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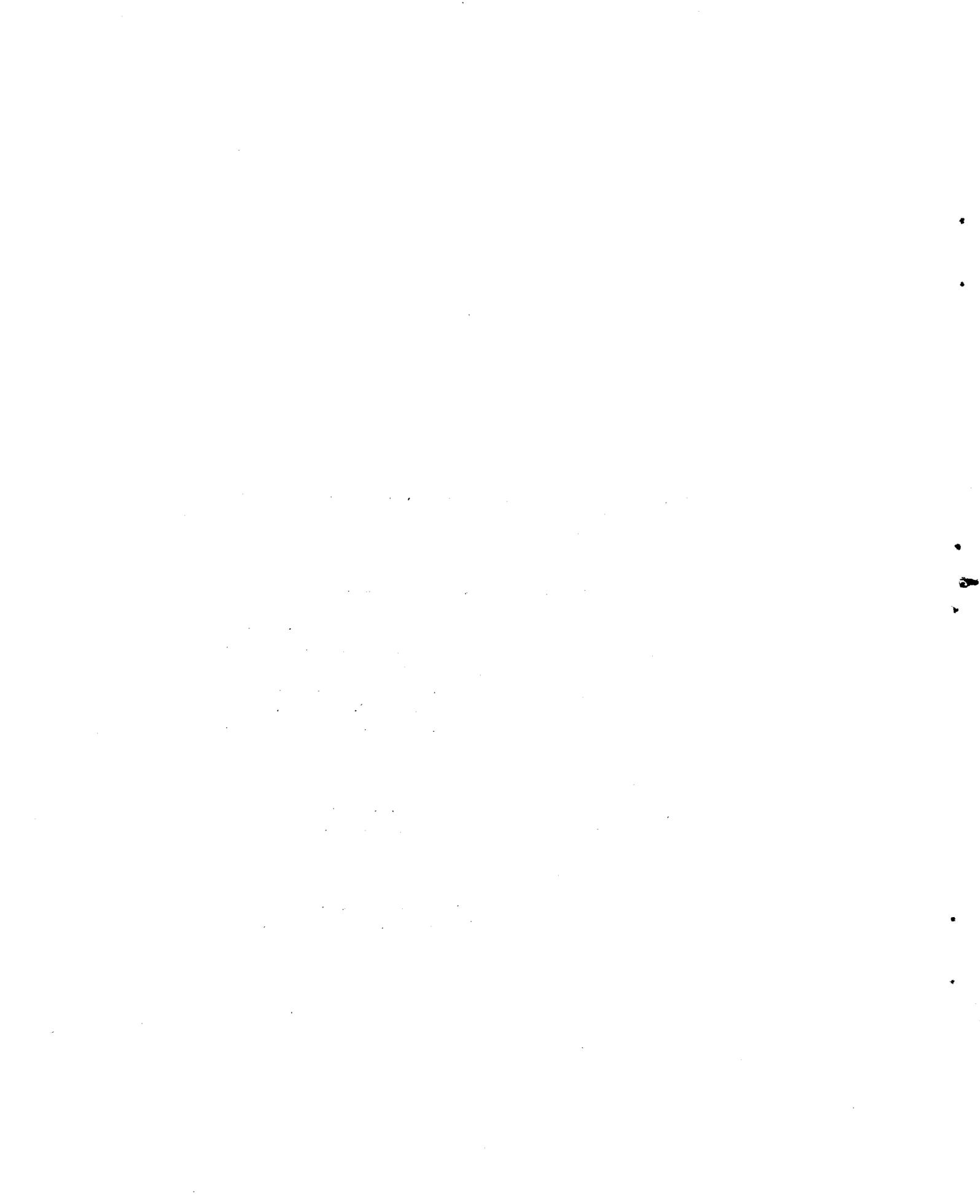
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AGRICULTURE IN MEXICO

INTRODUCTION

For reasons which are set forth later in this Report,^{1/} agriculture in Mexico on the whole, has always remained beyond the expansive impetus of capitalist economy, and to a certain extent still lies closely tied to the economic and social confines of the rural populations. Nevertheless, the fact that Mexico's economy is increasingly being patterned on the evolutionary course of modern world economy, and that consequently its industry is also being developed, has encouraged the expansion of certain branches of agriculture directed to the export of various products.

The last census in Mexico showed that 65.4 per cent of the gainfully employed population were agricultural workers, including those engaged in cattlebreeding, forestry, hunting and fishing. The following chapter shows that these people are inadequately distributed throughout the country, though concentrated in regions of milder climate, such as the southern part of the high plateau, which is not, from an agricultural point of view, the most productive; furthermore, the population in the numerous mountain regions is isolated and has practically no economic tie with the rest of the country. The causes determining the increase in population, which has occurred in the past few years, will be examined later; however, as the cultivated area has not increased correspondingly, the pressure of population on the land is heavy and has been the cause of many manifestations of social unrest. If the total area of agricultural land, as computed by the 1940 census, is divided by the number of persons engaged in agriculture,

^{1/} See Vol. 1, Chapter 1: "Extension of technical progress in Latin America and the problems it involves."

it will be found that each agricultural worker would have an area of 3.88 hectares, which, for the most part, can only be cultivated by utilizing the rainfall, - as a rule scarce and fortuitous, and generally limited to the months between June and October.

There is yet another drawback to the situation: - until 1910, rural property in Mexico remained divided into only a few large estates. The Agrarian Reform, which began in 1915 and is still being carried out, has to some extent diminished in size the vast tracts of land held by only a few owners, endowing the rural workers with the expropriated properties in the form of "ejidos". However, the average amount of arable land allowed each "ejidatario" is 4 hectares, which is not sufficient for those who work as independent farmers. The action taken by the Government in order to increase the amount of cultivated land by means of irrigation works of all types has definitely improved conditions and will continue to lessen the acute shortage of arable land, though it may not achieve a balance between the density of agricultural population and the natural resources required to enable that part of the population to be satisfactorily employed on the land.

There is a widespread conviction that Mexico lacks the ideal natural conditions for the ready development of agriculture, and that its productivity is hampered by serious restrictions which will be analyzed further on. It is even more pressing to make the best use of what agricultural wealth the country possesses in view of the lack of favourable conditions and the discrepancy between the available natural resources and the growing density of the farming population. This would justify the efforts made to redistribute the arable land and avoid large estates. One must not overlook the increase / in the amount

in the amount of irrigable land, the introduction and spreading of modern agricultural methods, and other measures which enable the small and medium-sized farms to make use of all that will ensure good returns from their owner's labour (agricultural credit, transport, etc.). One must also consider the development of industrial activities employing rural labour that is not working to capacity in agriculture in this way. It will be possible to eliminate certain factors promoting backwardness in Mexican agriculture: the low standard of life and the low purchasing power of the rural populations.

This Report will attempt to show that agriculture in Mexico is based fundamentally on irrigation, which will make farming a less insecure undertaking, even though it will always be subject to great risks and limitations. The Mexican Government has, since 1925, made a considerable effort in this direction, improving and irrigating a total of 1,012,656 hectares. When all the available resources of surface water courses have been utilized, this total will be raised to about 5 million hectares. Farm machinery can be employed in this area, together with fertilizers and improved seeds which ensure high productivity, and above all, the introduction of crop rotation. This has not been adopted until now because planting is determined by rainfall, which inevitably entails a system of mono-culture, or at the best, combination of the sowing of essential crops in order to satisfy basic food requirements. Despite irrigation, the greater part of agricultural production will continue to depend on rainfall, that is "the hand of Providence" which in Mexico is not merciful. Though there are damp

/scils in the

soils in the typically tropical zone, the coast of Veracruz and Tabasco and along the shores of the Pacific, in a region corresponding to Chiapas, - it will be necessary to drain this area before settling it, and this will require as much time and money as irrigation itself.

It has been indicated that one of the outstanding difficulties is to draw a large proportion of labour away from agriculture, and here the role of industrialization in the economic development becomes one of fundamental importance. But until the standard of living of the agricultural population is raised to a level ensuring their well-being, economic development will continue to be hampered by the extremely low purchasing power of the majority of the inhabitants. It is, therefore, most essential to improve agricultural methods in order to rehabilitate the economy of that section which is and will remain for many years the core of Mexico's population.

The foregoing naturally does not exclude but rather implies the necessity of industrial development, especially the growth of those occupations which involve the processing of raw materials and the maximum employment of all available resources.

/SECTION 1.

SECTION 1. STRUCTURE AND CHARACTERISTICS OF MEXICAN AGRICULTURE

I. POPULATION

Growth. According to the 1940 Census, Mexico had a population of 19,655,251 inhabitants, and in June 1949 it was estimated at 24,602,313 inhabitants. This extraordinary increase, outstanding in the last few years, can perhaps be partly explained by more prosperous living conditions caused by the economic changes which have recently taken place in Mexico. The raising of the standard of living was a natural consequence of the population's improved economic condition. The mortality rate was lowered from 22.6 to 16.3 deaths per thousand inhabitants between 1935 and 1948, and during the same period the birth rate rose from 42.3 to 45.3 births per thousand inhabitants. Government action in improving health conditions in different regions and in the medical services enlisted in fighting endemic and epidemic diseases has undoubtedly contributed to lowering the mortality rate, though in certain areas where the rural population is isolated and in poor economic circumstances, an impressively high mortality rate neutralizes the excessive birth rate.

Active Population. The total population census for 1930 and 1940 give the number of gainfully employed population as 5,165,803 and 5,858,116 respectively, showing an increase of 692,313 over the ten year period. It has been estimated that in 1949, there was a total of 7,327,339 gainfully employed persons in Mexico, of which 4,760,648, that is 64.9 per cent were engaged in agricultural pursuits, including cattle-breeding, forestry, hunting and fishing. The number of gainfully employed persons in agriculture has not increased proportionately to the total working population. In fact, there has been a reduction in the number of those engaged in agriculture due, as we have shown, to the growth of industry notwithstanding which it still holds true that Mexico is essentially an agricultural country.

The number of gainfully employed persons engaged in other activities is very small, compared with those in agriculture. For instance, there are 47,991 persons employed in mining and petroleum, 639,607 in primary manufacture, 149,470 in transport and 552,462 in business. It should be

/noted that these

noted that these statistics taken from the 1940 census do not include those persons temporarily engaged in the foregoing categories; these persons are considered as farmers or agricultural day labourers, even though they only work in the fields during the rainy seasons (from June to October) spending the rest of the year in other occupations, such as mining, or else in business on their own account. In other cases, as for instance in the wide desert area of the North, these persons registered as being gainfully employed in agriculture because they reside in rural areas and till the soil when the rains enable them to do so, also work in the mines occasionally or gather forest products such as fiddle, lechuzilla or palma (all hard fibres), Candelilla wax, Gueyule (a rubber bush), wood and coal. However, such details cannot be noted in a census and it is for this reason that the number of persons engaged in agriculture appears to be so high.

This category also includes those engaged in hunting and fishing, which cannot be properly classified as agriculture; but the number of persons performing these tasks is so small, 27,835, that is 0.72 per cent of the total number of persons employed in agriculture, that evidently the principal occupations in agriculture are the cultivation of crops and stockbreeding. We nevertheless intend to stress the fact that many farmers, and among them the "ejidatarios" to whom we will refer later, spend a great deal of their time in economic activities other than gathering the fruits of the earth. In the past few years they have been employed in road-building and as a rule, during the off-season in the fields, they operate small businesses, or else work as artisans in the small rural industries.

/The women

The women represent a very small proportion of the total number of persons gainfully employed in agriculture, a mere 1.04 per cent, and of these only 304 are engaged in forestry, hunting and fishing, and only 31 per cent are agricultural workers. This agrees with the facts: as a rule, though the women assist the men in some tasks (harvesting, gathering fruit, or wood for the home or for sale, pasturing the herds, contrarily to the customs of some other countries, they do not, save in exceptional circumstances, engage in heavy agricultural labour such as tilling or irrigating. This is chiefly because the preparation of the "Tortilla" (a sort of pancake made of ground corn meal, which is the basis of their staple diet) is a laborious business requiring no less than five hours daily, and which, when ready, must be eaten at once. The tortilla is unlike the bread that the labourers of other countries can carry with them to their place of work, and which can be eaten several days after baking. On the contrary, the women carry it to their menfolk working in the fields, together with the beans and other seasoning, which it is also the custom to eat hot. This is the most common diet of a peasant family, but in some states, such as Tabasco, Chiapas and Yucatán, the staple diet is the fermented corn flour diluted with water, known as "pozol", which the farm hand takes with him and drinks during the day. "Pozol" can be kept for several days without becoming sour.

Geographical Distribution

The agricultural population is inadequately distributed throughout the whole country, as regards agricultural possibilities and the amenity of the climate. The most favourable region is the southern part of the high /plateau,

plateau, in which agricultural resources are good and the climate is the best for human habitation. For this reason, it is the most densely populated. In other regions, the combination of the two factors is less favourable. For instance, in the coastal zones of Tabasco, Chiapas, Oaxaca, Guerrero and Michoacán, as well as along the southern coast of Veracruz, agricultural prospects are very good, but the climate is unhealthy where it is not unfit for human habitation, and consequently this sector is very slightly populated. In some of the mountainous regions of the ranges and desert areas of the North, the climate is good but agricultural possibilities are extremely limited; the population, however, is higher than would be expected in view of these limitations. Naturally there are other instances in which different factors counter the favourable or unfavourable influence of climate or agricultural prospects, such as in the case of the northwest coastal area, where the climate is healthy, and water and good soil are abundant, but which requires the investment of large sums for its exploitation. Consequently, the population thus far has remained low, though it is increasing in a measure with the execution of irrigation works.

These, however, are not the only factors determining the distribution of Mexico's agricultural population. Before the coming of Cortez, the predominant tribes, such as the Aztecs, drove away their enemies from the richer terrains. This same process was repeated during the colonial era, when some of the native groups, fleeing from enslavement by the colonizers or representatives of the Spanish throne ("encomenderos"), sought refuge in the mountainous regions. At this same period the development and prosperity of mining in some places resulted in the creation of agricultural colonies on inadequate lands. This is the case of the districts surrounding /the mineral

the mineral deposits at Pachuca, in the state of Hidalgo, at Zacatecas and in the northern part of Guanajuato.

Density

The census of 1930 show the density of the population gainfully employed in agriculture in relation to the total area of cultivated land, confirming what has been said previously. It can be seen from the attached table that while the density for the whole country is 25 inhabitants per square kilometer, it is the higher in the Central Zone, including the Federal District and the State of Mexico, which show the highest rate of density in the country. The lowest density of agricultural population is found in the Gulf Zone, in the states of Campeche, Quintana Roo, Tabasco, Veracruz and Yucatán; in the northern Pacific Zone it is a little higher, especially in the southern part of the state of Baja California, where it is quite high as being a desert area, there is practically no arable land. In the northern section of this state, the density of agricultural population in relation to cultivated land is very low, despite the fact that the land is well irrigated. The table shows that the density of such populations varies considerably and does not correspond to the area registered as arable. For instance, Campeche, Nayarit, Sonora and Querétaro, representing slightly more than 2,000 square kilometres, have a density of 6.11, 22.20, 22.81 and 26.8 persons per square kilometre; on the other hand, the greatest area of cultivated land is located in the state of Jalisco (12,202 square kilometres) where the density of population is 23.05; Veracruz with 11,006 square kilometres has a density of 30.34 persons per square kilometre; the cultivated area in the states of Puebla and Michoacán

/ is about

is about equal to that of Veracruz but here the density of population is 29.63 and 36.06 respectively; and, finally, the states of Chihuahua, Durango, Zacatecas, Chiapas and Guerrero, representing a little more than 6,000 square kilometres, have a density of 18.47, 17.07, 18.04, 25.71, 25.80 and 25.80 persons per square kilometre respectively. (See Table 1).

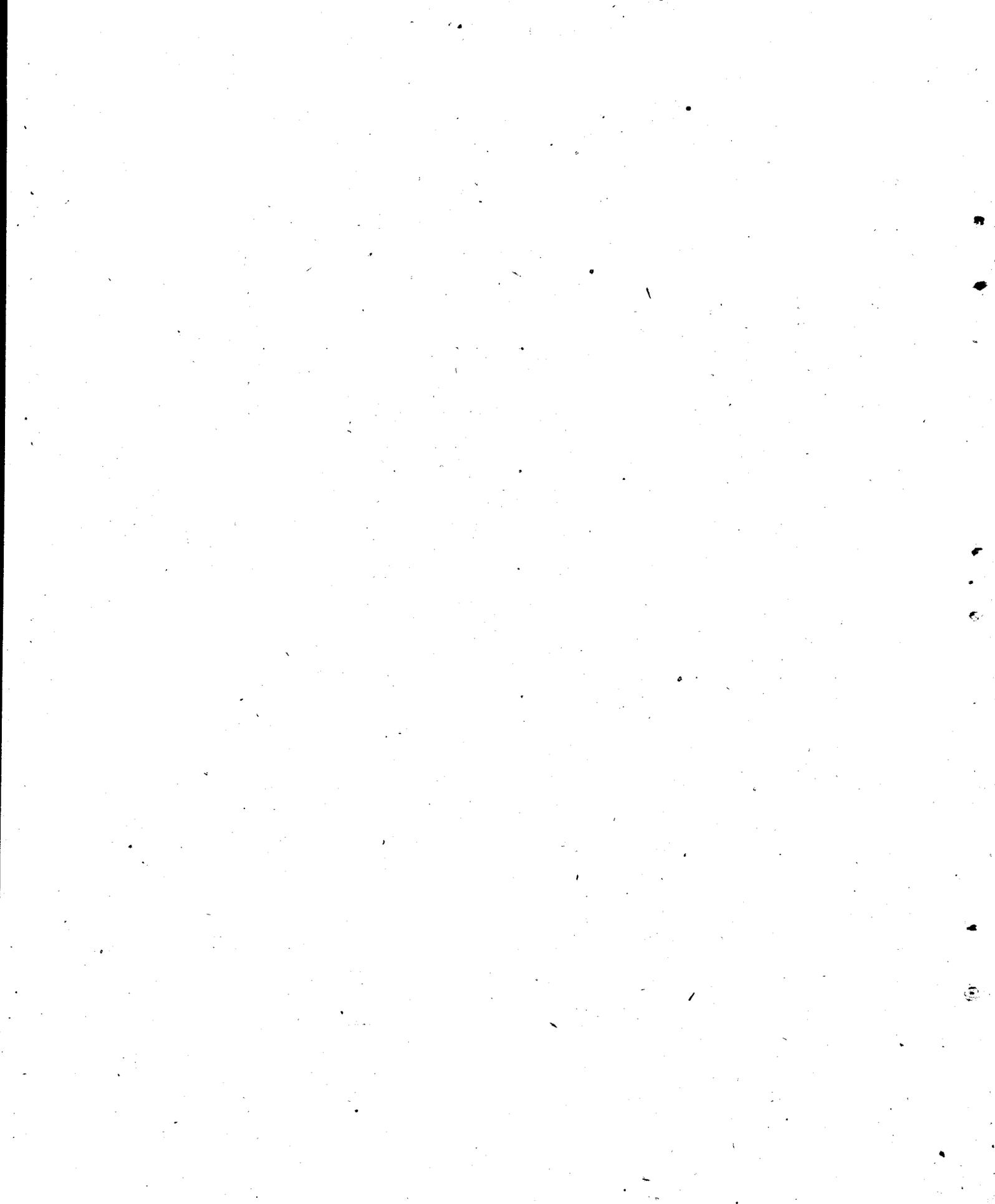
It should be noted that according to the 1940 census, the amount of arable land had increased by 3,533.79 square kilometres (353,379 hectares) since the previous census, in 1930, and this corresponds, to a certain extent, with the increase in the area of cultivated land, viz. 265,376 hectares. This apparently small increase may be due either to an extension of the cultivated area, or to an error in compiling the census data or because those taking the census, and the farmers themselves, were more severe in classifying arable land. However the increase is shown as having occurred in the states of Coahuila, Nuevo León, Tamaulipas, Baja California, Distrito Norte, Nayarit, Sonora, Michoacán and Morelos, where irrigation schemes have been developed. There are, nevertheless, some decreases which can only be explained by a change in the criterion of classification. In other words, it is possible that in the states of Chihuahua, Veracruz, Chiapas, Guerrero, Oaxaca and Guanajuato certain areas had been qualified as arable which in fact were not.

It is believed that in the 1940 census, an area of over 200,000 hectares of ploughed or arable land was omitted by error. These differences are naturally reflected in the figures for the density of the agricultural population. A simultaneous increase in the total area of arable land and the density of population, or a decrease of both has only occurred in the states of Sinaloa, Colima, Jalisco, Mexico and Morelos. Elsewhere, an

Table 1. Mexico : Density of the agricultural population in relation to the cultivated area, as shown by the censuses of 1930 and 1940

Region	1930		1940	
	Square kilometre	Density agricultural population	Square kilometre	Density agricultural population
United States of Mexico	145,176.99	24.98	148,710.78	25.76
Northern Zone	29,770.52	22.37	35,597.34	20.52
Coahuila	4,211.26	19.61	4,954.35	17.51
Chihuahua	6,506.18	15.74	6,045.98	18.47
Durango	5,108.27	19.44	6,210.01	17.07
Nuevo León	2,698.85	29.33	3,456.22	26.04
San Luis Potosí	4,395.80	29.76	4,912.89	28.34
Tamaulipas	1,765.91	35.85	3,243.49	23.05
Zacatecas	5,084.25	21.35	6,774.40	18.04
Gulf Zone	28,823.71	16.65	25,646.92	19.77
Campeche	6,419.89	2.72	2,813.74	6.11
Quintana Roo	37.58	62.18	675.85	7.02
Tabasco	5,006.56	10.58	3,365.33	18.45
Veracruz	12,893.29	25.28	11,006.25	30.34
Tucatán	4,472.39	18.16	7,785.75	11.44
North Pacific Zone	9,195.55	29.87	11,471.75	20.86
Baja California - North	1,262.96	9.27	1,877.19	7.22
Baja California - South	85.36	86.00	127.30	59.18
Nayarit	1,486.94	27.83	2,263.54	22.20
Sinaloa	4,111.43	23.08	4,508.27	23.64
Sonora	2,248.86	28.51	2,695.45	22.81
South Pacific Zone	24,541.19	24.99	21,725.13	30.05
Colima	914.17	14.11	1,034.52	14.87
Chiapas	8,438.88	15.97	6,661.55	25.71
Guerrero	7,185.65	24.48	6,827.97	25.80
Oaxaca	8,002.49	36.20	7,201.09	40.28
Central Zone	52,846.02	31.18	54,269.64	31.34
Aguascalientes	1,117.73	20.33	1,142.76	19.69
Federal District	318.47	133.34	519.01	73.84
Guanaajuato	9,268.84	24.48	8,743.92	25.10
Hidalgo	4,672.16	35.78	4,463.09	39.18
Jalisco	12,247.06	23.18	12,202.38	23.05
México	5,016.94	47.71	5,386.15	49.00
Michoacán	7,089.34	36.65	8,828.63	29.63
Morelos	954.72	37.77	1,076.61	39.07
Puebla	8,231.26	31.73	8,002.38	36.06
Querétaro	2,092.69	28.74	2,188.68	26.08
Tlaxcala	1,836.81	26.03	1,716.03	29.94

Source: Dirección General de Estadística.



increase or reduction of the arable surface has been accompanied by a corresponding decrease or increase in the density, as is only natural when the population does not increase simultaneously with the cultivated area. The table indicates that only in the central region of Mexico did the agricultural population increase together with the extent of arable land, and shows that the said rural population increased to a greater extent than the land they cultivate.

However, the agricultural population is very sparsely scattered, living in a region where climate, terrain and rainfall or water flow conditions are unfavourable to facile exploitation of the zone's natural resources. The population itself constitutes one of the problems because of its deficiencies, consisting, as it does, of many large Indian settlements, which have remained untouched by the country's social and economic development. It should be noted, in this connection that the agricultural population is mainly composed of "mestizos" (cross of white and Indian races) dwelling almost entirely in the rural area.

Standard of Living

The generally low standard of living of the agricultural population should be emphasized, and it can be ascribed to various reasons of a complex order. On the whole, one is justified in stating that the Indians, mestizos and "criollos" (second generation white population) in certain parts of the country conform themselves alike to this standard in a degree which varies in accordance with the sterility of the land they cultivate, the small area, the nature of the terrain and its isolation from the centres of consumption, as well as the crops raised and the poor yields,

/and finally

and finally the many risks involved in agriculture in Mexico. Wherever bad climate, poor soil or the accidents of terrain in the mountainous regions limit agricultural possibilities, the population barely manages to produce its most elemental subsistence needs. Farmers owning less than one hectare of land sown under uncertain weather conditions, do all the work themselves. Many of the settlements are high up in the mountains or hidden in the thickest tropical forests. The inhabitants are of Indian origin or other, and cultivate soil which has been depleted by centuries of monoculture; and they have no means of adopting better agricultural methods or employing fertilizers. It is not to be wondered at that their economic condition is so poor.

The agricultural population living in these conditions is, moreover, subject to other limitations springing from their inability to make the most of their own efforts. Living in a regime of auto-consumption, growing maize, beans and chili peppers at the threshold of their shacks, unable to produce greater quantities for sale, or to sell under more favourable circumstances because of their isolation from other communities, their crops are used to supply their scanty nourishment and furnish the means of acquiring a few essential goods they find at the nearby markets, such as blankets, straw hats, woven leather sandals, a ploughshare, salt, and so forth. The market farmer, who grows maize, beans, rice, wheat, sugarcane, coffee, sesame, ajonjoli, copra, tobacco or vanilla beans, often makes an advance sale without any notion of what his crop will amount to when cultivation has been completed or the crops harvested. His object in making such sales is to have liquid cash which will enable him to till the land, buy a plough or other instruments, but the prices he receives /are so low

are so low that there can be no capitalization of his efforts.

Composition of the Agricultural Population

If inadequate distribution is one of the chief characteristics of the agricultural population, its composition is even more unique; it is composed of groups of ejidatarios and peones, or agricultural day-labourers. The total figure for the economically active persons engaged in agriculture according to the census of 1940, was 3,830,871, and of these 1,601,479, or 41.80 per cent, were real ejidatarios, that is to say, they were registered as possessing the legal right to a share, in the ejidos, as established in the Agrarian Legislation. However, among these, 378,620 were not endowed with such a share at the time the census was taken, 461,035 did not cultivate their share, due to lack of resources or elements with which to work; consequently, 839,655 were compelled to work as peones or agricultural day labourers. Thus according to the 1940 census there was a total of 1,907,199 workers or day-labourers, including the ejidatarios who work principally as day-labourers, since their small ejidal plot does not absorb their total labour capacity.

In the past ten years, the number of ejidatarios has increased, so that by 1945 there were 131,212, but there has been little change in the proportion of peones or day-labourers, since the size of the ejidal shares is still insufficient and there is a dearth of monetary resources and of other factors among the majority of the ejidatarios. Furthermore, a form of economic and social security organization persists among them, which does not promote the maximum of fruitful labour.

The large part of the total number of persons gainfully employed in agriculture is made up of ejidatarios and peones, as can be seen

/from the

from the following table on which their respective percentages are indicated. But one must not overlook the fact that the 1940 census has included in the category day-labourers all the ejidatarios employed as agricultural labourers, whereas the census of ejidatarios encompasses all who had a right to a stretch of land, whether or not they did in fact possess it or cultivate it during the year in which the census was taken; however, Table 2, should be of use in demonstrating the composition of labour employed in agriculture. This same Table shows that the largest number of agricultural labourers is centered in the South-Pacific Zone (84.89 per cent), which can be explained by pointing to the almost complete absence of any industrial or mining activities in the area; the same conditions prevail in the region around the Gulf of Mexico, where the percentage of agricultural labour in relation to the total of those gainfully employed is 71.4; roughly the same percentage obtains both in the northern and North Pacific area, which include the states of Nuevo León, Coahuila and Baja California, where agriculture is relatively less important. In the Central Zone, the number of persons gainfully employed in agriculture is 58.76 per cent of the total gainfully employed population; this includes both the states of Guanajuato, Mexico, Michoacán, Morelos, Puebla, Querétaro and Tlaxcala, where the proportion is highest, and the Federal District where only 6.28 per cent of the gainfully employed work in agriculture. This latter area is essentially urban and highly industrial.

