Agriculture (a Muslim body distinct from the French Chamber). Of the total area 1,000 acres (400 Ha) are under soft and hard wheat while 250 acres (100 Ha) are planted with olives of the Shetwi variety. The olives are irrigated by means of several tube-wells and their fruit is pressed for oil at the farm itself which is equipped with a modern oil-press and storage facilities. American farm equipment is used. Yields obtained from hard wheat (12-14 Quintals per hectare or 1,600 lbs. per acre) compare favourably with those obtained by colonists. Superphosphate fertilizer is used. The farm has 100 workers.
The owner of farm 19 has a farm of 740 acres near Tunis which is representative of another crop emphasis. 75 acres are under olives while the entire remaining area is occupied by fruit-orchards.

**Rural Settlements**

The nature of rural settlement varies most noticeably with the types of crops grown. European farms, both French and Italian occur singly in the vine-growing areas with the huts of workers perched on a nearby slope. Muslim sedentary villages characterise the olive-growing tracts. These consist of single-storeyed mud houses and more often than not lie on a hill-slope wherever the surface is sufficiently diversified. This avoidance of valleys and basins may be rooted either in a desire to be safe from floods and ill-drained ground or in Spanish antecedents for large numbers of olive and fruit growers trace their descent from the Spanish Moors. It the cereal growing areas, peasants live in small hamlets of the type illustrated in photograph 106. Large proprietors whether European or Tunisians have modern farms.

In the delta of the Mejerda, settlements avoid the low-lying surface which is inundated periodically and is malarial. The three ancient islands are noticeable centres of population and have large villages such as Galaat-el-Andeless (meaning "fortress of the Andalous") on the island of the same name. Tunis itself is a large urban settlement, the administrative, commercial and cultural centre of Tunisia. It exerts a
considerable agricultural influence on its immediate vicinity as was pointed out earlier and small groups of white-washed brick houses extend outwards along the principal roads. Many of these lie in the centre of market-gardens catering to the needs of the city. To the south-east of Tunis stretches a line of large French settlements along the beach up to Hammam Lif. These are inhabited by colonists as well as by commercial and industrial personnel.

The irrigated plain of Grombalia contains two large settlements - Soliman and Grombalia - outside which the population is scattered in well-irrigated farms devoted to vines or fruits. Besides these fruit cultivation in the region of Tunis is usually associated with isolated farms. The aerial photograph of the coastal area north-west of Tunis illustrates this feature rather well.

**THE CAP BON FRUIT REGION**

East of the plain of Grombalia, the Cap Bon Peninsula is characterised by the prevalence of irrigated fruit orchards. The inhabitants of this region, most of them descended from the Spanish Moors are excellent fruit gardeners as was indicated earlier. They used windbreaks of cypresses and tamarisk long before the French entered Tunisia and practised perfect methods of grafting. In recent years, with the fillip given to citrus cultivation in the French territories because of the stoppage of Spanish supplies, this region has seen a great expansion of citrus plantations on account of irrigation.
facilities and deep light soils. Other crops such as olives, cereals and vegetables are also grown.

**Physical Background**

The Arabs call this region an island (Jezira) which indeed it was before it was joined to the mainland by the alluvial plain of Grombalia. The peninsula consists of a sandy area of geologically recent deposition with a central ridge that rises to 2,090 feet in Jebel Sidi Abder Rahman and consisting mainly of limestone which also outcrop here and there from beneath the wind-born sands that cover them in the low-lying coastal tracts. The region rises with gentle slopes from the plain of Grombalia to a height of 300 feet. Here the wooded central ridge has no steep slopes but descends gradually both to the north and south. Eastwards the relief becomes intensified and the topography shows greater contrasts between high hills and deep valleys, especially towards the north. The southern coastal fringe is a narrow lowland up to 200 feet high and fringed by dunes. This plain with its deep sandy loams and abundant supplies of underground water constitutes the agricultural core of the Cap Bon region. It is fringed by an intermediate zone of gentler slopes in an undulating region at the foot of the central ridge. The north-eastern part of the peninsula consists of a forested upland.

Rainfall in the Cap Bon Region exceeds 16" and this combined with the high water table provides an adequate basis for the cultivation of all crops associated with Tunisia.
Newly cleared sloping land

Main cultivated part of Farm 23
(Domaine de Sidi Châbane) in the Cap Bon region

Scale 1:1000
provided relief and soil conditions are favourable. The climate is characterised by high winds so that the lodging of cereal crops is a serious menace and all tree crops have to be protected with special care by means of multiple windbreaks.

**Land Use and Farm Types**

The lower gentler slopes of the central hills on the west and south are largely under olive trees held in small orchards by Tunisian peasants (Farm type F). Cereals are grown here and there and often intercultivated with olives. The northern part of Cap Bon is under cereals, mostly hard wheat cultivated in small holdings (type A). The southern coastal plain is devoted to citrus and other fruits planted in small gardens owned by the Andalusian and irrigated by means of wells. Several large fruit-growing domains also exist near Hammamet and Nabeul.

Farm 23 north-east of Nabeul belongs to a Tunisian notable and is managed by his nephew who is a graduate in agricultural science. The farm covering 900 acres (360 Ha) was purchased in 1921 from a French colonist. At that time only 50 acres were under olives and cereals and there was barely an acre of oranges. The rest of the land consisted of a sandy wilderness covered with brush and having a calcareous subsoil. By 1940, 5 acres of oranges had been planted, the area under olives tripled. Since the trained graduate took charge five years ago, development has proceeded apace. Over 125 acres have been cleared and prepared for cultivation only this year and the land is
Photograph shows Farm 23 and may be compared with diagram. In the foreground is the most recently cleared land with young orange trees. To the right of the white farm building stretch the citrus and olive plantations marked by the tall cypress wind-breaks. To the left of the building are the cereal lands and some vegetable fields. Notice white calcareous pieces on the light newly ploughed soil near the camera.

A close up of windbreaks in Farm 23 Tamarisk trees in the foreground and a row of saccharum grass behind the two gentlemen of whom the one on the left manages the farm. Ploughed land in the foreground has been planted with oranges none of which, however, is in the photograph.
112 Photograph of another part of Farm 23 shows hard wheat intercultivated with olives. The olives are old, planted at irregular distances.

113 A fruit garden near Hammamet in the Cap Bon region. Young orange trees have been planted between rows of olives. Photograph taken from the top of the wind-driven pump. Wild vegetation in the foreground with some cactus.
cultivated at present as follows:-

Cereals - Wheat 25 acres, Barley 75 acres

Olives - 150 acres (5,000 trees)

Citrus fruits - 42 acres

Vines - 30 acres

Vegetables - 25 acres

The rest is fallow. Cap Bon being a windy region there is great danger of incursions of sand from the coastal dunes. Hence windbreaks assume a special importance not only for the citrus fruits but the whole farm. Diagram 52 shows the arrangement of these windbreaks in the main part of the farm as well as the distribution of crops and wells. There are 14 wells with oil-engine pumps, each of them capable of irrigating 30 acres. The newly cleared lands are to be planted with citrus fruits. Oranges are planted 80 to the acre (22 feet apart) while only 28 olive trees are grown per acre. There are 30 permanent workers on the land. Apart from tractors for ploughing etc. a bull-dozer is employed to clear the land as yet uncultivated. Yields of cereals and fruits compare favourably with those from other modern farms. This farm is an example not only of enterprise and modernisation but also the reclamation of sterile land through the application of scientific knowledge. The newly cleared sandy and calcareous lands are brought under cultivation with the application of large quantities of compost.
Rural Settlements

The most striking feature of rural settlement in the Cap Bon Region is the existence of several large sedentary settlements in the fruit-growing zone. These are from west to east Hammamet, Nabeul, Dar Shabane, Beni Khiar, El Maamuri, Korba and Kelibia. They often approach urban settlements in their construction and function, i.e. in the existence of large quarters of brick houses, in their extensive commercial (cf. Nabeul) or touristic (Hammamet) activity, features associated with towns rather than villages. Yet they retain their essentially rural character for a majority of their residents depends directly on the soil. The development of these agglomerations is an outcome of the cultivation of fruits which permit concentration of population on account of the small size of individual holdings lying not far from the various settlements. Another reason for this concentration of settlement seems to have been the need for security against marine raiders. Other parts of the Cap Bon region have small hamlets, consisting of gourbis in the cereal-growing areas to the north and of mud houses on the olive growing slopes of the south and west.

The Sahel

The Sahel of Tunisia has a unique place among the agricultural regions of Barbary. It is the only extensive low-lying zone in which the olive is dominant. Some of the reasons for this characteristic were given earlier. Briefly,
the most profitable manner of exploiting a region of low rainfall without any possibilities of large scale development of irrigation but with appreciable "invisible precipitation" from the humid coastal atmosphere has been found to be the plantation of the olive tree. The other indispensable conditions for extending the orchards - peace and security - have been established finally by French although the Sousse region had most of its groves even earlier which were looked after by the local population concentrated in large villages. Finally the local population and especially the people of Sfax have shown themselves to be painstaking and ingenious in their management of the olive. Now, the Tunisian Sahel can compare with any other olive-growing region around the Mediterranean.

**Physical Background**

The Sahel does not differ profoundly from the Tunisian low steppes in the interior and stands out mainly as their cultivable part. In addition it is not traversed by many of those ridges that characterise the steppes of the interior. The region lies east of a line of Sebkhas extending from Sebkha Kelbia to Sebkha en Nwal and rarely exceeds 800 feet in height. Almost everywhere the surface consists of sandy deposits covering hills of calcareous rocks that emerge here and there to diversify an undulating landscape. The aspect on photograph is in many ways typical. Commencing south of Enfidaville, the Sahel is narrow and fringed by dunes that mark the coast all along. The lowlands expand in width south of Sidi bu Ali and
here begins the Sahel of Sousse which does not exceed 300 feet in elevation east of Sebkha Kelbia. The region is much eroded by torrents as photograph shows. Even these eroded basins are planted with olives which afford some measure of protection to the soil. The region of Sfax further south does not differ in the general aspect of the surface. Only the olive-growing lowlands extend further into the interior than in the north and terminate at the foot of steeply rising ridges over 60 miles inland.

Rainfall exceeds 12" in the northern (Sousse) section near the coast but over the greater part, it is between 3" and 12". The moisture-laden coastal winds provide additional supplies of water by means of abundant dews. Despite its coastal location, the Sahel is a region of inland drainage and there are no streams or rivers of any size to facilitate irrigation. Soils are generally light and sandy.

**Land use and Farm Types**

Most of the arable land is under olives so that holdings of type B and F predominate. The only uncultivated areas are the low limestone hills which are often devoid of a soil mantle and the salt-impregnated land around the Sebkhas. In the Sahel of Sousse olives are grown on terraces (muskat) on slopes in order to make the maximum use of water (See photograph 1/5). Olives are also grown in basins and eroded valleys (manqa). The Sahel of Sousse has over 6 million olive trees. South of the Sousse region, the olive-growing area becomes narrower but
one approaches a veritable forest of olives towards Sfax. These extend over a radius of sixty miles with Sfax as centre. The density of trees is less – only 13 to the hectare – as compared to 70 in the Sousse region. The extension of olivets has taken place comparatively recently and Europeans own a large proportion of the orchards. These are looked after mostly by Sfaxians working under the mgharsa contract. The light soil is continuously broken with the hand plough (maasha) and threes are skilfully pruned. Sfax is surrounded by fruit gardens of the type illustrated on diagram 51. These extend to distances of 8-12 miles on the north, west and south-west. Each garden-plot is surrounded by low mud walls (tabia) on which cactus is planted. Almonds, figs, pomegranates, pears, pistachio and even citrus trees are grown under well-irrigation. Each parcel has a small elevated house in the centre which is known as borj (tower).

Apart from olives, cereals, principally barley, are grown in the immediate vicinity of settlements. The unculticable lands are grazed by sheep.

Rural Settlements

Attention was drawn in an earlier chapter to the influence of rainfall on the distribution of sedentary settlements in the Sahel of Sousse. The concentration of large villages north of the 12" isohyet is a notable feature that was explained in terms of the concentration of orchards in the vicinity of settlements as trees were planted closely. The
influence of nomadic tribes has doubtless been considerable for it should be noted that this concentration of settlements occurs immediately to the east of Kairwan which has been a centre of some political and religious authority over several centuries. Around Sfax, scattered settlements are the rule on account of the widely spaced trees so that concentration in villages would necessitate long walks to individual orchards. Single-storeyed mud houses are the prevalent type of habitation in the Sahel. Around the zone of agglomerated settlement in the Sahel of Sousse extends a transition zone of scattered houses before the zone of dispersed tents and huts is reached. These features of Sahelian settlement are well illustrated by Map 26.

THE STEPPES

Inland from the Sahel Region, the conditions of aridity are not ameliorated by high humidity and continued insecurity in the past has further limited the possibility of the extension of olives. Cultivation is possible only under dry-farming or irrigation but facilities for the latter do not exist everywhere. This is essentially a pastoral region wherein the semi-nomadic population sows large areas with barley every year and then proceeds with the care of its flocks. If the amount and distribution of rainfall is favourable, they obtain an excellent harvest. Otherwise all they lose is the seed. In limited tracts, irrigation is practised by building stone and mud dams across torrential streams that lie completely dry for half the year but inundate the countryside with their floods
Picture shows the great uninterrupted groves of olives which surround Sousse, seen on the photograph near the horizon. Fields in the foreground are fallow.

Closer view of an olive orchard in the Sahel region. The olives rise one above another as they are planted in terraces according to the muskat system to conserve moisture.
The outskirts of Kairwan. Here vegetables and fruits are grown under irrigation from wells. Scattered white-washed houses mark the usual thinner settlement outside a town. A section of the wall of the town is seen at the bottom left.

Harvesting the barley crop by hand in the Kairwan region. Notice that both men and women work in the field. The flatness of the surface may also be noted.
in the rainy season. Among such areas is the Kairwan region.

Physical Background

The Kairwan region is a plain of alluvial soils lying to the west of the Sahel of Sousse between 200 and 300 feet. It is bounded on the west by the steeply rising hills of Jebel Baten, on its east by depressions occupied by the Sebkhas that limit the Sahel on the west. To the north and south it is delimited by the gentler slopes of the steppes but here there is no definite line of demarcation. It is drained by several ephemeral streams and rivers of which the Marguellil and Zeroud are the largest. Rainfall in the Kairwan region is less than 12".