The proportion of peones and ejidatarios in relation to the rural population hardly presents any contrast. The percentages throughout the Mexican Republic are more or less similar, the same result obtaining

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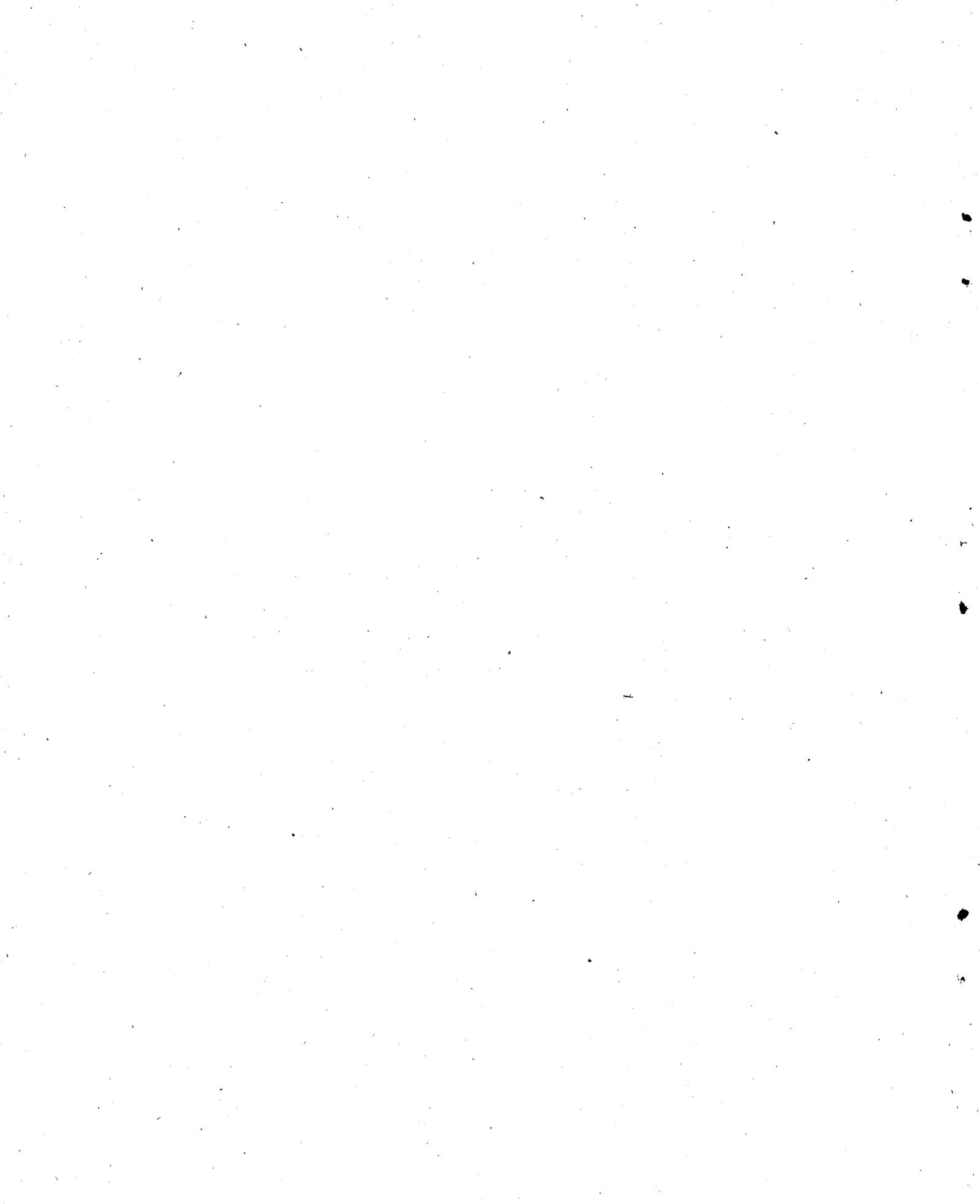
Table 2: Relation between the agricultural and the total gainfully employed population, and the number of farm labourers, according to 1940 population census

Zones and places	Total gainfully employed population	Agricultural population	% agricultural population of gainfully employed	Farm labourers ^{a/}	% labourers of agricultural population	"Ejidatarios" ^{b/}	% ejidatarios of agricultural population
United States of Mexico	5,852,116	3,830,871	65.39	1,907,199	49.78	1,601,479	41.80
North Pacific	363,107	239,354	65.92	121,997	50.97	103,863	43.39
Northern Low California	25,327	13,544	53.48	6,123	45.21	3,627	26.78
Southern Low California	15,031	7,533	50.12	3,022	40.12	2,410	3.20
Nayarit	68,424	50,242	73.43	25,577	50.91	29,137	5.80
Sinaloa	150,412	106,565	70.85	52,021	48.82	42,015	39.43
Sonora	103,913	61,470	59.16	35,254	57.35	26,674	43.39
North	1,121,258	730,589	65.16	340,248	46.57	318,115	43.54
Coahuila	158,179	86,727	54.83	41,157	47.46	46,240	53.32
Chihuahua	177,140	111,659	63.03	50,610	45.33	42,725	38.26
Durango	138,149	106,030	76.75	49,735	46.91	59,046	55.69
Nuevo Leon	164,121	89,995	54.83	43,984	48.87	20,909	23.23
San Luis Potosi	191,980	139,209	72.51	56,175	40.35	70,167	50.40
Tamaulipas	134,612	74,775	55.55	36,318	48.57	26,493	35.43
Zacatecas	157,077	122,194	77.79	62,269	50.96	52,535	42.99
Central	2,894,484	1,700,926	58.76	884,182	51.98	800,599	47.07
Aguascalientes	44,322	22,502	50.77	10,164	45.17	9,103	40.45
Federal District	610,115	38,322	6.28	18,308	47.77	32,719	85.38
Guanajuato	307,392	219,445	71.39	135,818	61.89	74,389	33.90
Hidalgo	229,070	174,884	76.35	101,114	57.82	84,565	48.35
Jalisco	437,000	281,230	64.35	142,138	50.54	82,432	29.31
Mexico	335,733	263,898	78.60	107,253	40.64	173,675	65.85
Michoacan	345,039	261,563	75.80	142,391	54.44	118,169	45.18
Morelos	54,436	42,064	77.27	23,020	54.73	29,218	69.46
Puebla	389,611	288,543	74.06	147,208	51.02	138,348	47.95
Queretaro	74,605	57,091	76.52	34,450	66.34	25,396	44.48
Tlaxcala	67,151	51,384	76.52	22,318	43.43	32,495	63.24
Gulf of Mexico	710,123	507,093	71.41	250,013	49.30	209,746	41.36
Campeche	27,556	17,205	62.44	7,419	43.12	10,283	59.77
Quintana Roo	6,715	4,745	70.66	2,415	50.90	1,895	39.94
Tabasco	76,994	62,099	80.65	30,077	48.43	21,857	35.18
Veracruz	463,941	333,946	71.98	183,637	54.99	114,259	34.21
Yucatan	134,917	89,098	66.04	26,465	29.70	61,462	68.98
South Pacifico	769,144	652,909	84.89	310,859	47.61	169,156	25.91
Colima	25,390	15,381	60.58	9,383	61.00	5,138	33.40
Chiapas	199,680	171,257	85.77	75,705	44.21	50,220	29.32
Guerrero	201,577	176,178	87.40	97,823	55.53	62,940	35.73
Oaxaca	342,497	290,093	84.70	127,948	37.36	50,858	17.53

a/ Including workmen, agricultural day-labourers and ejidatarios who work preferably as labourers.

b/ Actual ejidatarios, according to 1940 "ejidal" census.

Source: Dirección General de Estadística.



in all the statistical regions into which the country has been divided. The peones are more numerous than the ejidatarios in the states of Guanajuato, Colima, and Querétaro, whereas in the Federal District and in the states of Morelos, Yucatán and Tlaxcala, in which the proportion of agricultural labour is very low, 6.28 per cent - the proportion of ejidatarios is higher. This is due in the case of the Federal District, to the fact that almost the whole of the small agricultural population, (6.28 per cent) was allotted ejidos, and there are no large agricultural undertakings which employ peones. In the other states, the Agrarian Reform has covered the majority of the agricultural population.

In addition to the peones and ejidatarios, the 1940 census also considered as persons engaged in agriculture 1,217,657 owner-managers partners and contractors, 4,850 employees and their dependents, 190,648 unremunerated persons aiding their families, and 497,624 persons working on their own account, absentee owners and others, among whom are included the tenants and partners. These categories constitute 32 per cent, 12 per cent, 5 per cent and 13.09 per cent respectively of the total population engaged in agriculture. It should be pointed out that the first category includes many who should not be taken into account in computing the agricultural population; especially when one considers that a good many of the owner-managers live either in large or small urban communities where they follow other pursuits, and are only connected with agriculture through their investments. The very low proportion of employees and their dependents, in relation to the large number of peones, indicates that the greater part of agricultural development is being carried out with unskilled labour,

/since if the

since if the agricultural undertakings were better organized, there would be a larger proportion in this category.

Of the total number of persons engaged in agriculture, only 0.72 per cent are engaged in forestry, hunting and fishing, illustrating the slight importance of these activities, despite Mexico's large forest resources; the undertakings connected with forestry, and employing permanent labour, are only to be found in the vicinity of large urban centres, or where good transport facilities exist, other forest stands being cut only occasionally and to a limited extent. That there are so few persons engaged in the fishing industry and its by-products is characteristic of Mexico, practically no hunting or shooting takes place other than for pleasure.

We thus see that the agricultural population is almost exclusively engaged in farming and stockbreeding, and consists principally of peones and ejidatarios, which fact sets Mexico apart from other countries, where the main agricultural class is that of owner-farmers, who cultivate the land themselves, and employ no labour other than for certain tasks, and that only to a very limited extent.

Emigration

It is generally believed that the agricultural populations are especially adverse to emigrating, remaining rooted to the soil they cultivate and resist any attempt to transfer them elsewhere, even though the proposed move aims at a better distribution of the land, in accordance with its natural resources. However, experience shows that emigration automatically takes place, and the population seeks better working conditions as changes

/occur in its

Table 3 A. Population active in agriculture, livestock, forestry, hunting and fishing, according to 1940 population census.

<u>Item</u>	<u>Total</u>	<u>Men</u>	<u>Women</u>
Agriculture, livestock, forestry, hunting and fishing	3,830,871	3,791,007	39,864
Agriculture and livestock	3,803,036	3,763,476	39,560
Director owners, partners and entrepreneurs	1,217,657	1,205,162	12,495
Employees and clerks a/	4,850	4,680	170
Workmen and day-labourers	1,892,257	1,875,530	16,727
Unpaid family helpers	190,648	184,787	5,861
Independent workers, non-director-owners and others	497,624	493,317	4,307
Forestry, hunting and fishing	27,835	27,531	304
Director-owners, partners and entrepreneurs	109	104	5
Employees and clerks	607	578	29
Workmen and day-labourers	14,942	14,811	131
Unpaid family helpers	1,205	1,161	44
Independent workers, non-director-owners and others	10,872	10,877	95

a/ Including "ejidatarios"

Source: Dirección General de Estadística

Table 3 B . Population active in agriculture, livestock, forestry, hunting and fishing, according to 1940 population census.

(Percentages)

<u>Item</u>	<u>Total</u>	<u>Men</u>	<u>Women</u>
Agriculture, livestock, forestry, hunting and fishing	100	98.95	1.04
Agriculture and livestock	100	98.95	1.04
Director-owners, partners and entrepreneurs	100	98.97	1.02
Employees and clerks a/	100	96.49	3.50
Workmen and day-labourers	100	99.11	0.88
Unpaid family helpers	100	96.92	3.07
Independent workers, non-director-owners and others	100	99.13	0.86
Forestry, hunting and fishing	100	98.90	1.09
Director-owners, partners and entrepreneurs	100	95.41	4.58
Employees and clerks	100	95.22	4.77
Workmen and day-labourers	100	99.12	0.87
Unpaid family helpers	100	96.34	3.65
Independent workers non-director-owners and others	100	99.13	0.86

a/ Including "ejidatarios"

Source: Dirección General de Estadística.

occur in its density, as transport conditions are improved and economic and social relations of a different nature are established. Since the end of the nineteenth century, the flow of agricultural labour emigrating to the United States has become stronger, and the domestic mobilization of agricultural labour has increased as a result of improvements in the transport system and the construction of irrigation works which have extended the surface of arable land. The Revolution which began in 1910, and left the country in a state of political unrest and social insecurity for several years also affected the migration of the agricultural population.

During 1926-27, Dr. Manuel Gamio investigated the problem of Mexican emigration to the United States, and found that most of the emigrants were from areas which always had had a dense agricultural population; that is to say, they came from such states as Jalisco, Michoacán and Guanajuato, located in the southern part of the high plateau, as well as from the frontier states of Sonora, Chihuahua, Sinaloa and Durango. A poll among 57 Mexican emigrants to the United States showed that they issued from different social classes and that their reasons for leaving their native country were also quite different.

The emigration of the agricultural populations from densely populated areas and the frontier region has increased during the past few years. To a large extent it is seasonal depending principally on the demand for agricultural labour in the United States, especially for certain crops, such as cotton picking, and the harvesting of beetroot and fruits. There is an organized system for contracting agricultural labour, and there are

Labour Contractors (enganchadores) who contract and arrange transport for Mexican peones to areas where their services are required. But there is also a constant and uncontrolled clandestine migration of those who remain within the frontiers of the United States, and this takes place all along the border. Since the beginning, emigration has been voluntary, disorganized and has consisted principally of rural workers who crossed over into the neighbouring republic chiefly to obtain higher wages. The southern area of the United States has always been a better market for Mexican labour than its native country, even though it is poorly paid. This immigrated labour enters into competition with United States labour, on whose wage level they cause an unfavourable repercussion, accounting for the conflicts and differences of treatment which occur.

Conditions brought about by the last World War increased the demand for Mexican peones in the United States, especially to undertake agricultural work. Because of the situation created by the clandestine emigration and abuses which took place, official negotiations began between the two countries with the object of contracting labour and allotting it in accordance with the needs of the various regions. In this way the social status and economic condition of the workers was known, revealing that the greater part of the emigrants came from the Federal District and the states of Michoacán and Guanajuato, whereas the total number emigrating from other areas was insignificant; far smaller in fact than such states could have supplied without affecting economy. It was also shown that 71 per cent of those desirous of leaving Mexico were unemployed whereas 22 per cent were employed but their intention to emigrate was founded on a desire to

/obtain better

obtain better wages.

As can be seen from Table 3, the balance of the number of labourers entering and leaving the country for the United States during 1944 and 1945 (that is during the last War), was 53,802 and 25,251 respectively. This table also shows that the greatest emigratory current flowed from the Federal District, and the states of Michoacán, Zacatecas, Jalisco, San Luis Potosí and Guanajuato, all of which are in the southern part of the high plateau. It should be noted that from the point of view of their own civilization, those emigrating from the state of Michoacán may be considered Indians.

Migration within Mexico

In addition to the labour which leaves the country for the United States, there is a further section that moves about within Mexico's frontiers, seeking better working conditions; even the Indians, who are assumed to be the most sedentary section of the population, converge around the agricultural centres where there is a demand for labour. Harvesting on the great coffee plantations of the Sierra de Chiapas, for instance, is always carried out by labour which has travelled there from the interior of the state, and which is almost exclusively Indian. Cotton picking in the larger cotton growing areas is also carried out by rural workers drawn from various parts of the country and at present in the Valley of the Rio Bravo, there is a large concentration of workers who have come from other regions to work there as peones. On the sugar plantations the workers from the adjoining lands assist in the harvesting as occurs in the state of Morelos; in this case the peasants from the state of Mexico, and those from Guerrero, in the south, migrate for the reaping season. Even further away, in the distant /northeastern area,

northeastern area, in which is located the state of Sinaloa, one can already find evidence of this migration of agricultural labour in search of better prospects.

It would not therefore appear to be always true that the agricultural population is reluctant to emigrate, nor that it is impossible to carry out a project of colonization of the interior which would bring about a more adequate distribution of the population and above all the utilization of agricultural labourers in developing the new tracts of land brought under cultivation. Certainly in the unhealthy coastal strips, it was difficult to establish agricultural centres. The plan to take workers there from the high plateau often met with failure, since it is necessary to drain the land and render the area healthy. But it is believed that if such a plan of colonization were to be carried out under favourable conditions taking precautionary health measures and establishing a system of communication with parts of the country which have so far been isolated, as well as the creating of agricultural credit funds, it would be possible to correct to some extent the present inadequate distribution of agricultural labour.

Table 4: Movement of mexican labourers to and from the United States,
Second Part.

Places	1944		1945	
	Incoming	Outgoing	Incoming	Outgoing
United States of Mexico	64,257	118,059	79,190	104,641
Aguascalientes	1,755	2,718	2,190	4,146
Northern Low California	10	18	-	6
Southern Low California	1	-	1	-
Campeche	5	17	8	41
Coahuila	201	212	578	1,347
Coloma	98	219	30	15
Chiapas	41	221	36	34
Chihuahua	149	1,179	779	2,110
Federal District	23,953	29,282	36,154	36,686
Durango	596	3,260	2,109	2,556
Guanajuato	9,298	16,318	5,896	6,302
Guerrero	276	1,592	2,117	3,288
Hidalgo	806	3,390	1,145	1,726
Jalisco	3,352	7,701	2,396	2,965
Mexico	1,040	3,496	603	1,451
Michoacan	11,546	22,132	5,496	7,058
Morelos	313	1,191	426	568
Nayarit	220	476	41	21
Nuevo Leon	92	140	45	38
Oaxaca	751	2,355	3,378	8,142
Puebla	407	2,367	653	505
Queretaro	1,685	3,097	4,259	1,506
Quintana Roo	-	-	1	2
San Luis Potosi	2,670	3,408	719	1,768
Sinaloa	26	33	9	7
Sonora	14	28	7	9
Tabasco	92	889	1,125	2,482
Tamaulipas	329	1,267	1,401	3,076
Tlaxcala	259	822	432	884
Veracruz	362	2,280	2,554	4,230
Yucatan	20	82	87	264
Zacatecas	3,890	7,449	4,515	11,413

Note: Domicile was regarded as that of the labourers relatives, not the place where the contract was signed.

Source: Dirección General de Estadística.



II CLASSIFICATION OF THE LAND

The last census, that of 1940, classifies agricultural land as follows:

<u>Category</u>	<u>Hectares</u>
Arable land	14,871,075
Pasture land (plains and low hills)	56,179,177
Forest-covered areas	38,655,219
Productive but not cultivated	8,808,456
Unproductive	10,813,054
Other classes	33,095
	<hr/>
Total	129,410,076

When considering the position of agriculture, special attention should be given to one of the categories among those considered by the census, that is the arable land described as "land that has been cultivated during one or more of the five years immediately preceding the taking of the census". These are classified as irrigated lands either when artificial irrigation is used thereon, whether this consists of dams, well or canalization, or the soil is naturally humid or when water is supplied by climatic conditions, rivers or subterranean water courses. Finally, the lands termed non-irrigated are those on which the crops planted have to depend exclusively on rainfall, variable throughout the greater part of country but on the whole irregular and fortuitous. The same census shows the following area for each of these divisions:

Irrigated	1,999,215 hectares
Naturally humid	964,837 hectares
Non-irrigated	<u>12,007,023 hectares</u>
Total	<u>14,871,075 hectares</u>

Of the total cultivated area, 64.7 per cent consists of ploughed and

/arable land

arable land, and of this, 80.70 per cent is non-irrigated land, in which the crops run a constant risk of lack of water (almost permanent) in the arid and semi-arid regions which constitute 82.69 per cent of the territory, on which production and the agricultural population barely survive. Of this area, only 12.77 per cent can depend on water for production, though in any case the unfavourable climatic conditions in many areas cause agricultural production to be deficient. Nor do naturally humid soils, which represent a small proportion of the whole territory than the irrigated land (6.48 per cent) ensure the subsistence and yield of the crops grown on them, since in some of the larger zones, such as the Basin of the Papaloapan, on the southern coast of the state of Veracruz, there are some years when the sugar cane planters must employ irrigation, or again, the Basin of the Soconusco, on the coast of Chiapas, where the banana plantations must be irrigated in order to obtain larger crops.

It will thus be seen that in Mexico agriculture is greatly limited by the lack of water. But further to this there are other obstacles springing from climatic conditions, such as the frost in the high regions, and especially in the southern part of the high plateau, which is the most densely populated. These conditions frequently entail entire or partial loss of the crops even when irrigated. Also, though there are no figures to substantiate this statement, there is no doubt that land which is considered as highly fertile or productive is also subject to certain limitations. In some instances the soil is depleted as a result of several centuries of cultivation, without the use of fertilizers or other methods of restoring its lost fertility, whilst in other cases, the failure to impede erosion of cultivated land gives rise to the same soil conditions. But the principal restriction

/is that

is that imposed by the mountainous nature of the country, where the terrain is broken up, the soil stony, and the slopes too steep, all of which accounts for the low yield of agricultural production.

These lands involve the least risk and are the most productive in contributing to the total of domestic production because as a rule they are continuously used for the cultivation of the most valuable crops with relatively higher yields than those of the non-irrigated areas. The prospects of increasing the area of such land by wells or canalization of the available water supply, are uncertain since there are only rough estimates of the total flow of the principal water courses which, if utilized in their totality would permit an aggregate irrigated surface of 5 million hectares. Up to the present, and since construction of the works was begun by the National Commission of Irrigation, now known as the Secretaria de Recursos Hidraulicos (Water Resources Secretariat), 1,612,356 hectares have been irrigated under 72 irrigation projects of varying size (see table 7) in different states. The most important of these are located in the northern part of the country where the largest investments in irrigation works have been made and where there is the highest percentage of irrigated land in relation to the total area of improved lands. This includes the Lower Valley of the Rio Bravo, in the state of Tamaulipas; the Ciudad Delicias irrigation system in the state of Chihuahua; the Sanalena Dam in Sinaloa, the Angostura Dam in Sonora; the utilization of the waters of the Rio Colorado in the Northern District of the state of Baja California and the Lagunera region in Coahuila and Durango. But the majority are small projects, located in the heavily populated states of Michoacán, Morelos, Mexico, Hidalgo, Aguascalientes, Jalisco and Tlaxcala.

/Very little

Very little has been done in exploring the subterranean waters in the various zones, but some progress has been made in this direction in the vicinity of Mexico City, in the Lagunera region, and elsewhere. Consequently, it is difficult to estimate the possibilities of extending the area of irrigated land by means of boring wells and pumping water. However, these undertakings do offer a means of expanding the irrigational resources and so ensuring the productivity of agriculture. But we must stress one point: whether agriculture depends on irrigation or not, the cultivation of the soil in Mexico is subject to limitations and obstacles which are difficult to overcome.

The 1940 census returns reveal that a total of 56,179,175 hectares of plains and low hills were used as pasture land, that is 40.79 per cent of the total area covered by the census, which proportion, regarded as a numerical expression might justify the assumption that Mexico has abundant resources for livestock raising. But if one considers that rainfall is very low throughout almost all the northern sector, where the majority of the pasture land is located, that there are few permanent water courses in the region, and furthermore, that canalization of subterranean waters is both difficult and expensive, then one realizes that the country's real resources for cattlebreeding are substantially smaller than would appear. There are vast tracts considered as pasture land spread over different parts of the country, where the ground is very uneven, water is short and grass, which is of a poor quality at the best of times, is scarce. Consequently, there are regions where cattlebreeding cannot be carried on under good conditions, and the herds, both cattle and goats, are moved from place to place as they exhaust the scanty pasture available.

/The same may

The same may be said with regard to forest land. There are 30,655,219 hectares, that is 28.07 per cent of the area covered by the census, on which are found many different and varied species of trees, but which cannot be properly classified as forests, since they also include large tracts of scrubby, scarce vegetation, such as that of the deserts. The exploitation of the forests in many parts, is hampered by the lack of transport facilities and copious rivers, with currents strong enough to carry the lumber to points where it can be processed. The position can best be appreciated by flying over the forests, when it is seen that they are principally located in the mountainous area, isolated by the topography of the land; and in many zones, the stands are of a very low commercial value, owing to the climatic conditions. The exception to this general statement is the forested area of the state of Tabasco and the territory of Quintana Roo, but even here the value of the natural resources is limited and economic exploitation is difficult.

The first census of agricultural and livestock production in Mexico was taken in 1930. This census divided the land, among other categories, into forest lands "covered by large quantities of trees with tall trunks or trees and bushes with short trunks", but in view of the confusion arising from the definition of the category, its designation was changed in 1940, as follows: "those covered by large wooded areas in which timber species predominate, that is, trees of trunks, from which timber of sizeable scantling can be obtained, such as pine, oak, cedar, the Mexican fir (oyamel), ebony, walnut, mahogany, etc.; or, alternatively, those in which timber species do not predominate, that is, where the bushes do not yield timber up to certain measurements, such as the "chapparal" and "brambles". As a result of the change, we find the following statistics in the 1940 census

/returns:-

returns:- 14,776,554 hectares of land with timber species and 22,879,065 hectares of non-timber species-bearing forest land. The former returns give a better notion of the extent of Mexico's forest reserves, though one must not overlook the fact that in many of the richest forest lands the exploitation of their resources at different periods has been carried out in a haphazard way with no view towards the conservation and renewal of the forests. Furthermore, there are other regions inhabited by agricultural populations in which the clearing of the land for periodic sowing of a subsistence crop such as maize, has gradually but persistently reduced the forest resources.

One must also remember that land on which the chicle-producing species grow, chiefly in Quintana Roo and in Campeche, was definitely classified as uncultivated but productive in the 1940 census, whereas in the previous census (1930) it had been included in the category of forest lands, and accounting for more than 3 million hectares. This was because the "uncultivated but productive" category in 1930 had been described as land "covered by profit-yielding but uncultivated plants, such as lechuguilla, guayule, ixtle and candelilla", whereas in 1940, they were defined as "lands on which wild vegetation predominates, the products of which are different from timber or its derivatives, and among which may be included wild fruit trees, lechuguilla, zacatón root (yielding a hard fibre), prickly pear cactuses, guayula, candelilla, wild agaves, etc."

There are about 11 million hectares of land classified as unproductive according to the established definition, viz: "Land on which agricultural products do not and cannot thrive, such as stony ground, the yellow

/soapstone areas

soapstone areas, lakes, saltpetre beds, etc." The 1940 returns reveal that of the total area included in the census of that year, 8.4 per cent was unproductive for agricultural purposes, and to this must be added 67 million hectares not included in that census,-- the surface covered by lakes and lagoons, rivers and other water courses, etc., which are also unproductive, from the agricultural point of view. This means that in Mexico there are 77,008,000 hectares from which no profit-yielding vegetation can be obtained, that is, due to its sterility, 2/5 of the country's whole territory must be excluded from any immediate plan for agricultural development.

Furthermore, experience shows that there is not a square inch of arable land in Mexico which, given present conditions and prospects, and the economic and social circumstances of the agricultural population, has not already been employed or exploited, according to whatever system of cultivation is possible. In the deepest valleys cut by torrential streams, on the ridges of the highest mountains, on the slopes of the steepest ranges, wherever it is humanly possible to make use of the smallest piece of land, one finds the plough turning up the tiny strip cultivated by the rural population either during the rainy season, or with the help of irrigation. This by no means implies that there are no untapped reserves, for both in the northwest and south eastern part of the country, in the states of Sonora, Sinaloa, Nayarit and Veracruz, Tabasco and Chiapas, as elsewhere, there are undoubtedly possibilities of extending the area of arable land, either by irrigation or drainage and sanitation though there are not even any rough estimates for this task which might be of use in calculating the extent of the increment which would thus be obtained. The 1940 census showed a total

/surface of

surface of 8,304,137 hectares of potentially arable land, that is to say, land which could be brought under cultivation. This is, nevertheless, a very risky guess, since potentially arable land is that which the farmer can cultivate with his usual methods:-- manual labour, customary in the mountainous areas, or on soils such as those of Yucatán, which, though flat, cannot be turned by the plough, and which for this reason should not be used for agricultural purposes.

We would repeat that there are resources which have neither been developed nor even estimated, such as the land which can be irrigated by pumping, or the drainage and improvement of public health conditions in the lowlands and marshes of the coast. When these regions are improved by such essential public works - among which the amelioration of living conditions in the insalubrious areas is vital - they may then serve to increase the surface of Mexico's agricultural land.

III. DISTRIBUTION OF ARABLE LAND

According to the 1940 census, (see Table 8), arable land was divided between ejidal farms and private ownership, in the following percentages:

	<u>Ejidal Farms</u>	<u>Private Ownership</u>
Cultivated land	47.37 per cent	52.63 per cent
Irrigated land	57.39 " "	42.61 " "
Naturally humid soils	46.06 " "	53.94 " "
Non-irrigated land	46.50 " "	53.50 " "
Permanent crops	41.10 " "	58.90 " "

These percentages amply depict the conditions created in the country by the Agrarian Reform which, fundamentally, meant the expropriation of vast estates and the granting of these to hamlets with 20 or more peasants in need of such land in order to earn their living from agricultural pursuits.

/The following

Table 5. Utilization of land

Types of soil	Total	Ejidal farms	Farms over 5 hectares	Farms of 5 hectares or less
Total	<u>129,410,076</u>	<u>28,921,259</u>	<u>99,331,532</u>	<u>1,157,285</u>
1. Cultivated	<u>14,871,075</u>	<u>7,045,217</u>	<u>6,751,668</u>	<u>1,074,190</u>
Irrigated	1,732,531	994,407	617,164	120,960
Naturally humid soil	762,552	342,909	366,682	55,961
Unirrigated	<u>11,523,448</u>	<u>5,358,878</u>	<u>5,267,301</u>	<u>897,269</u>
With crops of a vegetative cycle of over 1 year	849,544	349,023	500,521	--
2. Pastures	<u>56,262,302</u>	<u>10,658,946</u>	<u>45,520,261</u>	<u>83,095</u>
Plains	<u>24,505,020</u>	<u>4,152,215</u>	<u>20,269,710</u>	<u>83,095</u>
Hills	<u>31,757,282</u>	<u>6,506,731</u>	<u>25,250,551</u>	--
3. Uncultivated but productive	<u>8,808,393</u>	<u>1,696,447</u>	<u>7,111,946</u>	--
4. Woodlands	<u>38,655,252</u>	<u>6,872,424</u>	<u>31,782,828</u>	--
In which timber species predominate	15,692,578	2,673,599	13,018,979	--
In which non-timber species predominate	<u>22,962,674</u>	<u>4,198,825</u>	<u>18,763,849</u>	--
5. Non-productive agriculturally	<u>10,813,054</u>	<u>2,648,225</u>	<u>8,164,829</u>	--

Source: 1940 "Ejidal" Census and 1940 Agricultural Census.



The following table shows that whereas the proportion of ejidal land to total area included in the census is less than one fourth, that of cultivated land is about 50 per cent; that of irrigated land increases to 57.39 per cent; those of permanent humidity and non-irrigated land making up a similar figure, while that of permanent crops is only 41 per cent.

These figures indicate the importance of the distribution of arable land among the farmers, but despite these measures, the system of large estates has not been abolished nor has one for small properties been created, such as exists in other countries where the owner-farmer possesses a strip large enough to employ his own total working effort.

The majority of the privately-owned farms and some of the ejidal farms employ peons, workers or day labourers which is why, as we observed when considering the structure of the population, this is the predominant labour class. Nor can it be said that the Agrarian Reform has given rise to a modern system of agricultural undertaking adopting intensive methods of cultivation and modern methods of work. In Mexican agriculture, the day labourer who owns no land, and the ejidatario or small landholder are still in the majority. Working with few implements and backward methods, they cultivate the soil deficiently and produce barely what is required to satisfy their limited needs. Lastly, there are the great landowners, acting as rentiers rather than entrepreneurs. However, there are exceptions, since a few modern agricultural undertakings have been established with farm machinery, working with improved methods of cultivation, and there are also a few ejidatarios or small landholders who have advanced beyond the stage of backwardness in which the majority persists.

Less than one fifth of pasture land is held under the ejidal system.

/In fact

In fact 38.7 per cent of such land is covered by pastures located on the plains and the remaining 61.3 per cent is spread over the mountainous areas, according to the census. This points to the poor prospects of livestock raising for the ejidatarios. But it must be noted that this proportion is larger than that of other classes of ejidal land recorded by the census. Forests, for instance, only represent 17.7 per cent of total surface covered by the census, and this is still smaller for forests where timber species predominate. It happens that this type of land, as well as the uncultivated productive land, is hardly used by the ejidatarios for livestock raising and forestry pursuits or in making use of the natural resources. Instead, they rent it to whosoever has the economic means of exploiting it on a commercial basis.

The same 1940 census reveals that 1,601,479 active ejidatarios were recorded, that is to say, those who in 1940 had legal right to a plot of land. Of these 1,222,859 (76.36 per cent) were in possession of their ejidal share whereas the rest were without it and only 1,140,444 (71.21 per cent) were actively cultivating their ejidal plot that year.

From tables 6A and 6B one can see that little more than a tenth of the total number of active ejidatarios held any land in private ownership. By adding the number of partners and tenants to that of labourers working as peons, that is 249,679 representing 15.09 per cent of the total, there would not be sufficient land to absorb their total capacity of labour. Alternatively even when endowed with a share of the ejidal land, this class would still be compelled to work as peons. One must remember that the ejidos are worked individually by the majority of the ejidatarios, that is to say, the arable

/land is

land is cut up into tiny plots which are cultivated with whatever means their owner has at his disposal. The figure for associated ejidatarios, shown on the table as 389,936 includes all those who were members of the local ejidal credit societies, or who formed part of any similar association, but this by no means implies that these ejidatarios work as an agricultural unit, that is to say, that they form any cooperative or collective association. This only occurs where the irrigation system, the nature of the crops or other factors require that the agricultural tasks be organized in larger units than the ejidal plot allows.

Of the active ejidatarios registered in the 1940 census, nearly half, that is to say, 49.99 per cent, inhabited the Central Zone and the area corresponding to it, in which the state of Jalisco accounted for the largest proportion, 10.85 per cent. Next in decreasing order comes the Northern Zone, in which San Luis Potosí figures with the largest number of ejidatarios, then the Gulf Zone, with 13.09 per cent, in which Yucatán accounts for the largest share, 3.83 per cent. The South Pacific area follows with 10.56 per cent of the number of ejidatarios in the country, of which 4 per cent are in the state of Guerrero, and finally the Northern Pacific zone, which is the least densely populated, but which has the best prospects for development, where 6.48 per cent of the ejidatarios are located and of these 2.62 per cent are in the state of Sinaloa. It should be emphasized that the ejidatarios, like the rest of the agricultural population, are scattered throughout the country and that nowhere at all do they represent the majority of the rural workers, since the ejidal endowments were made in proportion to the established agglomerations of population and not in relation to the

/available resources

available resources in the way of arable land.

The agricultural census of 1930 and 1940 reveal the following composition as regards the number and total area of privately-owned agricultural property:

	1930 Census		1940 Census	
	Number	Area (hectares)	Number	Area (hectares)
Farms of more than 5 hectares	33,324	122,206,411	290,336	99,331,532
Farms of less than 5 hectares	<u>576,588</u>	<u>889,388</u>	<u>928,593</u>	<u>1,157,285</u>
Total	<u>609,912</u>	<u>123,149,829</u>	<u>1,218,929</u>	<u>100,488,817</u>

As can be seen, the total number of farms increased from 609,912 in 1930 to 1,218,929 in 1940, which means they more than doubled in the ten year period. The increase was made up of 257,012 farms of more than 5 hectares and 352,005 of less than five hectares. The total area of agricultural land under private ownership showed a decrease of 22,661,012 in the same period, which may be explained by the changes in bad tenure brought about by agrarian reform, and the fact that a smaller area was covered by the census in 1940. The results shown by the census returns correspond to the situation created by the Agrarian Reform, that is, an increase in the number of farms both of less and of more than five hectares, and with an increase in the area of former and a decrease in that of the latter, denoting that agricultural property has been divided into still smaller holdings.

From the data of both the censuses, it will be seen that in 1930, of the total number of farms, 94.5 per cent averaged less than five hectares each whereas the remaining 5.5 per cent were over 5 hectares. By 1940, the proportion had altered and we find that 76.2 per cent of privately owned

/farms were

Table 6-A: Mexico. Economic characteristics of "ejidatarios" according to 1940 "ejidal" census.

Zones and Places	Actual	Land-owners	Having sown in "ejidal" land	Grouped in "associations"	Possessing lands as joint owners	Took lands as plots	Took lands on lease	Working as day labourers	Possessing rights to "ejidal" land
Total	1,601,479	1,222,859	1,140,444	389,936	172,976	32,962	23,164	185,553	378,620
NORTH ZONE:	318,115	249,732	232,674	92,708	12,385	6,267	1,361	15,442	68,383
Coahuila	46,240	38,673	35,658	23,141	594	658	420	2,189	7,567
Chihuahua	42,725	34,858	31,344	7,565	1,401	533	415	1,831	7,867
Durango	59,046	45,890	44,136	19,874	1,588	1,162	121	1,995	13,156
Nueva León	20,909	15,707	13,700	2,906	653	1,273	82	1,464	5,202
San Luis Potosí	70,167	53,266	50,435	15,628	5,266	685	110	5,202	16,901
Tamaulipas	26,493	23,394	20,868	12,123	815	348	108	934	3,099
Zacatecas	52,535	37,944	36,533	11,471	2,068	1,608	105	1,827	14,591
GULF ZONE:	209,746	181,444	165,000	78,948	8,422	1,441	2,505	18,989	28,302
Campeche	10,283	9,124	7,381	4,821	618		1,398	1,013	1,159
Quintana Roo	1,895	1,757	1,256	639	33		3	100	138
Tabasco	21,847	19,395	17,470	3,907	963	388	153	2,507	2,452
Veracruz	114,259	93,445	88,810	22,305	5,160	297	5,669	12,725	20,814
Yucatán	61,462	57,723	50,081	47,276	1,648	756	2,282	2,644	3,739
NORTH PACIFIC ZONE:	103,863	71,564	62,751	26,162	2,041	1,693	1,816	10,672	32,299
Northern Lower California	3,627	3,474	3,367	2,784	13	21	1	9	153
Southern Lower California	2,410	1,191	963	243	34	252	232	197	1,219
Nayarit	29,137	19,643	19,173	7,820	511	809	1,492	805	9,294
Sonora	42,015	29,410	24,482	8,234	1,088	611	91	5,047	12,605
Sinaloa	26,674	17,646	14,766	7,081	1,395	611	91	4,615	9,028
SOUTH PACIFIC ZONE:	169,156	129,308	120,172	24,465	2,236	2,505	2,829	17,107	39,848
Colima	5,138	4,104	3,734	958	40	89	169	379	1,034
Chiapas	50,220	39,872	36,046	7,029	1,182	627	1,437	4,207	10,348
Guerrero	62,940	45,640	44,011	9,434	1,493	485	1,673	4,143	17,300
Oaxaca	50,858	39,692	36,381	7,044	6,521	2,304	550	8,378	11,166
CENTRAL ZONE	800,599	590,811	559,847	167,653	139,892	20,056	6,652	123,342	209,788
Aguascalientes	9,103	8,102	7,742	3,395	212	189	4	363	1,001
Distrito Federal	32,719	21,210	18,901	975	14,934	450	116	10,319	11,509

Continuation. Table 6-A: Mexico. Economic characteristics of "ejidatarios" according to 1940 "ejidal" census

Zones and Places	Actual	Land-owners	Having sown in "ejidal" land	Grouped in associations	Possessing lands as joint owners	Took lands as plots	Took lands on lease	Working as day labourers	Possessing rights to "ejidal" land
Guanajuato	74,389	53,744	52,199	27,198	890	1,690	468	4,175	20,645
Hidalgo	84,565	66,703	62,261	14,839	17,605	5,838	609	20,917	17,862
Jalisco	82,432	64,188	59,396	20,956	1,404	1,753	706	6,422	18,244
Mexico	173,765	129,137	123,173	36,055	51,960	2,255	282	39,057	44,628
Michoacán	118,169	82,644	79,072	27,101	5,158	2,521	1,253	10,969	35,525
Morelos	29,218	20,974	20,398	8,816	4,686	45	440	4,776	8,244
Puebla	138,348	99,052	94,194	16,307	35,674	4,011	2,614	17,280	39,296
Querétaro	25,396	17,683	15,741	10,468	770	827	84	2,979	7,713
Tlaxcala	32,495	27,374	26,770	1,543	6,599	477	77	6,665	5,121

Source: 1940 "ejidal" census.

Table 6B. Economic characteristics of "ejidatarios" according to
1940 "ejidal" census
(Percentages)

EJIDATARIOS

Zones and places	Actual	Landowners	Having own "ejidal" land	Grouped in associations	Possessing 1/2 land as joint owners	Took lands as plots	Took lands on lease	Working as day labourers	Possessing rights to "ejidal" land
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
North Zone:	19.86	20.42	19.02	23.77	7.15	19.01	5.87	8.32	18.06
Coahuila	2.88	3.16	2.91	5.93	0.34	1.99	1.81	1.17	1.99
Chihuahua	2.66	2.85	2.56	1.94	0.80	1.61	1.79	0.98	2.07
Durango	3.68	3.75	3.60	5.09	0.91	3.52	0.52	1.07	3.47
Nuevo León	1.30	1.28	1.12	0.74	0.37	3.86	0.35	0.78	1.37
San Luis Potosí	4.38	4.35	4.12	4.00	3.04	2.07	0.47	2.80	4.46
Tamaulipas	1.65	1.91	1.70	3.10	0.47	1.05	0.46	0.50	0.81
Zacatecas	3.28	3.10	2.98	2.94	1.19	4.87	0.45	0.98	3.85
Gulf Zone:	13.09	14.83	13.49	20.24	4.86	4.37	41.03	10.23	7.47
Campeche	0.64	0.74	0.60	1.23	0.35		6.03	0.54	0.30
Quintana Roo	0.11	0.14	1.02	0.16	0.01		0.01	0.05	0.03
Tabasco	1.36	1.58	1.42	1.00	0.55	1.17	0.66	1.35	0.64
Veracruz	7.13	7.64	7.26	5.72	2.98	0.90	24.47	6.85	5.49
Yucatán	3.63	4.72	4.09	12.12	0.95	2.29	9.85	1.42	0.98
North Pacific Zone	6.48	5.85	5.13	6.70	1.75	5.13	7.83	5.75	8.52
Northern lower Calif.	0.22	0.28	0.27	0.71	0.007			0.004	0.04
Southern lower Calif.	0.15	0.09	0.07	0.06	0.01	0.06	0.004	0.10	0.32
Nayarit	1.81	1.62	1.56	2.00	0.29	0.76	1.00	0.43	2.45
Sinaloa	2.62	2.40	2.00	2.11	0.62	2.45	6.44	2.71	3.32
Sonora	1.66	1.44	1.20	1.81	0.80	1.85	0.39	2.48	2.38

/South Pacific Zone

Table 6b. Economic characteristics of "ejidatarios" according to 1940 "ejidal" census (Percentages)

Zones and places	EJIDATARIOS										
	Actual	Land owners	Having own "ejidal" land	Grouped in associations	Possessing Land as joint owners	Took Lands as plots	Took Lands on lease	Working as day labourers	Possessing rights to "ejidal" land		
South Pacific Zone	10.56	10.57	9.82	6.27	5.33	10.63	16.52	9.21	10.52		
Colima	0.32	0.33	0.30	0.24	0.02	0.27	0.72	0.20	0.27		
Chiapos	3.13	3.26	2.94	1.80	0.68	1.90	6.20	2.26	2.73		
Guerrero	3.93	3.73	3.59	2.41	0.86	1.47	7.22	2.23	4.56		
Oaxaca	3.17	3.24	2.97	1.80	3.76	6.98	2.37	4.51	2.94		
Central Zone	49.99	48.31	45.78	40.43	80.87	80.84	28.72	66.47	55.40		
Agascalientes Distrito	0.56	0.66	0.63	0.87	0.12	0.57	0.01	0.20	0.26		
Federal	2.04	1.73	1.54	0.25	8.63	1.36	0.50	5.56	3.03		
Guanajuato	4.64	4.39	4.26	6.97	0.51	5.12	2.02	2.25	5.45		
Hidalgo	5.14	5.45	5.09	3.80	10.17	17.71	2.62	11.27	4.71		
Jalisco	10.85	5.24	4.85	5.34	0.81	5.31	3.04	3.46	4.81		
México	7.37	10.56	10.07	9.24	30.03	6.84	1.21	21.04	11.78		
Michoacán	1.82	6.75	6.46	16.19	2.98	7.64	5.40	5.91	9.36		
Morelos	8.63	1.71	1.66	2.26	2.70	0.13	1.89	2.57	2.17		
Puebla	1.58	8.10	7.70	4.18	20.62	12.16	11.28	9.31	10.37		
Querétaro	2.02	1.44	1.28	2.68	0.44	2.50	0.36	1.60	2.03		
Tlaxcala	3.25	2.23	2.18	0.39	3.81	1.44	0.33	3.59	1.35		

Source: Ejidal Census of 1940

farms were of less than 5 hectares each, and 23.8 per cent of more than five hectares. This suggests that the proportion of farms of more than 5 hectares has increased, while that of the small farms (less than 5 hectares) decreased.

Farms of more than 5 hectares accounted for 99.3 per cent of the total surface and those smaller than 5 hectares for the remaining 0.7 per cent. This proportion remained practically the same in 1940, when 98.8 per cent of the surface was divided up into larger units and 1.2 per cent into smaller units. The consequences of this situation are evident in the country's economy: viz, that small holdings still represent an infinitesimally small percentage of the total area of the larger estates, despite the larger number of the former. Though there are no returns to show this in the census, it would appear that whereas the number of farms of less than five hectares correspond to an equivalent number of owners, in the case of the larger farms, the corresponding number of landlords is smaller since they frequently own several estates.

Table 7 in which farms are classified by their size shows that in 1940 there were still many huge estates, accounting for a large proportion of the total surface of privately-owned land. This situation is determined to a great extent by the natural and demographic conditions of the country, since in the more isolated or desert areas, or when the land is scantily populated or the ground very uneven one still finds vast tracts belonging to a single owner. But there is the further conditioning factor of tradition; the system of large estates is deeply rooted in the country's economy, and is not easily abolished.

It is impossible to establish a given area which may be taken as

/characteristic of

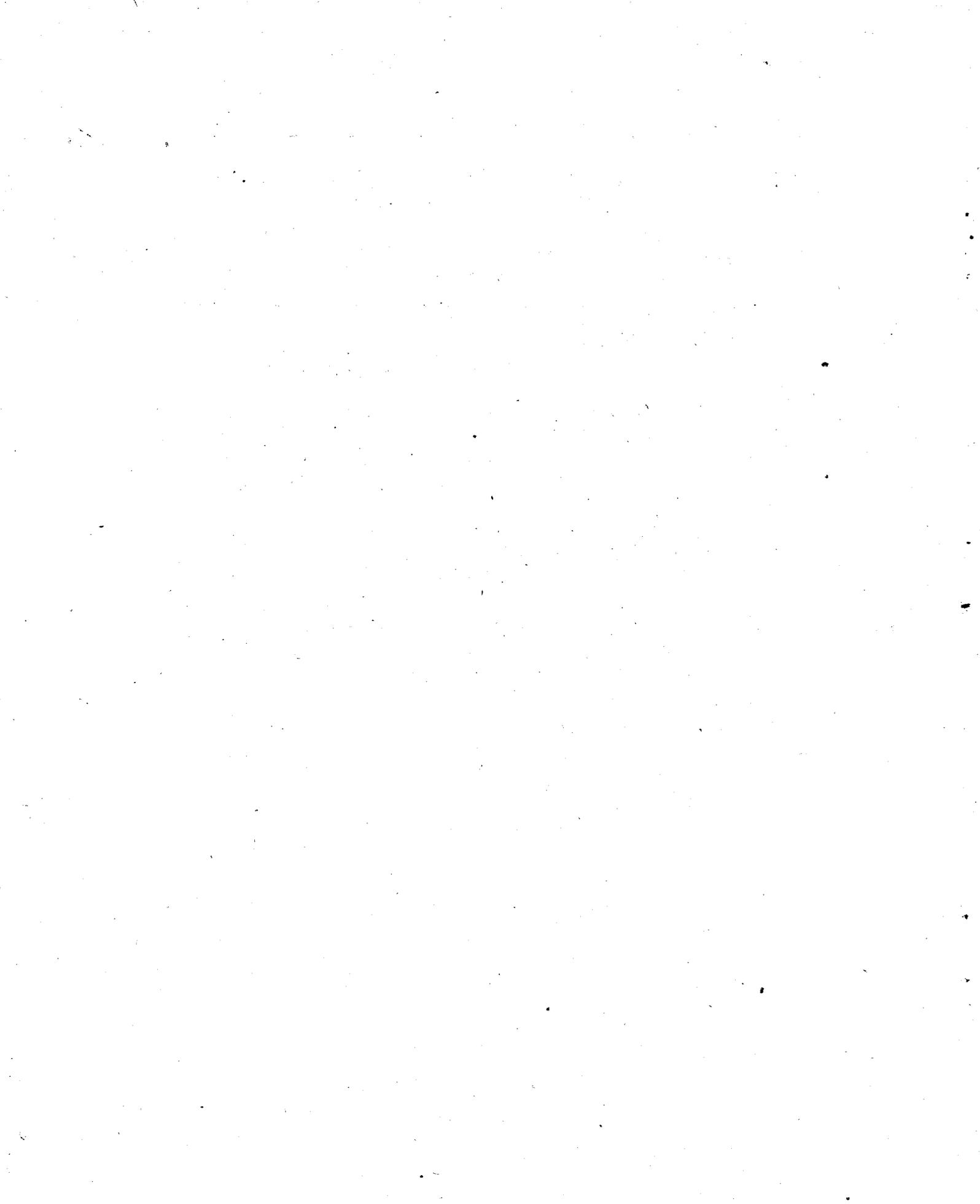
characteristic of the small agricultural holding, one that is which can adequately absorb the full labour capacity of the farmer, principally because conditions obtaining on the agricultural land, whether arable, pasture or forest are very different from one another, in both quality and productivity and conform to diverse economic and social patterns. For instance, there is naturally a great difference between irrigated and non-irrigated land; whereas on the former, crops can be continuously and intensively grown, on the latter the soil can only be utilized during the rainy season, generally speaking between June and October. The equipment available is also a decisive factor as is the nature of the crops grown. For instance, if non-irrigated land is turned up, as is mostly the case, with a wooden plough drawn by a yoke of oxen, the peasant can sow about four to six hectares annually, but this surface will be considerably less if he works only with manual implements, or alternatively substantially greater, if the land is flat and the farmer disposes of mechanical equipment. The differences are even greater on pasture land, as regards the extent necessary for cattle raising, since natural resources of grasses differ widely. In some cases, as much as 20 hectares are required per head in the case of larger animals, in the more arid regions, whereas in the humid coastal strip, the area required may vary between one and four hectares, and only half a hectare where grazing fields are cultivated as pastureland. On the other hand, on land where permanent crops are sown, such as coffee, bananas, cocoa and fruit trees, the extent of the area which a single worker can tend varies even more; it therefore becomes impossible to determine the area required to absorb the total capacity of labour of one person.

Table 7. Number, area and percentages of farms of more and less than 5 hectares, according to the groups of total area

1940 agricultural and livestock census

<u>Classification of farms</u>	<u>Number</u>	<u>Percentage</u>	<u>Area</u>	<u>Percentage</u>
Total over 5 hectares	<u>290,336</u>	<u>100.00</u>	<u>99,331,532</u>	<u>100.00</u>
From 5.1 to 10.0	74,187	25.55	578,156	0.58
From 10.1 to 25.0	82,013	28.25	1,391,351	1.40
From 25.1 to 50.0	46,466	16.00	1,742,528	1.75
From 50.1 to 100.0	31,763	10.94	2,374,910	2.39
From 100.1 to 200.0	22,695	7.82	3,346,732	3.37
From 200.1 to 500.0	17,428	6.00	5,695,120	5.73
From 500.1 to 1,000.0	6,087	2.10	4,455,366	15.65
From 1,000.1 to 5,000.0	6,883	2.37	15,547,956	9.82
From 5,000.1 to 10,000.0	1,342	0.46	9,751,944	10.68
From 10,000.1 to 20,000.0	751	0.26	10,612,599	12.02
From 20,000.1 to 40,000.0	420	0.14	11,943,349	32.41
From 40,000.1 over	301	0.10	31,981,521	- -
Total under 5 hectares	<u>928,593</u>	<u>100.00</u>	<u>1,157,285</u>	<u>100.00</u>
Of less than 1 hectare	497,378	53.56	168,509	14.56
Of 1 to 5 hectares	431,215	46.44	988,776	85.44

Source: Dirección General de Estadística.



By the terms of the law of restitution and endowment of the ejidos to the people, the following areas were declared inalienable: 100 hectares of irrigated land, 200 of arable non-irrigated land or summer pasture, 150 of cotton bearing land, whether irrigated by drainage of the river overflow or by pumping, 300 hectares of cultivated land for the planting of bananas, sugar cane, coffee, henequen, rubber, grapevines, olive trees, cinchona, vanilla, cocoa and fruit trees, and finally a tract of pasture land the area of which shall not exceed that required to raise 500 head of larger animals or their equivalent in smaller animals, in accordance with the clauses established. These areas are now regarded as small holdings. However, they do not always appear to be the ideal land divisions for the economic exploitation of agricultural undertakings.

The ejidal endowment has been calculated differently for each farmer, in accordance with the different categories of land. At present, the law establishes 10 hectares of irrigated land or of naturally humid soil as the unit for individual endowment, or, should the available area of these not suffice, their equivalent in other categories, in the following proportion per hectare: two of non-irrigated land, four of high grade summer pasture and eight of thickets or summer pasture in arid zones. These amounts were not computed in relation to the farmer's capacity for work, the nature and system of the crops, the productivity of the soil and the peasants requirements, but in accordance with the availability of arable land and the political conditions obtaining at the time. Consequently, the ejidatarios own and cultivate land which is inadequate for their requirements, because the area formerly assumed sufficient for individual endowment was smaller than present day needs and also because of the opposing interests affected

Ejidal Legislation which tends to establish the extent and nature of the Reform.

This can be shown by the returns of the 1940 census. Of the 29 million hectares so far granted to the ejidatarios, 7,045,000 are of arable land. By dividing this total among the active ejidatarios registered by the same census, we would obtain individual allotments averaging 4 hectares each. If this same method of division is repeated for each of the other categories of land, it will be found that each ejidatario would receive 0.6 hectares of irrigated land, 0.2 of naturally humid soil, and 3 of non-irrigated land. However, these averages are inaccurate since it will be found that in some cases, the ejidos are entirely composed of irrigated land, such as those in the Valley of the Yaqui and in Mexicali, in the state of Sonora and in the Lagunera region of Coahuila and Durango. Elsewhere, along the coast of Veracruze and Tabasco, for instance, they consist only of naturally humid soil. In any case, the ejidal share is very small. Few ejidatarios have received more than 10 hectares of irrigated land, - only in the Yaqui Valley were the individual endowments so extensive, - whereas in other ejidos, the irrigated land is so scarce that it is distributed by furrows to each of the ejidatarios.

Furthermore, as the agricultural population increases, the ejidal shares are subdivided among those who come into ejidal rights either by agreement with the administrative authorities of the ejido system or else because the ejidatario himself must divide his holding with his sons as they come of an age to work on the land. Again, too much land was distributed, not because larger plots of arable land were distributed but either because the number of persons entitled to ejidal property had increased when the

/census was

census was taken which served as a basis for the calculation of the endowments, or else because the classification of the land was inaccurate. In the latter case, land which was in fact arable was classified as pasturage or thickets. Even so, the figures point to an extreme subdivision of the arable land among the ejidos and explain why different systems of exploitation have been considered to replace individual labour in order that agriculture should be modernised by the use of farm machinery and that labour and other forms of investment should be used more efficiently.

We have already pointed out that only under exceptional circumstances are pasturelands and forests worked by the ejidatarios, still less individually. These portions of the ejidos remain undivided, as communal property, to be used by each hamlet either for supplying wood or other products, for free pasturage of the herds owned by the ejidatarios, etc., when they are not rented or contracted for by private entrepreneurs. Above all, it should be noted that in any case the estimated averages point to the small size of the ejidal endowments in this class of land.

Though, as the censuses show, privately owned land has also been split up, this has only occurred in certain regions in which the predominant class of farmer owns a small amount of land, as, for instance, in the neighbourhood of the cities of Mexico, Puebla and Caxaca where the rural workers are market gardeners, or where the density of the agricultural population is excessively high, such as in the Valley of the Mezquital (in the state of Hidalgo) and in certain regions of the Bajio. As a rule there is a tendency towards concentration, except that instead of the landowners possessing a vast estate, such as those existing prior to the Agrarian Reform, they have various inalienable properties in different parts of the country. This process of

/concentration becomes

concentration becomes more frequent in the better irrigated areas. Since the construction of the first irrigation schemes was concluded by the former Comisión Nacional de Irrigación, for instance, the irrigation works at El Mante, in the state of Tamaulipas, Don Martín in the state of Nuevo León, Delicias in Chihuahua and Pabellón en Aguascalientes, where the rural population was very dense and irrigated land scarce, farmers have been allowed to acquire two or more lots of a limited area, from among those which of each of these systems had set aside to be granted to the farmers residing thereon or those who came to settle there. Before determining the size of these lots, no preliminary investigation was carried out in order to verify their optimum size in relation to the quality of the soil, the crops which could be grown or the commercial position, so that the lots vary from five hectares to those of 500 hectares in the Yaqui Valley. Naturally there is no possibility of preventing the inevitable economic process of concentration on agricultural land, which emerges every time its yield, the availability of cheap labour or the need for large investment combine to favour such a tendency. We would emphasize that in many cases irrigated land can now be acquired in indivisible tracts, in accordance with the agrarian law at present in force. Furthermore, there are many ejidos in irrigated areas such as that of the Culiacán River in the state of Sinaloa, which are rented out to contractors who transform them into vast sugar cane plantations or else plant them with tomatoes or other vegetables.

As regards pasturage and forest lands, in the case of the former, cattle breeders have been obtaining certificates of inalienability for areas calculated in relation to the number of head of cattle which it is

/intended to

intended to raise, - formerly 300 and now 500, - according to the indices, calculated on the basis of the available pasture land. Forest land has largely remained private property, covering large areas, the exploitation of which is limited solely by the lack of transport facilities and capital.

The redistribution of land in Mexico cannot be said to have established an agrarian system which places agricultural economy on a sound and lasting basis. Both ejidatarios and landowners aspire to the possession of the larger portion of the best arable land and in fact the economic and social structure of Mexican agriculture remains still undefined.

Nor can one assert that any rational progress has been made in adapting the area to the crops grown on it, to the implements used for cultivation or to the capital available for investment. It has been stressed that insufficient investigation has been carried out to allow for the estimation of the optimum area, from the economic point of view, for the units of agricultural exploitation in accordance with the methods of cultivation, or with the crops sown and plantations established. Furthermore, within the limits of the present organization of production, it is difficult to carry out such an investigation, and even though the irrigated land has been divided up by what is now known as the Secretaria de Recursos Hidraulicos, into plots that as a rule cover 20 hectares, we would stress that there is a tendency toward the concentration of land in units of 100 hectares, which is the inalienable area of the ejido endowment. Nor has there been any decision on the optimum area for cultivation in other categories of land, such as the naturally humid or the nonirrigated. As a rule the area sown by the different types of farmers is limited among those who work along on the soil, to about 4 to 6 hectares of non-irrigated land,

/on which

on which maize is grown and which is ploughed with a yoke of oxen. Among other classes of land owners, - contractors or owner-managers, - the extent is determined by the capital available. Among the ejidatarios the area is naturally determined by the extent of the ejidal endowment made to each hamlet, but among them there are also some who cultivate a larger area than that of the ejidal share, by renting land from those who have not the means of working their own share.

On the other hand, the varied nature of the natural conditions under which agriculture is carried out, resulting in a great diversity of crops and of types of enterprise, prevent there being any determination of the optimum area for each one. The same occurs with regard to the land used for cattle breeding; as a rule, such undertakings are large and require vast tracts covering hundreds or thousands of hectares, being limited only by the density and quality of the pasture and the presence of water. If one recalls that the leading cattle raising area is located in the arid northern zone, it is easier to see why these systems of exploitation and of ownership have arisen. In regions where the soil is naturally humid, cattle ranches are also large, but for other reasons, the principal of which are the low density of the agricultural population and the lack of transport facilities, which have prevented the intensification of agricultural exploitation.

Finally, the forest lands are exploited in large units because such activities require substantial capital investments. The forest area exploited at present is further limited by the dearth of good transport facilities and above all because the country lacks water courses which could be utilized to carry away the timber that has been cut down.

IV. QUALITY AND CONDITION OF THE SOIL

The territory of Mexico is particularly mountainous and desert. The Dirección de Geografía, Meteorología e Hidrología, (Administration of Geography, Meteorology and Hidrology) of the Secretaría de Agricultura y Ganadería (Secretariate of Agriculture and Livestock) under the meteorologist Alfonso Contreras Arias, has made an estimate of the mountainous area, dividing the total territory into areas with gradients higher and lower than 25 per cent. The area with a gradient of over 25 per cent is considered mountainous, and that with a gradient of less than 25 per cent is considered undulating or flatland. The first amounts to 550,000 square kilometres; the second covers 1,414,000 square kilometres. As the territorial extent of Mexico is 1,964,000 square kilometres, this means that according to the classification indicated above, only 28 per cent can be considered mountainous. However, from the agricultural viewpoint, taking into consideration the fact that a large part of the undulating land is broken and hilly, while other lands are stony, and those with gradients of more than 15 per cent do not lend themselves to mechanised cultivation, the initial statement is justified. On the other hand, there are great flat regions, like the Peninsula of Yucatan, where the consistency of the soil makes even the use of the wooden plough impossible, so that to topography should be added the limitations imposed by these other conditions. In Yucatan, however, it has only been possible to cultivate plantations of henequen, more on account of the climate than because of the consistency of the soils.