Land Use and Farm Types

In the immediate vicinity of Kairwan market-gardening is carried on on a small scale. West of Kairwan sub-soil water lies close enough to the surface to be utilized for irrigation by means of wells. Here olives, almonds, pomegranates and pears are grown in small holdings of type B along with some vegetables. This area is known as Awarab.

Most of the land around Kairwan is under cereals, chiefly barley, grown on holdings of type A and C. Farm 24 lies 6 miles to the south east of Kairwan and covers 2,000 acres (800 Ha) It belongs to a Muslim notable who is the president of the local society of agriculturists. Except for 50 acres devoted to olives, the entire farm is under cereals. Half this area is
sown with barley and soft wheat every year, the other half lying fallow. Some 500 acres receive irrigation from earthen dams on Wadis Zeroud and Marguellil which also spread their fertile silt on the land. Yields of 1,300-1,400 lbs. per acre (14-15 Quintals per hectare) are received from the irrigated fields but the unirrigated area yields only a quarter of this. This year (1948-49) as there were abundant rains in autumn and spring, 1,750 acres are under cereals and a yield of over 2,000 lbs. per acre (24 Qx. per Ha) is expected. About 50 acres have also been cultivated with flax this year.

The farm was formerly ploughed with traditional implements but two tractors have been purchased this year. According to the proprietor one tractor saves the labour of 20-30 workers. The light sandy soils near the wadis are still cultivated with wooden ploughs.

Rural Settlements

Kairwan is the main settlement in the plain and is a well-known religious centre. In the rest of the region, scattered mud houses are the rule though a few hamlets occur with greater distance from Kairwan.

THE AGRICULTURAL REGIONS OF WEST PUNJAB

The province may be divided into the following agricultural regions:

1. The Potwar Plateau: This undulating region between
the Murree Hills and the Salt Range is cut up by a maze of ravines at its edges and is subject to intense erosion. The rainfall varies from about 20" in the south-west to 31" at Rawalpindi and a larger proportion of it falls in the winter than in the other parts of the province. Irrigation has not developed in this region partly because it is not absolutely necessary but mostly because the terrain is unfavourable. Less than 7% of the total area is irrigated. Well irrigation is practised along principal streams and cannot be extended because the water-table is very low over a large part of the plateau due to deep gullying.

The region is devoted mainly to cereal-growing about half the cultivated area being devoted to wheat. Bajra is the important summer crop. Maize is grown under well irrigation in the eastern part while gram is more important in the Attock district. Fodders, pulses and oil seeds are the other main crops grown.

The plateau is inhabited by war-like Muslim tribes among whom tribal affiliations are still strong. They have only recently emerged from a semi-pastoral stage and large numbers of sheep and goats are kept. The villages, usually situated on higher ground, still have the appearance of strongholds dating back to the times, not very long past, of insecurity. The infertile and hard-to-work soil on the other hand set in a tendency for scattered homesteads to work in the fields.
These two conflicting tendencies have resulted in the older villages consisting of a central "abadi" inhabited by the landlord surrounded by a cluster of hamlets or "dhoks" in which the tenants live. The newer villages are more compact. As agriculturists, the inhabitants of the Potwar Plateau are not outstanding and are given to feuds and crime when impelled by poverty and prejudice. They, however, make fine soldiers.

The Ghacch tract along the Indus needs special mention. This is a lacustrine plain about seventy miles long but less than ten miles broad which is intensively cultivated with wheat, maize, sugar-cane, vegetables etc. Farming is of a high standard and most of the area is double-cropped. In other parts of the Potwar Plateau, fruit cultivation occupies a fairly important position and recently plantations of oranges have been set up in the Jhelum District under irrigation. The Murree Hills are under terraced cultivation of cereals and the typical village consists of houses scattered in groups over the cultivated slopes. The Salt Range is mainly given to grazing though some of the plateaux between its two ridges afford good agricultural land.

2. The Sub-Montane Region

This consists of the districts of Gujrat and Sialkot which get a rainfall of over 20" and where the high water table has led to a great development of well-irrigation. The soils are generally fertile, being light loams. Wheat, maize,
sugar-cane and fodders are the principal crops. Rice is grown under irrigation from wells in Sialkot and occupies 4% of the cultivated area.

This part of the province has been cultivated since long, the plantation density is high and holdings small. Yields of crops are, however, among the highest in West Punjab. The tribal organisation is still marked in Gujrat though in Sialkot it has lost its hold due to the mixing up of various elements. Erosion is a serious problem in the Gujrat district and plans are now in hand to check its growth.

3. The North Central Plain

This includes the old settled districts of Lahore, Gujranwala and Sheikhupura where cultivation with or without irrigation has been carried on since prehistoric times. Rainfall varies from 10-20". The agricultural population is very dense and holdings small. Irrigation has been extended to most of this area so that 80-90% of the cultivated area is secure for water-supply. Well-irrigation is also carried on, particularly in the riverain tracts. It also supplements the canal supplies of water.

Wheat is again the principal cereal occupying a third of the cultivated area but rice is grown very extensively in Gujranwala and Sheikhupura which is accounts for 16 and 15% respectively of the area under crops. Cotton, especially American cotton is an important crop in Lahore. In this district market-gardening is also highly developed because of
the location of the biggest urban centre of the province. The agricultural settlements consist of compact villages and the standard of cultivation is fairly high.

The village of Gajju Chak in Gujranwala presents an example of the type of cropping associated with this region and is also a type settlement. In 1925-26, the cultivated area was 451 acres out of the total village area of 473 acres. Rabi (winter) crops account for 62.7% of the total agricultural production and wheat and gram predominate. Kharif (summer) crops are fodder crops, bajra, cotton and sugar-cane. In the same year, 240 acres were irrigated from wells, 56 acres from the Upper Chenab Canal, and 155 were Barani (dependent upon rain). Thus about two-thirds of the area is irrigated. Out of 22 holdings in the village, 11 were of 7½ to 10 acres, 5 of 10-15 acres and 3 of 15 to 20 acres. The village is built of houses of unbaked brick which are not planned so that the lanes are narrow and winding.

4. The Canal Colonies

This region includes the districts of Lyallpur, Jhang, Montgomery and Multan and a large part of Shahpur. Except for the riverain lands, these areas receiving less than 10" of rainfall were formerly a barren prairie in which nomadic tribes grazed their cattle. The opening of a new canal system in the course of the last 75 years has resulted in the complete transformation

(i) These details are based on "Punjab Village Surveys" No.6 An economic Survey of Gajju Chak, by Anchal Dass, published by the Punjab Board of Economic Enquiry, 1934.
of this region into the most productive and progressive part of the province from the agricultural point of view. Dependence upon irrigation is almost cent per cent and as the settlers from congested districts were selected with special care and established in well-planned villages, the agricultural landscape presents an orderly and prosperous appearance with its rectangular or square fields. Most of the irrigation is from canals. As most of the lands were settled in recent years, agricultural holdings are large and compact and none of the evils of excessive sub-division and fragmentation that paralyse agricultural improvements in other areas are present.

Cropping in the canal colonies is fairly uniform everywhere. Wheat is the principal Rabi crop followed by gram while American cotton, fodder crops and bajra lead among the Kharif crops. Fruit-cultivation has been extended in recent years and many citrus orchards of imported varieties established notably in the Montgomery and Lyallpur districts. Yields of crops are higher than in other districts due to the cultivation of better strains and the security of irrigation.

Agricultural settlements in the canal colonies consist of a large number of planned villages established recently in the newly-settled tracts which are mixed with an older type of village existing mainly in the riverain tracts and consisting of several hamlets scattered around wells. One example of each may be taken. The village of Kala Gaddi Thamman, 11 miles south of Lyallpur, was colonised in 1899 by Sikhs from three
villages in the Gurdaspur District from which it derives its triple name. During the upheaval of 1947, they must have been replaced by Muslim immigrants from East Punjab. The system of cropping, however, cannot have changed appreciably since 1925-26 when the enquiry on which this outline is based was conducted.

Of the total area of 1856 acres, 1362 acres were cultivated in that year, entirely under canal irrigation from the Lower Chenab Canal. The following figures give the percentage of leading crops:

Kharif: (28.2% of the annual total)
- Cotton 13.9%
- Sugar-cane 5.1%

Rabi: (71.2% of the annual cropped area)
- Wheat 41.7%
- Fodders 10%

The village consists of well-planned houses of unbaked brick aligned along broad lanes and is divided into several blocks.

The village of Durrana Langana in the Multan District is a large village lying six miles to the north east of the city of Multan and covers a total area of 4,902 acres. Owing to the uncertain supply of water from the two canals which irrigate the village and the abundance of land the cultivated area varies from year to year. In 1924-25 it was 70% but increased to 74.6% in 1935-36. Rabi crops are on the whole more important than Kharif crops but on account of the unreliability of irrigation from seasonal inundation canals, the percentage of

---

1) "An Economic Survey of Kala Gaddi Thamman" by Randhir Singh Punjab Board of Economic Enquiry, 1932.
2) Based on "An Economic Survey of Durrana Langana" by R.K. Seth and Faiz Elahi, Punjab Board of Economic Enquiry, Lahore, 1938.
crop-failures is fairly high, being 47% in the canal irrigated area although it is only 27% in the section irrigated by wells. Cropping over the five years 1930-1 to 1934-35 was as follows:

### Kharif: (Total sown 1521 acres)
- Rice 302 acres
- Cotton 245 "
- Fodder 697 "

### Rabi: (Total sown 3314 acres)
- Wheat 1266 acres
- Fodders 429 acres

There were 78 wells in the village in 1935-36 of which 75 were in use. Canals irrigate 1362 acres of land. These take off from a branch of the Sidhnai canal. The shape of the fields is irregular and their area small in the well irrigated tract. They are, however, large and rectangular in the canal irrigated zone.

Due to the dependence on wells which has been an even more marked feature in the past, the village is scattered consisting of two large hamlets and numerous scattered houses. The larger abadis (village sites) are inhabited by the well-to-do landlords and their servants and workers. The landlords live in brick houses while the tenants and poorer peasants live in mud houses.

### The Western Districts:

The districts of Mianwali, Muzaffargarh, Dem Ghazi Khan and the western part of the Shahpur district are climatically arid, the rainfall being below 10" everywhere and around 5" in the southern part. This region includes the Thal desert most of which is a sandy waste and in other parts profitable cultivation is not possible without
irrigation. What distinguishes this region from the Canal Colonies is the fact that large-scale perennial irrigation has not developed to the same extent and most of the land is still irrigated precariously from inundation canals or from wells. It is bound to undergo a complete transformation with the completion of the Thal Project but for purposes of present analysis, its cropping and agricultural landscape make it into a distinct entity. The river Indus passes through the middle and is the source of whatever canal irrigation has been developed except for the eastern fringe which derives its water from the Chenab.

Cultivation is at present confined mainly to the zone fringing the rivers. Wheat, gram, bajra and fodders are the principal crops although their relative importance varies in different parts. Thus gram occupies almost the same percentage of cultivated land as wheat in Mianwali while millets are prominent in Dera Ghazi Khan and fodder crops in Muzaffargarh, following wheat. As cropping is precarious and the percentage of crop failures high, large holdings are a rule. Agricultural settlements tend to be dispersed in groups of houses around wells. Along the Indus, however, and in the Thal area, large compact villages predominate. In this part of the province an appreciable percentage of the dwellings consists of thatched huts with mud walls.
The village of Bhambu Sandila in Muzaffargarh District typifies the rural settlements of the region. It consists of 19 scattered hamlets 300-400 yards apart from each other, the main settlement being that in which the head-man lives. The total area of the village is 1362 acres of which 869 acres were cultivated in 1930-31. Kharif crops are as important as rabi crops owing to the influence of summer inundation. The entire cultivated area is irrigated. The following figures indicate the chief crops (average of 1926-27 to 1930-31):

**Kharif:**
- Bajra: 67 acres
- Cotton: 57 "
- Fodders: 35 "

**Rabi:**
- Wheat: 201 "

Crop failures amount to 38% in Kharif and 28% in Rabi. The higher crop-failure figures for Kharif are due to the uncertainty of inundations and the intense heat which affects crops quickly if irrigation or rains fail. Of the 130 houses in the village, 112 have thatched roofs while 18 have mud roofs. All of them have mud walls.

---

*(1) Based on "An Economic Survey of Bhambu Sandila", by Abdur Rahim Khan, Punjab Board of Economic Enquiry, Lahore, 1935.*
Chapter 20

THE IMPROVEMENT OF AGRICULTURAL STANDARDS

Both Barbary and West Punjab are regions where a paradoxical and dangerous situation exists today from the agricultural point of view. A large and fast-increasing rural population among whom small-holdings are the rule is continuing to practise extensive methods of cultivation with great dependence on the livestock. There is no adequate provision against the vagaries of a variable rainfall especially in Barbary where the drought of 1945 brought on acute distress and famine. The small-holder is also incapable of making any considerable improvements in his implements and the farm. This is not the only major problem of agriculture. The vast majority of rural populations in both regions are steeped in tradition and at the same time illiterate. This means that they cannot be expected to put in any corporate effort towards their improvement without State initiative because while by virtue of tradition they are attached to antiquated methods and systems of tenures, their ignorance is a barrier against the spontaneous propagation of new techniques. The governments in such a case have a heavy responsibility.

(1) "Agricultural Development of the Middle East", London, 1946, p.17.
While reporting on the agricultural problems of the Middle East which are almost identical, B.A. Keen saw two main problems in bringing about an improvement in the standards of cultivation.

(i)

Firstly how far and by what means improvements could be made in the existing system without altering the essential agricultural and social structure.

Secondly whether there are opportunities for developing a better structure and if so what forms they should take. Departures from the traditional system start an evolutionary process through their success and are much more convincing to the practical peasant than any amount of propaganda.

The governments thus have to make a choice when they launch projects for the extension of agriculture or legislate for the reform of tenures as to which of these policies to adopt. From the preceding chapters, it is obvious that British policies in West Punjab followed the first-mentioned trend, and in the settlement of canal colonies, which was by far the most considerable state-administered agricultural development, they endeavoured to preserve the traditional foundations of the rural population, i.e. in tenures, in the installation of settlers in tribal groups etc.

No violent breaks with current practice have been attempted. The State's interest in the cultivator - the main source of government revenue - has been manifested in the provision of credits and in the development of improved varieties of crops and animals and their propagation. There has, however, been no enforcement of these improvements and the most that has been attempted in the way of novel experiments has been the initiation of the co-operative movement. This has not been a violent departure from tradition because a certain degree of co-operation had always existed in the corporate village unit.