As regards climatic conditions, the quality of the soil is

/mainly determined.

by the rains. Arid regions predominate throughout the territory, with an area estimated at 1,024,818 square kilometres, representing 52.13 per cent of the total; 600,776 square kilometres are semi-arid, that is 30.56 per cent; semi-humid soils cover 206,812 square kilometres, equivalent to 10.52 per cent, and only 133,484 square kilometres, representing the small fraction of 6.79 per cent, are humid. Those regions are considered arid where the rainfall is not sufficient to ensure agricultural production, so that artificial irrigation is indispensable; these are mainly located in the north of the country, forming a broad triangle with its base along the frontier with the United States, and whose sides are formed by the two Cordilleras; the vertex continues to the southern part of the High Plateau, in very narrow belts which reach the States of Hidalgo, South Puebla and North Oaxaca. However, the whole of the state of Sonora, the north of Sinaloa and the territory of Baja California are also arid. The lands which have a scanty and irregular rainfall are considered semi-arid, since they require permanent irrigation for crops, including, at times, during the rainy season; they are located in the southern section of the High Plateau, on the coast of Tamaulipas and North of Veracruz on the Pacific Coast from the Isthmus of Tehuantepec to the south of Sinaloa, in the high valleys of Grijalva and the rio Balsas, and also in Yucatan. The semi-humid lands are those where the rainfall is sufficient for agriculture, although there are occasional periods of drought, requiring what is known as auxiliary irrigation; these are located on the centre and southern part of the coast of Veracruz, Chiapas, Campeche and part of the Nayarit coastline. Finally, the humid lands are those which

/receive a regular

receive a regular and abundant rainfall; they are situated in the state of Tabasco, the southeastern part of Campeche and the south of Yucatan, and also comprise the Territory of Quintana Roo, the slope towards the Gulf of Mexico of the Sierra Madre Oriental (part of the states of Puebla and Veracruz) and the slope towards the Pacific of the Sierra Madre de Chiapas, where the densest rainfall in the country is registered, on the slopes of the Tacaña volcano.

However, it is not only the rainfall which affects the productivity of the arable lands. The temperature and its main determining factor, altitude, affect the development and ripening of the plants cultivated. It is worth noting, for example, that in the High Plateau the fruit trees suffer damage during flowering and ripening, owing to variations in temperature. There is no marked difference between the seasons on the High Plateau, and it is very common for frosts to cause the total or partial loss of the harvests.

On the other hand, the climate, which helps to form the soils and the vegetation, gives the tropical regions - such as the humid zones of Mexican territory - special characteristics, which condition their use and the method of working them. According to Rómulo A. Ferrero,^{1/} "In a large number of cases, perhaps in the majority, the great fertility of the tropical soils covered with forests is only apparent; once the trees are felled and the land cleared and put under cultivation, a progressive exhaustion has been noted, which is frequently very rapid and unexpected."

^{1/} Los Problemas de la Colonización en el Perú by Rómulo A. Ferrero.
/The agrological

The agrological studies undertaken since 1926 by what was formerly the Comisión Nacional de Irrigación (National Irrigation Commission) have made it possible to know the condition of the soils which are irrigated or which it is planned to irrigate in Mexico, and until the present time the Departamento de Estudios del Suelo (Department of Soil Surveys) of the Secretaría de Recursos Hidraulicos (Secretariate of Hydraulic Resources) - has carried out nearly 200 surveys in different regions of the country, which cover almost the whole territory, with the exception of the Peninsulas of Yucatán and Baja California.

In general, Mexican soils are lacking in nitrogen. The Departamento de Estudios del Suelo (Department of Soil Surveys) has drawn up a map of the fertility of the land according to the nitrogen it contains; it is considered fertile where the nitrogen content reaches 0.2 per cent, and as arid where it does not contain more than 0.1 per cent. The first are situated in the Peninsula of Yucatán, where, however, the lack of agrological surveys makes it impossible to state precisely what area they cover; in Tabasco and the coast of Veracruz, extending to south of the city of Jalapa, and then on the northern coast of the same state, to that of Tamulipas; there they fork, on the one side to Nueva Leon up to the south of Monterrey, and on the other side, along the state of Hidalgo, as far as Atlacomulco and La Virgen, in the State of Mexico. Land of this kind is also found in the Pacific coastal regions from Nayarit, through Jalisco, Colima, Michoacán and the Costa Grande of Guerrero, until near Coyuca de Benítez; between Morelia and Uruapán, state of Michoacán, and finally along the Chiapas coast from the Isthmus of Tehuantepec as far as the frontier /of Guatemala. This

of Guatemala. This land is a minimum part of Mexican territory. The rest only comprises soils with a nitrogen content not exceeding 0.1 per cent, that is, soils of deficient fertility. It should also be noted that the soils with a greater nitrogen content are also those with a greater degree of humidity.

The Departamento de Estudios de Suelos, of the Secretaría de Recursos Hidráulicos, has studied an approximate area of 5,000,000 hectares, comprising the state of Tlaxcala; the northern part of Tamaulipas; the zone of Monte Morelos, in the State of Nuevo León, which produces citrus fruits; all the coast of Sinaloa; the Valle de Yaqui, with 300,000 hectares; 300,000 hectares more in the Comarca Lagunera and in general the other lands included in the irrigation works projected or constructed by the present Secretaría de Recursos Hidráulicos.

It should be stressed that apart from other factors, in many regions, the topography, the arid climate, the torrential rains, and in others the poor systems of cultivation, where the land is steep, all limit the productivity of the land.

Many examples could be given to indicate the destructive effects of erosion, which are particularly serious in many regions, although in others, it is erosion which has formed flat alluvial lands, the extent of which is gradually increasing, as is the case along the coasts of Chiapas and Tabasco. In some parts of the High Plateau, where cultivation brought about deforestation, the wind has been a decisive factor in the loss of soils; this happens, for example, in the region of Los Altos, in the state of Jalisco. Along the inner and outer

/slopes of the

slopes of the cordilleras, the cultivation of steep slopes causes the soils to be washed away during the rainy season. This is aggravated by the fact that once the soils have been washed away, their reforestation is difficult, if not impossible. In the Peninsula of Yucatán, (where the henequen plantations have kept the northern lands under cultivation), owing to the limy, cavernous structure of the soil, the infiltration of water has washed away the vegetable layer, which the ancient Mayas preserved by sowing maize every 11 years. Finally, in the unirrigated lands, the system termed every other year, under which the land remains fallow during a whole agricultural cycle, without any protection, exposes the soils to a very active process of erosion.

There are no data available by which the damage caused by erosion can be measured, but it is obvious that this is a constant process, which in course of time has caused a serious loss of fertility in land under cultivation.

The methods recommended for soil protection, such as crop rotation, cover crops or strip and contour croppings, are only partly applicable in Mexico and over limited areas.

In the first place, crop rotation and cover crops are only feasible in humid or irrigated land. As has been seen, these are the least extensive. In unirrigated lands, which represent the greater proportion, rotation would have to consist in alternating crops from one year to another, using the plants most suited to the climate; thus during the dry period it is impossible to prevent erosive agents from operating on the soil, which lacks a vegetable covering. This system of alternation which may, for example, consist in sowings of maize and

/beans, maize and

beans, maize and sesame or some other combination of cereals and pulses, deprives the farmer during a whole year of his basic food, which is maize. This is aggravated by the fact that loss of the maize harvest is frequent, in different regions, and thus the population suffers from economic upheavals. Cover crops would modify to advantage the method of cultivation, so general in Mexico, which consists in leaving half of the available lands fallow for a year; but when it is remembered that livestock has to graze on the uncultivated land, through lack of other pastures, it is not easy to introduce that system.

On the other hand, strip and contour crops, either alone or combined with terracing, have been long established in Mexico. Before the Indians knew the plough, in the pre-colonial period, this form of cultivation was common, in order to make use of steep slopes. This system has been abandoned where the use of a yoke of oxen and the plough permit the land to be tilled more easily and rapidly than before, when all the work was done by hand. Vestiges of these terraces can still be found in many mountainous regions, where they followed the contours of the land and formed belts, separated at times by live hedges of maguey or other plants, and in other places with stone fences - tecorrales - which retain the soil washed away by the rains. Moreover, contour tilling is common in all lands with a sharp gradient, where the farmer follows with the plough the curves of the level land, to form the furrow in which he sows maize, beans, sesame, peanuts and other unirrigated crops; but in the irrigated lands, which are generally flat, and are tilled with modern instruments, strip and

/contour crops are

contour crops are not often found, since the crops sown are extensive ones. The modern farmers, especially those who have colonised the new irrigated regions, lack the tradition or technique which would have taught them better methods of cultivation. The land is worked with the sole object of obtaining the greatest profit, following price fluctuations. In the rich and extensive system of the River Yaqui, in the State of Sonora, wheat and rice crops predominate, and no study has been made of the convenience of adopting rotation. The Comarca Lagunera, in the states of Coahuila and Durango, has been characterized by one crop - cotton. Only in the last few years, when new cotton regions have been developed - Lower Valley of the Rio Bravo in Tamaulipas, Delicias and Don Martin in the states of Chihuahua and Nuevo León respectively - have other crops been sown there such as the vine, wheat and alfalfa, but without an adequate rotation being established. These examples are sufficient to demonstrate the backwardness of agriculture in this respect.

Soil protection against washing away by rain is also particularly important, since the rains are torrential in very large areas. Although the decrease in areas of cultivation through this cause has not been measured, it undoubtedly reaches large proportions. In a very few years, it may be observed how lands which were under cultivation, forests or natural pastures, have been lost, where the topography lends itself to the formation of drainage ditches, which in a short while are transformed into gulleys, or where the pasturing of livestock or land clearance have increased the stripping process. The opening and building of roads aggravates this destructive process, since regions

/which were formerly

which were formerly uncultivated owing to their isolation, have now been ploughed, with alarming results, as can be seen along the length of the highway from Mexico to Laredo, on the stretch which traverses the Sierra madre Oriental.

In other cases, such as in the region known as Sierra de Puebla, where the forest lands were handed over to the peasants as "ejidos", the density of the population has caused the cultivation of pine-covered slopes, which lose their agricultural topsoil in a few years. In desert regions, where the natural vegetation consists of plants from which hard fibres are obtained - guayule, cora de candelilla, etc. the excessive cutting down has left the lands bare and exposed to both wind and water erosion. In the coffee regions of Chiapas and Veracruz, Oaxaca and Guerrero, where the plantations were made on over-steep slopes the washing away by rainwater, although checked the coffee shrubs and shade trees, is limiting the zones suitable for cultivation and diminishing their fertility. On the other hand, the annual burning of thickets, sometimes for the sowing of maize, at other times to obtain young grasses for livestock, at times, either through accident or design, also causes erosion and loss of fertility of the soils.

With the object of conserving the natural resources and restoring useless lands, the Dirección de la Defensa del Suelo, of the Secretaría de Agricultura, has set up stations which are also charged with studying and propagating systems of land utilisation. The organisation of this service is too recent for it to have shown any results yet. At the same time, the construction of works for

/defending the soil

defending the soil at times involves a tremendous outlay.

Up to the present, Mexican agriculture has been notable for its low consumption of fertilisers. This is partly explained by the fact that 80 per cent of Mexico's tilled lands are unirrigated, and taking into account the scanty, irregular rains, the use of fertilisers would not be economic in the greater part of them. However, in certain unirrigated areas - the Valley of Toluca, in the state of Mexico; the Bajío, the region of Los Altos, in the southern part of the High Plateau - as well as in other isolated regions, where the exhaustion of the soil is apparent, the application of cattle, sheep or goat manure is carried out through necessity. Even in the mountainous regions, where the Indians sow maize, the fallow lands are fertilised by means of corrals where the animals are shut in at night; the land is manured in this way. In any case, agricultural farms, whether large or small, are not combined with the livestock industry and only those which engage in milk production use manure to cultivate alfalfa, as is done in the immediate vicinity of the great cities.

According to the opinion of Dr. Alfonso González Gallardo, of the 6,000,000 hectares cultivated annually, only 3 per cent or 180,000 hectares can be economically fertilised; this is done at the rate of 500 to 600 kilos per hectares, almost exclusively for vegetables, fruit trees, sugar cane, cotton and chilli (red pepper), which do not depend on the rainy season. Naturally, as the irrigated areas increase or humid lands are opened up, or yields are higher, through using better seed on the same land, or more remunerative

/crops are sown, so

crops are sown, so the use of fertilisers will become more economic. There are, moreover, cases such as sugar cane, in the state of Veracruz, where the use of fertilisers is practically impossible because the rainfall continues during eight consecutive months, so that these could only be applied during four months, and there are no fertilisers which can preserve their properties throughout the time which would have to elapse from their application until the plant could take advantage of them.

On the other hand, the lack of research and ignorance of the soils have prevented the farmers from knowing which fertilisers they should apply, in what proportion and under what conditions, according to the particular soil and crop. In those places where these experiments and surveys have been carried out, such as the irrigated district of Pabellón, Aguascalientes, the Comarca Lagunera, in Coahuila and Durango, and certain coffee regions in the State of Chiapas, fertilisers have given positive results and the farmers use them to advantage.

In any event, the use of fertilisers in Mexico is recent, and their manufacture in the country only dates back about 35 years, when a factory for bone meal and phosphate fertilisers with 1.5 to 2 per cent of nitrogen began production. When coking furnaces were installed in Nueva Rosita, Coahuila, small quantities of ammonium sulphate were produced. During the first few years, owing to lack of domestic consumption, these were exported to the United States; recently domestic consumption has reached 5,000 tons annually.

Later, small factories of organic fertilisers were established, mainly for bone meal, and one for super-phosphate of calcium, in the

/State of

State of Durango, with a production of 3,000 tons annually. Other firms have traded in imported fertilisers, such as Chilean nitrate, the imports of which are limited, owing to the high price charged in the domestic market.

The Empresa de Guanos y Fertilizantes de Mexico, S.A. (Guano and Fertiliser Enterprise of Mexico, S.A.) was created with capital subscribed by the Nacional Financiera S.A., according to presidential decree of 17th June 1943. This is a mixed capital enterprise, in which are concentrated all activities tending towards promoting agricultural production, through the proper use of fertilisers. This body has undertaken the promotion of guano production on all the Mexican islands considered appropriate. The extraction of this product commenced in 1944. This same enterprise has started detailed scientific research, mainly oceanographic, ornithological and climatic surveys, to determine the possibilities of feeding the bird population. This grows from year to year and the results obtained up to the present time indicate the possibility of obtaining shortly a copious production.

Guanos y Fertilizantes de Mexico, S.A. has also installed the following: a plant using raw bone, which can produce eight tons of meal daily, with 27 per cent of P_2O_5 and 1 - 1.5 of total nitrogen, a factory engaged in preparing fertilising formulae; another factory, built at San Luis Potosí, for super-phosphate of lime, which is one of the most modern in Latin America, with a production capacity of 75 tons daily; a plant in Guadalajara, Jalisco, where the guano collected on the Northeastern Islands is processed; this factory's output is later

/distributed among

distributed among the different mixing plants owned by the enterprise in different parts of the country; in these factories the complete formulae are manufactured, known as Guano-Mex. Moreover, this institution is building, near Mexico City - Cuautitlán - a plant for producing ammonium sulphate with 21 per cent nitrogen. It is expected that this factory, the annual capacity of which will be 70,000 tons, will start production in August 1950, and it is estimated that it will sell the ammonium sulphate at 300 pesos per ton. This fertiliser has been imported until now at the price of 850 pesos per ton, with 20.5 per cent of nitrogen. Sodium nitrate, with 16.5 per cent of nitrogen and 14 per cent of K_2O today costs 950 pesos per ton. These prices make the use of fertilisers prohibitive, even in irrigated crops with high yields. This factory will be able to satisfy a tenth of the estimated demand.

In fact, it has been calculated that to fertilise the whole extent of irrigated crops, 1 million tons of fertiliser would be needed each year, and 700,000 tons if only the most remunerative irrigated crops were fertilised.

Production of fertilisers in 1949 shows an increase of 13.1 per cent in relation to 1945, but the fertilisers manufactured are on the basis of phosphorus - P_2O_5 - both in its mineral form - super-phosphate of calcium, derived from phosphoric rock - and in its organic form - super-phosphates derived from bones or from the guano of marine birds - so that the country will continue for a while to lack the other necessary fertilisers. The adjoining tables indicate domestic production and imports of fertilisers, during the last few years. (See

V. STATE OF AGRICULTURAL TECHNIQUE

Generally speaking, it may be said that the working methods which prevail in Mexican agriculture are most backward and that the technical skill of the farmers is very poor. Methods of cultivation, however, vary according to the river system, the type and quality of the land under cultivation, and the plants grown. Nearly all plantings are carried out taking advantage of the rainfall; and on the whole, primitive methods of cultivation are used.

Mechanisation

The use of modern machinery is particularly important in agricultural technique. Although, as has been stated, there is a general backwardness in this respect, certain tasks have been mechanized since the beginning of this century, above all since the agrarian reform. This can be appreciated from data covering imports of machinery, since Mexico only produces rudimentary farming implements. (See Table 10).

The mechanisation of Mexican agriculture has been more rapid in those regions with greater areas of flat land, where the most remunerative crops are grown, and where labour is scarce. Mecanisation has expanded above all in irrigated lands, which present least difficulties. Naturally, the figures for imported machinery are alone insufficient to appreciate the degree of agricultural mechanisation in the country, since there are no data available to determine the type of lands and crops for which farm machinery is used. However, it is evident that there is a direct relationship between the use of machinery and the natural possibilities of the lands and the economic resources of the farmers. It has already

/been stated that

Table 8. México: Imports of Fertilizers

<u>Years</u>	<u>Quantity (tons)</u>	<u>Value (Mexican pesos)</u>
1925	4,482	679,707
1926	4,271	566,541
1927	5,951	678,042
1928	10,269	1,124,603
1929	10,120	977,636
1930	12,396	1,308,812
1931	8,052	984,940
1932	3,392	630,222
1933	6,499	913,227
1934	10,302	1,380,659
1935	14,617	1,823,829
1936	15,525	2,278,189
1937	15,559	2,294,358
1938	14,802	2,557,118
1939	18,477	3,649,425
1940	14,149	3,506,099
1941	22,122	5,322,355
1942	12,219	4,388,098
1943	24,770	7,257,157
1944	17,690	5,310,440
1945	23,796	6,515,480
1946	17,602	5,095,835
1947	27,844	9,297,381
1948	18,511	7,816,757

Source: Foreign Trade Year books and tables of the Dirección General de Estadística.

Table 9. Production of fertilizers in 1945 to 1949

	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	
CALCIUM SUPER- PHOSPHATES (mineral, phosphoric rocks)	5,000	6,000	7,500	10,000	14,000	tons
CALCIUM SUPER- PHOSPHATES (organic, calcinated bones)	-	-	-	-	500	"
BONEMEAL	-	400	600	900	1,000	"
ISLAND GUANO	1,500	2,000	2,000	2,000	3,500	"
AMMONIA SULPHATE	<u>3,000</u>	<u>3,000</u>	<u>3,000</u>	<u>3,000</u>	<u>3,000</u>	"
Total tonnage	<u>9,500</u>	<u>11,400</u>	<u>13,100</u>	<u>15,900</u>	<u>22,000</u>	tons

Table 10. Imports of machinery and agricultural implements from
the United States

(in units)

	Tractors a/	Ploughs	Harrows	Cultivators	Crain drills	Threshers	Shellers
1925	-	4,258 b/	..	..	..	..	..
1926	1,352	4,946 b/	..	..	..	..	..
1927	731	3,253 b/	..	..	..	..	..
1928	608	3,669 b/	..	..	..	..	..
1929	640	3,477 b/	..	..	..	..	..
1930	930	2,027 b/	..	..	..	..	..
1931	434	971 b/	..	..	..	..	..
1932	52	2,494	222	571	19	5	34
1933	115	9,965	341	653	39	33	422
1934	352	23,591	2,019	3,084	90	67	249
1935	581	44,838	2,041	5,883	96	54	181
1936	631	23,438	3,034	6,619	113	50	1,094
1937	848	41,592	3,659	7,092	192	73	480
1938	278	14,732	975	1,833	223	66	208
1939	503	12,501	1,075	2,624	139	241	179
1940	675	8,019	1,201	2,120	122	123	161
1941	1,626	22,933	2,389	7,173	257	176	368
1942	517	9,894	1,206	3,059	324	128	221
1943	1,420	7,582	1,810	4,464	363	40	275
1944	2,028	13,707	5,510	5,007	413	82	541
1945	2,768	16,478	3,267	7,492	456	235	312
1946	2,972	13,407	4,086	5,292	661	304	71
1947	6,425	22,332	5,188	5,842	951	348	921
1948	6,894	31,033	4,509	8,939	850	484	987

a/ Total imports from the United States and other countries.

b/ Total imports in tons.



been stated that greater mechanisation exists in the better quality irrigated lands, but as the irrigated area has increased together with means of communication, so has the degree of mechanisation increased. This growth is almost equal in private property and "ejidos" although naturally, as the use of machinery is determined by the size of the farms, in the case of the "ejidos" it depends on the organisation of labour in common, in a cooperative form.

Draught animals

In order to judge technical progress, it is also important to consider the number and class of draught animals. According to the 1940 census, 1,927,419 horses and mules and 1,868,429 oxen and cows are used in the country, showing a ratio of 2.01. The number of horses and mules is considerably greater in the Northern region - 455,573, which is explained by the fact that the land is mainly flat there. Less than half of the horses and mules are used in the Central Zone and the number of them in the Gulf and South Pacific Zones is insignificant. On the other hand, the number of cattle reaches 1,114,285 in the Centre, being only 357,469 in the North, and in the Gulf and North Pacific it reaches its lowest figure. The number of horses and mules used on private property, greater and less than five hectares, is almost the same - the difference is only 30,625 - but in the privately owned farms of less than 6 hectares, 526,894 more cattle are used than horses and mules. This greater use of cattle is explained, both on the ejidos and privately owned property, by the advantages of oxen over horses and mules in unirrigated agriculture is so uncertain and provides such low yields. (See Table 11).

Pests

Finally, reference should be made to plagues (diseases). In the greater part of the country, where desert conditions predominate, diseases and epizooty are scarce, but along the coasts, south of the Tropic of Cancer and, above all, in the Southeast, from the Isthmus of Tehuantepec, they are numerous and hinder the productivity of land and labour. Among the crops of the High Plateau and the Northeastern irrigated zones, wheat is attacked by different forms of "chahuixtle"; this becomes worse with the rains and accompanying humidity, and there is no way of combatting it except by using resistant varieties of wheat. Cotton, in those same regions, is attacked by the pink worm and the "picudo", technical advice in the struggle against diseases is particularly followed in the case of this crop. Maize and beans do not suffer from serious diseases in these regions, but they are damaged by the irregularity of the rains and frosts, which also affect the production of fruit. On the other hand, in the typically tropical humid regions, diseases cause serious damage. The main plague, throughout agriculture, is the locust - *Schistocerca paranensis* - which periodically ruins the production of the whole southeast. Other plagues such as the "chamusco" - *cercospora musae* - and the "Panama disease" - *fusarium oxysporum cubensis* - only attack certain plants. The chamusco has made it necessary to spray the banana crops with Bordeaux mixture and the Panama disease has forced fertile regions to be abandoned. Fortunately, coffee and cacao are free from serious diseases, as well as rice and sugar cane. The citrus fruits, on the other hand, are attacked by the fruit fly - *anastropa ludens* - and the black fly -
/aleurocactus woglumi

Table 11. Mexico: Draught Animals used in Agriculture

	Horses and mules	Oxen and cows	Ratio of cattle to horses & mules
Mexico	927,419	1,868,429	2.01
North	455,573	357,469	0.78
Gulf	63,676	85,916	1.35
North Pacific	157,705	63,817	0.40
South Pacific	32,818	246,942	7.52
Central	217,647	1,114,285	5.11
Private property over 5 hs.	235,070	461,739	1.96
Private property 5 hs. and under	265,695	792,589	2.98
Ejidos	426,654	614,101	1.44

Source: 1940 agricultural census

Table 12. Mexico: Unharvested areas of the principal crops according to the specified census of loss, in 1940.

CONCEPT	Totals	%
I. Total unharvested area	1,233,057	100.00
a) Frost	184,702	14.98
b) drought	872,512	70.76
c) floods	40,989	3.32
d) pests & diseases	92,364	7.49
e) others	42,490	3.45
II. Unharvested area of maize	908,805	100.00
a) Frost	101,357	11.15
b) drought	708,435	77.96
c) floods	24,045	2.65
d) pests & diseases	48,163	5.30
e) others	26,805	2.94
III. Unharvested area of beans	114,259	100.00
a) Frost	8,535	7.47
b) drought	84,066	73.58
c) floods	3,031	2.65
d) pests & diseases	14,956	13.09
e) others	3,671	3.21
IV. Unharvested area of wheat	78,421	100.00
a) Frost	24,180	30.83
b) drought	31,455	40.11
c) floods	2,412	3.08
d) pests & diseases	14,921	19.03
e) Others	5,453	6.95
V. Unharvested area of "other crops"	131,572	100.00
a) Frast	50,630	38.48
b) drought	48,556	36.90
c) floods	11,501	8.74
d) pests & diseases	14,324	10.89
e) Others	6,561	4.99

aleurocantus Woglumi Ash - pests which have prevented the export of these fruits to the United States. Estimates regarding the extent of the damage caused by diseases and bad weather, as summed up in table 12, are derived from the 1940 Census data. It is estimated that the Panama disease, on the coast of Chiapas, during the last few years, has caused damage to the extent of 3,600,000 pesos. The data registering the extent and value of insecticides and fungicides imported to fight pests (see Table 13) only indicate a part of what it costs to fight them, not the crop losses, which are very considerable.

Skill of the farmers

To the foregoing should be added, in order to know the present state of agricultural technique, the fact that the farmers lack the knowledge and experience necessary to develop intensive, diversified agriculture, and that the capacity and yield of agricultural labour are, in many cases, deficient. A distinction should be made between two large groups of farmers: the proprietors or administrators of the different farms and the agricultural workers who work their own lands or those of others; the first group includes individuals of various economic situations and different social conditions, but with the common and general factor of ignoring and despising modern agricultural skill; the latter consists of Indian peasants or mestizos, who lack the elementary knowledge for rational tilling of the soil.

However, the pre-Cortes agriculture was transformed, in many fundamental aspects, by the teachings of the coloniser - missionary or encomendero - who introduced new plants and new methods of cultivation;

/since the agrarian

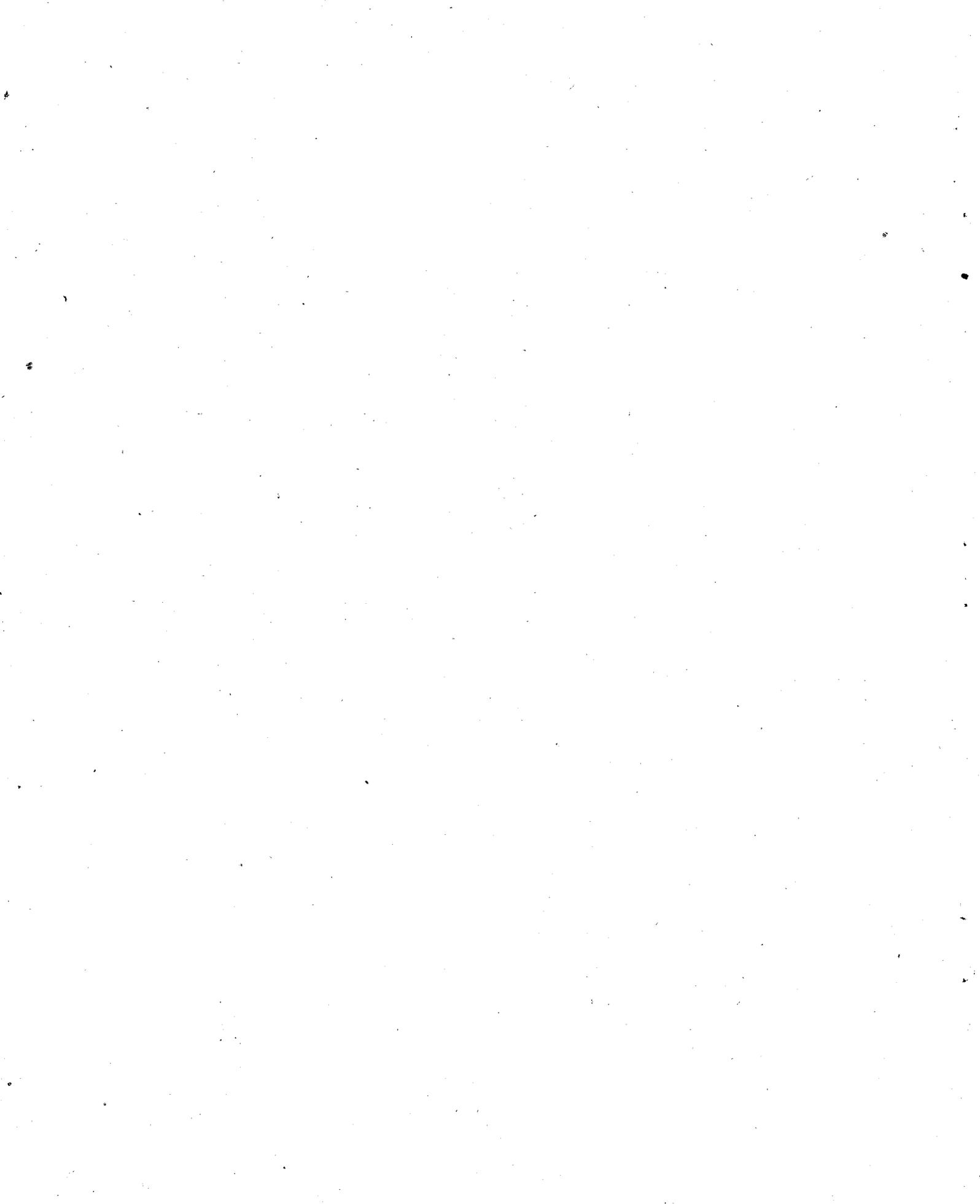
since the agrarian reform, where natural, social and economic conditions permit, agricultural technique has been progressing; but where owing to bad soil and worse climate, where the backward economic and social conditions have kept the farmers in misery, their incapacity for progress is obvious, although this should not be attributed to lack of faculties. This technical backwardness is also due to the farmer's inability, through the prevailing economic organisation, to increase investment and to the fact that practically nothing of any importance has been done in the way of agricultural teaching and propaganda, since all the projects attempted by the State have failed, for different reasons.

Table 13. Mexico: Volume and value of 1940-48 imports of insecticides and pesticides ^{a/}

Years	Volume	Value
1940	466,381 Kg.	\$ 622,115
1941	732,376 "	1,018,883
1942	1,808,398 "	1,604,743
1943	1,423,611 "	1,485,522
1944	884,765 "	1,409,916
1945	1,091,767 "	2,894,443
1946	737,031 "	2,417,990
1947	1,167,215 "	2,613,260
1948	1,838,532 "	4,043,482

Source: Dirección General de Estadística

a/ Destined to combat pests attacking plants, cereals, etc.



VI. AGRICULTURAL CREDIT

Background

The organisation of agricultural credit in Mexico began during the last third of the past century, when large-scale agricultural production was commenced, above all of export products, such as henequen, coffee, cotton, chick-peas, bananas, plantains, etc.

While the country's economy was in a pre-capitalist stage, credit was not necessary, and consequently did not develop. At that time, agricultural production, which moreover enjoyed considerable tariff protection, financed itself. Until 1910, the farmers, who were nearly all great estate-owners, only resorted to mortgage credit. This was generally in order to satisfy requirements other than those of farming and at times to invest in arable land, which would round out their properties. It was rarely for the purpose of improving methods of cultivation or developing new agricultural possibilities.

The other farmers, small and medium proprietors, resorted to mercantile credit, granted at high interest rates by local tradesmen and moneylenders, on the basis of real guarantees, which generally took the form of agricultural products valued at a low price. At times, the moneylenders also demanded a mortgage on the land. This brought about concentrations of real estate, many of the moneylenders being already great estate owners, while the tradesmen managed to own property within a short time, partly owing to the foreclosure of unpaid mortgages.

Mortgage credit, however, could only be used by property owners of some standing. The others, whose properties were small or lacked legal

/title deeds,

title deeds, were forced to resort to mercantile credit, as mentioned above. On the other hand, a proportion of these small farmers, difficult to estimate, engaged and still engage in subsistence farming, and only resort to credit under extraordinary circumstances, such as the marriage, illness or death of relatives, religious obligations, loss of crops etc.

The situation described still prevails in many districts, particularly the more isolated and backward ones. Usury credit has not entirely ceased to exist, but must be still taken into account as one of the obstacles of present-day agriculture. In fact, recent research indicates that there are still short term loans in force, with crop guarantee, at interest rates which at times reach 7 and 10 per cent per month; other loans combined with the "green" purchase of crops and interest at 15 per cent per month; finally there are loans granted by the owners of the coffee-processing plants, cotton ginning plant and wheat mills. These are also granted at high rates of interest, with the conditions that the borrower has to sell his crop to the lender, who in this way ensures the cheap operation of his processing plant.

Research has also been carried out with the object of verifying the distribution of the average value of one hectare's production between the main factors of the process of production and distribution. The results for certain crops are summarized below, taking the average rural price, deducting transport charges paid by the farmers, normal interest, storage etc., as well as the wholesale prices in Mexico City, during the year 1946:

/Farmers

	<u>Farmer</u>	<u>Transport to Factory</u>	<u>Normal Interests</u>	<u>Industries</u>	<u>Trade</u>
Wheat	42.4	0.8	2.3	48	6.5
Rice	44	0.8	1.6	38	15.6
Sesame	34	6	1	43	16
Cotton	22	1	1.4	68	7.6
Sugar cane	36	6.7	1.8	41	14.5

Source: "El Crédito Agrícola en México", Contrán Noble, México, 1949.

These data, covering the five main crops, show that a very high proportion of the value of the products remains with the industrialist, whose investments are relatively small, except in the case of sugar mills. Taking into account, on the other hand, that those who process wheat, clean rice, pick cotton or extract sesame oil, also lend money to the farmer, the profits are multiplied and the disparity in the distribution of commercial prices of products is accentuated.

Reforms of agricultural credit

In order to remedy this situation, and with the clearly defined object of consolidating agrarian reform economically, the Government created institutions specialising in agricultural credit, since, as the reform was put in hand, the need for credit accessible to the peasants became evident.

Organisation of agricultural credit

The institutions which were organised at the beginning were called Bancos Agrícolas Ejidales (Ejidal Agricultural Banks), founded in certain agricultural regions where the ejidal grants were already important and where the prevailing economic-social conditions were studied, agricultural schools being established to impart technical knowledge to the "peons" transformed into "ejidatarios". The main characteristic of these

/institutions was, then,

institutions was, then, to serve the latter, support and encourage their economy, and achieve a new agriculture for the future, based on the work and progress of the farmers themselves. It was therefore necessary to consider the cooperative organisation of credit, first because the "ejidos" were not a private estate which could constitute a real guarantee for loans, but a possession or tenure of the land, for its working, and in the second place, because the "ejidatarios" lacked other goods which could serve as guarantees for loans.

Ejidal credit began to function with funds derived from capital contributions by the Federal Government, but at the same time the first law of agricultural credit was passed. This law encompassed broader aims, the principal one being to build a new agrarian economy, which would be the result of the reforms being carried out in the system of land tenure. That law created a whole system of agricultural credit institutions, formed by local and regional societies which had to operate through the central institution, whose capital was also constituted with contributions from the Federal and local Governments. This organisation had to take into account the need for granting loans to cooperative credit societies, for the reasons already explained when discussing the Ejidal banks, although loans were not to be granted only to "ejidatarios", but also to owners. In effect, mortgage credit could not function when property was expropriated to provide villages with ejidos, and it was necessary to establish a different system, which would guarantee the recovery of loans. This was all the more necessary since the main object pursued at that time consisted in equipping economically the small owners and ejidatarios who

/had to form

had to form part of the local agricultural credit societies. The former could not provide real guarantees either, because in their great majority they lacked duly legalised title deeds to their property, as well as other goods other than the lands they possessed.

The existence of the Bancos Agrícolas Ejidales (Ejidal Agricultural Banks) on the one hand, and the organisation, on the other hand, of credit institutions depending from the Banco Nacional de Crédito Agrícola (National Agricultural Credit Bank), whose objectives had much in common, was conducive to the unification of the system within a single central organisation, operating as much with the ejidatarios as with the small owners. However, the initial aim of forming true credit cooperatives among the ejidatarios and small owners was not achieved. Credit action, on the whole, was unable to restore the economy of the peasant, and worse still, not only did the bank's capital not increase, but on the contrary, its operating possibilities decreased, through the losses suffered and the impossibility of obtaining funds from sources other than the direct contributions of the Federal Government.

Under these conditions, the Banco Nacional de Crédito Ejidal (National Bank of Ejidal Credit) was created along the same lines as the Banco Nacional de Crédito Agrícola (National Bank of Agricultural Credit), but for the purpose of operating exclusively with the ejidatarios. The law founding it contained no other innovations except to point out that the purpose of ejidal credit was to operate with the ejidos, organised in a collective form, that is, not cultivated in individual plots by each ejidatario, but in larger units, formed with the total ejidal plots located in one district.

Thus from 1936 to the present time, two national agricultural credit institutions have co-existed, both being linked to the State. The operations of each are very important, not so much for the volume of the loans granted, but because they represent the Government effort to consolidate the new system of agrarian property. The figures corresponding to loans of all kinds granted by these banks reveal, on the one hand, that credits have been insufficient to place the agricultural activity of ejidatarios and small owners on an economic footing and on the other, that they have had to be distributed all over the country, not so much to promote agricultural production in any particular sense as to satisfy the demand of the farmers. The difficulties which occur in distributing agricultural credit and in channeling private capital towards this type of loan, either through the issuing of bonds or other values or through the subscribing of shares issued by these banks, have been learned from their operating experiences. The scarcity of capital is due to the fact that although farming is always risky, it presents greater risks in Mexico, because of particular natural conditions. This natural insecurity was aggravated because, since 1910, the country lived in a state of revolutionary fervour. On the other hand, private capital has sources of safe investment, such as commercial loans. Consequently, with the object of obtaining capital to enlarge their loans, contracts have been made with private investors; under these agreements, the national banks receive the funds necessary for financing certain crops, and the investors acquire the harvests. In this way, these same national banks have been able to extend their crop loans, but they have not had /sufficient resources

sufficient resources to make real estate loans which would broaden the possibilities of agriculture.

Types of loans

The different types of loans granted by the two national credit institutions referred to above, are classified as crop improvement, real estate and lien loans.

The greater part of the loans granted are crop loans, both in the Agricultural and the Ejidal credit banks, since the clientele of both banks - small farmers and ejidatarios - require money in order to live and to pay the expenses of the most common crops. The obvious result of this is that they have to sell their crops as soon as they are harvested, both to cover their credit obligations - as well as to satisfy delayed requirements, and also because there is a general shortage of warehouses, in which to store them. Thus they obtain the lowest prices, losing a large proportion of the reward of their labour.

The amounts loaned in other ways have always been limited, although the convenience of improving the technology of agricultural production is obvious, in every sense and among the different types of farmer. However, in the Agricultural Bank's operations, improvement credits have represented a proportion in relation to the total loans varying from 15.18 per cent, in 1938, to 40.01 per cent in 1947. The latter was an exceptional year in this respect, since in nine of the twelve years since 1936, the percentage of improvement credits is lower than 30 per cent. In the Ejidal Bank, during the same period, improvement credit represented an even lower proportion; during 1936 and 1937, the respective percentages

/were 25.02 and 23.99

were 25.02 and 23.99 per cent; from 1938 to 1942, from 10.6 per cent to 12 per cent, and in the last few years since 1943, less than 10 per cent. This was due to the fact that the subsistence requirements among the ejidatarios were more pressing and the bank resources were never sufficient to attend to all of them.

Real estate credits represented a very small proportion in both banks. In the Agricultural Bank, they were less than 1 per cent, during 7 of the years surveyed, with a similar proportion - 3.81 per cent, for the year 1947. In the Ejidal Bank the percentage is also lower than 1 per cent, for six of these years, only reaching 4.77 per cent in 1939. In this latter bank, real estate credits are only applicable to improvements of a permanent nature, and not to land purchases. The latter, in exceptional cases, may be effected through assistance from the Agricultural Bank.

Finally, lien credits also represent a very small proportion in both institutions. In the Agricultural Bank, they were nil in the year 1941, less than 1 per cent during four of the years surveyed and only reached nearly 20 per cent in 1946. These loans represented less than 1 per cent in the Ejidal Bank, from 1936 to 1942; during 1943, they reached greater proportions, and from the following year until 1947, the percentages were 1.43, 3.90, 5.30 and 2 per cent respectively.

Crops encouraged and capital invested

For both institutions, during all their years of operation, the area where cultivation is promoted through crop loans is insignificant, in relation to the total area cultivated by farmers and ejidatarios.

/On the other hand,

On the other hand, the majority of the crops grown in the country have been protected, without any prevailing tendency to favour the increase of any particular one. (See Tables 14 and 15).

The loans granted by the Agricultural Bank vary from a minimum of 4,826,169.- pesos, in 1940, to a maximum of 38,004,490.- pesos, without any tendency towards increasing operations for certain crops. If this is noted in the total amount of the loans, the same applies to the amounts loaned for each crop, the greatest being for cotton, because the greater number of clients are found in the regions producing this fibre. Moreover, this is the most remunerative irrigated crop, and the one involving the least risks.

Similar observations can be made regarding crop loans granted by the National Bank of Ejidal Credit. It began operations in 1936, and in that year granted loans for 15 principal crops and various others, the latter covering very small areas. During the institutions twelve years of operation, loans have increased more or less rapidly, except in 1943, when the area assisted by crop loans was reduced by more than 300,000 hectares. During all these years, maize is the crop occupying the greatest area assisted by credit. This area fluctuates owing to the fact that the extent harvested depends on the variations in the rainfall. The figure for 1943 - only 160,745 hectares - is very low, owing to the scanty rainfall that year, although the tendency which existed during the last war to grow other crops may also have influenced this decline.

In 1936, the Ejidal Bank granted crop loans to a value of 12,739,839.- pesos. In succeeding years, the total loans increased constantly, until /in 1949 they

in 1949 they reached the important sum of 178,894,821.- pesos. (See Tables 16 and 17).

Amount of loans

Naturally, the loans of the two national credit institutions just described do not represent more than a small part of the credit granted to domestic agriculture. All the following grant loans to farmers, for a very much higher total amount: private banks, and above all private individuals who either as tradesmen or commission agents advance the value of the crops; the owners of industrial plants which require agricultural raw material (flour mills, rice-cleaning, cotton ginning, vegetable oil extractors, coffee processing etc.).

The credits granted by private banking to agriculture and the livestock industry are shown in Table 18. In 1949 the total of these credits only represented, in relation to those for other economic activities, 15.3 per cent, a proportion which prevailed during the other years noted, with the exception of 1947, when it was 11.0 per cent, and 1944, when it rose to 23.06 per cent. It may also be observed that within the credits granted to agriculture and livestock, the amounts loaned for the former are always greater. This is because, prior to the appearance of foot-and-mouth disease, the breeding of cattle, in the more important northern regions, financed itself, through the sale of cattle on the hoof in the United States; besides, generally speaking, this activity does not require great investments. Besides, the stockbreeders generally have large resources and manage several enterprises, which is not the case with the majority of farmers.

/An important part

Table 14. Banco Nacional de Crédito Agrícola

Planted and Harvested Area for which Production Loans have been Granted
(in hectares)

Crops	1936	1937	1938	1939	1940	1941
Totals	44,118	120,200	136,751	111,018	89,066	95,638
Sesame	655	1,548	656	-	-	5
Cotton	15,871	61,804	21,326	21,157	14,867	25,217
Rice	-	-	176	259	414	287
Ground nuts	-	-	19	-	30	3
Coffee	-	-	608	2,146	1,715	1,524
Sugar cane	5,785	6,443	1,680	1,860	1,034	1,288
Barley	21	3,163	2,117	1,994	1,716	4,175
Dry chili	-	1,901	378	683	661	513
Beans	763	707	24,655	14,108	8,845	9,951
Chick peas	3,344	788	1,403	2,058	3,753	9,150
Maize	8,563	21,955	57,453	45,191	26,177	26,698
Potatoes	10	206	181	-	-	1
Bananas	40	-	39	-	155	-
Tobacco	-	-	-	-	-	-
Wheat	5,291	10,250	16,092	19,130	22,280	9,148
Others	3,774	11,435	9,968	2,432	7,419	7,678
	<u>1942</u>	<u>1943</u>	<u>1944</u>	<u>1945</u>	<u>1946</u>	<u>1947</u>
Totals	85,567	81,805	100,010	123,082	109,308	122,307
Sesame	1,700	1,972	3,055	5,231	409	2,604
Cotton	33,305	33,272	25,577	27,292	27,556	28,563
Rice	590	1,555	4,540	3,997	3,886	4,683
Ground nuts	1,025	2,194	2,229	2,510	2,546	1,623
Coffee	320	245	417	668	809	541
Sugar cane	1,702	1,950	2,410	3,265	3,123	1,230
Barley	2,265	1,436	2,474	7,825	8,050	3,798
Dry chili	1,077	617	958	820	709	937
Beans	4,992	6,449	5,278	7,354	1,692	5,742
Chick peas	8,272	3,371	4,046	2,496	1,597	727
Maize	16,582	18,624	31,345	39,151	36,143	40,909
Potatoes	515	1,664	1,544	1,830	2,940	1,040
Bananas	-	-	35	53	731	369
Tobacco	35	-	-	3	-	-
Wheat	4,476	3,510	9,209	10,767	10,208	21,702
Others	8,711	4,946	6,893	9,820	8,904	7,839

Table 15: Mexico. Banco Nacional de Crédito Ejidal, S.A.
Areas harvested by societies of ejidal credit.

Crops	1936	1937	1938	1939	1940	1941	1942	1943
1. Sesame	7,933	5,912	11,113	12,182	6,722	14,119	17,418	15,178
2. Cotton	8,058	115,708	99,557	93,692	87,493	88,554	92,925	102,853
3. Rice	7,527	12,166	8,477	13,837	24,015	22,177	23,559	23,341
4. Peanuts	4,440	2,921	2,287	1,841	1,521	2,957	5,437	5,303
5. Coffee	5,591	5,180	3,500	7,688	11,106	12,339	12,362	11,342
6. Sugar cane	2,661	7,224	6,994	8,838	27,090	33,332	30,481	33,324
7. Dry chili	1,325	1,418	1,037	1,090	685	808	1,757	1,410
8. Barley	9,591	13,661	77,379	11,662	8,491	9,552	15,385	8,648
9. Beans	29,202	22,768	26,309	19,076	20,040	23,205	33,924	18,170
10. Chickpeas	11,006	20,452	25,883	18,554	20,754	19,825	22,965	13,664
11. Maize	289,266	398,794	320,411	342,554	268,683	386,007	382,618	160,745
12. Potatoes	485	741	489	808	1,347	1,230	986	1,501
13. Bananas	694	8,998	1,557	3,918	4,651	5,049	3,674	1,144
14. Tobacco	937	4,210	264	2,900	1,740	231	391	193
15. Wheat	60,117	79,422	149,241	180,208	179,125	158,153	187,193	117,109
16. Others	22,924	34,583	14,371	8,276	11,308	25,344	12,900	24,407
	469,757	734,158	678,869	727,124	774,771	802,882	843,975	538,332

Table 15: (Continued)

Crops	1944	1945	1946	1947	1948	1949	1950	1951
1. Sesame	8,856	16,470	33,496	50,710	58,202	60,601	52,043	
2. Cotton	117,073	93,230	79,105	88,108	83,204	83,960	93,659	
3. Rice	20,524	26,149	37,956	29,060	27,827	33,262	40,431	
4. Peanuts	7,914	3,041	4,326	5,139	5,139	5,188	7,120	
5. Coffee	11,153	13,895	15,206	24,111	19,038	18,433	17,784	
6. Sugar Cane	26,077	26,708	41,129	32,868	31,383	19,058	14,433	
7. Dry chili	1,244	1,438	7,430	4,243	4,690	2,262	2,722	
8. Barley	12,873	7,669	6,736	4,099	2,510	1,574	1,000	
9. Beans	52,819	58,099	34,154	72,615	32,811	35,691	46,416	
10. Chickpeas	13,035	22,497	23,278	30,662	20,766	17,387	16,983	
11. Maize	413,529	346,367	498,254	559,377	367,800	358,114	570,658	
12. Potatoes	2,644	592	1,148	624	634	816	1,264	
13. Bananas	4,712	4,448	5,091	5,403	3,635	300	1,663	
14. Tobacco	1,634	1,311	1,334	245	245	—	—	
15. Wheat	109,302	112,000	120,535	136,456	166,607	167,275	175,261	
16. Others	21,714	27,906	76,871	53,939	17,459	11,373	14,317	
	825,122	762,720	986,060	1,097,747	841,950	815,294	855,754	

Note: The term "others" includes the following: garlic, alfalfa, birdseed, "albergón", oats, "cacahotero, sweet potatoes, onions, copra, "chicharo", green chili, string beans, sunflower seeds, strawberries, fruit, flowers, forage crops, bread beans, "higuerilla", vegetables, jícama, tomatoes, lentils, linseed, melons, oranges, papayas, pineapples, beet root, water melons and forest produce.

Table 16. Mexico. Banco Nacional de Crédito AgrícolaCredits - Production loans

(thousands of pesos)

Crops	1936	1937	1938	1939	1940	1941
Totals	5,845	13,135	9,338	5,118	4,826	5,057
Sesame	33	94	7	-	-	a/
Cotton	2,894	7,627	3,505	2,530	2,364	3,231
Rice	-	-	32	55	92	25
Groundnuts	-	-	2	-	1	a/
Coffee	-	-	101	195	146	105
Sugar-cane	1,658	1,696	558	200	120	144
Barley	a/	78	60	25	36	44
Dry Chili	-	570	141	-	70	55
Beans	13	12	601	101	94	80
Chickpeas	123	30	102	191	268	476
Maize	230	860	2,061	494	474	390
Potatoes	3	78	62	-	-	a/
Bananas	16	-	14	-	4	-
Tobacco	-	-	-	-	-	-
Wheat	410	825	1,368	1,170	918	218
Others	465	1,265	724	157	239	289
Crops	1942	1943	1944	1945	1946	1947
Totals	8,015	9,978	13,127	15,209	13,838	18,801
Sesame	296	160	334	640	133	465
Cotton	5,446	6,948	6,484	5,632	4,646	8,011
Rice	74	249	717	1,036	779	1,080
Groundnuts	56	216	333	408	413	266
Coffee	15	35	52	119	144	116
Sugar-cane	315	393	798	1,186	1,243	468
Barley	49	87	107	219	223	132
Dry Chili	97	36	121	136	157	191
Beans	51	88	114	166	88	373
Chickpeas	421	149	208	252	143	65
Maize	384	436	1,584	1,989	1,988	2,756
Potatoes	100	343	404	544	1,042	983
Bananas	-	-	9	171	61	167
Tobacco	1	-	-	1	a/	-
Wheat	196	149	681	977	1,048	2,251
Others	514	679	1,181	1,734	1,730	1,477

a/ Less than 1 thousand.

Table 17. México. Estimate of production loans per crop in the
Banco Nacional de Crédito Ejidal.

(thousands of pesos)

Crops	1936	1937	1938	1939	1940	1941	1942
Sesame	254	338	950	528	358	847	1,540
Cotton	967	17,500	16,400	16,400	13,121	13,283	16,200
rice	655	1,368	1,753	2,560	3,482	3,216	4,550
Groundnuts	180	279	197	187	228	617	774
Coffee	408	539	540	1,091	1,666	1,851	1,664
Sugar cane	270	1,873	2,515	2,510	6,637	7,166	7,180
Barley	102	293	384	476	255	297	412
Chili	131	222	282	293	258	---	384
Beans	372	1,150	1,422	1,580	802	928	817
Chickpeas	250	551	1,593	1,000	954	892	1,560
Maize	5,496	10,601	10,035	14,240	11,798	12,352	10,090
Potatoes	80	276	134	288	324	---	232
Bananas	104	2,122	366	1,560	1,200	1,301	597
Tobacco	82	616	481	567	372	437	68
wheat	2,979	5,745	14,300	16,370	14,330	12,652	10,052
Others	407	4,705	2,529	1,059	676	258	1,353
Totals	12,737	48,178	53,881	60,789	56,441	56,097	57,473

Crops	1943	1944	1945	1946	1947	1948	1949
Sesame	2,770	974	1,677	3,368	6,655	9,625	8,847
Cotton	28,022	35,122	28,062	27,585	50,782	44,420	50,763
Rice	4,375	8,210	10,720	16,796	12,684	15,268	18,885
Groundnuts	1,420	1,108	436	986	1,023	1,381	1,994
Coffee	2,060	2,509	3,122	3,483	4,441	7,742	5,904
Sugar cane	7,900	8,609	8,902	11,737	18,654	9,409	6,307
Barley	422	232	129	129	23	33	51
Chili	453	759	3,102	2,605	2,972	908	471
Beans	853	1,159	694	2,360	3,714	5,144	5,338
Chickpeas	1,038	912	1,373	1,995	2,623	4,537	2,717
Maize	12,500	16,128	13,448	13,609	25,134	37,671	35,583
Potatoes	620	925	283	301	186	311	388
Bananas	1,500	708	493	597	1,108	51	1,251
Tobacco	163	243	200	719	223	---	---
wheat	10,965	12,133	12,471	19,222	36,220	37,647	36,630
Others	2,600	2,156	5,435	5,317	6,094	4,750	5,499
Totals	77,661	91,892	91,547	111,839	178,736	178,897	180,628



An important part of agricultural production is financed by short-term loans, of a mercantile nature, granted by the banking institutions, with the guarantee of the crops as they stand and the personal guarantee of the borrower. This is particularly the case with products such as coffee, chickpeas, cotton etc., which since they are for export, have an assured demand and yield good profits on sales, these, moreover, being in the hands of commercial companies which are subsidiaries of the banks. The production of sugar, almost in its entirety, is financed by the Unión Nacional de Productores de Azúcar, S.A. (National Union of Sugar Producers S.A.) a cartel which grants crop and improvement loans to the sowers of cane, with the guarantee of the crop, assured and verified by the sugar mills or industrial plants which receive the sugar cane to manufacture sugar. This organisation has existed since 1932, and the loans granted by it are important: 35,125,000.- pesos in 1939, an amount which rose to 90,000,000.- pesos in 1947, increased in 1947 to 100,166,000.- pesos and finally reached 162,216,000.- pesos and finally reached 162,216,000.- and 151,600,000.- pesos in 1948 and 1949, respectively.

It is impossible to estimate accurately the total amount of the loans granted to farming; the estimates compiled taking into account the total value of agricultural production and supposing that 50 per cent at least of this value is invested in loans, are very unreliable. Loans are granted under varying conditions, according to the client and the value of his personal guarantee, so that in some cases almost 100 per cent of the estimated value of the crop is lent, while in other cases only a tiny fraction of this value is obtainable.

/The total loans

The total loans granted to the livestock industry by private banking in 1949 amounted to 85,278,000.- pesos; the greater part - 23,312,000.- pesos - corresponded to the northern region, where the richest cattle ranches are located; the Northwest follows it in importance, including the State of Sonora, which is also a livestock state; finally, there are the relatively small sums lent to the Northeast.

The loans granted by institutions or individuals for agricultural or livestock production exported to the United States are other sources of credit, these operations being negotiable outside Mexico, and it is not possible to ascertain their extent. The operations which take place along the Northwest coast for tomato cultivation, for example, are very important, as well as those undertaken by Anderson & Clayton for cotton production, or those which certain stockbreeders close to the frontier received from North American buyers.

Conclusions

In summary, it may be said that in Mexico, credit does not fulfil the function of promoting agriculture either in sufficient proportion nor with the required efficiency. The greater proportion of loans are made as crop credits with the object of meeting the most urgent requirements of the farmers; improvement credits represent a lesser proportion, and are requested by farming enterprises with greater resources; seldom by the peasants, for the purchase of equipment, draught animals, fertilizers etc.; real estate credits, however, which have to be long term, for investments of a permanent nature, which farming needs so much, are only granted in exceptional cases by the credit institutions. This

/problem appears

Table 18. Mexico. Credit granted by private Mexican banks to principal economic activities

(millions of pesos)

Years	Total	Commerce	Industry	Agri- culture	Livestock	Mining
1942	533.8	237.1	210.6	59.0	21.7	5.4
1943	683.6	327.4	244.0	82.7	22.5	7.0
1944	216.0	65.8	96.1	41.9	9.2	3.0
1945	974.0	455.7	360.9	111.3	37.4	5.7
1946	1,010.3	504.2	371.0	92.6	37.7	4.8
1947	1,176.4	569.4	467.0	97.7	33.1	4.2
1948 (a)	1,187.4	555.2	480.1	107.1	40.7	4.3
1949 (b)	1,575.2	723.3	604.4	156.0	85.2	6.3

(a) Balance as of 31st of January 1948.

(b) Balance as of 31st of December 1949.

Source: Banco de México, S.A. Multiple Credit Department.

problem appears to have no solution: the greater the amounts granted as crop loans, and the greater and better the crops, the greater the profits of bankers and moneylenders. Meanwhile the majority of farmers continue to exist without any possibility of capitalising their efforts, and as a result, agriculture continues to be backward. There are few exceptions to this situation, and they have scarcely any influence on the economic picture of agriculture. Large investments and more important credits, which are necessary for modernising and improving the technology of this economic activity, are not easily granted by the private banking institutions and there are always limitations to the State's ability to substitute for this lack of credits. The possibility of obtaining important investments from foreign capital is conditioned, on the other hand, by the demand for securities and guarantees which in many aspects imply refusal to improve the economy of the producers. This improvement, in spite of the sacrifices entailed, has been achieved in part through placing these producers in possession of half of the arable lands; but now it is necessary that credit administered by domestic institutions and for the purpose of achieving progress in agriculture and the social welfare of the peasants, should become more and more efficient. This is the only way to create a healthy agrarian economy.

Although there are no complete data available regarding the total amount of loans to agriculture, Table 19 has been drawn up, adding the amounts lent during the last five year period by the national credit institutions and the Unión Nacional de Productores de Azúcar, the only

/entities which

entities which register the credits granted each year to agriculture. Nevertheless, it should be stressed that the private banks also grant agricultural credits, but they only register the corresponding balances at the end of each year; in 1945, these were 151,700,000.- pesos, and they increased to 241,200,000.- pesos in 1949. These quantities do not give an exact idea of the quantity invested annually in credits to farming activities. In any case, the increase in loans granted by national institutions indicates the attention they pay to agriculture, although it should also be borne in mind that the increase in loans is partly due to the increase in the cost of production caused by the depreciation of the currency.

The foregoing may be clearly observed in the accompanying charts, relative to the crop loans of the Banco Nacional de Crédito Ejidal and the Banco Nacional de Crédito Agrícola. The considerable increase in loans granted by the former, from 1936 to 1949, has not been followed by a corresponding development of the areas harvested, which are the same as those covered by the Bank, and from 1942, the curve of these, which followed the ascending line of loans, remained below it, until 1949, with fluctuations due to the variable natural conditions.

Table 19. Mexico: Total accumulated loans of the credit institutions
shown below

(thousand pesos)

Years	Banco Nacional de Comercio Exterior, S.A.	Banco Agrícola S.A.	Azúcar S.A.	Banco Ejidal S.A.	TOTAL
1945	1,219	15,210	33,825	91,547	141,802
1946	1,190	13,839	90,000	111,838	216,867
1947	24,993	18,801	100,166	178,736	322,696
1948	47,041	41,541	162,216	178,895	429,693
1949	37,883	58,004	151,600	180,628	428,116

NOTE: The sums of the loans granted by the institutions shown above correspond to agricultural credits, but they do not include total agricultural loans made by other institutions. The figures also exclude agricultural credits granted under some other name.

Balances of credits extended by commercial
banks for agricultural purposes, as of
31st December of each year.

(in thousands of pesos)

1945	151,700
1946	130,300
1947	135,800
1948	147,800
1949	241,200



VII. STORAGE METHODS

The method of storing the harvests has a decisive influence, not only in preventing losses, but also in permitting a better concentration and distribution of products. It is also particularly useful for guaranteeing agricultural credit operations, since where the credit institutions have appropriate warehouses, thus guaranteeing the recovery of the loans, the farmer does not need to sell his products at the moment of harvesting them, and consequently, serious economic difficulties are prevented.

A considerable part of those products harvested which are essential for the subsistence of the population, do not reach the market, since the producers keep them for family requirements. These products therefore, which are distributed among a multitude of small producers, do not require large warehouses for their preservation, nor any special conditions. However, the lack of granaries at times reduces the farmer's supplies and forces him to sell products which he later has to purchase at a higher price.

Produce which enters the market and is composed of articles of higher value, is stored by the successive distributors. These generally have refrigerated warehouses for perishable goods.

Naturally, the concentration and distribution centres are located according to the situation of the markets and places of consumption, and communications. However, there are no great specialised productive regions in Mexico, and railways and, in recent years, highways were built without giving special preference to agricultural requirements. As a result, therefore, of the mountainous territory, and the disposal of the

varied agricultural production, the system of warehousing is scattered, and is not adequate to the geographic characteristics of production. Nevertheless, for certain articles, such as cotton, coffee and wheat, which require processing before transport to the market, the cotton ginneries, the coffee processing plants and the wheat mills, are generally located in the production centres and have sufficient warehouses for the products which they process.