The French land policy was described in some detail earlier and was clearly doctrinaire and revolutionary. Its disastrous impact on the indigenous population resulted in a modification of policies, but the dominant trend of the administration has been to initiate policies and improvements without reference to the native genius. The fundamental necessity of organising rural credit and of propagating better seeds and implements resulted in developments parallel to those in West Punjab, but in the domain of the modernisation of agriculture, the French have recently launched schemes of collectivisation and modernisation that
aim at nothing less than a revolution in the methods at present practised.

These several aspects of the State's influence on agriculture may now be taken up in brief.

**The Organisation of Rural Credit.**

**Barbary:** In Barbary, there is a great contrast between the credit organizations of the European cultivators and those that provide loans to the Muslim peasants. Apart from the liberal credits that the "Regional Banks of Agricultural Credit" provide, they have a highly developed co-operative organisation and can also command credit from ordinary banks on account of their large holdings and resources of capital. The assistance of the native Muslim peasants is conducted by the S.I.P.s (Société Indigènes to Prévoyance). They were founded in Algeria in 1884, in Tunisia in 1907 and lastly in Morocco in 1917. They derive their finance from a compulsory levy on the Muslim cultivators. They make long and short term loans in cash or in grain, give assistance in years of drought, arrange for the sale and storage of peasants' produce and also provide technical advice to the peasants. Since 1939, they have also been responsible for providing famine relief. While the value of their assistance cannot be exaggerated, it has its limitations with regard to the amount of credit. In Morocco, for instance, the limit of cash loans in 1945-46 was 10,000 francs (approx. £20).
As these loans are provided only to needy peasants, i.e. those whose normal state of poverty has been reduced to one of utter destitution, they can at the most put the peasant back on his feet and generally preclude any real improvement in his farm or implements.

It may be added in fairness that the traditional regime of property in Barbary impedes the operation of a system of credits, for, as Despois points out, it is difficult to advance loans on lands held collectively under an uncertain title. At the same time, there has been no development of a co-operative movement among the Muslim cultivators and spontaneous growth has been discouraged. Thus over 50 Societies of Muslim Cultivators formed in Tunisia have received neither recognition nor assistance from the government. Hence they confine their activities to giving advice to cultivators, not having the funds to finance credits.

West Punjab:- There are two sides to the organisation of credit in West Punjab. The state makes takavi loans in distressed areas or to farmers in great need of financial assistance. Side by side there has grown up a vigorous co-operative movement under the initiative and the

supervision of the government. Due to his poverty and traditionally extravagant social customs, the West Punjab peasant was always chronically in debt and official credit organisations functioning since 1904 had had little effect on his indebtedness. Moneylenders charged fantastic rates of interest from the illiterate peasants - ranging from 25 - 300% per annum. In 1939 when provincial legislation curbed the activities of moneylenders, the total rural debt for undivided Punjab stood at 1350 million rupees (over £100,000,000 at pre-devaluation exchange rate) or £7 per head of a population whose agricultural income stood at £2 1/2 per capita. The activities of co-operative credit societies have been expanded in recent years and their number for the undivided province increased from 1071 in 1911 to 20,742 in 1931 and by 1945 there was one co-operative society for every two villages. Loans are issued for productive purposes for periods ranging from 3 months to 3 years and rates of interest charged are moderate. These credits have generally been utilised by the peasants for digging wells, for improving their implements or for other productive changes in their holdings. The government exercises supervision over the activities of co-operative societies but their running is left largely to the members themselves.


(2) Propagation of the results of Agricultural Research:-

As under any modern administration, experimental and research stations have been established in the two regions and some of the steps in their development and varieties they have developed were described earlier. The present organisation of research and experimentation in West Punjab dates back to the recommendations of the Royal Commission on Agriculture in 1923 while in Barbary, the lead in the establishment of the present pattern of state agricultural research came from Tunisia after the establishment of Service Botanique et Agronomique in 1922. The research organisations in both regions have concentrated on developing varieties that give the best yields under the prevailing climatic conditions. Numerous government experimental farms exist in both regions, the central ones being located near the capitals of the three territories in Barbary (at Ariana near Tunis, Maison-Carrée near Algiers and outside Rabat), while the centre of agricultural research in West Punjab is at Lyallpur. There are numerous regional farms in both regions to try out crops under different conditions. In Barbary, large colonists also make their lands available for experimentation with new varieties.

The propagation of improved varieties takes place through the S.I.P.'s in Barbary which distribute seed among cultivators. The new strains also become popular through the larger Muslim landlords, who along with the
colonists are among the first to adopt them and by demonstrating their success induce the smaller peasants to accept them. In West Punjab, there are agricultural officers and demonstrators within tehsils (sub-divisions of districts) who maintain demonstration plots here and there. Their number is however small. Another means of extending the use of improved varieties is through revenue officials - patwaris (village revenue assessors) and village headmen. The influence of larger landlords and of irrigation authorities has also been used. It may be said that on the whole, improved varieties developed by the government research stations are propagated slowly and have not entirely replaced the old mixed varieties as was evident from earlier figures. An increased number of pilot farms and demonstrators can secure quicker results. The development of improved breeds of cattle which constitute the draft power for cultivation is one of the primary tasks of research organisations in both countries and some progress has been made, especially on large farms. It was noticed under agricultural regions how some farmers in Barbary have themselves made experiments of cross-breeding with European and Indian breeds.

Modernisation Projects in Barbary

With the growing realisation that there are limits to which more land can be brought under the plough and also that the agricultural production cannot be raised
appreciably by limited efforts at improving the varieties of crops or providing credit, the governments of the three territories in Barbary have in recent years embarked upon ambitious plans of modernising the fellah. The methods they have followed differ sufficiently to justify their treatment separately under each country.

**Tunisia:**

In Tunisia there are contrasts not only between Europeans and Muslim peasants but also between different groups of Muslim peasants themselves. To bring the major part of the native peasantry up to the level of the garden-cultivators of Cap Bon and the olive growers of the Sfax would be a great advance in the amount and reliability of production. Improvement of production has been planned in the following ways:

1. **Expansion of the field of activity of the Tunisian group of S.I.P.s.** By a decree of 1945, they have become responsible for assisting all native cultivators, not only in times of difficulty but also in their efforts to buy improved implements or animals. A scheme of fire- and hail-insurance is being tried.

2. **Some centres for lending agricultural machinery** have been created since 1946 notably those at Gafour, Souk es Sebt and Tajrurine.

3. **Clearing of cultivable wastelands** has been undertaken with the help of machinery.
Headquarters of the Service Botanique et Agronomique of Tunisia at Ariana outside Tunis. It is at the centre of a large farm in which experimentation with species is carried on. The building contains laboratories and a large library.

These two young bulls are the offspring of an Indian (Sindhi) sire and a Tunisian cow. They have been bred at the Government Veterinary Farm at Sidi Tabet in Tunisia. Part of the stables on the farm visible behind. The owner of farm 19 on the right.
A herd of horses and mules at the same farm. They are kept together but breeding is supervised.
The reaction of the peasants to the last two steps has been very favourable and they have eagerly come forward with the payment of their shares of expenses. Certain French colonists have also grouped their machinery into co-operatives from which it is hired to Muslim proprietors as well. These as well as the official tractors have been kept very busy. It may be added however that these plans for hiring out machinery to those who cannot buy it benefit mainly the owners of medium-sized holdings whose fields are large enough to allow of the use of a tractor. The smaller holdings have remained largely unaffected.

The new policy of "Paysanmat" (French equivalent of rural uplift) is aimed at reorganising the countryside into new agricultural and pastoral communities grouped together in well-planned settlements. One instance may be quoted - that of Ain Jelloula 20 miles west of Kairwan. It was a prosperous centre in ancient times as is evidenced by remains of a city but had been practically in ruins for several centuries. In 1939, a well and a reservoir were created, the irrigated land was distributed among the inhabitants and apricot plantations were established.

The area now under the "revival plan" of the Paysanat covers over 370,000 acres and envisages the creation of 23 weirs and 150 other irrigation works (wells, reservoirs etc.)

---

Algeria:-

In Algeria, land-hunger is greater than in any other part of Barbary because of greater European colonization combined with the greater pressure of population on the soil. The annual increase of population exceeds 130,000 and in 1946 the number of agricultural families with insufficient or no land was estimated at 600,000 or 60% of the total. The problem of rehabilitating this floating population as well as the general demographic position requires a great effort to expand the cultivated area. Even in years of good rainfall the total Algerian production hardly satisfies 90% of the requirements. When a year of drought occurs as that in 1945, production may be a third of the normal and 70% of all food requirements may have to be imported or else famine conditions prevail. In 1945 - 46 a plan was adopted and advocated the following steps:

1. To improve the cultural methods of the melk proprietors.
2. To bring under cultivation the extensive communal lands then ill-utilised and distribute them among disinheriteds peasants.
3. To buy European or Muslim lands offered for sale and also distribute them among the destitute cultivators.
4. To bring new areas under irrigation.
5. To improve the condition of pastoralists in the dominantly pastoral areas.

(i) Documents Algeriens "Peasnat Musulman", Secteurs d'amélioration rurales et Société Indigènes de Prévoyance 1st June 1946.
The plan took the shape of rural uplift sectors (Secteurs d'Amelioration Rurales or S.A.R.) under the administration of the S.I.P. They draw their financial support largely from the funds of the S.I.P and also benefit from its functions of providing improved seed, storing facilities and technical assistance. The government may make subventions for any large capital expenditure involved. They constitute miniature geographical units, large farms in each type of terrain and rainfall regime. They consist of communal lands or melk lands grouped into co-operative farms or again land purchased from various sources. Although they exist mainly for Muslim peasants, European cultivators can participate in their collective estates and use the facilities. On principal, machinery is employed mainly to clear the lands and thereafter, cultivation is conducted on a family-holding basis by the resettled fellahs with improved iron ploughs etc. The S.A.R.'s practise the type of cultivation characteristic of the region in which they exist although each allotment holder is encouraged to plant a small garden and follow some additional pursuit i.e. stock-rearing. The S.A.R.'s are divided into several types:

1. Cereal-growing S.A.R.'s on Melk Lands:

On these the fellahs own the lands they cultivate with the help of khammes tenants. They receive loans from the S.I.P. for buying improved ploughs and seed and to apply fertilizer.

---

These S.A.R.'s also hire their tractors to other private landowners.


An example of these is the S.A.R. at Berthelot established on 5,000 acres of abandoned land on which 64 landless families were settled. Each family received 30 acres of land of which 15 are cultivated each year, 6 sheep, a small plot of irrigated land for garden crops and on a ten year payment basis, one mule. Each grantee agreed to follow the instructions of the agricultural officer in charge. All agricultural operations are conducted in groups, using the dry farming methods with deep ploughing. On hardened soil, tractors are used. A settlement of 64 houses was under construction in 1948 for the families of the grantees.

3. Another type of S.A.R. for rehabilitating landless peasants in the irrigated type on which individual allotments consist of parcels of only 4 acres or so which are then planted with fruits and vegetables. This allotment may appear small but it can support a family of five quite easily with intensive cultivation.

4. Fruit-growing S.A.R.'s :-

They are planned to extend the area under fruits over communal and melk lands. Planting is done with the help of the service for soil-conservation and the care is then taken by fellahs under the supervision of an expert. Manures and insecticide sprays are used to ensure high yields. About 3,800 acres have thus been planted in the region of Tlemcen.
Other S.A.R. types are those devoted to olive-growing wherein methods perfected at Sfax are used and those devoted to stock-rearing on which watering points are provided and the breeds improved.

At the beginning of 1947, the following S.A.R.'s were in existence:

(a) 34 devoted to cereals; area - over 675,000 acres, grouping 12,000 fellahs.

(b) 5 devoted to fruit growing - area 25,500 acres, over 1,100 fellahs.

(c) 1 under vegetables - area 3,700 acres with 150 fellahs.

(d) 41 under grazing covering over 12 million acres.

The S.A.R.'s were at first looked at with suspicion by the Muslim peasants but slowly their fear of being expropriated is giving way to a realisation of the value of this remarkable plan which is helping to support thousands of dispossessed families and at the same time to increase production.

Morocco:-

In Morocco, land is more plentiful than in Algeria so that whereas complete mechanisation has not been tried in Algeria, it has been made the basis of the modernisation policy in this territory. The institution of the S.M.P. (Secteurs de Modernisation du Parpanat) has for its objects

(a) The demonstration of the advantages of mechanised cultivation to the Muslim peasants and to train them in all the modern methods of agriculture.
(b) To affect social and judicial advancements from an initial state of collectivisation to one of private property, at the same time retaining a degree of co-operative enterprise without which advanced techniques cannot be practised. The provision of medical facilities, improved housing and village is planned side by side with the agricultural advancement of a tribe or group of tribes.

Each S.M.P. constitutes an ethnic unit as it combines the lands of one or several related tribes; it is also a unit of public administration in which the government and the jemaa participate thus bringing about a fusion of tribal laws with those of the central government and finally, it is a centre for the provision of social services for the improvement of health, housing etc. The autonomy of each of the S.M.P.'s is one of the government's objectives.

The decree initiating this experiment in modernisation was passed in June 1945 and five sectors were established, two in the Fez-Meknes region, one in the plain of Triffas, one in the Tadla plain and one north of Marrakesh. Each had a collective farm of several thousand acres of virgin land and the participating tribes enjoy rights in proportion to their share of the land. Crops that are normally associated with the region are grown and most of the work is done by Muslim peasants who are paid wages out of the income. The government finances the setting up of the farm, the purchase of machinery and arranges for European technical personnel.

(i) P. Prefol - "La Modernisation Rurale au Maroc", AGRA, June 1945 p.145.
The collective farms are designed to continue till full production has been reached and the peasants have been trained. It is then proposed to divide a part of them into individual holdings, retaining a large central farm.

This type of S.M.P. functions on collective lands. In regions of old-established agriculture with a melk regime of property, collectivisation has a co-operative aspect and the system resembles the S.A.R.'s of Algeria, only there is a greater use of machinery. These large farms are known as S.E.R.A. (Secteurs d'exploitation rurale améliorés).

The third form of the S.M.P.'s is the specialised types concentrating on fruit growing, vegetables or stock-rearing. Some of the larger S.M.P.'s combine the characteristics of the several types - that of El Hajeb, one of the first to be established, consists of a large collective farm, a section devoted to stock rearing and a zone of intensive irrigated cultivation.