Perishable goods are at a greater disadvantage. The production of bananas, for example, which are exported to the United States on a large scale, at the production centres lacks even the most elementary places to store the fruit until it is shipped. Nor are there sufficient refrigerated warehouses to store the production of tomatoes and fresh vegetables in the Northwest, which causes heavy losses when shipments are delayed. The fruit produced near the great cities has to be taken to market every day, because there are no warehouses to store and distribute according to demand or prices. The producers of fruit, such as oranges and pineapples, do not have any of the facilities indicated in Mexico City, which is the principal consumption centre for fruit; consequently at harvest time, the market is glutted and the supply far exceeds the demand.

The operation of the Banco Nacional de Crédito Agrícola forced the creation of an auxiliary entity charged with warehousing the fruit given in guarantee of loans. This body was made into a national institution in 1936, called "Almacenes Nacionales de Depósito, S.A." (National Deposit Warehouses, Ltd.) and had to serve the two already existing

agricultural credit institutions, to store the crops of their clients.

In this way the recovery of loans was assured and, at the same time, attempts were made to sell the produce at the best prices. Unfortunately, the difficulty of satisfying the many and very varied requirements of the farmers, spread over the whole territory, producing such varied crops, of such different qualities, and at such different times, and the competition of private tradesmen and warehousemen, caused the institution to operate at a loss during its early years. Later it had to be converted into a warehousing enterprise, operating within the channels already established by private enterprise.

Later, when the rise in prices made it necessary for the State to control those for essential goods, not only to protect the consuming power of wage-earners, but also to assure the farmer of better selling prices, the "Comité Regulador del Mercado de las Subsistencias" (Committee Regulating the Subsistence Market) was founded. Since this institution had no warehouses, it had to rent them from private firms. Later it was converted into the "Nacional Reguladora y Distribuidora S.A." (National Regulating and Distributing Body), with the functions of regulating prices of essential articles and raw materials; it had the dual purpose of assuring the consumer of prices adjusted to those paid to the farmer, promoting the organization of storage systems and attempting to unify the tariffs for this service etc.

The Nacional Distribuidora y Reguladora intervened marginally in the distribution and sale of maize, wheat, rice, sugar, beans and lard. It generally worked with "Almacenes Nacionales de Depósito S.A."

National Deposit Warehouses Ltd.) which, being a company with State participation, charged moderate fees; this, however, did not mean that the Reguladora had solved the problem of warehousing the products which it handled.

Other bodies, such as the "Union Nacional de Productores de Azúcar S.A. de C.V." (National Union of Sugar Producers), the "Compañía Exportadora e Importadora Mexicana" (Mexican Export and Import Company), a subsidiary of the Banco Nacional de Comercio Exterior, and the Banco Nacional de Crédito Agrícola y Ganadero and the Banco de Crédito Ejidal, use the services of Almacenes Nacionales de Depósito, although they have their own warehouses in some places, for certain purposes. However, generally speaking, agricultural products which are concentrated and distributed to satisfy consumer needs, are handled in great volume by private and commercial institutions, which have their own warehouses. There are at present 21 storage undertakings, operating under the authorization of the Comisión Nacional Bancaria, of which 10 are in Mexico City and the rest in different parts of the country, even these are not able entirely to meet the requirements of agricultural production entering the market.

The warehouses of national institutions have a total registered volume of 728,467.54 cubic metres, in warehouses distributed throughout this country; in many of them the grain is exposed to numerous risks. The registered volume of storage space belonging to private enterprise is 768,380.499 cubic metres, but it should be repeated that neither one nor the other satisfies total requirements. This situation is aggravated

/through lack of

through lack of classification of products, preventing large volumes of one article from being stored, with the economic and easy handling conditions obtained when, through the uniformity of their qualities, they can be stored in great silos and handled as if they were liquids. In dealing with articles like cotton or hennequen, which are transported in bales, the lack of classification is no great inconvenience, but in the case of grains, like maize, wheat, coffee, etc., operations are complicated when the products cannot be mixed on account of their different natures.

In any case, the operation of the Almacenes Nacionales de Depósito and the experience acquired by the Nacional Reguladora y Distribuidora and by the Bancos Nacionales de Crédito Agrícola, have permitted an understanding and partial solution of the problem of storing agricultural produce. Since 1947, the building of warehouses in ports of embarkation has been planned, to store the wheat imported in recent years. Requirements have also been determined, among them the building of warehouses on the Pacific Coast, from Nayarit to Sonora, where production has increased through new lands being placed under cultivation and the construction of vast irrigation works. Storage requirements have not only been concentrated in this region, but also in the central part of the country and other places which lacked sufficient warehouses for the handling of agricultural produce. The total investment which was considered necessary in 1947 for the construction of new warehouses, amounted to 4,416,100.-, and is certainly greater at the present time. Since no complete plan has been coordinated to take care of these requirements, the

/deficiencies which

deficiencies which now exist become more and more aggravated, which it will require heavy investments of capital to correct.

VIII. TRANSPORT

Until the beginning of this century, Mexican agriculture lacked a system of land communications to hasten the development of many agricultural regions, where production was bottled up or limited by the difficulties of getting it out of a territory largely isolated by its topography. The available roads were only suitable for beasts of burden. In some cases, the railways promoted agricultural development, such as, for example the production of coffee in the Sierra of Chiapas and in Veracruz, cotton production in the Comarca de la Laguna, cattle ranching in the states of Chihuahua and Coahuila, cereal production in the lower part of the High Plateau, and the development of the sugar industry in the State of Morelos; but large areas of the country remained without communications and with no possibility of utilising their agricultural resources.

River and maritime communications have had scarcely any influence on the development of agriculture. It is already known that Mexico has no navigable rivers since, with the exception of the Tabasco rivers, which facilitate the transport of bananas to the ports of embarkation and permitted the exploitation of precious timber during the past century, the other rivers are of no use for communication purposes. Only in short sectors, close to their outlets, have the Panuco, Tuxpán, Papaloapán and Coatzacoalcos rivers been used, for the transport of a very small part of agricultural production to the Gulf ports. None of the rivers on the Pacific side are navigable. Only the Rio de las Balsas is used in part - with the current - to transport articles consumed by that region, in rafts

with very little draught; however, this river cannot be navigated against the current, and therefore it is useless for transport of agricultural produce to the sea.

Maritime communications have not facilitated the transport question either, since as there is little flat land along the coast and only a scanty population, there has been no consumption incentive for commercial interchange. Products for consumption in the interior of the country have to be transported over the steep slopes of the cordilleras separating the coastal regions from the High Plateau, where the population is concentrated. Moreover the great extent of the country's coastline (9,418 kilometres) and the lack of good ports for deep sea and coastal trade on the one hand, and on the other of a merchant fleet, has prevented the use of the existing possibilities of maritime communications.

The highways built from Mexico to Veracruz, Laredo, Guadalajara, and Acapulco, and finally the great Pan-American highway, which has established communication from the frontier of the United States to that of Guatemala, have facilitated the transport of certain agricultural products of slight volume and high value, above all that of fresh fruits and vegetables, and grains, such as coffee, or raw materials, such as copra. Without these highways, for example, the agricultural region which is now known as Valles and El Mante, along the length of the Mexico-Nuevo Laredo highway in the sector crossing the states of San Luis Potosí and Tamaulipas, would never have been developed. Neither would the plantations of coconut trees along the Pacific Coast, in the state of Guerrero, have been developed without the Mexico-Acapulco highway; nor would agriculture in the interior of the country have been diversified, as has happened in recent years, had transport by lorries not facilitated the distribution of

the articles now being produced.

In spite of the fact that certain agricultural regions are still isolated, the main transport problem consists at present in establishing a network of feeder roads, to connect the railways with the main highways. When this is achieved Mexico will not only be able to produce, but to distribute those products which are not taken advantage of now through lack of facilities and cheap means of communication. The Northwestern zone, which is one of the most important, demands the extension and improvement of the means of transport linking it with the interior of the country. In general, many of the coastal regions of the Pacific and the Gulf of Mexico also lack communications which would contribute to the increase and diversification of agricultural production.

The building of highways is therefore very important, and above all, it is essential to complete the railway network. Owing to steep hills certain railway lines have remained unfinished, including those of Kansas City to Mexico and Oriente; Balsas, planned as far as Zitahuatanejo and Acapulco; the Interoceánica del Sur, Mexico-Oaxaca, and the line from Morelia to Apatzingón. Maritime transport is also important for the progress of agriculture. Unfortunately, there do not appear to be any prospects for the country having a sufficient fleet of its own; until now, it has lacked the financial resources for acquiring the essentials for the most urgent needs, and for exports, Mexico depends completely on other countries, mainly the United States. This is particularly the case with tropical products and with the fine woods exported or which could be exported from the Southeast.

The bulk of agricultural production is transported by rail,

/particularly goods

particularly goods of greater volume and easy preservation, but this transport is irregular, slow and costly. The lack of trucks among other deficiencies, contributes to this, since they have to be hired from United States' enterprises, which raises the rates and causes frequent delays. This lack of trucks has been aggravated recently, particularly since the last war. Perishable goods, such as bananas and tomatoes, suffer considerable damage during transit, and in fact all articles transported by rail suffer to a greater or lesser degree. Road transport, by motor vehicles, is only complementary to the railway, although in many cases the former is preferred, especially in the case of short distances and articles of greater value and difficult preservation.

The transport costs of four of the most important agricultural products and several other industrial articles during the five years between 1944 and 1948 are shown in tables 20 and 21. These data show that the transport of mineral rock, in full trucks, is cheaper than that of any of the other articles studied; that cattle pay as much and in some years more than building iron; and that among agricultural articles, wheat has paid the lowest freight rates in recent years. With the prices registered during the five year period and taking 1939 as a base, the index of increase in the cost of transporting the same articles (see adjoining tables) has been compiled. This index proves that the costs for maize were greater than those for the other agricultural products studied, greater even than for cattle, in spite of the fact that this cereal has a lower selling price and is transported in great volume throughout the whole country. If these indices are compared with those for the industrial products selected, it is proved that the costs of mineral rock, cement and charcoal were less
/than those

than those for maize; that the cost for cattle was lower than for charcoal, and that the increase in the rate for wheat was almost the same, in 1948, as that for cement, although in the years before this five year period, the rate of increase is greater for the latter than the former. The foregoing indicates that the transport of agricultural products is more expensive than for industrial products. The increase in the cost of transport is not, on the whole, greater than that of the wholesale prices, which was, in 1947, 238.5 in relation to the base year of 1939. This rate of increase is lower than that for the rates of the four agricultural articles studied.

It is not possible to obtain similar data regarding the tariffs for road transport, but undoubtedly these are higher than the railway rates. In spite of this, the volume transported by motorized vehicles has increased considerably in recent years, not only to fill the deficiencies of the railways, but to achieve greater rapidity. Moreover, some agricultural regions have no other means of transport than the highways, and for short distances and products which are difficult to preserve, roads are preferred to the railways.

Finally, the transport of freight by air is exceptional and is only carried out in the very mountainous regions, where there are no other means of communication, and in the case of very valuable products. In the State of Chiapas it is common for coffee and lard, which are produced in the more isolated regions, to be transported by air to the nearest shipping points, either to the railway or to the river ports of the State of Tabasco. This means of communication is also used for other products of high value, such as flowers or certain fruits, as well as for the chicle of Quintana Roo and Campeche, but up to the present it has never been able to replace the lack

/of railways

Table 20: Mexico. Cost of rail transport for selected agricultural and industrial products

(Ton-kilometre - whole wagon)

Years	Agricultural				Industrial		
	Maize	Wheat	Cotton	Cattle	Iron for building purposes	Cement	Charcoal
1944	2.23	2.52	3.78	3.10	2.83	3.31	2.26
1945	3.18	2.94	4.38	4.03	3.35	4.01	2.56
1946	3.80	5.18	5.10	4.31	4.12	4.47	3.14
1947	3.49	3.18	5.16	5.12	5.03	4.18	3.20
1948	3.90	3.33	5.33	5.00	5.03	3.98	2.80
1949	1.99	2.11	3.37	3.04	1.92	2.41	2.73

Source: Revista de Estadística, Dirección General de Estadística, México D.F.

Table 21: Mexico. Cost of rail transport for selected agricultural and industrial products (Freight paid by ton-kilometre, whole wagon)

Base year: 1939 = 100

Years	Maize	Wheat	Cotton	Cattle	Iron for building	Cement	Charcoal
1944	112	119	112	102	147	136	83
1945	160	139	150	132	174	166	86
1946	191	151	151	141	214	185	115
1947	175	151	153	138	263	173	117
1948	196	160	158	134	263	165	102

Source: Revista de Estadística, Dirección General de Estadística, México, D.F.

of railways or roads.

In summing up the general situation of transport as regards agriculture, it can be said that it still represents a great limitation for agricultural development, which is natural, considering the mountainous nature of the territory, which lacks river highways and which has along its coastline few ports with easy access to the interior of the country. Consequently, it is urgently necessary to increase and improve the communications network, in order to improve the transport of agricultural production. This objective should perhaps prevail over that of continuing to build great, costly highways parallel to the railways. The areas under cultivation are so widely dispersed throughout the territory, and some of them are so isolated owing to accidents of the river system, that the necessity of building roads to link the greater railway lines with the national highways constructed up to now, is obvious.

SECTION 2. DEVELOPMENT OF PRODUCTION SINCE 1925

I. AGRICULTURAL PRODUCTION

Mexico is probably the country in Latin America where, during the last twenty-five years, agricultural production has increased most and where the greatest diversification has been achieved. Possibly it is also in this country that the greatest difficulties have had to be overcome in order to achieve that increase. Compared with the increase in the population, production underwent a heavy drop during the years of the economic depression, being unable to recover the level which it had attained in the period from 1925-29 until the beginning of the forties. In this decade, owing to technical progress, to a heavy increase in irrigation and to having overcome the transition period of the agrarian revolution, production increased at an accelerated rate, rapidly surpassing that of the population.

The volume index of Mexican agricultural production has been calculated from 1925 to 1948, using figures compiled by the Dirección de Economía Rural (Direction of Rural Economy) of the Secretaría de Agricultura. This index includes 24 of the principal articles which in 1947 formed 93 per cent of the agricultural production of the country for which there exists statistical information (64 products).

Comparing the five year period from 1925/29 with the period 1945/48, it can be seen that while the population increased by 46.9 per cent, production rose by 55.1 per cent. As greater proof that the true development of agriculture took place in the forties, it is sufficient to record the fact that, between the five-year period from 1934-38 and 1944-48,

/production increased

production increased by 52.4 per cent. (See table 22.)

If it is considered that in Mexico conditions are not altogether favourable to agriculture, it can be seen that the increase in production has been the exclusive result of its people's conquest of a hostile ecologic environment and of known limitations of a physical, economic and social nature. These limitations can be summed up as follows: the existence of extensive regions with scanty and irregular rainfall; the relative scarcity of naturally fertile lands such as the Argentine pampas and Colombian savannahs, which can be cultivated without any great difficulty; the heavy pressure of the population on that land which can be cultivated economically; the scarcity of both private and State capital, for investment in agriculture; the lack of technical skill and the difficulties in the way of changing the methods of cultivation established by traditions; the poor communications and the deficient transport systems.

According to the data of the 1940 census, Mexico possesses a total area of 129.4 million hectares, of which only 14.87 million are considered arable land. Of this, 82.7 per cent, or 12,297,000 hectares, are unirrigated lands where the crops are subject to the uncertain and, for the most part, scanty rainfall of the country; 6.5 per cent, or 674,000 hectares, correspond to soils of natural humidity which, in many cases, require improvement and drainage in order to be reclaimed and, in others, auxiliary irrigation in order to assure the crop. Only 1,900,000 hectares, 12.8 per cent of the total, are irrigated lands.

The high percentage corresponding to unirrigated lands, added to the unfavourable climatic conditions of many regions, particularly in the

/southern part

southern part of the High Plateau, has determined the perpetuation of primitive agriculture, with all its drawbacks and defects, in the greater part of the area suitable for agricultural work. In the greater part of the unirrigated lands, maize has been established as a single crop and, although from time to time it is associated with beans, this does not permit the use of rotations beneficial to the soil, while, on the other hand, it favours erosion and progressive exhaustion. Thus the yields obtained are exceedingly low and uncertain and cultivation, under these conditions, is uneconomic.

In order to counteract this situation, which is extremely dangerous, and to remedy at least partly the growing pressure of the population on the land ^{1/}, the Mexican Government; through the Comisión Nacional de Irrigación (National Irrigation Commission) first, and the Secretaría de Recursos Hidráulicos (Secretariat of Hydraulic Resources) later, undertook, in 1925 a programme of irrigation, which achieved great progress in a relatively short number of years. Up to 1949, the irrigation system had been extended over 1,290,630 hectares.

It is these irrigated lands which have contributed most to the production increase already described and to the diversification of agriculture, since the crops obtained from these lands are almost assured.

^{1/} The population growth is around 3 per cent per year, and the lands which can be cultivated in their natural state, without having to make large investments to put them into operation, have been or are being used in their entirety; the incorporation of other lands to cultivation through irrigation, drainage and clearance increased in a proportion much lower than the growth in the population. Consequently, not only as regards the number of persons gainfully employed in agriculture but as regards the total population of the country, the proportion of land under cultivation is diminishing.

Table 22. Mexico. Agricultural production

Volume index
Base 1957 = 100

Years	Food- stuffs a/	Sugar- cane	Hene- quén	Various b/	Oil- seeds c/	Fruit d/	Cotton	General
1925	110.4	70.9	136.1	86.2	54.4		58.8	92.3
1926	120.6	77.9	116.5	93.6	86.4		105.6	106.6
1927	121.1	73.9	146.7	91.0	60.2	58.9	52.6	97.7
1928	122.0	72.7	138.3	98.6	77.2	61.7	81.7	103.3
1929	93.3	74.7	120.8	103.7	69.6	63.8	72.2	85.9
1930	87.3	81.2	118.0	90.3	55.5	66.5	52.1	79.5
1931	122.7	91.1	94.4	90.8	66.6	66.5	61.6	99.3
1932	106.5	83.9	108.5	90.8	51.8	63.3	29.7	86.1
1933	113.3	68.5	112.4	83.0	72.4	61.9	76.4	95.4
1934	99.6	68.5	103.5	94.1	70.4	75.9	65.4	88.5
1935	98.9	88.1	80.7	92.3	85.6	86.6	92.3	93.9
1936	104.9	107.0	114.6	84.8	109.1	98.3	116.6	105.3
1937	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1938	105.0	101.9	79.6	100.9	97.2	105.4	90.0	101.1
1939	121.0	112.4	85.2	113.5	101.9	110.6	91.6	112.2
1940	110.8	122.6	95.7	117.6	91.4	92.7	83.6	105.2
1941	133.6	140.0	101.4	113.5	130.4	96.9	109.9	124.3
1942	147.6	167.7	112.2	119.9	150.7	101.9	139.4	139.9
1943	123.4	169.1	130.8	121.7	149.9	107.2	156.8	130.9
1944	145.1	166.6	129.1	143.1	150.2	110.6	143.7	142.4
1945	140.8	166.3	105.4	152.4	136.5	123.7	132.1	138.3
1946	146.5	177.5	107.4	157.6	148.8	132.2	123.4	143.3
1947	158.7	207.5	116.4	157.6	171.3	127.6	129.8	152.9
1948	171.7	233.1	122.1	162.9	178.0	135.7	161.9	168.4

Source: Research Centre, Economic Commission for Latin America.

Notes: a/ Including maize, wheat, barley, beans, chickpeas, tomatoes, potatoes, dry chile, green chile, coffee.
 b/ Including tobacco and alfalfa.
 c/ Including cottonseed, sesame and copra.
 d/ Including avocadas, oranges, roatán bananas, other varieties of bananas and grapes.



They are used permanently, permitting the establishment of adequate crop rotation and are, in fact, those where the most certain and economic yields permit the use of skilled mechanisation and fertilisers, with great probabilities of success.

In spite of the general scarcity of investment capital for agriculture, whether in a fixed or circulating form, mechanisation, particularly in the irrigated regions, has increased remarkably, to such an extent that Mexico today is one of the most mechanised countries of Latin America ^{1/}. The 1940 census establishes the existence of 4,604 tractors in use in that year; in 1947, it was estimated that this number had increased to 17,035 units. In the 'thirties the average number of tractors imported did not reach 500 a year, while in the 'forties, this average rose to almost 5,000 a year. In 1947 and 1948, 6,425 and 6,394 units were imported, respectively. (See table 10). Imports of other agricultural machinery increased in a similar manner.

The use of machinery and implements in farm work was further increased by the domestic manufacture of ploughs and other small implements. In 1948, about 10,000 ploughs of different types were manufactured, particularly ploughs with a single point mouldboard ^{2/}. The most highly mechanised crops are wheat, cotton, rice, vegetables for export and, to a lesser degree, sugar and sesame.

Another factor which has contributed considerably to the development of agriculture has been the greater use of fertilisers; in the five-year period 1925/1929, only an average of 7,000 tons per year was imported,

1/ Report of the ECLA/FAO Joint Working Party, Economic Commission for Latin America (E/CN.12/83) Chapter II.

2/ Alan E. Hoel, Report N° 505 "Agricultural Machinery Market - Mexico" (Embassy of the United States, Mexico, D.F. 29 July 1949).

while in the 1945/48 period, this average had risen to 22,000 tons. (See Table 8). Domestic production of commercial fertilisers has also been increasing and in 1949 this reached 13,100 tons ^{1/}. (See Table 9). However, in 1947, the area fertilised represented only 13 per cent of the area irrigated. ^{2/}

These factors, added to the technical skill which has been introduced by degrees in different sectors of agriculture, have contributed towards improving the yields of many crops. Thus, while agricultural production increased by 55.1 per cent between the periods from 1925-29 and 1945-48, the total area under cultivation (for 63 products) only increased by 15.2 per cent. Undoubtedly it is irrigation which has contributed most towards increasing the agricultural yields and the growing diversification of production.

Development of the different sectors of agriculture

To facilitate the analysis of agricultural development in Mexico, total production in various sectors has been divided according to the nature and importance of the crops, that is: food, oil seeds, sugar cane, cotton, henequen, fruit and others.

A. Food Products

Maize, wheat, barley (for grain and malt), rice, beans, tomatoes, chickpeas, potatoes, dry chili, green chili and coffee have been included in this group. All of them are important within Mexican agriculture, either on account of the volume of their production, their value, their importance

^{1/} The capacity of the fertilising plants reached 36,000 tons in that year, but it was limited to satisfying the actual demand.

^{2/} Report of the ECIA/FAO Joint Working Party, op. cit. Chapter 3.

within the national diet, or as export products. Among them, rice, tomatoes, chickpeas and coffee are partly influenced by export trade. The others are products for domestic consumption.

The group as a whole was subject to fluctuations of varying intensity in the 'twenties and 'thirties, and this growth could only be affirmed in the 'forties, when they acquired an accelerated rate of development. Even so, in the 1944-47 period production was not able to reach the same level in relation to the population, as in the five year period from 1925-29, since, while the latter rose 45.4 per cent, the former only increased by 31.1 per cent. An analysis of the main products which form this group give a clearer idea of what has happened to its components.

Maize

The fluctuations of the "food" group are heavily influenced by the high volume of maize production, an article which, both on account of its value and of the area assigned to its cultivation, is the most important within Mexican agriculture.

Due to the variable rainfall and the fact that this crop is cultivated mainly on unirrigated lands, production has undergone pronounced variations. Within these annual changes, it can be seen that, after having reached a high level of production in the years 1925-29, it diminished notably during the greater part of the 'thirties, reaching its lowest point during the middle of the decade. During the forties, in spite of having shown an accelerated rate of increase, it could not recover the level it had attained in relation to the population in the period 1925-29. Between this five year period and the period from 1944-47, average production only increased by 20 per cent. Due to this reduction in production in relation

/to the population

to the population and the fact that the average imports did not increase much, the apparent consumption per capita dropped from 128 kilos in the first period indicated to only 106 kilos in the second. (See Table 23).

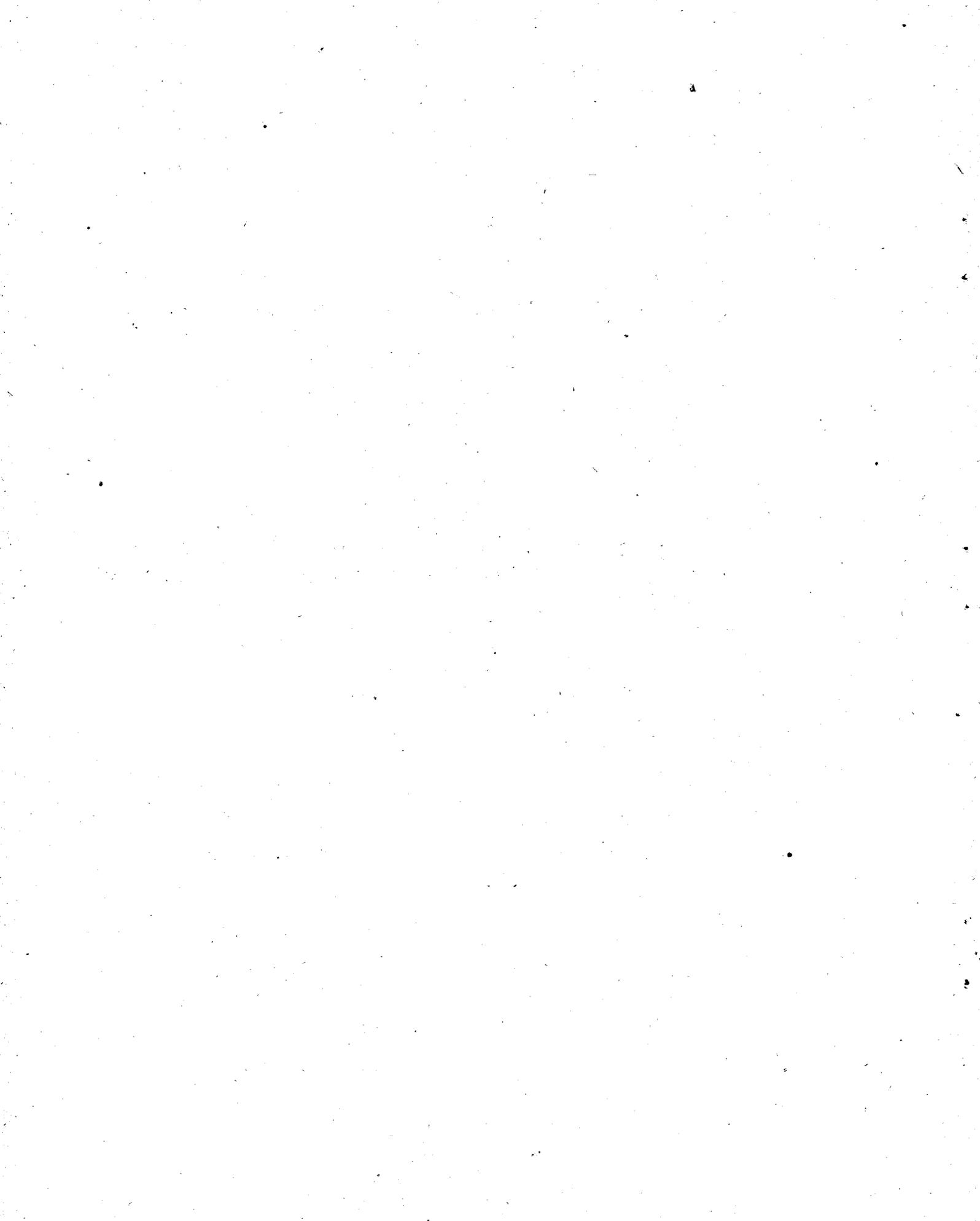
However, at the same time it should be noted that the increase in production was mainly due to improved yields, as a result of the cultivation of greater irrigated and naturally humid areas and the use, in these lands, of more skilled methods of production, and the partial use of fertilisers. The favourable climatic conditions have also played a part. While production increased by 20 per cent between the periods indicated, the area under cultivation only increased by 5 per cent and the yield by 10 per cent, rising from 642 to 703 kilos per hectare. Recently, due to the efforts of the Government, of the Comisión Nacional del Maíz (National Maize Commission) and the cooperation of the Rockefeller Foundation, the possibilities of obtaining better yields throughout the country have greatly improved, since the new varieties of hybrid maize, suitable for different ecological environments of the country, would permit a rapid growth of production. In some regions where these varieties have already been used, increases of over 25 per cent in the yields have been obtained.

The cultivation of maize is carried out throughout the territory, under the most varied and heterogeneous conditions, both in the most arid mountain regions and on the coastal plains, either in tiny plots with the most primitive methods, and over greater areas using modern methods and mechanisation; either in a periodic manner on unirrigated lands as a crop every 6 or 7 years, or in a permanent manner on irrigated and naturally humid lands.

Table 23. Harvested area yield, production, imports and apparent consumption of maize

Years	Harvested area (hectares)	Yield per hectare (kilogrammes)	Production (tons)	Imports	Apparent consumption
1925	2,936,169	670	1,968,132	66,432	2,034,564
1926	3,137,289	680	2,134,842	109,300	2,244,142
1927	3,181,384	647	2,058,934	28,423	2,087,357
1928	3,112,274	698	2,172,845	9,991	2,182,836
1929	2,865,119	513	1,468,805	7,898	1,476,703
1930	3,075,043	448	1,376,762	79,315	1,456,077
1931	3,377,538	633	2,138,677	18,731	2,157,408
1932	3,242,647	609	1,973,469	37	1,973,506
1933	3,198,494	601	1,923,867	117,464	2,041,329
1934	2,970,381	580	1,723,477	16	1,723,493
1935	2,965,633	565	1,674,566	9	1,674,575
1936	2,851,636	560	1,597,203	10	1,597,213
1937	2,999,907	545	1,634,730	3,663	1,638,393
1938	3,093,873	547	1,692,666	22,062	1,714,728
1939	3,266,766	605	1,976,731	53,899	2,030,630
1940	3,341,701	491	1,639,687	8,271	1,657,958
1941	3,491,968	608	2,124,085	24	2,124,109
1942	3,757,937	628	2,363,223	437	2,363,660
1943	3,082,732	587	1,808,093	32,040	1,840,133
1944	3,354,933	690	2,316,186	162,824	2,479,010
1945	3,450,889	634	2,186,194	45,588	2,234,780
1946	3,313,194	719	2,382,632	9,745	2,392,377
1947	3,512,264	717	2,517,593	695	2,518,288
1948	3,721,000		2,829,985	305	2,829,985

Source: Research Centre, Economic Commission for Latin America. Series "Estadística de la República Mexicana, 1925-1945", published by the Secretaría de Agricultura y Ganadería.



The greater part of the area cultivated with maize is unirrigated, and in view of the somewhat unsuitable conditions of the soil and the irregular rainfall, the results are, on the whole, uneconomic. In fact, the crop is continued exclusively because maize is the only sustenance of the owner of the land and because, in many cases, there is not enough knowledge or initiative to sow other crops. Under these conditions, the labour cost is excessively high and the monetary cost, in many cases, is higher than the price which the product can fetch in the market.

In spite of the fact that the greater part of maize production is strictly for the use of the farmers themselves, the volume of the crop has nevertheless been heavily influenced by the fluctuations in its price. It is clearly seen that, in the first part of the thirties, in spite of these being relatively normal years as regards yields, the heavy drop in prices which occurred on account of the crisis, resulted in smaller areas being sown, and consequently, in lower production. Between 1935 and 1937, the prices to the producer were doubled, with immediate repercussions on production, which began a period of heavy increase. After the war, prices were again subject to heavy increases which fluctuated between 400 and 500 per cent in relation to the 1934 prices.

In conclusion, it may be stated that, in spite of technical progress, of remunerative prices, and of the credit assistance given to farmers, it will be difficult for production to increase greatly if maize continues to be grown mainly on unirrigated land, since the harvests will always be subject to the uncertain weather conditions.

Wheat

Wheat follows maize in importance, owing to its volume, its value and
/the area

the area under cultivation. The production of this cereal was subject to considerable variations between 1925 and 1948. Between 1925 and 1930, production increased at a greater rate than the population, but in 1931, owing to an extraordinary increase in the area under cultivation and to exceptionally high yields, a harvest of very great proportions was registered, which has not been equalled up to the present. In the following years, production tended to decline, and only between 1937 and 1941 was there a new period of rapid growth which, however, did not manage to stabilise production, since the four following years were marked by low harvests. Finally, in the years 1947 and 1948, production recovered somewhat, but it did not reach the equivalent of the good harvests of 1931 and 1941. In the period from 1944-47, the average production was only 8.8 per cent higher than in the five year period from 1925-29; during this same lapse of time the population increased by 43.4 per cent. (see Table 24). The decline in wheat production per capita was partly offset by greater imports not only of wheat but of flour, but in any case, there was a decline in consumption per capita. In effect, during the same period 1925-28, domestic production managed to supply 66 per cent of the apparent demand for wheat (and flour in terms of wheat), which was 33 kilos per person; in the period from 1945-48, production was only 52 per cent of apparent consumption, which only reached 30 kilos per capita.

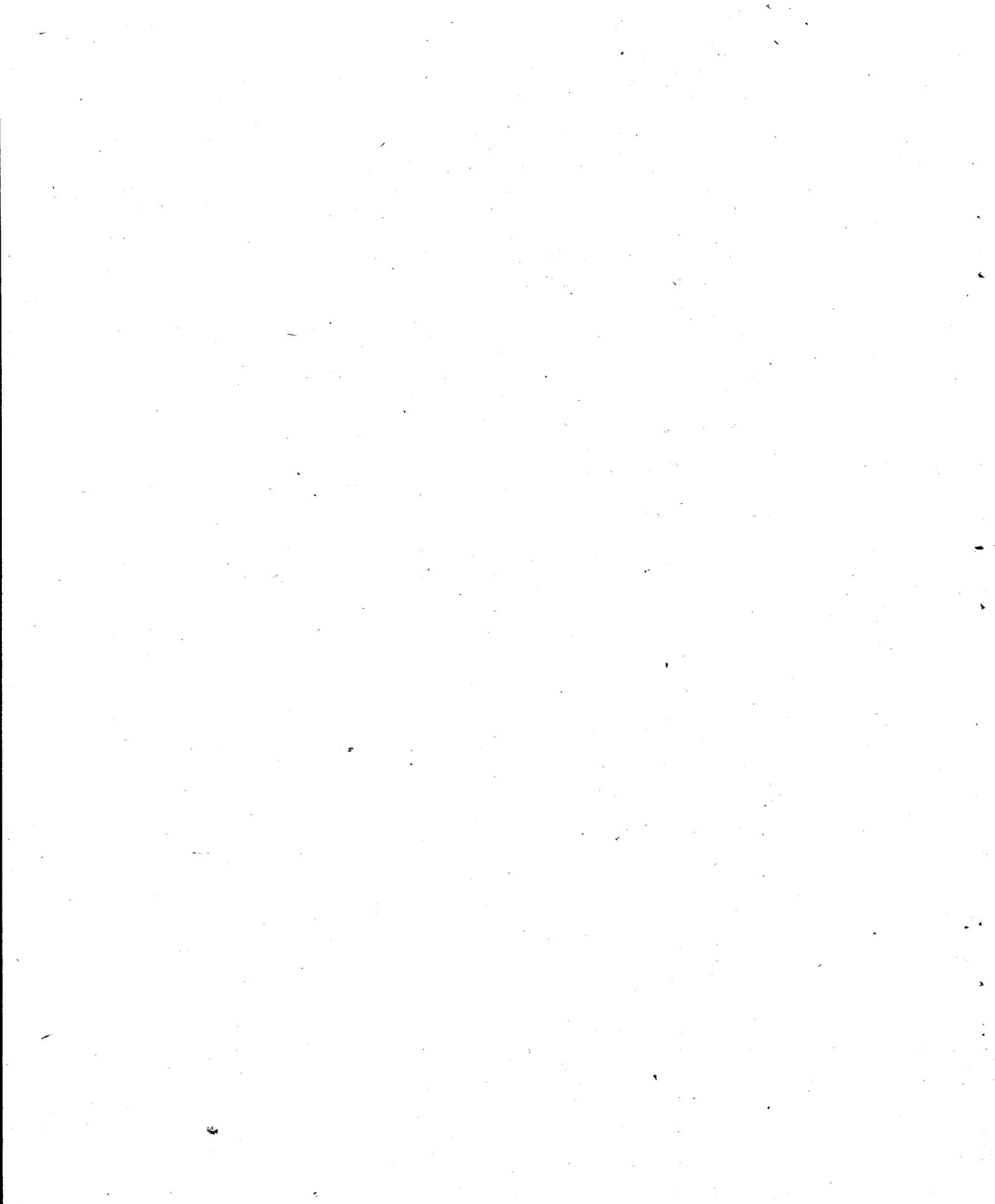
Wheat is cultivated in different regions of the country under varying conditions as regards fertility of the soils and adaptability of the plant to climatic conditions, but preferably under irrigation and during the winter months. However, during the last ten years new productive regions have been developed for this cereal in the North, above

Table 24: Mexico. Harvested area, yields, production, imports and apparent consumption of wheat

Years	Harvested area (hectares)	Yield per hectare (kilogrammes)	Production (tons)	Imports a/	Apparent consumption
1925	455,050	655	298,131	70,204	368,335
1926	517,987	646	334,365	113,807	448,172
1927	528,022	729	384,768	51,243	436,011
1928	516,475	691	356,951	54,990	411,941
1929	520,771	704	366,744	110,721	477,465
1930	489,772	756	370,394	74,523	444,917
1931	604,224	869	525,071	30,504	555,575
1932	444,708	703	312,932	174	312,706
1933	472,327	830	392,249	1,781	394,030
1934	492,900	719	354,326	290	354,616
1935	460,162	753	346,620	119	346,749
1936	508,410	864	439,464	166	439,630
1937	484,207	708	342,594	5,033	347,627
1938	500,790	771	386,349	89,790	476,139
1939	563,371	762	428,784	51,257	480,041
1940	600,645	772	463,908	1,308	465,216
1941	582,759	745	434,293	121,785	556,078
1942	600,161	815	489,144	114,571	603,715
1943	509,574	715	364,294	288,538	652,832
194'	527,223	710	374,421	509,476	883,897
1945	468,491	740	346,757	328,294	675,051
1946	415,435	819	340,441	322,131	662,572
1947	498,861	846	421,859	308,096	729,955
1948	576,000		447,156	276,454	723,610

Source: Research Centre, Economic Commission for Latin America. "Serie Estadística de la República Mexicana, 1925-45", published by the Secretaría de la Agricultura y Ganadería.

a/ The heading of wheat imports includes flour imports in terms of wheat. Between 1925-29 the series include flour and starch of all types.



all in the Yaqui valley in Sonora and the Mexicali valley in Baja California, which have surpassed the conditions under which it has been cultivated in the fundamental cereal region located in the central part of the High Plateau. According to the degree to which this cereal is cultivated in the new irrigated regions situated in the north, it is probable that its cultivation will be abandoned in the regions where it has been grown under less favourable conditions, solely because of the need to supply the consumption centres. The area planted with wheat has not followed exactly the same course as production, since, while this tended to increase during the quarter century, the former has tended to diminish. Once more comparing the periods 1925-29 and 1944-47, it will be seen that, while production rose by 8.8 per cent, the area under cultivation fell 6 per cent. Just as with maize, this situation is due to the improvement in the yields, which rose from an average of 685 kilos per hectara to one of 802 per hectara in the two periods mentioned before. Cultivation on irrigated lands, the sowing of new selected varieties, resistant to blight, the use of increasing quantities of fertilizers and the mechanization of cultivation are the factors which have contributed towards improving the yields.

Regarding this product, it can be said that it will be difficult for Mexico to supply its own requirements of wheat since, as the population increases and its standard of living improves, there will be an increase in demand which cannot be met by production, limited to certain favourable regions. Moreover, on account of its climate, Mexico produces a greater proportion of soft wheats and has always had to import those termed "hard" in order to manufacture flour as required by the market.

Rice

Among cereals, rice is the only product which has been produced in sufficient quantity to satisfy completely the domestic demand and even to have an exportable surplus. Between 1925-29 and 1944-47, the production of rice increased by 53 per cent, that is, at a higher rate than the population increase (See Table 25). The cultivation of this cereal has a more even development than that of maize and wheat, due to the fact that it is cultivated in irrigated or naturally humid regions, and that the foreign market has been able to absorb all or part of the surpluses produced; moreover, it appears to be the most remunerative cereal, with the safest harvest. As in the majority of products, production tended to decline between 1925 and 1933; from that year, however, it began to increase almost without interruption and at a rate slightly higher than the growth of the population. Between 1945 and 1948, greater areas were sown and the rate of production rose sharply. Yields, however, remained relatively unchanged in spite of the technical progress made in the cultivation of this cereal.

Production areas are located where there are irrigated or naturally humid lands, those of the Yaqui Valley in the State of Sonora, the ejidos of Lombardia in Morelos and the southern part of Puebla being the most important. It is grown to a lesser degree on the coasts of Veracruz, Tabasco, Chiapas, Oaxaca and Guerrero.

The greater profitability of rice (particularly due to higher yields and higher prices) in relation to other cereals and many other products, has made it possible for this crop to achieve a high grade of mechanisation, particularly in the irrigated Yaqui valley. There

Table 25. Mexico: Cultivated area, yields, production, exports
and apparent consumption of rice

Years	Cultivated area (hectares)	Yield per hectare (kilogrammes)	Production (m e t r i c t o n s)	Exports	Apparent Consumption
1925	50,423	1,708	86,126	4,066	82,060
1926	52,934	1,726	91,356	9,950	81,406
1927	50,112	1,654	82,909	11,058	71,851
1928	45,409	1,831	83,153	7,298	75,855
1929	35,302	1,906	67,280	7,838	59,442
1930	36,541	2,047	74,793	131	74,662
1931	36,032	2,002	72,150	4,452	67,698
1932	33,744	2,145	72,382	974	71,408
1933	32,817	2,040	66,950	5,833	61,117
1934	31,723	2,166	68,729	8,554	60,175
1935	30,575	2,307	70,549	18,511	52,038
1936	39,735	2,170	86,227	13,471	72,756
1937	39,665	1,880	74,560	19,969	54,591
1938	39,403	2,033	80,119	6,445	73,674
1939	45,054	2,287	103,078	2,202	100,876
1940	61,529	1,751	107,713	1	107,712
1941	53,095	2,060	109,355	7,321	102,034
1942	65,260	1,658	108,177	23,250	84,927
1943	65,580	1,746	114,487	3,173	111,314
1944	67,994	1,532	104,195	-	104,195
1945	59,444	2,037	121,103	-	121,108
1946	63,593	2,193	139,465	1	139,464
1947	72,238	1,908	137,821	10,020	147,841
1948	81,000		162,892	28,599	134,293

Source: Serie Estadística de la República Mexicana, 1925-1945, published
by the Secretaría de la Agricultura y Ganadería.



mechanical planters are used, and the rice is harvested with reapers and binders and stationary threshing machines. The economic use of fertilisers has also been possible.

Beans

The production of this pulse, which is of basic importance in the diet of the Mexican population, has been unstable and, in the 25 years under survey, has undergone many rises and falls which in the long run, are self-defeating, since the level of production in the four years from 1945-48 was only 0.6 per cent higher than for the period 1925-29; this has been mainly due to a sharp decline in the area under cultivation (between the two periods previously indicated it diminished by 20 per cent), since the average yields increased by 24 per cent, from 187 to 232 kilogrammes per hectare between these periods (see Table 26).

The stagnation in production of this pulse can be attributed both to its low yield and to its low price in comparison with other products, and to the fact that this is a typical unirrigated crop, which to a considerable extent is sown in association with maize.

Potatoes

The production of this tuber has become more and more important as time goes by, and among the primary food products, it is one of those which has increased most, since between the periods 1925-29 and 1944-47, production rose 177 per cent. The use of greater irrigated areas in its cultivation and the greater use of fertilizers contributed to increase the yields considerably, particularly in the decade of the forties, a period in which an average higher than 4,000 kilos per hectare was registered; in the last part of the twenties, the average yield barely exceeded 3,000 kilos

/per hectare.

per hectare.

Tomatoes. After sesame, linseed and peanuts, the tomato is the crop which has shown the greatest increase within Mexican agriculture. In 1925, it did not form 2 per cent of the volume of total agricultural production, and in 1947, it already represented 5 per cent. The development of production was not important between 1925 and 1941, but from 1942 its rate of growth strengthened, and in a few years the 1940 production was trebled, exceeding 200,000 tons in 1944 and subsequent years. This rapid growth was brought about by an increased demand from the United States market, where the Mexican product managed partly to displace the Cuban tomato.

The increase of production in itself, was due more to a considerable increase in yields than to a greater area under cultivation, since, while production between 1925-29 and 1944-47 increased by 188 per cent, the cultivated area only increased by 48 per cent. The average yields in both periods were 2,700 kilos and 5,650 kilos per hectare respectively. The use of advanced technical processes and the use of fertilisers are the main factors which caused these increases. The tomato is almost exclusively an irrigated crop.

Chickpeas. This crop has also been heavily influenced by foreign trade and was subject to considerable expansion in the forties. The average production in the last part of the twenties was 73,000 tons, dropping to an average of 40,000 tons in the thirties and reaching around 100,000 tons in the forties.

During recent years, production of this pulse has created certain problems, since domestic consumption has remained stationary and surpluses have not found an easy outlet in foreign markets. Consequently appreciable

/stocks are

Table 26: Mexico. Harvested area, yield, production, imports
exports and apparent consumption of beans

Years	Harvested area (hectares)	Yield per hectare (kilogrammes)	Production	Imports	Exports (tons)	Apparent consumption
1925	923,655	203	187,629	2,704,159	9,775	2,882,013
1926	965,150	207	199,471	2,797,620	1,383	2,995,708
1927	959,975	198	189,899	2,091,278	6,223	2,274,954
1928	887,491	198	176,134	343,709	9,749	510,094
1929	733,421	129	94,971	313,333	9,127	399,177
1930	709,460	116	82,577	3,985,320	767	4,067,130
1931	723,197	188	135,960	8,311,999	55	8,447,904
1932	640,215	206	131,840	300,661	215	432,286
1933	661,896	231	185,049	34,521	5,585	214,785
1934	597,065	207	123,776	32,019	11,588	144,207
1935	567,791	213	120,980	160,155	5,550	275,585
1936	527,751	202	106,524	44,269	954	149,839
1937	546,995	190	103,796	24,143	1,387	126,552
1938	596,459	177	105,499	311,423	30	416,892
1939	632,106	234	148,152	3,688,984	30	3,837,116
1940	635,447	152	96,752	18,096	802	114,046
1941	672,257	238	160,022	36,660	7,981	188,701
1942	750,400	244	182,802	117,232	12,042	287,992
1943	699,796	225	157,372	21,149	5,406	173,115
1944	734,398	249	183,183	11,269	4,032	190,420
1945	727,731	222	161,729	219,891	6,638	374,982
1946	733,607	189	138,629	14,113	574	152,168
1947	740,892	268	198,854	2,064,744	24	2,263,574
1948	788,000		209,629	70,180	80	279,729

Source: Serie Estadística de la República Mexicana, 1925-1945, published by the Secretaría de la Agricultura y Ganadería, Foreign Trade Yearbooks and Tables belonging to the Dirección General de Estadística.



stocks are being accumulated which, with the unsold crops of 1948 and 1949, reached 60,000 tons.^{1/}

Coffee. About two thirds of the production of coffee is exported. Production has remained relatively stationary in spite of an increase of 43 per cent having been registered (1944-47 over 1925-29) in the area under cultivation. The decline in the yields which, from an average of 500 kilos in the twenties, dropped to an average of 416 kilos in the forties, as mainly due to a falling off in the efficiency of the coffee estates expropriated during the war from German subjects.

Oil seeds. Encouraged by the high prices in force during the last war and the decline in imports of fats, the production of oil seeds increased rapidly until it managed to supply almost entirely, the requirements for those raw materials which the industry of edible oils and fats had previously imported. The production of oil seeds as a whole increased between the period 1925-29 and 1944-47 by 142 per cent. Within the group, the production of sesame grew most rapidly since, in the period indicated, it increased by 471 per cent (from an average of 12,000 tons to one of 68,000 tons). Peanuts increased by 420 per cent. The production of copra remained relatively stationary. Among oilseeds of an industrial nature, linseed, which was a relatively unknown crop in the twenties, occupied a place of relative importance in agriculture in the central part of the High Plateau and in the last few years in the Yaqui Valley, Sonora, and

^{1/} "El Garbanzo - el henequén de ayer y el algodón de mañana".
Revista de Economía, Vol. XIII, No. 15, January 1950, Mexico D.F.

the Mexicali Valley. Its production increased from an average of 1,180 tons in 1925-29 to 22,940 tons in 1944-47.

Sugar cane. The production of sugar cane has maintained a marked tendency to increase, both in the cultivated area and in the volume produced, and it has been able to satisfy completely the ever-growing requirements for raw material for the expanding industries of sugar and alcohol. Production in the latter part of the twenties averaged 3 million tons, while in the last four years under survey, it had risen to an average of 8 million. This increase has been mainly due to increases in the yields (from 44.5 tons per hectare in the period 1925-29 it rose to 49.5 in 1945-48), since the area under cultivation rose relatively less than production. For this crop also, technical progress in the form of imported varieties of high yield, greater and better use of fertilizers, together with the cultivation of new and more fertile irrigated lands have all contributed towards improving those yields. On the other hand, the extension of this crop to naturally humid lands, where the yields are lower than in the irrigated regions, has contributed towards diminishing the results obtained with the procedure described above.

Cotton. The production of this fibre tended to decline between 1927 and 1932, but since then it recovered the high level which it had achieved in 1926 and continued to rise with some setbacks until, in the 1945-48 period, it reached a production level 78 per cent higher than that obtained in the five year period 1925-29. This increase was mainly due to a greater area under cultivation, since the yields showed a slight downward trend.

/Although this crop

Although this crop is cultivated exclusively on irrigated lands, the yields are generally, lower than those obtained in other countries producing irrigated cotton, such as Peru, Egypt, Guatemala, etc.

Selected seed has been used for some time past, imported from the United States. They are first fumigated to prevent pests. Cultivation is carried out with mechanical equipment and modern cultivators. There is constant vigilance against pests, and in the region of the Comarca Lagunera, the use of aircraft is being adopted to spray the plants more rapidly.

The cultivation of cotton has increased to a greater extent than the requirements of the cotton textile industry, since exports, which in the five year period 1925-29, only amounted to 38 per cent of production, formed almost 50 per cent in the 1944-47 period.

Hennequén. The economic life of a large sector of the population concentrated in the Yucatán region depends almost exclusively on hennequén, since it is almost the only crop grown there. Recently, a new production area has been created on the southern coast of the state of Tamaulipas where, since it is nearer the United States frontier and also to the region where hennequén is industrialised (the State of San Luis Potosí), there have been certain advantages over Yucatán.

In spite of the fact that new regions have been cultivated with this crop, production has tended to decline, since the demand for this fibre in the world market was less, because of the availability of other cheaper fibres of a similar nature. During the last war, production began a new period of prosperity, since the competitors in
/the world market

the world market were unable to get their products to the consumer markets. This prosperity was, however, of short duration, since as soon as active competition appeared again, harvests declined. Between 1925-29 and 1944-47, production dropped from an average of 132,000 to 115,000 tons, that is, a reduction of 13 per cent.

The cutting of the "pencas" or hennequén leaves is governed by the price of the fibre in the North American market, and in many cases, the total capacity is not harvested, only the better quality fibre being collected. Thus the yields and the harvests have diminished in spite of the increase in the area under cultivation.

The increase in production costs, mainly due to the rise in wages and the lack of more skilled processes not only in the cultivation but in the preparation of the fibre, have also contributed to the decadence of hennequén.

For this important sector of agriculture to recover again, it would be necessary to improve considerably productive techniques in the different stages, in order to bring about a substantial reduction in costs. This is the only way in which it could meet the competition of more efficient producers.

Fruit. After the oil seed group, the fruit group showed the highest increase, since between the periods 1927-31 and 1944-47, production increased by 95 per cent due, to a large extent, to the stimulus of foreign trade. The fruits which most contributed towards this development, were oranges, their production having increased 182 per cent between the periods indicated, grapes, which increased by 150

per cent, and avocado pears, which increased by 109 per cent. Bananas increased to a lesser degree.

The main difficulties of fruit cultivation are the pests which either sporadically or permanently, attack the different species. The black fly in the case of oranges, and the chausco in the case of bananas, have caused the greatest ravages.

II. LIVESTOCK PRODUCTION

Owing to the lack of adequate statistics, it has not been possible to include livestock production in the index of production. However, the figures given in the 1940 Census and the estimates made by the Dirección General de Ganadería of the Secretaría de Agricultura, for the following years (see table 27) show that the livestock population has been increasing, although at a different rate for the various species. While the livestock population increased by 21 per cent between 1940 and 1948, the number of head of cattle increased by 24 per cent, horses and mules by 14 per cent, asses by 22 per cent, hogs by 8 per cent, and sheep by 5 per cent.

Both as regards the number of head and their value, cattle are the most important; in 1940, there were 11.6 million head, representing 60 per cent of the value given in that year to the total Mexican livestock industry. They were followed in importance, according to value, by horses and hogs.

The 1940 Census considered the area of pastures suitable for the breeding of cattle, in plains and hills, as 56 million hectares. This by itself is insufficient to appraise the country's livestock

/possibilities, since

possibilities, since within this area there are large regions of poor pastures or others which are only seasonal owing to the irregularity of the rainfall; the provision of water for livestock, either in the form of rivers with a permanent flow, natural or artificial lakes, or the use of underground waters is scanty or else very costly. These natural limitations and the methods imposed by them have become evident in the difficulty of maintaining intact the characteristics of the improved breeds which were imported first from Europe, and later from the United States. Except in privileged regions with adequate humidity and climate, this results in a slow progressive degeneration of the original breeds.

It will thus be understood that in the arid or semi-arid regions like the North, the breeding of cattle has to be carried out in large areas of hundreds or thousands of hectares, according to the density and quality of the pastures and the availability of water. In some places it is necessary to have up to 40 hectares per head of cattle per year. This situation is gradually being remedied, however, by the drilling of artesian wells. In many places, this factor has reduced the area mentioned above to 10 hectares. This practice has been followed by important livestock undertakings in the States of Sonora, Chihuahua, Durango and Coahuila, which possess rich herds of improved breeds of cattle for the production of meat, and a smaller number of herds of sheep for the production of wool.

In other more humid regions of the country, such as the coast of Veracruz, a head of cattle requires about 4 hectares of natural pasture per year. In these regions there are modern livestock farms /which have fields

Table 27. Mexico: Livestock numbers 1940-48

(In thousands)

Years	Cattle	Horses	Mules	Donkey	Sheep	Goats	Pigs
1940 a/	11,591	2,509	939	2,319	4,452	6,844	5,106
1941	11,802	2,569	935	2,313	4,539	6,829	5,097
1942	11,884	2,599	945	2,351	4,610	6,866	5,168
1943	12,009	2,613	967	2,374	4,672	6,883	5,255
1944	12,139	2,647	984	2,433	4,704	6,913	5,329
1945	12,214	2,676	987	2,460	4,754	6,920	5,309
1946	12,420	2,641	1,001	2,471	4,742	6,885	5,314
1947	12,783	2,777	1,025	2,627	4,756	7,010	5,356
1948	14,404	2,863	1,053	2,826	4,772	7,101	5,422

Source: Secretaría de Agricultura y Ganadería, Departamento de Zootécnica.

a/ 1940 figures taken from 1940 census.



which have fields cultivated with "zacate guineo", a pasture which has a capacity of one head per hectare and per year or more.

Given the limitations of climate, soil, population, means of transport and the almost general need for more or less extensive areas for breeding a head of livestock, it may be said that the livestock industry has remained outside the Agrarian reform, and continues to a great extent, under the traditional regime of private ownership. According to the 1940 Census, only 7.4 per cent of the pasture lands on the plains and 11.6 per cent of the pastures on hills are in possession of the ejidos, almost the whole of the remainder, 80.9 per cent, corresponding to properties larger than 5 hectares and only 0.1 per cent to those of an area less than that. This situation has certainly not changed since 1940, since agrarian expropriations of that type of land have been almost entirely suspended, owing to the fact that the majority of livestock properties have obtained certificates of exemption from the Agrarian Reform laws for the lands assigned to the breeding of livestock over an extension necessary to maintain, according to the first regulation issued in 1937, 300 head of large cattle and 500 since December 1946, or their equivalents in small animals, the coefficients for their maintenance being estimated in accordance with the indices of aridity and richness of the pastures. The above certificates protect the properties for a period of 25 years, which may be extended if it can be shown that the lands are being properly worked.

On the other hand, the most important livestock regions are also the least populated, and as the ejidal provision is only granted
/to villages where

to villages where there are 20 or more peasants without land, the result is that the large estates have not been affected by the agrarian reform except in a very small degree. While it is true that the extensive breeding of animals on enormous estates, as has been practiced in the greater part of the country, has no permanent guarantee of continuing, this has been no obstacle to the prosperity of enterprises which have introduced, where the natural resources are favourable and the commercial situation advantageous, modern methods with selected stock and with frequent renewals of the strain through the import of thoroughbred stud animals.

Foot and mouth disease and the production of meat. Until the end of 1946, when the central region of the country was affected by the virus of foot and mouth disease, Mexico annually exported to the United States a large number of head of cattle (around 450,000 annually in the first part of the forties). With the attack of this plague, that country closed its frontier, leaving the Mexican livestock industry in a difficult economic situation. It was necessary to impose substantial modifications in the livestock ranches of the central and northern regions to obtain an outlet for the abundant annual production. Together with the wholehearted campaign against the disease, in which the United States Government cooperated, it was necessary to install meat packing and refrigerating plants with the object of exporting the meat which formerly left the country (as cattle) on the hoof. Fifteen meat canning plants and three refrigerated packing plants were established. This alternative has not only offset the effects of the closing of the United States frontier, but

/has opened up

has opened up new prospects for the livestock industry in the region, since the products of the packing plants can reach the markets in the centre of the country, where the consumption per capita is greater and, moreover, can obtain full advantage of the slaughtering and of the by-products (hides, offal, etc.).

SECTION 3. YIELD AND PRODUCTIVITY

I. Yield of principal crops

A. General Analysis

Many factors combine to cause the extremely low agricultural yield of Mexico's fields. The country's geographic position, the quality of the soil and the climatic conditions prevailing in large areas are all unfavourable to high yields.

The low yield originally due, as will be seen, to natural conditions unsuitable for cultivation, leads to the development of agricultural activity over far more extensive areas than would be required to obtain the same volume of production if the yield were proportionately higher, thus causing a dispersal of capital available to agriculture, that is to say, an insufficient concentration of capital per unit of surface.

The low yield also means that numerous agricultural workers are bound to the land, in apparent unemployment, during the greater part of the year. Nevertheless, the units of human labour employed are excessive in relation to the volume of crops harvested; consequently, production costs are high despite the low salaries; the introduction of modern methods for agriculture and stock breeding is difficult and the final result is the existing poverty of the majority of Mexico's rural population.

The detrimental factors reducing the yield of the crops are often so intense that they cause the total loss of the harvests, and the consequent upheaval in the economy of both the agricultural classes and the nation itself. Of the total area cultivated annually in the

/country,

country, 10 per cent in the good years and 20 in the worst years, cannot be harvested through droughts, floods, frosts, or pests and plant diseases and generally speaking the purchasing power of the agricultural population is proportionately reduced. For a good many years, efforts have been made to overcome the causes of the low yields, with the following results for the different crops.

B. Survey of the principal crops

Maize. Long before breeding experiments produced better varieties of maize, when agricultural machinery had not yet been widely introduced, and fertilizers were not yet employed on so large a scale, farmers in the United States obtained a yield of 1,606 kilos of maize per hectare (1866-1875). Seventy years later, the yield had only increased by 11 per cent, reaching 1,788 kilos per hectare (1935-1944). The North American maize crop yield is 3 times higher than in Mexico due rather to more favourable factors of climate and soil than to the progress of agricultural technique in the United States.

Choosing localities in the United States maize belt where yields are very high, - an average of 2,196 kilos of grain per hectare, (24 states, harvests of 1914 to 1929, on non-irrigated land) - the following rainfall and temperatures were registered, which would seem to be the optimum climatic conditions for maize production:

<u>Period</u>	<u>Rainfall during 3 months in m.m.</u>	<u>Average Tempera- tures, Centigrade</u>
December - January - February	150 to 300	- 4 to - 2
March - April - May	168 to 300	6 to 11
June - July - August	225 to 450	20 to 22
September - October - November	225 to 336	8 to 13

/It has been

It has been shown that a crop yield depends not only on the temperature and humidity available to the plants during their vegetative cycle but also on climatic conditions in the months preceding the sowing period.

The rainfall régime in Mexico differs considerably from the ideal, since there is a dry season from December to May, and the rest of the year is generally too wet for maize. This becomes evident in the following rainfall statistics of four different localities which may be considered as typical of the vast Mexican territory.