**Attitude of Muslim peasants** :- Except where virgin lands have been brought under the plough, the individual fellahs whose lands have been collectivised have been suspicious of the government's intentions. The policy of the government - that of initiating a policy of doing good without consulting the intending beneficiaries has manifest disadvantages because the Muslim fellah cultivating melk lands is an individualist in his personal outlook. The construction of the farms of the S.M.P. has in all cases started with the provision of comfortable modern quarters for the European personnel whose number on each farm may be up to 20. This causes uneasiness among a people who have had
experience of official European colonization in the past. The cost of working these farms is also unduly increased through the maintenance of a large European staff and the fellah, reduced for the time from a state of independence to one almost of a wage-labourer is often resentful. The experiment should be followed with interest and on its success will depend the future agricultural policy of the government. It is necessary however that the administration does not lose sight of its primary objective - that of improving the condition of the fellah. The use of machinery means that not all the collectivised peasants find work on the farm. Alternative means of employment must be found for the extra hands either through the establishment of small-scale agricultural industries or by initiating additional means of making a livelihood from the land through garden plots etc.

By 1948, 17,400 acres were directly cultivated by the S.M.P., 4,000 acres in association with individual owners and partial cultivation was undertaken on 7,400 acres. In addition, 7,200 acres had been cleared for future cultivation. About 29,500 acres were under the care of S.E.R.A.'s. The original plan envisaged an increase in the total number of S.M.P.'s to 110 in 5 years with an area of half a million acres covering most of the regions of Morocco.

Modernisation in West Punjab:

No projects parallel to those initiated in Barbary have been undertaken. The co-operative credit societies have

been the nucleus around which have grown other co-operative societies for dealing with other problems of the peasant. The co-operative consolidation of holdings was described in an earlier chapter. "Better Living Societies" have been founded to reform social customs. Some of them have been holding village competitions in improving methods of cultivation, home industries, cattle, implements etc. Their total number in undivided Punjab was 2,097 in 1943-44. (i)

Exhibitions and fairs have been organised periodically in which improved implements, better breeds of cattle and better villages are popularised. There has been no attempt however to experiment with collectivisation or mechanization as in Barbary.

Other fields of governmental effort:— The eradication of widespread illiteracy among the cultivators and the institution of elementary instruction in better agricultural methods remain some of the major tasks of the respective administrations. Provision of village plots along with primary schools has been tried successfully in some parts of West Punjab. Whatever the methods used, educational uplift is the pre-requisite of all real agricultural progress and no effort and expense is excessive for this purpose.

121 A harvester-combine on Farm 7 in Morocco. Use of motorised transport has made it possible to extend commercial crops into the mountainous interior. Truck on the left is ex-army. Haystack to the right. Stubble of barley on the ground.

122 "Auto-rails" such as the one in this picture seen at Biskra station are run by diesel-oil and go almost twice as fast as ordinary trains. Their role in linking Saharan outposts with the Tell cannot be overestimated. This one did the mountainous Constantine to Biskra journey of 200 miles in 4 hours.
The family of a son of the owner of Farm 13. There are seven children and there is always hope of further "gifts of God". Pine trees and a gourbi at the back on the sloping ground.

The writer with the members of the "Society of Tunisian Agriculturists" at Mateur. Its office seen at the back of the group is located in a mosque. It furnishes agricultural information and gives advice on marketing.
CONCLUSION

THE FUTURE ORIENTATION OF AGRICULTURAL PLANNING

This study as a whole has been concerned with the geographical aspect of agriculture, i.e. with crop production and its problems in relation to the environment. Some striking similarities in the basic physical and cultural features of Barbary and West Punjab have been established and ultimately considered in detail in their regional aspect along with the associated types of land-use and farms. Finally a brief survey has been made of the present efforts towards the improvement of agricultural standards. It is now proposed to draw some practical conclusions from this parallel study of the two regions. These conclusions do not in themselves constitute an agricultural plan as the formulation of such a plan was not the primary object of this study. In the course of an intensive study and field enquiries about physical, cultural and economic facts certain results were arrived at that furnish the basis for a number of constructive suggestions. These will now be set forth briefly in the hope that they may be of some practical utility to those who direct the agricultural development of either of the two territories.

Any policy or plan aiming at the agricultural development of these two regions will begin with a realisation of three fundamental problems:
1. The Demographic Problem: The relation of agricultural production to population is a basic one in determining the adequacy of food supply. In essentially agricultural countries like Barbary and West Punjab, the present and future prosperity of the people depends largely on the volume of production per unit area and per head of the agricultural population. Over several decades there has been a rapid increase in the population of these regions but agricultural production has failed to keep pace with it. The present time is one of a precarious balance but the persistence of rapid population growth along with static or only slowly increasing agricultural production is bound to create serious problems in the future. The question needs to be analysed in detail but to emphasise its essential features some salient facts may be set out:
(a) The population of Algeria, which may be taken to represent conditions typical of Barbary and for which alone reliable statistics are available over a long period, increased from 4½ millions in 1901 to about 8½ millions in 1946 or 89% in 45 years. In West Punjab, an increase of 82% was recorded between 1901 and 1941 - from 8½ million to over 15½ million.

The following table of comparisons with some other countries puts the position into perspective. The increase of total population in these regions from 1901 to 1931 has been comparable to that in Egypt but much greater than that in Great Britain.

<table>
<thead>
<tr>
<th>Country</th>
<th>1901</th>
<th>1931</th>
<th>Increase%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>4,739</td>
<td>6,544</td>
<td>38.3</td>
</tr>
<tr>
<td>West Punjab</td>
<td>8,500</td>
<td>12,809</td>
<td>50.5</td>
</tr>
<tr>
<td>Egypt</td>
<td>11,287</td>
<td>15,921</td>
<td>41</td>
</tr>
<tr>
<td>Great Britain</td>
<td>37,000</td>
<td>44,795</td>
<td>21</td>
</tr>
</tbody>
</table>


The much greater increase in West Punjab can partly be attributed to immigration into the canal colonies from the districts now in east Punjab.

(b) This rapid increase of population has continued, and may be ascribed to the contrasted effects of western science

(i) Egyptian figures for 1907-1937.
on the birth and death rates. Among a strongly religious and generally illiterate population, the attempts of modern medicine to preserve life meets with approval whereas any attempt to limit fertility will be strongly resisted. Hence while the death rate is reduced, the birth rate continues high. This tendency may not be checked for some time to come. The example of this trend may be given from India. The death rate declined from 41 in the decade 1881-1891 to 31 in 1931-41; the fertility figures on the other hand showed a smaller decrease from 49 to 45.\(^1\) The trend in the interval has not been uniform but has varied. The net rate of increase has on the whole continued to rise. This will become evident from the following table showing per-cent increase in each decade over the previous decade since 1901. After an appreciable fall during the decade 1911-1921, due in the case of West Punjab to the terrible influenza epidemic of 1918, the rate has continued to rise steadily.

<table>
<thead>
<tr>
<th>Decade</th>
<th>ALGERIA Increase%</th>
<th>Decade</th>
<th>WEST PUNJAB Increase%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1901-1911</td>
<td>15.7</td>
<td>1901-1911</td>
<td>17.6</td>
</tr>
<tr>
<td>1911-1921</td>
<td>3.8</td>
<td>1911-1921</td>
<td>7.7</td>
</tr>
<tr>
<td>1921-1931</td>
<td>14.2</td>
<td>1921-1931</td>
<td>17.6</td>
</tr>
<tr>
<td>1936-1946</td>
<td>20.9</td>
<td>1931-1941</td>
<td>23.4</td>
</tr>
</tbody>
</table>

(Table compiled from Vivet and Laumont, Op.Cit. and Census Reports for Punjab)

\(^1\) Kingsley Davis, "Demographic Fact and Policy in India", Demographic Studies of Selected areas of Rapid Growth, New York, 1944, p.41

\(^{ii}\) Algerian increases are only for the Muslim population which constitutes 85% of the total.
than in Algeria or Morocco and their influence on agriculture is even less marked. The distribution of rainfall and the nature of the soil constitute the main natural controls. Their significance however is secondary to that of the human factor for nowhere else in Barbary does one find the same contracts between neighbouring regions of similar rainfall and soils as in Tunisia. The garden cultivators of Cap Bon have long since practised methods of cultivation that approximate to the best traditions of modern fruit culture and stand out in contrast to the elementary type of cultivation by the native population of the interior. The olive-growers of Sfax have similarly excited the admiration of French colonists and officials by their systematic application of dry-farming methods and the extension of olive orchards in an area getting less than 8" of rainfall is as much an achievement of their labour as it is a result of peace and security established by the Protecting Power. Not far inland the steppes with similar rainfall and soils are still under semi-nomadic grazing and the population lives seasonally in tents. These contrasts cannot be explained away simply in terms of higher coastal humidity. The calibre and traditions of agriculture among different communities have a role in the nature of the exploitation of the soil which it is proposed to consider in the following scheme of agricultural regions adopted for Tunisia.
THE NORTHERN TUNISIAN WHEATLANDS

Northern Tunisia, like north-western Algeria, presents an instance where the agricultural landscape is uniform over several physical regions, the basis of this unity being the predominance of wheat among the crops grown. From the Beja plateau and the Mateur plain to the plains and basins of the Tell range stretches a belt of wheatlands with colonists and large local landowners growing mostly soft wheat while the great mass of fellahs devote their small holdings to hard wheat. Barley has a secondary importance while vines, olives and fruit trees occur sporadically. Leguminous crops are grown over a considerable proportion of the lands farmed on a large scale but they are cultivated only in rotation with wheat to give the land some rest from the exacting requirements of the cereal.

Physical Background

The Northern Tell ranges of Kroumirie and the Mogods in the north are largely forested and can therefore be passed over. Their ascent from the coast is an abrupt one so that there is no coastal lowland, the only stretches suitable for cultivation being the alluvial and often marshy deposits from short coastal streams. The Nefsa basin alone is of sufficient extent to deserve notice. This mountainous region merges into the series of plateaux extending up to the Mejerd valley which have been grouped into the Beja region. These constitute an undulating surface in which limestones are predominant and rise as gentle hills with marls forming depressions. The elevation in this region ranges from 500 feet to over a thousand feet, the greater heights prevailing.
Photograph shows part of Beja, the largely European settlement at the centre of the fertile Beja plateau. Lands near the town are under vegetables as can be observed on the picture but the surrounding undulating countryside is planted entirely with cereals.

Another part of the Beja region. White patch shows the ripe barley crop while the darker part is under wheat. The undulating plateau surface is again seen to advantage. In the foreground are three gourbis inhabited by workers.
102
Ripened soft wheat lying on a European farm north of the Mejerda west of Mejez-el-Bab. Slopes of the hill in the distance are also under cereals. Field has been ploughed after harvesting according to dry-farming practice.

103
The new orange plantation on farm in the Mejerda Valley. Notice wind-breaks and the manure lying on the ground. The trees are planted hexagonally allowing three-way movement of tractors.
towards the north and the west. Towards the south, the region is fringed by a range 1,500 - 2,000 feet high situated between the Wadis Tine and Mejerdha. The Baja region provides some of the best farm lands in Tunisia because of its variety of deep fertile soils. Striking changes in the colour of the soil over short distances are a notable feature over several parts, and one may observe in close proximity red decalcified soils lying over limestones, dark heavy soils associated with marls and intermediate varieties where these zones merge. The tops of the limestone heights are commonly bare of soils and the settlements are located on these.

East of the Baja and northern Tell regions lies a depression occupied by the lake of Bizerta and the inland basin of Garaet Ashkal around which occurs an alluvial plain which was called the Mateur plain under "Relief." The low-lying parts of the area are barely a few feet above sea level and are covered with marshes during the rainy season. Some of the heavy clay soils of this area have been brought under the plough. Southwards and to the west are gentle slopes towards the higher surfaces formed by alluvial deposition from streams among which Wadis Tine and Kloufi are the most prominent. Lighter soils occur on the higher slopes.

The Mejerdha Valley consists of two main basins as was described in Chapter II and these form distinct plains separated by a narrower section of the valley. The plain of Ghardimaou which is known as the Rekba plain is barely 6 miles wide. The
Dakhla plain around Suq el-Arba and the Merja plain south of Suq el-Khemis form a continuous alluvial basin within which several of its larger tributaries join the Mejerda, the largest of these being the Mellegue. Their fan slopes above the marshy lands close to the river provide the best agricultural land and the plain gains in breadth along their valleys. The Mejerda valley lies between a low series of heights to the north seldom exceeding 1,500 feet while southwards rise the mountains of the High Tell. Gradients within the valley are low for the Mejerda falls only 600 feet in its total length of 300 miles below Ghardimaou. Slopes are not regular, however, for whereas the river meanders sluggishly between high banks in the two basins described above, it descends rapidly during its passage through a gorge above Testour along an elbow of capture. The hills on either side rise steeply to over 1,500 feet and are mostly wooded. Below Testour the Mejerda is joined by Wadi Siliana from the south and after traversing a short distance enters its delta below Jedeida. The delta has however been included in the Tunis Mixed-Farming Region.

The Mejerda valley has deep alluvial soils. The hydrographical regime of the river is subject to violent fluctuations and during periodic floods, the normal winter flow of 34,000 cusecs at Tebourba may exceed 460,000 cusecs. The flood menace is most serious in the Delta. During summer, the flow of the river is down to 35 cusecs.
The southern part of the Northern Tunisian Wheatlands consists of several basins that lie between the low hills prolonging the Tell range towards the east. These include some semi-closed basins like the Goubellat plain between 400 and 500 feet south-east of Mejezel-Bab, the Bled Boucha basin between 600 and 700 feet with its imperfect drainage marked by the existence of two sebkras. A series of lowlands south-west of Tunis lie between steeply rising low hills. These are the plains of Sminja (400-500 feet), Pont due Fahs (500-600 feet) and Bu Arada (600-700 feet). No intermediate slopes occur between the fertile plains with their heavy alluvial soils and the limestone eminences which are bare of a soil mantle. The southern limit of the wheatlands lies where barley becomes more important than wheat on account of increasing aridity.

Just as the topography and soils are varied in the wheatlands, rainfall also ranges from below 16" in the south to the highest rainfall in Tunisia at Ain Draham in the coastal range. "Over a larger part of the area, however, annual precipitation exceeds 16" which is adequate for unirrigated cereal-cultivation.

**Land-use and Farm Types**

Intensity of land-use varies according to rainfall and the Mejerda valley divides the wheatlands into two parts:

1. North of the Mejerda valley rainfall is in excess of 20" and a biennial rotation is applied with leguminous crops in alternate years.

2. Southwards, dry-farming methods are resorted to and
only one crop - that of cereals - is obtained in two years. This is a biennial rotation with cultivated fallow.

The main basis of diversity in the quality and quantity of the crops produced is that of the size of holdings. Large estates, most of them owned by European colonists, are cultivated by means of agricultural machinery which is best suited for the predominantly heavy soils of northern Tunisia. Thus the proper utilization of several areas, notably the Mateur plain and parts of the Mejerda valley dates back to the introduction of heavy ploughing machinery some thirty years ago prior to which the heavy soils could not be exploited fully. Over the sloping lands fringing these lowlands and especially south of the Mejerda Valley, extensive areas are cultivated in holdings of type A by fellahs who obtain low yields and are dependent on the vagaries of the rainfall.

Starting with the north, the Mateur plain is dominated by medium to large sized wheat-growing holdings (farm type C). Some of these are still cultivated with traditional methods by khammes tenants but a large majority are modern farms in which machinery is employed. Farm 19 in this region belongs to an enlightened Muslim landlord who founded the first co-operative society of Muslim cultivators in Tunisia at Mateur which does useful work in diffusing information, in supplying improved seed and advising on agricultural methods. It is a private body which meets in rooms under the main mosque of Mateur. The farm six miles south of Mateur consists of 5,500 acres (2,200 Ha)
This was cultivated this year as follows:

Wheat: Hard Wheat 1235 acres (500 Ha) (Mahmoudi and Roussiah)

Soft Wheat 495 " (200 Ha) (Florence Aurore)

Barley 125 " (50 Ha)

Leguminous crops 495 " (200 Ha)

Flax 740 " (300 Ha)

Forage & pastures 990 " (400 Ha) The rest - unploughed

The introduction of flax on a large scale is a comparatively recent development as in other parts of Barbary. Cattle-rearing is carried on at the farm on a large scale there being 225 head of cattle, many of them crossed with European and Indian breeds. They require a large number of farm-workers which increases from 20 in winter to 30 in summer when the cattle are out in the open. The rest of the farm requires only 60 permanent workers as American-manufactured tractors are employed.

Yields average 1070 lbs. per acre (12 Qx per Ha) for hard wheat, slightly more for soft wheat, 1425 lbs. per acre (16 Qx per Ha) for barley and 1070 lbs. (12 Qx) on the average for leguminous crops. A biennial rotation is employed with leguminous crops each alternate year. Phosphate fertilizers are used for cereals and potash for other crops. Yields are highest on the well-drained soils on the slopes.

The undulating Beja region north of the Mejerda Valley is entirely cereal-growing and held by European colonists in holdings of the Type C. Contrasts between black heavy soils on argillaceous (marly) strata and the red soils on ferrigenous limestone give rise to differences in crops. Photo shows
the ripening barley crop extending over the poorer sandstone soils on the left while wheat extends to the right. A biennial rotation with beans and peas each alternate year is practised. The area under flax is increasing.

The Mejerda valley is also under cereals with an occasional new plantation of fruits towards its lower part. Farm 20 at Souk el-Khemis is typical. Of its 1,235 acres (500 Ha), 1,110 (450) are under cereals, half of these being soft wheat and half hard wheat of improved varieties. About 20 acres of land has been planted with oranges since 1945-46 and is irrigated by means of 3 wells worked by oil engines. The rotation, use of fertilizers and yields approximate to farm 19. As the Mejerda emerges from its valley below Mejez-el-Bab, olive plantations and vineyards become increasingly prominent but this zone merges into the Tunis region to be described later. The Mejerda valley is cultivated in large holdings but the valley sides and the upper part of the plain is held in small holdings by the Muslim fellahs.

South-east of the Mejerda valley and south west of Tunis the several basins and plains described above are cultivated with cereals in large holdings by Europeans and Muslim notables as well as in smaller holdings by fellahs who, in general, occupy the poorer hillsides. A European Colonist's farm (No. 21) near Bu Arada was visited for detailed study. The owner is at the same time the postmaster at Bu Arada. The farm covers
European farm and farm family. Behind and to the right are various machines used on the farm. The aeromotor is typical of modern farms. Land in the background is under wheat and barley for the most part.

Ploughing a field by tractor on Farm, in accordance with dry-farming practice for the wheat crop in the following season.
An excellent standing crop of soft wheat (Florence Aurore) in the Bu Amda region. Low bare hills in the background. A European farm is also seen. The entire plain is devoted to wheat in this section.

View of sloping plough land taken from the same farm. Scattered groups of gourbis surrounded by trees on the hillside.
675 acres (277 Ha) of gently undulating land with outcrops of limestone here and there which render restricted areas uncultivable (see diagram 50) Except for 7 acres under fruits and vegetables and 91 acres of poorer land in pastures, the entire area is under soft wheat (Florence Aurore) This is grown on a biennial rotation with cultivated fallow every alternate year. The colonist also cultivates 30 acres belonging to Muslim owners supplying his own seed, implements and labour and pays them one-fifth of the produce. This arrangement is thus seen to be the reverse of the khamessat contract and works according to the formula of the five bases of cultivation described in Chapter 8. Yields of wheat average 1070 lbs. per acre (12 Qx per hectare) but may exceed 1780 lbs. (20 Qx) in good years. The surrounding area has mostly small Muslim holdings of type A. Yields obtained from these average less than half those obtained from modernised farms.

Olive plantations occur sporadically in the region south of the Mejerda Valley. Most of these are old and give low yields. Sheep are grazed on uncultivated areas. The owner of the farm described above has 200. The building of this farm is shown in photograph

**Rural Settlements**

The pattern of rural settlement varies a great deal and accords with the pattern of relief, intensity of cultivation and the relative prosperity of cultivators. Traces of the effect of insecurity are found in many older hill-top settlements occurring
north and south of the Mejerda.

The coast has small settlements in the limited stretches of lowland relief at the mouth of some streams, notably the Nefsa river. Tabarka in the north-west is a larger town with some Europeans and is surrounded by a small plain. Southwards the forested Kroumirie and Mogods ranges have relatively few settlements, these being located in cultivated clearings on spurs or on hill-tops. The slopes of hills rising around the Mateur plain as well as those that border the Beja region have small Muslim hamlets on the prominent spurs and also on their tops. The majority of the habitations in these hamlets consist of gourbis with mud walls and thatched roofs although poorer gourbis constructed entirely of thatch are also found.

Within the Mateur plain, the settlement is concentrated in the town of Mateur which is illustrated in photo. Scattered European farms occur mainly south-east of the town. The Mejerda valley has a number of large rural centres. Two of these - Suqel-Arba and Suqel-Khemis - have developed on the sites of large suqs and contain a considerable European element. Their situation on the fans of tributaries of the Mejerda is noticeable. Smaller settlements also tend to occur away from the river whose course is often marshy and which is subject to floods. The hill slopes north and south of the valley have a marked concentration of hamlets consisting of a mixture of gourbis and houses.
In Algeria and Tunisia, the annual rate of population increase in 1937 stood at 2.08% and 1.64% respectively and they ranked among the 25 countries with the highest rates of increase in the world. (i)

(c) Agricultural production has not increased in Barbary at the same rate as population. In Algeria, whereas there was a three-fold increase of population from 1856 to 1938, the areas under the three principal cereals (hard wheat, soft wheat and barley) increased only 115% while yields remained almost stationary. It is not possible to provide figures of total agricultural production over this period but the figures for the staple food crops indicate the general lag of production in relation to the population. The country which was a net exporter of grain before 1930 imported almost as much as it exported in the following years. (ii) Since the war, it has satisfied only 90% of its requirements. (iii) While a grain deficit does not exist at present in Tunisia and Morocco, population may outstrip production when the limit of expansion in area is reached. The same is true of West Punjab. Thereafter, increased production from the same areas is the only hope of self-sufficiency in food.

Apart from providing food, agriculture is also the chief source of livelihood in these areas. As, unlike the

countries of Western Europe, prospects of industrial expansion along with the increase of population are limited, agricultural planners have to face up to the task of maintaining a rapidly increasing population on the land. Large-scale emigration is out of the question under existing world conditions.

II The Low Standards of Living:

That the general standard of living in both Barbary and West Punjab is very low is widely recognised. But the popular conception remains vague and neither the real implications nor the measure of actual poverty is realised. Unfortunately, no attempt has been made to establish standards of national income on a scientific basis nor have the living standards of the various classes been measured relative to higher local and world standards.

Colin Clark has arrived at very approximate but nonetheless useful figures for India as a whole on the basis of total national income and for Algeria on the basis of the prevailing wage rates, both for the decade 1925-34. (ii) The average income per head of an Indian was 200 international units (this being purchasing power of a U.S. dollar for the same decade henceforward referred to as I.U.) and a little under that figure for Algeria (192.4 I.U. at 3.7 dollars per week).

Conditions do not vary in Barbary very much and the Algerian

---

(i) See Appendix on Industrialization
(ii) "The Conditions of Economic Progress", London, 1940, Chapter II
figures may be applied to the region as a whole. According to Clark's classification, the two regions belong to the lowest category of national income in the world. India, of course, includes regions of economic variation and West Punjab probably has a slightly higher national income. The national income per head of certain leading countries may be indicated for contrast from the same source (in I.U.'s for 1925-34):

<table>
<thead>
<tr>
<th>Country</th>
<th>National Income (I.U.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.A.</td>
<td>1381</td>
</tr>
<tr>
<td>India</td>
<td>200</td>
</tr>
<tr>
<td>New Zealand</td>
<td>1202</td>
</tr>
<tr>
<td>Algeria</td>
<td>192</td>
</tr>
<tr>
<td>Great Britain</td>
<td>1069</td>
</tr>
<tr>
<td>Australia</td>
<td>930</td>
</tr>
<tr>
<td>France</td>
<td>684</td>
</tr>
</tbody>
</table>

This table contains figures for some predominantly agricultural countries like New Zealand and Australia to show that the richer countries need not always be industrial ones.

The implications of low national income per head is that nutrition is inadequate, housing and clothing unsatisfactory and there is next to no provision for education and medical care. It also means that the rural population can barely keep going in normal years and does not possess any surplus to meet drought or disaster (such as floods, hail etc.) and may therefore become chronically indebted. Any expenditure for agricultural improvement is out of the question. Detailed statistics or economic surveys are not available for either territory but the following survey conducted jointly by the
figures may be applied to the region as a whole. According to
Clark's classification, the two regions belong to the lowest
category of national income in the world. India, of course,
includes regions of economic variation and West Punjab probably
has a slightly higher national income. The national income per
head of certain leading countries may be indicated for contrast
from the same source (in I.U.'s for 1925-34):

<table>
<thead>
<tr>
<th>Country</th>
<th>National Income (I.U.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.A.</td>
<td>1381</td>
</tr>
<tr>
<td>India</td>
<td>200</td>
</tr>
<tr>
<td>New Zealand</td>
<td>1202</td>
</tr>
<tr>
<td>Algeria</td>
<td>192</td>
</tr>
<tr>
<td>Great Britain</td>
<td>1069</td>
</tr>
<tr>
<td>Australia</td>
<td>980</td>
</tr>
<tr>
<td>France</td>
<td>684</td>
</tr>
</tbody>
</table>

This table contains figures for some predominantly
agricultural countries like New Zealand and Australia to show
that the richer countries need not always be industrial ones.

The implications of low national income per head is
that nutrition is inadequate, housing and clothing unsatisfactory
and there is next to no provision for education and medical
care. It also means that the rural population can barely keep
going in normal years and does not possess any surplus to meet
drought or disaster (such as floods, hail etc.) and may
therefore become chronically indebted. Any expenditure for
agricultural improvement is out of the question. Detailed
statistics or economic surveys are not available for either
territory but the following survey conducted jointly by the
Punjab Department of Public Health and the Board of Economic Enquiry conveys some impression of the standard of living in West Punjab.\(^1\) The survey was conducted in a canal colony village in Lyallpur in which actual area cultivated per family varied from 15-39 acres. This is relatively prosperous for West Punjab when comparison is made with the average size of holdings. Even so food accounted for 47-50% of the expenditure. Out of 75 families, 40 had a deficit budget and only 35 were able to meet their expenses. Of the latter, only 21 depended entirely on agricultural income. As regards diet, wheat was the chief cereal followed by maize. Pulses figured prominently but the consumption of green vegetables was very low while fruits found practically no place in the general diet of Muslim families. Flesh foods were also of insignificant importance and nutrition was found to be highly inadequate.

When it is realized that the average peasants in West Punjab and Barbary are much poorer than those in this irrigated village of medium-sized holdings, the appalling poverty of the agricultural population can be realised. Even this poor subsistence may be replaced by famine and distress if population continues to outstrip agricultural production. The raising of this exceedingly low standard of living is therefore the second fundamental problem of the agricultural planner. In fact if this can be achieved fast enough, a flattening of the population curve may be expected as has been experienced in other countries.

\(^{1}\) Afzal Hussain "The Nutrition Problem of the Villager", Developing Village India, 1946, p.148-149
The Remedies: The solution of both these problems lies in increasing agricultural production. This can be achieved along two lines -

(1) an increase in the cultivated area, and

(2) the modernisation of agriculture both in its methods and organisation.

Any initiative for the planning and execution of large-scale schemes of development must come from the state for the general level of personal income as well as illiteracy both preclude the possibility of spectacular achievements by private enterprise.

I The Increase of Cultivated Area: Some of the problems that hinder the expansion of cultivation have been discussed in the course of this study. The most fundamental and permanent of these is inherent in the regions - that of climatic aridity. The progress made in the development of irrigation and the application of dry-farming methods has been reviewed earlier and further scope for development has been indicated. With the completion of the Thal Project in the near future, the water resources of West Punjab will have been utilised as fully as is economically possible at present. The largest remaining uncultivated area - the Thal - will have been brought under the plough. Thereafter, the maintenance of fertility as well as further extension must come about on the basis of dry-farming. The methods applied in parts of Tunisia - especially those in the drier southern regions -
offer possibilities. Repeated ploughing at intervals, weeding and harrowing and the bunding of plots can conserve enough moisture to yield one good crop in two years in the unirrigated parts of the western districts. Results achieved during experiments at Rohtak were sufficiently encouraging to warrant the extension of these methods. In Barbary, the scope for the extension both of irrigation and dry-farming is much greater than in West Punjab. Numerous irrigation schemes are at present in hand though the government has not been able to propagate dry-farming techniques sufficiently. It should be realised that though dry-farming methods do not give striking results quickly like irrigation they bring about an all-round and lasting improvement in agriculture by their emphasis on soil and water conservation.

An increase in the cropped area can also be achieved through the reclamation of saline and waterlogged lands of which considerable areas exist both in Barbary and West Punjab. It may be added that the removal of excess sub-soil water can not only liberate large areas for cultivation but also provide additional irrigation supplies. Thus Sir Bernard Darley envisaged the extension of irrigation in West Punjab through tube-wells now that the development of canal irrigation had reached its limit. This method of draining land and extending irrigation may also be tried in Barbary.

(i) Op.Cit. p.50
Soil conservation measures in both Barbary and West Punjab need to be intensified. Planning and achievement in the latter appear to be far ahead and some of the catchment projects that have succeeded in the Potwar Plateau may well be studied in Barbary. The peril of soil erosion is much more serious at present in the largely mountainous landscape of Barbary and needs to be faced with better organisation and larger trained staffs as the officials themselves admitted.

II The Modernization of Agriculture

Contrasted policies: The present policies of the respective governments of Barbary and West Punjab were outlined (i) in the previous chapter. The British policy in West Punjab that has been maintained under the Dominion's administration was one of making effective use of the existing social and economic organisation to foster co-operation, to introduce improved crops and methods within the framework of the traditional mode of agriculture. This was the policy of an administration which was organised by a relatively small number of British officers who knew by their experience that the only hope of governing the great mass of people lay in retaining the old-established system in its essentials. The system of ownership and tenures was at most codified without appreciable change; spectacular developments were confined to transforming the earth rather than the men, i.e. the great extension of irrigation without any attempt at changing the basic features of

(1) From B.A.Keen's (Op.Cit.) outline of British policy in Sudan, it would appear that this policy has been followed pretty generally.
the rural society as was evident from the system of colonization in the irrigated areas. Indigenous officers and staffs were used to carry out most of the agricultural propaganda. In brief, this has been a policy which aims at achieving an improvement of the traditional methods and systems without introducing any fundamental changes.

French policy was conditioned firstly by the proximity of Barbary to metropolitan France, secondly by the influx of a considerable number of colonists and administrators and lastly by the theories of assimilation which believed that the best thing that could happen to any subject people was their adoption of the French political, economic and social system. The disastrous attempts at bringing about a change in the system of land-ownership were one consequence of this policy. Other more happy measures were the recent launching of ambitious schemes for the mechanization of agriculture. The main trend in French agricultural policies has been one of imposing improvements rather than of persuasion, hence the apathy of the population. The administrators have viewed with distrust any tendency for spontaneous mutual co-operation among the Muslim population. Thus the numerous Associations of Muslim Agriculturists in Tunisia formed on the initiative of the cultivators themselves were not given any encouragement through subventions or grants. The S.A.R's in Algeria and the S.M.P's in Morocco are however among the more successful results of this policy. Ambitiously conceived as these projects
are, they cannot in the writer's opinion, achieve appreciable success as long as European colonization of cultivable lands continues. While on one hand it reduces the land resources at the disposal of the native population, it also fosters suspicion of government efforts and propaganda.

Comparing these two policies, both have their merits and those measures in either region that have been successful in achieving an improvement of the peasant's condition and methods may be briefly re-stated with relation to the main problems:

(1) **The Small-Holding**

The emphasis in West Punjab has been on the co-operative consolidation of widely scattered plots into composite fields through mutual agreement among the cultivators themselves. Some instances of this were given in a previous chapter. Under the Islamic regime of property that still prevails in Barbary, equal sub-division of lands containing parcels of different quality is bound to result very often in the partition of each parcel. This tendency can lead to such extremes of fragmentation that a great deal of time and energy may be wasted in ploughing scattered plots. An investigation into the existence of this problem as well as the adoption of co-operative consolidation is therefore desirable in Barbary.

While attempting to solve this problem of fragmentation the West Punjab government has not interfered with the other problem, that of progressive sub-division among succeeding
generations. The need to halt this trend was realised in Morocco in 1945 when in a year of drought and widespread distress small peasants sold their lands heavily to the large proprietors. The law that was then passed fixed the minimum size of a family holding as follows: beyond which subdivision or sale is not permissible:

- 18½ acres of unirrigated land
- 3½ acres of irrigated land
- 2 acres of fruit orchards

The imposition of such a minimum limit is an urgent necessity in West Punjab as well as in the other territories of North Africa where the number of minute and uneconomic holdings has been increasing. The size of what constitutes an economic holding will depend upon the nature of crops grown and the intensity of farming.

(2) Rural Credit

The problem of providing adequate credit arises out of the smallness of the average holding and the low level of personal and national income in the two regions. At present rural credit in Barbary is administered exclusively by the S.I.P's which are equivalent to the takavi grants made by the government in West Punjab. There is hardly any counterpart for the additional credits provided in West Punjab by the Co-operative Societies. It may be added that co-operation among the European

---

(1) E.C.M., "Maroc", p.246
population of Barbary is highly developed but its spread to the native population has not been countenanced. This is a regrettable aspect of French policy because mutual self-help among closely-knit village societies has been found to be the best insurance against difficulties and also the most successful means of financing small-scale improvements in cultivation in West Punjab, i.e. in the digging of wells, purchase of better bullocks or improved implements and seeds.

(3) Rural Organisation and Leadership

Adherence to tradition has been considered to be at least as important an obstacle in the way of agricultural progress as the prevailing poverty of peasants. It has been the excuse of governments which do not wish, for some reason, to embark upon a programme of ameliorating the condition of the villager. That a change of outlook can be achieved has been demonstrated by the transformation of the Beni Amir tribe in

(i) Morocco. Furthermore the success of F.L.Brayne's attempts to improve rural conditions in West Punjab within the framework of the "village democracy" shows convincingly that with sympathetic guidance, and practical propaganda, the neglected village democracy can be revived into an active stimulant of rural progress.

(i) Brayne, an officer of the Indian Civil Service, set the pattern for rural uplift in India by his experiments in Gurgaon District (now in East Punjab) He revived panchayats, established village nurseries, stimulated education and in other ways tried to get village life to go forward. Details from his book "Better Villages" and from his evidence before the Royal Commission on Agriculture (Report, Volume VIII)
Traditional institutions and group-loyalties are still very much alive in both Barbary and West Punjab. The Jemaa (tribal assembly) has been used by the governments in Barbary for negotiating with tribes. This institution which in the Kabylie region still has an effective control over the administration of the tribe can be made a vehicle for spreading better agricultural techniques and can be modernised in its functions by being entrusted with the provision of amenities - roads, schools, watering places etc. This has been achieved by the revival of the ancient "Panchayat" institution in West Punjab villages. This is a body of elected village elders who used in olden times to practically govern the village. Today this complete autonomy is not possible but panchayats have exercised a useful function as a stabilising influence in rural life. In the United Provinces, India, experimental panchayats in certain areas became the veritable centres of social and cultural activity, organising co-operative village stores, fruit nurseries, grain distribution depots etc. By encouraging a similar growth of the Jemaa or of co-operative self-help in Barbary, the state can simplify the task of propagating agricultural information and maintaining social and economic stability. The process could also be further extended in West Punjab.

The training of indigenous persons in advanced agricultural techniques needs to be encouraged in Barbary. It was indicated in earlier chapters that the rural population resists progress as advocated by the French because of a deep-

(1) "Developing Village India", p.62-64
seated hostility and suspicion. Political remedies are beyond the scope of this work but the use of Muslim personnel can greatly facilitate the improvement of agricultural standards. Keen noted how in the absence of British officers from parts of Sudan during the late war, native Sudanese officers made much greater progress in popularising improved methods. The somewhat better standards of the Punjab peasant and the greater propagation of better varieties of crops can also be attributed to this factor.

(4) Intensification and Commercialization of Production

With this we come to an aspect of agriculture in which West Punjab has much to learn from Barbary - mainly from European agriculture. Among the practices that were studied at close quarters, the following can be propagated in West Punjab:

(a) The extension of fruit orchards, especially citrus

(b) The use of chemical fertilizers

(a) Extension of fruits: The essential requirements of fruits such as light loamy soils, safety from winds and frost, supplies of irrigation water are present in West Punjab. There has been, in fact, a gradual expansion of the area under fruits, and Roberts and Kartar Singh noted an increase of 100% for undivided Punjab from 1933 to 1944-45. But the area under fruits remains very low and even after this expansion covered only 56,291 acres or less than 3% of the area. Of this area over 52% was under mangoes and 28% under citrus fruits. Out

of the area under citrus, improved varieties (locally called maltas) are grown mainly in the canal colonies and have flourished excellently. In the remainder of the province, loose-skinned indigenous oranges are grown. Areas under lemons and grape-fruit are insignificant. On the other hand, consumption of citrus fruit per head of population is among the lowest in the world. An expansion of citrus and other fruits would therefore appear to be one possible step in agricultural improvement. It may be added that some of the varieties of citrus grown in West Punjab are identical to those in vogue in Barbary, i.e. Valencia Late and Blood-red.

The cultivation of citrus fruits brings high returns per acre, demands the use of a large labour force and provides dependable returns. It can also diversify and enrich rural diet. Unfortunately, there is not sufficient demand for the crop at present. But demand can be created with the propagation of the crop and the increasing urban population is bound to increase its consumption.

(b) Use of Chemical Fertilizer: West Punjab at present consumes insignificant quantities of chemical fertilizer which is among the outstanding discoveries of science for agriculture. In the various farms visited in Barbary, it was noted how yields per unit area increased by 100% and more through the application of fertilizer. This appears to be the most important trend which can be introduced into West Punjab

(i) Ibid, p.351
agriculture. Unlimited quantities of gypsum occur in the Salt Range (i) and as this is a major ingredient in the manufacture of ammonium sulphate, a large fertilizer industry can be established.

From West Punjab, the only crop with commercial possibilities that could be extended into Barbary is cotton. Small areas are already devoted to improved long-stapled varieties (Pima) in Morocco. The crop had undergone great vicissitudes in Algeria where a great expansion of the crop was envisaged during the 19th century. The results were, however, disappointing. Barbary lies at the northern limit of cotton growth so that while on one hand climatic variability may shorten the essential growing season, the crop is also susceptible to pests like the prickly worm which resulted in its recession 1938. Economic factors are the competition of cheaper produce from U.S.A., Egypt and other countries. The area under cotton increased from 2,400 hectares in 1914 to 8,300 hectares in 1926. Thereafter the area became progressively reduced till a mere 200 hectares remained in 1933 and the crop almost disappeared in 1938. The difficulties of importing cotton due to the war resulted in a rise in its area up to over 2,500 hectares in 1941 but once again a recession set in due to pests (ii) on one hand and cheaper imports on the other. The areas

(i) Bhatty M.A., A Regional Survey of the Potwar Plateau, 1946, p.127 A chemical plant had already been established at Khewra in 1942.
(ii) Figures from E.C.M., "Algerie", p.335
within which the crop can be extended are limited to the low-
lying alluvial plains i.e. the valley of Shelif, the plains of
Relizane, Sig, Habra and Marnia where it has been grown under
irrigation. In the Bone plain it has been grown unirrigated.
In Morocco, it is at present confined to the Beni Amir plain.

Considerable demand exists in France for the long-
fibred varieties (cross of American and Egyptian strains)
produced in Barbary. The dollar shortage is another factor
in its favour. Within the region, the crop has a history
that goes back to the 8th century but on the whole a great
expansion is unlikely as the crop has to compete with vines and
citrus fruits and also because it is susceptible to pests.

Some of the oil-seeds grown in West Punjab might be
suitable for conditions in Barbary.

(5) The Mechanization and Collectivization of
Agriculture:

The state-initiated projects of the S.A.R's and
S.M.P's in Barbary offer an example to West Punjab, daringly
conceived plans aimed at bringing about a radical change in
the outlook and methods of the rural population. The one
prerequisite for a large-scale experiment of this type would
be extensive, virgin, uncultivable land because the best
start is one made from scratch. The collectivization of
hundreds of small-holders may be attempted but is obviously
much more difficult. A long-range plan of this type has
several advantages:
(1) It is possible to train large numbers of cultivators in advanced techniques of cultivation.

(2) Such a plan renders possible maintenance of a planned production of crops as well as the popularization of improved varieties. Large-scale farming also brings down costs.

(3) The system of land tenures can be overhauled over extensive areas.

Apart from the problem of finance and the supply of machinery, the integrity and selflessness of the staff on such large state-run estates is of fundamental importance otherwise with the decentralised control of several scattered collective farms, no end of abuse and waste can result. The experiment of collectivisation is worth a trial. As the lands to be irrigated by the Thal project are just being brought under the plough and most of them are government waste lands, an experimental farm of this type could be established. Large-scale mechanisation of agriculture may or may not be attempted and the question is debatable, yet the success of such enterprises not only in Barbary but also on a much larger scale in Russia has demonstrated how the problem of the small-holdings, of complicated tenures and low production can all be solved.

In the settlement of collectivised farms or "sectors", the principle of grouping the cultivators according to tribal or village groups ought to be followed as the success of this principle was demonstrated so well in the settlement of the Canal colonies in West Punjab.
It shall be observed from the above suggestions that both the methods, of modifying existing systems (the British policy) and of making novel state-initiated experiments (the French practice), can be practised in West Punjab and Barbary. Exactly what steps ought to be taken will be determined by long range policies on one hand and by the social and economic circumstances that obtain. The practical result of the comparable physical and cultural background of West Punjab and Barbary is to show that many of their problems are common and many of the attempted solutions mutually applicable. Their basic crops are and others can be interchanged, though economic as well as physical factors may hinder a closer approximation of the crop regimes. The physical diversity of Barbary, however, stands out as an agricultural factor of great importance, as has been illustrated by the detailed study of regions, and to these contrasts, reflected in land use and modes of life, West Punjab has no parallel.
SELECTED BIBLIOGRAPHY

General

FRENCH NORTH AFRICA


4. L'Encyclopedie Coloniale et Maritime, editors Eugene Guernier and G. Froment-Guieyesse, Paris:
   - Maroc 1948.
   - Algerie et Sahara 2 vol. 1948
   - Tunisie 1948.

5. Geographical Handbooks, Naval Intelligence Division, Algeria 2 vols, 1943.
   - Tunisia, 1945.
   - Morocco, 2 vols.


Morocco

7. Celerier J. Le Maroc, Paris 1931


Algeria


Tunisia

WEST PUNJAB


17. Developing Village India", Special Number of "Indian Farming", 1946.


25. Punjab District Gazetteers, Parts A and B.


27. Annual Reports of the Punjab Colonies 1931 - 36.

Physical Background
Structure and Relief.
Barbary


West Punjab.


35. Heron, H., "The Klrana and Other Hills in Jech and Rechna Doabs," R.G.S.I.


Climate


Barbary.


West Punjab.


56. Frequency of Thunderstorms in India, Scientific Notes, Vol.1.

Hydrography

Barbary


West Punjab.


Soil and Vegetation

General

61. Hall, Sir A.D., "The Soil".


Barbary


65. Agafonoff,V. and Yankovitch,L, Carte pedologique de la Tunisie, 1:800,000.


West Punjab.

Barbary

West Punjab.
98. Baden-Powell, Land Systems of British India.


The Problems of Agriculture
Irrigation


West Punjab.

117. Harris, D.G., "Irrigation in India" 1923, London 1924.


Water-Logging and Saline Lands.


Barbary.


West Punjab.


Soil Erosion.


Barbary
West Punjab.
Dry Farming
CROP PRODUCTION
Barbary.
152. Vivet, E. & Laumont, P., "La Production Agricole de l'Algerie"1940
155. Expose de la Situation Generale de l'Agriculture en Algerie en 1948"

West Punjab.

Improvement of Agriculture and Conclusion
184. Demographic Studies of Selected Areas of Rapid Growth, New York, 1944.

STATISTICS
Renseignements Statistiques Agricoles - Algerie - 1938, 1946.
Census of India, 1901, 1911, 1921, 1931, 1941.

MAPS
Barbary
Geographical Section General Staff,:
1. 1:1,000,000
2: 500,000
1:200,000
1:50,000
U.S. Army Map Service, Morocco 1:125,000
West Punjab
Survey of India 1 inch, ½ inch and ¼ inch to a mile maps.

ABBREVIATIONS
A.G. = Annales de Geographie
E.C.M. = Encyclopaedia Coloniale et Maritime
G.R. = Geographical Review
G.J. = Geographical Journal
J.R.S.A. = Journal of the Royal Society of Arts
R.S.M. = Quarterly Journal Royal Meteorological Society
R.G. Maroc = Revue de Geographie Marocaine
1.R.A. = International Review of Agriculture
S.G.M. = Sea History Geographical Magazine
T.A. = Tunnisie Agricole
B.I.M. = Bulletin d'Information du Maroc
G.H.N.I.D. = Geographical Handbook, Naval Intelligence Division
Note on the crop statistics of Barbary

The figures in the above tables are derived from the official statistical publications of the three territories concerned.

The agricultural statistics of Morocco, Algeria and Tunisia as at present published are entirely unsatisfactory from the point of view of a regional or statistical analysis. Neither the total area sub-divisions nor their total cultivated area is provided so that it is not possible to known what percentage of the area is cultivated or what is the exact percentage of an individual crop in terms of the area cultivated. This presented a serious difficulty in determining dominant crops on a statistical basis. The areas under cereals, vines, olives and other fruits were added up for each sub-division and percentages of crops calculated from these figures. Although not exact, the results provide a useful measure of the importance of different crops. The margin of error in this method is not very large. Thus the total cultivated area in Morocco when calculated in this manner was 3,080,000 hectares only 200,000 hectares short of the official total. This represents an error of 6% but as the additional area is mostly that covered by scattered fruit trees such as almonds, figs etc. it does not affect the figures of annual crops to a very great extent.

The published statistics for olives are given mostly in the number of trees. Areas were calculated by dividing these with the regional or national average of trees per hectare as given in

(i) Annuaire Statistique de Maroc 1945-46
Renseignement Statistiques Agricoles, Algerie 1946
Annuaire Statistique de la Tunisie 1947
various publications of the International Institute of Agriculture, Rome, (see bibliography). As an example, calculations for Tunisia were made according to the averages of 150, 70 and 18 trees per hectare respectively for the regions of Northern Tunisia, Sousse and Sfax.

Some further remarks may be made on the published statistics of each territory:

Morocco The statistics of annual crops are given under two categories - European and Moroccan, on different pages and totals are not provided. This is inconvenient. The present sub-division of the country into only seven regions is geographically inadequate. Thus the regions of Meknes extends from the Sebu Basin across the Middle Atlas and the High Plateaux of eastern Morocco to the Sahara.

Algeria The number of sub-divisions in Algeria is satisfactory from the point of view of regional studies. Two larger divisions - Algiers and Mostaganem have recently been subdivided but as the boundaries of new sub-divisions are not obtainable from published matter, they have had to be dealt with collectively. The figures for many crops are given according to larger divisions i.e. Departments. Thus it is not possible to judge from statistics as to where exactly in the Department of Algiers are early vegetables grown. A uniform degree of detail in figures would be a great advantage.

Tunisia The sub-division of the country into only two large zones is totally inadequate. If the detailed sub-divisions adopted for olives could be applied to other crops as well, the
statistics would be of much more use. Calculations for the northern and southern parts as a whole are valueless. Even this detail is not provided for most crops apart from principal cereals.

<table>
<thead>
<tr>
<th>Location</th>
<th>Casablanca</th>
<th>177</th>
<th>147</th>
<th>272</th>
<th>258</th>
<th>5</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fez</td>
<td>384</td>
<td>93</td>
<td>41</td>
<td>80</td>
<td>101</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Marrakesh</td>
<td>662</td>
<td>98</td>
<td>49</td>
<td>326</td>
<td>140</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>Meknes</td>
<td>241</td>
<td>69</td>
<td>48</td>
<td>46</td>
<td>29</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Oujda</td>
<td>81</td>
<td>18</td>
<td>11</td>
<td>40</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Rabat</td>
<td>542</td>
<td>144</td>
<td>76</td>
<td>91</td>
<td>130</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

**ALGERIA**

<table>
<thead>
<tr>
<th>Location</th>
<th>Algiers</th>
<th>299</th>
<th>916</th>
<th>514</th>
<th>729</th>
<th>10</th>
<th>351</th>
<th>144</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algiers</td>
<td>299</td>
<td>84</td>
<td>14</td>
<td>81</td>
<td>-</td>
<td>78</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Medea</td>
<td>70</td>
<td>28</td>
<td>13</td>
<td>23</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Miliana</td>
<td>146</td>
<td>54</td>
<td>46</td>
<td>30</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Orleansville</td>
<td>98</td>
<td>26</td>
<td>31</td>
<td>33</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Tizi-Ouzou</td>
<td>60</td>
<td>16</td>
<td>7</td>
<td>8</td>
<td>-</td>
<td>4</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

**Constantine**

<table>
<thead>
<tr>
<th>Location</th>
<th>Batna</th>
<th>104</th>
<th>44</th>
<th>8</th>
<th>51</th>
<th>1</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone</td>
<td>56</td>
<td>26</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Bougie</td>
<td>90</td>
<td>18</td>
<td>-</td>
<td>20</td>
<td>1</td>
<td>5</td>
<td>44</td>
</tr>
<tr>
<td>Constantine</td>
<td>348</td>
<td>186</td>
<td>41</td>
<td>114</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Guelma</td>
<td>88</td>
<td>65</td>
<td>1</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Region</td>
<td>Total Area</td>
<td>Hard Wheat</td>
<td>Soft Wheat</td>
<td>Barley</td>
<td>Maize &amp; Sorghum</td>
<td>Vines</td>
<td>Olives</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>--------</td>
<td>----------------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>MOROCCO</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agadir</td>
<td>189</td>
<td>3</td>
<td>2</td>
<td>157</td>
<td>17</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Casablanca</td>
<td>959</td>
<td>177</td>
<td>147</td>
<td>272</td>
<td>258</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Fez</td>
<td>384</td>
<td>93</td>
<td>41</td>
<td>80</td>
<td>101</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>Marrakesh</td>
<td>662</td>
<td>98</td>
<td>49</td>
<td>326</td>
<td>140</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>Meknes</td>
<td>241</td>
<td>69</td>
<td>48</td>
<td>46</td>
<td>29</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Oujda</td>
<td>81</td>
<td>18</td>
<td>11</td>
<td>40</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Rabat</td>
<td>542</td>
<td>144</td>
<td>76</td>
<td>91</td>
<td>130</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td><strong>ALGERIA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algiers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algiers</td>
<td>299</td>
<td>84</td>
<td>14</td>
<td>81</td>
<td>-</td>
<td>78</td>
<td>15</td>
</tr>
<tr>
<td>Medea</td>
<td>70</td>
<td>28</td>
<td>13</td>
<td>23</td>
<td>-</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Miliana</td>
<td>146</td>
<td>54</td>
<td>46</td>
<td>30</td>
<td>-</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Orleansville</td>
<td>98</td>
<td>26</td>
<td>31</td>
<td>33</td>
<td>-</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Tizi-Ouzou</td>
<td>60</td>
<td>16</td>
<td>7</td>
<td>8</td>
<td>-</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>Oran</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mascara</td>
<td>182</td>
<td>35</td>
<td>75</td>
<td>35</td>
<td>-</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Mostaganem</td>
<td>403</td>
<td>93</td>
<td>109</td>
<td>79</td>
<td>-</td>
<td>81</td>
<td>5</td>
</tr>
<tr>
<td>Oran</td>
<td>236</td>
<td>36</td>
<td>39</td>
<td>50</td>
<td>1</td>
<td>89</td>
<td>8</td>
</tr>
<tr>
<td>Sidi bel Abbes</td>
<td>185</td>
<td>28</td>
<td>73</td>
<td>32</td>
<td>-</td>
<td>34</td>
<td>4</td>
</tr>
<tr>
<td>Tlemcen</td>
<td>131</td>
<td>35</td>
<td>32</td>
<td>45</td>
<td>-</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Constantine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batna</td>
<td>104</td>
<td>44</td>
<td>8</td>
<td>51</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bone</td>
<td>56</td>
<td>26</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Bougie</td>
<td>90</td>
<td>18</td>
<td>-</td>
<td>20</td>
<td>1</td>
<td>5</td>
<td>44</td>
</tr>
<tr>
<td>Constantine</td>
<td>348</td>
<td>186</td>
<td>41</td>
<td>114</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Guelma</td>
<td>88</td>
<td>65</td>
<td>1</td>
<td>15</td>
<td>-</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Total Area</td>
<td>Hard Wheat</td>
<td>Soft Wheat</td>
<td>Barley</td>
<td>Maize &amp; Vines</td>
<td>Olives</td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>------------</td>
<td>------------</td>
<td>------------</td>
<td>--------</td>
<td>---------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td><strong>ALGERIA (Contd)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippeville</td>
<td>59</td>
<td>24</td>
<td>1</td>
<td>14</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Setif</td>
<td>231</td>
<td>120</td>
<td>20</td>
<td>96</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>TUNISIA</strong></td>
<td>1740</td>
<td>512</td>
<td>131</td>
<td>487</td>
<td>12</td>
<td>27.6</td>
<td></td>
</tr>
<tr>
<td>Northern Tu</td>
<td>750</td>
<td>322</td>
<td>126</td>
<td>157</td>
<td>12</td>
<td>27.6</td>
<td></td>
</tr>
<tr>
<td>Central &amp; Southern Tu</td>
<td>980</td>
<td>190</td>
<td>5</td>
<td>330</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE SHOWING PERCENTAGE OF AREA UNDER PRINCIPAL CROPS TO TOTAL CULTIVATED AREAS IN THE STATISTICAL REGIONS OF BARBARY (1945-46)**

<table>
<thead>
<tr>
<th></th>
<th>Hard Wheat</th>
<th>Soft Wheat</th>
<th>Barley</th>
<th>Maize &amp; Vines</th>
<th>Olives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MOROCCO</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agadir</td>
<td>19</td>
<td>11</td>
<td>32</td>
<td>21</td>
<td>-</td>
</tr>
<tr>
<td>Casablanca</td>
<td>24</td>
<td>15</td>
<td>28</td>
<td>26</td>
<td>-</td>
</tr>
<tr>
<td>Fez</td>
<td>12</td>
<td>8</td>
<td>21</td>
<td>26</td>
<td>-</td>
</tr>
<tr>
<td>Marrakesh</td>
<td>15</td>
<td>20</td>
<td>50</td>
<td>21</td>
<td>-</td>
</tr>
<tr>
<td>Meknes</td>
<td>22</td>
<td>12</td>
<td>49</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Oujda</td>
<td>26</td>
<td>13</td>
<td>17</td>
<td>24</td>
<td>1</td>
</tr>
<tr>
<td>Rabat</td>
<td>30</td>
<td>17</td>
<td>24</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td><strong>ALGERIA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algiers</td>
<td>28</td>
<td>5</td>
<td>27</td>
<td>-</td>
<td>26</td>
</tr>
<tr>
<td>Algiers</td>
<td>4</td>
<td>20</td>
<td>31</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Medea</td>
<td>38</td>
<td>30</td>
<td>20</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Miliana</td>
<td>25</td>
<td>30</td>
<td>32</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Orleansville</td>
<td>27</td>
<td>12</td>
<td>13</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Tizi-Ouzou</td>
<td>19</td>
<td>40</td>
<td>19</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td>Oran</td>
<td>23</td>
<td>27</td>
<td>20</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>Mascara</td>
<td>15</td>
<td>16</td>
<td>21</td>
<td>-</td>
<td>37</td>
</tr>
<tr>
<td>Mostaganem</td>
<td>15</td>
<td>39</td>
<td>17</td>
<td>-</td>
<td>18</td>
</tr>
<tr>
<td>Oran</td>
<td>27</td>
<td>25</td>
<td>35</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Constantine</td>
<td>43</td>
<td>8</td>
<td>49</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Batna</td>
<td>45</td>
<td>3</td>
<td>11</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>Bone</td>
<td>20</td>
<td>-</td>
<td>22</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Bougie</td>
<td>53</td>
<td>11</td>
<td>33</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Constantine</td>
<td>74</td>
<td>1</td>
<td>16</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>Guelma</td>
<td>40</td>
<td>2</td>
<td>23</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Philippeville</td>
<td>52</td>
<td>9</td>
<td>41</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Setif</td>
<td>43</td>
<td>17</td>
<td>20</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>TUNISIA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern</td>
<td>43</td>
<td>17</td>
<td>20</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Central and Southern</td>
<td>19</td>
<td>34</td>
<td>-</td>
<td>-</td>
<td>46</td>
</tr>
</tbody>
</table>
**Note on the General Statistics of West Punjab**

After the Partition of India in 1947, only 15 out of the 29 districts of the former province of Punjab were included entirely in West Punjab. Most of Lahore district was included but a portion of the district went to India. At the same time, the Shakargarh Tehsil of the Gurdaspur District was included in West Punjab. Throughout this thesis figures have been calculated for 16 districts including the whole of Lahore on the basis that the area lost in Lahore was more than made up by the inclusion of Shakargarh.

**Note on the Year 1944-45 in West Punjab**

The Season and Crops Reports make comparisons between the current production of various crops with the normals calculated over several years. In 1944-45, the production of principal cereal crops for the undivided province was generally in excess of the normal although the excess was not very considerable. Thus wheat was 111% of the normal, bajra 109% rice 124%. Cotton on the other hand was 90% of normal. This may have been the result of the "Grow More Food" campaign launched during the war. These features were fairly uniformly distributed over the province.
### Areas Under Principal Crops in 1944-45

<table>
<thead>
<tr>
<th>Crop</th>
<th>Cropped Total Area</th>
<th>Wheat</th>
<th>Bajra</th>
<th>Gram</th>
<th>In thousands of acres</th>
<th>Fodder</th>
<th>Cotton (A)</th>
<th>Cotton (B)</th>
<th>Sugar Cane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lahore</td>
<td>1333</td>
<td>351</td>
<td>75</td>
<td>128</td>
<td>351</td>
<td>110</td>
<td>51</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Sialkot</td>
<td>884</td>
<td>377</td>
<td>65</td>
<td>41</td>
<td>95</td>
<td>25</td>
<td>1</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Gujranwala</td>
<td>1085</td>
<td>408</td>
<td>56</td>
<td>91</td>
<td>153</td>
<td>22</td>
<td>13</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Sheikhupura</td>
<td>126</td>
<td>399</td>
<td>44</td>
<td>91</td>
<td>173</td>
<td>16</td>
<td>81</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Gujrat</td>
<td>1054</td>
<td>405</td>
<td>170</td>
<td>88</td>
<td>137</td>
<td>11</td>
<td>65</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Shahpur</td>
<td>1740</td>
<td>560</td>
<td>129</td>
<td>359</td>
<td>296</td>
<td>20</td>
<td>187</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Jhelum</td>
<td>702</td>
<td>340</td>
<td>180</td>
<td>27</td>
<td>37</td>
<td>11</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rawalpindi</td>
<td>586</td>
<td>243</td>
<td>81</td>
<td>10</td>
<td>26</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attock</td>
<td>1061</td>
<td>584</td>
<td>181</td>
<td>69</td>
<td>48</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mianwali</td>
<td>1140</td>
<td>424</td>
<td>72</td>
<td>373</td>
<td>148</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montgomery</td>
<td>1942</td>
<td>598</td>
<td>72</td>
<td>159</td>
<td>442</td>
<td>41</td>
<td>314</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Lyallpur</td>
<td>1876</td>
<td>689</td>
<td>34</td>
<td>130</td>
<td>370</td>
<td>42</td>
<td>328</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Jhang</td>
<td>987</td>
<td>369</td>
<td>48</td>
<td>54</td>
<td>203</td>
<td>3</td>
<td>128</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Multan</td>
<td>2223</td>
<td>773</td>
<td>86</td>
<td>122</td>
<td>368</td>
<td>22</td>
<td>543</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Muzaffargarh</td>
<td>817</td>
<td>372</td>
<td>28</td>
<td>69</td>
<td>160</td>
<td>16</td>
<td>13</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>D.G. Khan</td>
<td>979</td>
<td>230</td>
<td>104</td>
<td>76</td>
<td>47</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>19637</strong></td>
<td><strong>7122</strong></td>
<td><strong>1425</strong></td>
<td><strong>1887</strong></td>
<td><strong>3054</strong></td>
<td><strong>357</strong></td>
<td><strong>1732</strong></td>
<td><strong>250</strong></td>
<td></td>
</tr>
</tbody>
</table>

(1) Cotton (A) is Desi (indigenous cotton) and (B) American varieties.

### Percentage of Cultivated Area Under Principal Crops 1944-45

<table>
<thead>
<tr>
<th>Crop</th>
<th>Wheat</th>
<th>Bajra</th>
<th>Gram</th>
<th>Fodder Crops</th>
<th>Cotton (A)</th>
<th>Cotton (B)</th>
<th>Sugar Cane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lahore</td>
<td>27</td>
<td>6</td>
<td>10</td>
<td>27</td>
<td>13</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Sialkot</td>
<td>40</td>
<td>7</td>
<td>4</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Gujranwala</td>
<td>40</td>
<td>6</td>
<td>9</td>
<td>15</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Sheikhupura</td>
<td>36</td>
<td>4</td>
<td>8</td>
<td>15</td>
<td>8</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Gujrat</td>
<td>40</td>
<td>16</td>
<td>8</td>
<td>13</td>
<td>7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Shahpur</td>
<td>32</td>
<td>7</td>
<td>20</td>
<td>18</td>
<td>12</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Jhelum</td>
<td>48</td>
<td>25</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rawalpindi</td>
<td>40</td>
<td>14</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attock</td>
<td>57</td>
<td>18</td>
<td>6</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mianwali</td>
<td>37</td>
<td>6</td>
<td>33</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montgomery</td>
<td>30</td>
<td>4</td>
<td>8</td>
<td>22</td>
<td>17</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Lyallpur</td>
<td>37</td>
<td>18</td>
<td>7</td>
<td>20</td>
<td>19</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Jhang</td>
<td>37</td>
<td>5</td>
<td>5</td>
<td>20</td>
<td>13</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Multan</td>
<td>31</td>
<td>4</td>
<td>5</td>
<td>16</td>
<td>22</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Muzaffargarh</td>
<td>45</td>
<td>2</td>
<td>8</td>
<td>20</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>D.G. Khan</td>
<td>24</td>
<td>11</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>W.PUNJAB.</strong></td>
<td><strong>38</strong></td>
<td><strong>7.1</strong></td>
<td><strong>11</strong></td>
<td><strong>15.8</strong></td>
<td><strong>10.7</strong></td>
<td><strong>1.3</strong></td>
<td></td>
</tr>
</tbody>
</table>
### CLASSIFICATION OF CULTIVATED LAND IN WEST PUNJAB 1931-32

#### In Thousand Acres.

<table>
<thead>
<tr>
<th>District</th>
<th>Chahi</th>
<th>Nahri</th>
<th>Sailab</th>
<th>Barani</th>
<th>Abi</th>
<th>Total Cultivated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lahore</td>
<td>247(20)</td>
<td>738(59)</td>
<td>59(5)</td>
<td>169(13)</td>
<td>1</td>
<td>1213</td>
</tr>
<tr>
<td>Sialkot</td>
<td>340(42)</td>
<td>7(1)</td>
<td>77(10)</td>
<td>346(42)</td>
<td>16(2)</td>
<td>706</td>
</tr>
<tr>
<td>Gujranwala</td>
<td>364(40)</td>
<td>359(40)</td>
<td>44(5)</td>
<td>144(15)</td>
<td>5</td>
<td>916</td>
</tr>
<tr>
<td>Sheikhpuria</td>
<td>158(16)</td>
<td>707(70)</td>
<td>34(3)</td>
<td>87(9)</td>
<td>7(1)</td>
<td>888</td>
</tr>
<tr>
<td>Gujrat</td>
<td>174(17)</td>
<td>321(31)</td>
<td>55(5)</td>
<td>470(46)</td>
<td>-</td>
<td>1020</td>
</tr>
<tr>
<td>Shahpur</td>
<td>147(9)</td>
<td>829(47)</td>
<td>75(5)</td>
<td>511(33)</td>
<td>2</td>
<td>1564</td>
</tr>
<tr>
<td>Jhelum</td>
<td>243(3)</td>
<td>-</td>
<td>30(4)</td>
<td>662(83)</td>
<td>1</td>
<td>717</td>
</tr>
<tr>
<td>Rawalpindi</td>
<td>3</td>
<td>2</td>
<td>564(68)</td>
<td>3</td>
<td></td>
<td>572</td>
</tr>
<tr>
<td>Attock</td>
<td>29(3)</td>
<td>7(1)</td>
<td>9(1)</td>
<td>1026(95)</td>
<td>2</td>
<td>1073</td>
</tr>
<tr>
<td>Mianwali</td>
<td>35(3)</td>
<td>13(2)</td>
<td>222(21)</td>
<td>780(74)</td>
<td>1</td>
<td>1056</td>
</tr>
<tr>
<td>Montgomery</td>
<td>243(15)</td>
<td>1136(59)</td>
<td>44(3)</td>
<td>183(11)</td>
<td>4</td>
<td>1611</td>
</tr>
<tr>
<td>Lyallpur</td>
<td>30(2)</td>
<td>1376(96)</td>
<td>10(1)</td>
<td>.4</td>
<td>5</td>
<td>1423</td>
</tr>
<tr>
<td>Jhang</td>
<td>273(29)</td>
<td>507(55)</td>
<td>130(14)</td>
<td>13(1)</td>
<td>1020</td>
<td>924</td>
</tr>
<tr>
<td>Multan</td>
<td>814(47)</td>
<td>740(43)</td>
<td>124(7)</td>
<td>6</td>
<td>12(1)</td>
<td>1696</td>
</tr>
<tr>
<td>Muzaffargarh.</td>
<td>400(55)</td>
<td>108(15)</td>
<td>186(25)</td>
<td>8(1)</td>
<td>17(2)</td>
<td>720</td>
</tr>
<tr>
<td>D.G.Khan.</td>
<td>249(27)</td>
<td>127(14)</td>
<td>153(17)</td>
<td>363(40)</td>
<td>9(1)</td>
<td>900</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>3530(21)</td>
<td>6982(41)</td>
<td>1312(8)</td>
<td>4876(28)</td>
<td>86</td>
<td>17099</td>
</tr>
</tbody>
</table>


(i) For all districts except Sheikhpura. 1928-29.
WEST PUNJAB: ARIDITY MAP
1" = 73 Miles
Climatic Regions of Barbary and West Punjab according to Thornthwaite's Classification.

B - Forest
C - Grassland
D - Steppe
E - Desert
West Punjab
annual Rainfall
Variability of Rainfall (1917-1936).

West Punjab.

(After Randad)
SOIL TYPES

GENERALISED SKETCH MAP DRAWN FROM TUNISIAN ANALOGUES, FIELD OBSERVATIONS AND DOCUMENTARY ACCOUNTS OF SUB-REGIONS.

1. Solid colouring indicates definite types ascertained from reliable sources.

2. Colouring in spaced lines indicates rough distribution from documentary description or similarity of climate, vegetation etc. with some documentary evidence.

3. Gaps indicate lack of any information.

DARK MOROCCAN SOILS LOCALLY CALLED "JRS" ARE MARKED T

Podzols
Rendzinas
Soils with a crust
Soils of the steppes, also coastal sandy soils
Mountain soils (skeletal)
Alluvial soils
The Vegetation of West Punjab

Scale 1" = 75 Miles.
West Punjab
Average Size of Holdings
1931
1" = 34 miles

Below 6 acres
6 to 7.5 acres
7.5 to 10 acres
Over 10 acres
IRRIGATION FROM THE WADI FODDA DAM

- Principal Canals
- Proposed Canals
- Area Irrigation
- Irrigated Area
- Area partly irrigated from other sources
- Area irrigated by the Wadi Fodda Dam
- Dam in barrage
- Settlement

Scale 1:100,000
Irrigation from the Bakhadda Dam

Scale 1:100,000

Area at present irrigation by canals
Area limit of area projected to be irrigated by canals
Area irrigated by tube-wells
Canals
Drains in existence
Projected drains
Railway

Selekra of Peri Llane
Ferry
Cinchanb
West Punjab

Distribution of Wells

1944-45

Each dot represents 250 wells.
AREAS under IRRIGATION in the W. PUNJAB

1944-45
1" = 54 miles.

SOURCES OF IRRIGATION:
- Wells
- Govt. Canals
- Tanks
- Private Canals

2,000,000 ACRES
1,000,000 ACRES
500,000 ACRES

24,000,000 ACRES
THE WATER-TABLE OF WEST PUNJAB

DEPTH OF WATER TABLE BELOW THE SURFACE

Underground ridge

boundary

Source 2
West Punjab

Map illustrating the spread of the desert fringe 1870-1935
(after G. Col. Wright)

THAR DESERT

SHIFTING SAND

1" : 75 miles
Barani - Dependent on rainfall
Chahi - Irrigated by wells or other types of water lifts
Nahri - Irrigated by canals
Sailab - Lands periodically flooded or naturally moist by proximity of rivers

Classification of Cultivated Land
BARBARY HARD WHEAT

One dot = 9880 Acres (4000 Hectares)

1946-46.
BARBARY SOFT WHEAT

One dot = 9380 Acres (3800 Hectares)
1965-66
BARBARY BARLEY
One dot = 9880 Acres
4000 Hectares
BARBARY OATS

One dot = 1,940 Acres (2000 Hectares)
BARBARY LEGUMINOUS CROPS

Each dot = 2470 Acres (100 Hectares)
BARBARY OLIVES

Each dot represents 50,000 trees
BARBARY CITRUS FRUITS

Cada dot representa 50,000 hectáreas de 1948-49.
Barbary

DOMINANT CROPS ACCORDING TO STATISTICAL DIVISIONS (1935-36)

Relative importance of crops, indicated by the frequency of colored lines.

- WHEAT
- Barley
- Field Cereals
- Vines
- Olives
1 dot represents 10,000 acres.

1 dot represents 1000 acres.
WEST PUNJAB

FODDER CROPS

MAIZE

1 dot represents 10,000 acres.

1 dot represents 1,000 acres.

1 dot represents 1,000 acres.
1 dot represents 1000 acres.
1 dot represents 1000 acres.
Barbary Agricultural Regions

Map No.

102
West Punjab
AGRICULTURAL REGIONS
West Punjab
Increase of Population 1901-1941.