<u>Period</u>	<u>Saltillo, state of Coahuila</u>	<u>León, state of Guanajuato</u>	<u>Ruiz, state of Nayarit</u>	<u>Champotón, in Campeche</u>
Dec. - Jan. - Feb.	42	31	66	124
Mar. - Apr. - May	47	29	0	107
June - July - Aug.	158	411	692	562
Sept. - Oct. - Nov.	94	189	284	406
Total	<u>339</u>	<u>660</u>	<u>1,042</u>	<u>1,199</u>

The annual average temperature of Saltillo and León were 17.6° and 18.8° respectively, whilst in Ruiz and Champotón, which are known to be hot, and are located near the coast, the average temperature was 26.7° and 26.4°, respectively. Two or even three crops a year may be grown under such climatic conditions as exist in regions similar to Ruiz and Champotón.

The rainfall regime is an obstacle to the cultivation of maize, limiting its yield very considerably. In Coahuila, cultivation of non-irrigated land yields about 400 kilos per hectare, whilst in the state of Guanajuato, the yield rises to some 625 kilos, on the average; in Campeche, the yield is 815 kilos per hectare, despite the primitive technique employed in maize production; and finally in the state of

/Nayarit, the

Nayarit, the yield reached as much as 1,307 kilos per hectare (1948).

The fluctuations of maize yields over the years has been of great significance in Mexico, since more than 3 million hectares are given over to its plantation and the value of the maize crop equals about 30 per cent of the total value of agricultural production in Mexico.

<u>Period</u>	<u>Kilos per Capita</u>
1925-1929	642
1930-1934	574
1935-1939	564
1940-1944	596
1945-1948	706

The yield during the last period was 10 per cent higher than that recorded 20 years ago, and this highly important fact will be examined shortly.

The greater yield is in part due to the geographic displacement of the maize growing belt from the centre, once the principal producer, to the rest of the country. The central zone where maize is grown on non-irrigated land, and where the yield is extremely low, produced 54 of the domestic crop in 1926 whereas in 1948 it only produced 38 per cent. The total area of irrigated, semi-irrigated and naturally humid land on which maize is grown has consequently increased in proportion. There have been other favourable factors contributing to this increase of production, including greater rainfall, a wider use of farm machinery and some progress in technical methods.

In Mexico, maize cultivated on non-irrigated land produced 700 kilos per hectare whereas that planted on irrigated soil yielded 38 per cent more (1946). In the United States, maize grown on semi-arid non-irrigated land produced 961 kilos per hectare, whereas that grown on

/on irrigated

on irrigated land, principally in the West, yielded 93 per cent more (1939). In Egypt, where maize is only grown by irrigation and without the aid of rainfall, the yield was 2,120 kilos per hectare (1937), that is to say about 14 per cent higher than that of maize grown on irrigated soil in the western United States. These differences in the yield of the crop sown on irrigated land constitute further proof of the influence which the amount of water, in the form of irrigation, has on the growth of maize.

The Mexican Government and the Rockefeller Foundation have been investigating the matter, and this has led to the distribution by the Comisión Nacional de Maíz (National Maize Commission) of 2,500 tons of improved seeds in 1948 and 3,000 tons the following year. This last amount was sufficient to sow 7 per cent of the total area planted with maize in 1949. The new synthetic varieties and other selected types, freely pollinated, yield about 35 per cent more than the new hybrid varieties in laboratory tests. In practice, an increase of 25 per cent has been achieved. The average yield for the country should rise about 2.5 per cent when improved seeds are used on 10 per cent of the total area sown.

The use of fertilizers is spreading among the maize planters. Large tracts of land require the application of nitrogen and phosphates in order to obtain a relatively higher yield. The Federal Government is engaged in building a plant to manufacture 70,000 tons of sulphate of ammonium annually. Assuming that this production is to be used solely to further maize cultivation, it would only suffice for 10 per cent of the total area sown annually. Furthermore, the use of fertilizers is

/advisable on

advisable on irrigated lands, semi-irrigated and naturally humid soil, which probably account for less than 20 per cent of the total area on which maize is grown.

Wheat. In the 18 European countries where climatic conditions are ideal for wheat growing, the average yield was 2,020 kilos of grain per hectare (1901-1920). Further to the excellent climate in Europe, there are other favourable factors contributing to yields which are higher than those obtained by North American wheat growers. The following may be considered the optimum conditions for the cultivation of wheat:

<u>Period</u>	<u>Rainfall in 3 months</u>	<u>Average temperatures, Centigrade</u>
December - January - February	132 to 252	- 1 to 4
March - April - May	138 to 228	4 to 6
June - July - August	120 to 228	14 to 16
September - October - November	180 to 360	7 to 10

It is well-known that the majority of the crop grown in Europe is Winter Wheat, which does not require irrigation, because the rainfall and thaws are sufficient for the development of the plant.

In Mexico too, nearly all the crop is Winter Wheat, but it is cultivated with the aid of irrigation, or else on naturally humid soils since the winter rainfall is very slight, as can be seen from the following rainfall incidence table for four principal localities representative of wheat growing areas:

<u>Period</u>	<u>Pénjamo, in Guanajuato</u>	<u>Múzquiz, in Coahuila</u>	<u>Ciudad Lerdo, in Durango</u>	<u>Mexicali, in B. California</u>
Dec. - Jan. - Feb.	36	63	18	30
Mar. - Apr. - May	47	141	23	12
June - July - August	507	221	94	11
Sept. - Oct. - Nov.	199	277	96	24
Total	789	702	231	77

The adverse conditions obtaining in the Bajío, in which Pénjamo is situated, cause the planter to obtain a yield of only 663 kilos of wheat per hectare sown, despite the aid of irrigation. In the northwest of Coahuila, where Musquiz is located, rainfall is more favourable and the yield reaches 840 kilos per hectare. In La Laguna, to which the Ciudad Lerdo figures correspond, and in the valley of the Mexicali, there is little rainfall but the yields are 984 kilos and 1,200 kilos respectively (1945-1946). In the Yaqui region, a great wheat growing area, the yield is 1,479 kilos per hectare.

<u>Period</u>	<u>Kilos per hectare</u>
1925-1929	635
1930-1934	776
1935-1939	772
1940-1944	752
1945-1947	802

The average yield in 1945-1947 was about 17 per cent higher than that of 1925-1929, but much of this increase can be attributed to the expansion of the wheat growing area in the past 20 years. This cultivation has been extended to regions where the yield is relatively high. For instance, the Central Zone, which in 1924-1925 accounted for 54 per cent of the domestic crop, only supplied about 35 per cent in 1947-1948.

Irrigation increased the yield of wheat in a proportion which varies from 20 and 40 per cent of the yield of wheat planted on naturally humid soils. The new types of wheat improved by breeding tests and which are now being widely introduced in the irrigated areas will gradually raise the yield of the crop. A further favourable factor is the growing utilization of chemical and natural fertilizers

/and the rotation

and the rotation of crops. Moreover, further irrigation of land for wheat planting is being undertaken in the northwestern section of Mexico, where there is a very high unitary yield, as a result of highly mechanized agricultural technique.

Rice. The rice grown in Japan before the First World War yielded 3.7 tons of palay (hulled) grain per hectare. In the five year period immediately preceding the Second World War, Japan's average yield was 4.4 tons per hectare, which was an increase of about 20 per cent over the 25 year lapse. The annual rainfall recorded in Tokio is 1,537 millimetres, fairly evenly spread over the period from March to November, leaving a three-months dry season. These are the ideal conditions for the cultivation of rice.

In the Mexican rice-growing area, rainfall is insufficient for the successful cultivation of the crop and so irrigation becomes indispensable. This system, combined with the quality of the soil and the methods of cultivation employed, results in the following yields of palay rice (hulled):

<u>Period</u>	<u>Kilos per hectare</u>
1925-1929	1,765
1930-1934	2,030
1935-1939	2,140
1940-1944	1,749
1945-1948	2,033

The Central Zone, outstanding for its high yield, has lost its supremacy as the principal domestic supplier, since percentage of its contribution has decreased from 50 per cent of the domestic crop in 1926 to 37 per cent in 1946. This in part explains the reduced yield of the period between 1940 and 1944, which, nevertheless, is 26 per cent higher than 20 years before. This increase is perhaps evidence of the effect
/of transplanting

of transplanting the cultivation to other regions and the introduction of progressive technique.

Beans. Three fifths of the beans in Mexico are grown on lands sown exclusively to this crop. The other two fifths are grown on land where maize is the principal crop and the beans secondary. This combination of maize and beans is found especially in the central zone where the yield of maize is extremely low. Droughts, floods and frosts which interfere with the development of maize also damage the bean crop, though the latter is harvested earlier. This crop cannot stand up to bad weather and is easily subject to pests and disease of all sorts.

The preceding analysis is essential if one is to understand why agricultural statistics reveal such a remarkably low yield for beans. The yield is calculated by dividing the total production of the dried bean by the total area sown, including the area where maize is the main crop and beans secondary. The yield thus estimated, with the figures for domestic production, varies from a minimum of 116 kilos per hectare (1930) to a maximum of 281 (1933). The yield of a bean crop grown on land exclusively sown with this plant is about 450 kilos per hectare, which is rather low. Experiments are being carried out with the intention of raising this by improved seeds.

Tomatoes. The yield of this crop has been increased continuously and extraordinarily during the past twenty-five years. The value of the harvested crop is equivalent to a little more than 5 per cent of the total value of agricultural production, but this percentage is tending constantly to increase. Mexican tomatoes are exported in substantial amounts to the United States, and their cultivation has been extended

/considerably in

considerably in Mexico's new agricultural areas. It is estimated that within a few years this product may be, economically, as important as beans or wheat.

The following table shows the yield of tomatoes:

<u>Period</u>	<u>Kilos per hectare</u>
1925-1929	2,889
1930-1934	3,644
1935-1939	4,202
1940-1944	4,900
1945-1948	5,700

During the last period shown on the table, the yield was twice that of the first period recorded, when the cultivation of tomatoes was principally located in central Mexico, where it had been carried on for several centuries.

Coffee. The value of the coffee harvested in 1948 was less than that of the Mexican tomato crop in the same year. Nevertheless, the cultivation of this product is of much importance since two thirds of the production is exported. The strong varieties of coffee which were formerly grown have gradually given way to the milder species which are preferred by the growers, since they are the type demanded by the United States market.

Coffee yields declined 11 per cent over a period of 20 years, as will be observed in the following table:

<u>Period</u>	<u>Kilos per hectare</u>
1925-1929	458
1930-1934	438
1935-1939	478
1940-1944	420
1945-1948	407

The decrease is even more impressive when one compares the minimum and maximum yields. This reduction can be almost entirely accounted for

/by the fact

by the fact that the principal coffee plantations, which were owned by Germans, have been placed under the control of an organ which has manifested its inability to maintain the former level of efficiency.

Cotton. The cotton crop in Mexico represents about 30 per cent of the value of the maize crop, the country's principal agricultural product. Cotton plantations have been consistently increased in size and number since 1932. The product is cultivated in areas where irrigation is essential, and highly mechanized methods have been introduced into this activity. In the Lagunera area, the principal cotton growing region, the predominant species has a fibre one inch long, but its length is gradually being improved. Of the Laguna crop, 33 per cent was classed as Middling, 21 per cent as Strict Low Middling and the rest fell into other gradings. These proportions are similar to those of the United States cotton growers.

The cotton grown on the rich soil of the Lower Nile has a much higher yield, which, on the average, is about 595 kilos per hectare. In the lowlands of Peru, the yield is about 462 kilos of fibre per hectare, accounted for by the use of guano as a fertilizer on the irrigated cotton plantations. In the United States, the average yield is 291 kilos per hectare, about half of the Egyptian figure. Most of the cotton grown in the United States is cultivated without irrigation, and in some regions in the cotton belt, a substantial amount of fertilizer is used. The yield from the Mexican cotton fields averages about 277 kilos per hectare, which is only 5 per cent less than that of the United States (1939-1940 to 1943-1944).

The variations in Mexican cotton yields are shown below:

<u>Period</u>	<u>Kilos per hectare</u>
1925-1929	285
1930-1934	299
1935-1939	248
1940-1944	271
1945-1947	278

The decrease which will be noted between the second and third five-year period is probably due to the deficiencies which inevitably occurred as a result of the agrarian reform in the cotton fields. But by 1947, the cotton crops were once again as high as they had been in 1925-1929.

Sugar Cane. The value of the sugar cane crop is somewhat lower than that of the cotton crop; nevertheless sugar cane production is the basis of an industry which has grown considerably, so that it can be considered to typify the economic development of Mexico and its yields are therefore worth analysing.

The cultivation of sugar cane in Hawaii showed a yield of 115 metric tons per hectare in 1895, before the advantages of the new varieties created on the agricultural experimental stations became evident, and long before the use of fertilizers was introduced on the sugar cane plantations. At present, in Hawaii, no irrigation is used in the cultivation of sugar cane, and the average yield is about 160 tons per hectare, that is, 39 per cent more than 55 years ago, which is nevertheless lower than that obtained in Java. In Mexico, sugar cane is planted on irrigated land (50 per cent of the sugar cane plantations) and on non-irrigated land. In the latter case, however, the yield of the plantation is reduced by as much as 40 per cent in the bad years.

/Of the types

Of the types grown in Mexico, 53 per cent of the area is planted with POJ species, 35 per cent is sown with the Coimbatore varieties, 10 per cent with native cane and the remaining 2 per cent with other types.^{1/} Furthermore, some of the Mexican sugar cane planters make use of chemical fertilizers. However, the unitary yield of sugar cane is about one fourth of that in Java, which is ideally suited for this crop.

The following figures show that the yield is nevertheless increasing:

<u>Period</u>	<u>Metric tons per hectare</u>
1925-1929	44.5
1930-1934	44.4
1935-1939	47.4
1940-1944	50.2
1945-1948	51.3

This increase is due to technical progress in the cultivation of sugar cane, including the distribution of improved species and the use of fertilizers, the beneficial results of which appear less evident than in fact they are because the naturally humid soils on which sugar cane is planted without the aid of irrigation (though the yield here is generally lower), now represent a greater percentage than before of the total sugar cane producing area.

Henquen. This product is almost exclusively grown on the Yucatán Peninsula, where it is the sole crop. Yet as a competitor of sisal on the world market, it is of great importance in the list of Mexico's exports. The henquen fibre is taken from agaves that begin to produce from 5 to 7 years after planting. The yield of the fibre varies in accordance with the drought, though the plant resists dry weather extremely well. But there are other agricultural and industrial factors

^{1/} Investigación y Experimentación de la Caña de Azúcar en Mexico, by Ing. Alfonso Gonzalez Gallardo.

/(such as the

(such as the extraction of the fibres) which affect the yield, over and beyond the influence of economic and social conditions.

The unitary yield of henequen has diminished considerably, as is shown below:

<u>Period</u>	<u>Kilos per hectare</u>
1925-1929	1,114
1930-1934	1,146
1935-1939	976
1940-1944	929
1945-1947	787

The agrarian reform took place in 1936 in Yucatán and its results were different from those in the rest of the country.

Alfalfa. In value, this forage crop is only slightly less important than henequen, yet it is harvested in limited regions, generally in the vicinity of large cities, and its development is closely linked with the production of milk and dairy products. In Mexico it is nearly always grown on irrigated land, and fertilized with cattle manure.

The growing yield of alfalfa is shown on the following table:

<u>Period</u>	<u>Kilos per hectare undried alfalfa</u>
1925-1929	36,880
1930-1934	40,980
1935-1939	40,700
1940-1944	42,550
1945-1948	43,130

It will be observed that in 1945-1948, the yield was 17 per cent higher than that in 1925-1929, which increase can be partly attributed to the fact that cultivation has been extended toward the fertile Lagunera area and the valley of the Mexicali, as well as in the Irrigation District of Tulum, where the soil has been improved by the sewerage waters of Mexico City.

C. SUMMARY.

The combination of natural factors affecting agricultural yields is generally unfavourable in Mexico, especially as regards the important crop of maize, principally located on non-irrigated land and subject to inadequate rainfall which is scarce and badly distributed both in the month and in the year. Other natural circumstances, and certain conditions imposed by man, unite to maintain the level of Mexico's agricultural yields extremely low in relation to the cultivated area. This situation, however, has been changing for the better during the past twenty-five years, due to the opening up of new and fertile lands, many of which have been improved by irrigation projects. The increase in unitary yield has been equally important, and can be ascribed to the application of fertilizers, a better organized system of combatting pests and the introduction of improved seeds and varieties obtained through breeding experiments. This last method is expected to permit an even greater increase in agricultural yields in the course of the next few years.

The agrarian reform in Mexico has brought in its train an agricultural revolution which in its characteristics and development differs from that of other countries. "The agricultural revolution, from a historical point of view, is nothing more than the incorporation of agriculture by capitalist economy"^{1/} and in this process, costs of production are of the very greatest importance. But one must remember that the costs

1/ Del Agrarismo a la Revolución Agrícola by Ing. Marco Antonio Durán.

of production are profoundly influenced by unitary yield, which may vary as a function of interdependent natural elements and economic factors. The real unitary yield of Mexican agriculture has been raised, especially in the recent past, by diversification of crops, by the cultivation of products better suited to possibilities of the land and by a more intensive exploitation of the land that is employing more units of fixed and moveable capital per unit of the cultivated area. Agricultural credit and a rural price policy have stimulated the development of agriculture, but there is still a great deal to be done. The investigators at the seed breeding centres, on their part,⁶ have only just taken up the struggle against environmental conditions very unfavourable to prosperous agriculture on a large scale.

II. PRODUCTIVITY - MAIN CROPS

A. General Survey

In the year 1840, the number of persons gainfully employed in agriculture in the United States equalled 80 per cent of their total gainfully employed population. The changes which occurred later in that country's economic structure were such that by 1870, only 47 per cent of the gainfully employed population was engaged in agriculture, and by 1910 this proportion had been reduced to 35 per cent, and by 1947 to 14 per cent. This drastic reduction effected over the course of a century, has not hindered the progress of agricultural development there. This means that a relatively small number of agricultural workers have increased productivity to the extent that they can supply the total requirements of a numerically greater population, whose individual capacity of consumption has been notably increased and diversified. This is a historical event of outstanding importance, occurring several decades after the Agricultural Revolution in Great Britain and to a certain extent contemporary with the latter's Industrial Revolution.

The changes in Mexican agriculture though slight at the outset were already evident at the beginning of the century in the introduction of technical methods, as well as in economic and social progress. In 1921, they gained sudden impetus. At this period, 71 per cent of Mexico's gainfully employed population was engaged in agricultural pursuits. It is estimated that by 1951, this proportion will have fallen to 60 per cent and if this is correct,

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the productivity of the agricultural population should increase sufficiently to supply the 25 million Mexican citizens with foodstuffs, raw materials of agricultural origin and also export goods thereby enabling them to obtain a fair proportion of the foreign exchange required for the importation of such capital goods as are not produced in Mexico. To what extent has such an increase in productivity been prepared?

This question can best be answered with the help of explanatory statistics. From 1929 to 1948, the total population of Mexico increased 47 per cent whereas the number of persons gainfully employed in agriculture only rose 21 per cent. Nevertheless, the volume of production increased by 85 per cent during the same interval. It becomes at once evident that the productivity of agricultural labour increased during the 19 years, by 53 per cent. This has been brought about by a number of factors and must be interpreted in relation to many events which have modified land tenure and land exploitation system, substantially changing the geographical distribution of the crops; introduced important changes into the structure of domestic agricultural production; enabled large investments to be made in irrigation schemes and other public works intended to hasten agricultural progress; provided substantial funds for agricultural credit purposes; introduced improved technical methods of divers sorts in agriculture, etc.

Further proof of the foregoing rests on the following facts:
FAO comparative estimates of Mexican supplies and those of other

/Latin American

Latin American countries reveal that the foodstuffs consumed in Mexico during 1947 were 19 per cent higher in per capita calories than those consumed in 1934-38, which increment is greater than that of any other Latin American country. The importation of foodstuffs, the volume of which is sometimes astounding only amounted to 8 per cent of total imports during 1947, a year remarkable for the enormous quantities of wheat imported. This 8 per cent includes edible animal products, wild and cultivated plants and forest products, agricultural products and those of the fisheries, either in their natural state or in a processed form. If one adds the total imports of inedible animal products and wild and cultivated plants to the above mentioned imports of foodstuffs, their sum will equal 17 per cent of the country's total imports in 1947.

The value of the total exports of animal and vegetable products for the same year was estimated to be 48 per cent higher than that of imports of the same class of goods.

The increase of productivity in Mexico agriculture is closely linked with an almost general and continuous increase which has taken place to a lesser degree in yield per unit, as was shown at the beginning of this chapter. The substantial investment of private and government funds in the form of both fixed and moveable capital incorporated in agriculture has enabled large tracts of agricultural land to be improved by engineering and agricultural techniques. Agriculture, with the exception of livestock and forestry, contributed 14 per cent to the total of Mexico's national /income in 1948,

income in 1948, which was 6 per cent more than in 1940 and slightly more than in 1929. In 1948 therefore, agriculture had retained the same position it held 20 years before in relation to the national income, despite the sudden growth of the processing industries and services, which developed during this period.

B. Analysis of the principal crops

Productivity should be considered in more concrete terms in relation to some of the main crops, but before doing so, it would perhaps be advisable to clear up certain doubts. Real productivity is the ratio between the volume of products harvested and the amount of human labour employed in the cultivation of these products. We propose to express productivity in terms of kilos of crop harvested per man hour, not including the labour applied in regions where the crops were lost. This is net productivity, whereas gross productivity is the quotient obtained by dividing the total harvest by the labour it involved, including that in regions where the crops were lost, a considerable amount in certain agricultural areas. Gross productivity is more appropriate when considering the costs of production and the purchasing power of the agricultural populations. But, we intend to deal with net productivity, not taking into account the sum of human labour applied on crops which were totally lost.

The ratio between the amount of human labour employed in an enterprise and the area under cultivation for this enterprise may be termed the unit of labour, which we shall measure by man hours

/per hectare harvested.

per hectare harvested. This net unit of labour is different from the gross unit, which is the relationship between the total amount of labour applied and the total area cultivated, including the regions where crops could not be harvested. The unit of labour is thus a measurement of the Labour Factor applied to cultivation, which factor is determined by physical, technical, social and economic conditions. The concepts of productivity and the unit of labour though related to each other, are very different from one another. Productivity multiplied by the unit of labour sites the yield per unit, i.e. $P \times UL = Y$. The unit of labour increases with yield and varies in inverse proportion with productivity. Productivity changes proportionately to yield and inversely to the units of labour.

Maize - In the states of Guanajuato and Jalisco, which are representative of the areas in which maize is cultivated without irrigation and unirrigated Mexican maize growing area depends on scarce rainfall, and where old methods of cultivation prevail and human labour is used to a very large extent, 3 kilos of grain are harvested per man hour. On the other hand, in Iowa, where the yield is high even for the United States, the yield is 75 kilos per man hour, which is only a little higher than the 1909 figure. The average yield for the whole of the United States is 28 kilos of maize per man hour in the production of the crop, obtained through a combination of very favourable circumstances.

In Guanajuato, 311 man hours are required per hectare in order

to harvest 875 kilos. In Jalisco, 274 man hours are needed per hectare to harvest 829 kilos. The agricultural labourer in Iowa applies only 41 man hours per hectare for a crop totalling 3,063 kilos. The general average for the whole maize harvest in the United States' territory is 67 man hours per 1,855 kilos of maize per hectare.

The poor yield of the Mexican maize crop, its extremely low productivity, and the excessive amount of labour required determine relatively high prices and low wages. The agricultural day labourer in Mexico earns a wage that is five and a half times less than that of the United States day labourer, in terms of corresponding amounts of maize. The two essential requisites for Mexico's most important agricultural crop are to increase productivity and raise wages to economic levels.

Wheat - An important irrigated wheat growing area in Mexico is that of La Laguna, where the fertile soil produces a high yield, as compared with the general average for the rest of the country. Here agriculture has been mechanised to a considerable degree and ejidal land tenure created by the Agrarian Reform is prevalent. In spite of this, the yield is only 6.8 kilos of grain per man hour. In the Yaqui Valley, the yield rises to 9 kilos per man hour whereas across the border, 84 kilos per man hour is obtained in the state of Kansas, in the United States. In this latter country, the average yield is 48 kilos of grain per man hour.

As a rule, wheat in Mexico is grown with the aid of gravity

/irrigation or by

irrigation or by pumping water. This implies the employment of at least 40 per cent more human labour than would have been required on non-irrigated land. Figures for the Puebla-Tlaxcala area show that the cultivation of wheat on irrigated land and the use of threshing machines increase productivity by 25 per cent over that of wheat grown on non-irrigated land and using animals in the threshing process. Irrigation adds 14 per cent to productivity, as will be observed from the figures given for the Oaxaca area. If mules instead of oxen are used in agricultural activity, productivity is stepped up 10 per cent, according to data from the Bajio zone. The increase of productivity obtained by the simultaneous use of all the means of production, is smaller than that of increases obtained by using the means separately.

In La Laguna, the units of labour employed in the cultivation of wheat vary between a minimum of 166 man hours per hectare to a maximum of 305 man hours. The minimum employment of labour units occurs where the method of cultivation used involves gravity irrigation in deep wells, the employment of tractors for ploughing, as well as mules, and of harvesters and tractors in the harvesting of the crop. The maximum employment of units of labour occurs when the same method of cultivation is used, but the crop is cut down by hand scythes and threshed by machine. In the Yaqui Valley, 111 man hours per hectare are required, which is very high, especially when contrasted with the 22 man hours per hectare which is the general average in the wheat producing areas of the United States.

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The clearing of the borders and the canals, the flooding and the secondary irrigation systems, all of which are unnecessary in the United States, compel the La Laguna wheat growers to employ 48 man hours in such tasks, that is 29 per cent of the total labour. With the exception of the labour used for this type of work, the number of labour units employed in Mexico in wheat growing is almost three times higher than in the United States. The sum of labour units employed in the latter country was reduced almost to half its former level during the 25 year period, 1909-1934. A similar reduction might conceivably take place in the Mexican wheat fields, though ultimately, Mexico in this aspect would always remain in a less favourable position than the United States because of its topographical and geographical conditions.

Rice. An interesting comparison is that between the two principal rice growing areas of Mexico where the crop is cultivated with irrigation. Of these, one is the state of Morelos, where cultivation is highly intensive in relation to the amount of human labour employed and where a relatively high yield is obtained. The other region is that of the Yaqui Valley, where the cultivation is widespread and highly mechanized, but where the yield is relatively low. In Morelos, 3 kilos of palay (hulled) rice are obtained per man hour, whereas in the Yaqui Valley, 10 kilos per man hour, are obtained, though other sources quote as high as 12 kilos per man hour for this region. In the rice growing area of the United States, the average yield is 30 kilos per man hour.

In the state of Morelos, 1,394 man hours per hectare produce 4,000 kilos of hulled rice. This total of units of labour is high compared to that required in the extensive and mechanized enterprises of the Yaqui Valley

/where only

where only 156 man hours produce a total of 1,512 kilos. The rice growers of the United States as a rule employ 79 man hours per hectare for a total of 2,384 kilos. It is evident that in Morelos the law of diminishing returns obtains, since only a moderate increase of yield is derived from the substantial increment of human labour, though the yield might be raised by the use of better seed.

Cotton. In the La Laguna area, cotton is planted on land flooded by the rivers or irrigated by water drawn from deep wells. This produces 0.9 kilos of fibre per man hour, including the picking. Productivity rises to 1 kilo of fibre per man hour if the direct labour involved by irrigation, flooding and the maintenance of the canals, is excluded. The United States cotton growers obtain 1.3 kilos of fibre per man hour; for the most part they do not employ irrigation but replace it with the substantial use of fertilisers and machinery.

In the La Laguna region, it is assumed that 448 man-hours are employed in the production of an average of 395 kilos of ginned cotton. In the United States, the yield is about 291 kilos, but requires only 225 man hours per hectare, or 291 man hours, when irrigation is used in the cotton fields.

Sugar cane. It has already been remarked that irrigation is used in the cultivation of Mexico's sugar cane, but the crop is also planted on naturally humid soils. Considering only the amount of labour involved until the cutting down of the cane, productivity varies between 53 and 77 kilos of cane per man hour, which is less than the average in the United States sugar cane plantations, viz: 93 kilos per man hour, which can largely be accounted for by the high degree of mechanization.

The human labour necessary in the Mexican fields prior to the cutting of the cane varies between 511 to 914 man hours per hectare. Average production in the United States is 22 metric tons, but to obtain this total only 240 man hours per hectare are involved. There can be little doubt that this has been achieved by successive improvements of the methods of cultivation.

C. Summary Real productivity in the Mexican agriculture, expressed in kilos per man hour is about 3 for maize, from 7 to 9 for wheat, between 3 and 12 for rice, more or less 0.9 for ginned cotton and finally between 53 and 77 for sugar cane. This is very low because the real yield (kilos per hectare) are very low and the units of labour (man hours per hectare harvested) are generally extremely high.

To understand better how low the levels of Mexican agricultural productivity are, one must compare them with the United States equivalents. Natural causes mainly account for the differences and agriculturists in the United States have sought to strengthen the advantage gained there from such causes, though as yet this has only been achieved to a relatively small degree, by improving the methods of cultivation and especially by introducing mechanization of the tasks. The latter has been made easier by the favourable nature of that country's general topography, and by social conditions and the prevailing economic situation. Comparing United States productivity with that of Mexico, we find that it is nine times higher in the cultivation of rice, and 1.5 times greater in the production of cotton and sugar cane.

The unit of labour, that is, the amount of human labour needed for

/each

each unit of harvested area, varies considerably even in the production of the same crop. For instance, they may vary to the following extent: from 274 to 311 in the production of maize, 111 to 305 in the production of wheat, 156 to 1,304 in the production of rice, 448 to 630 for cotton and 511 to 914 in sugar cane. These limits are from 2 to 10 times higher than the corresponding unit of labour indices in the United States, where a tendency has always prevailed to economise human labour as much as possible.

The excessive labour needed in Mexico has a direct effect on the extent to which human labour weighs in computing the costs of production. Labour generally accounts for a larger percentage of agricultural costs but where the methods of cultivation are highly advanced technically, wages fall considerably in proportion since other factors increase the costs more than the labour factor.

Problems of productivity or of units of human labour should only be viewed in relation to the situation of each individual country or region, at a given moment, and it is naturally inadvisable to pronounce final judgment on such questions. On the other hand, it is of some use to indicate, in qualified statements, what would be the optimum condition, whether in relation to the country's interests, or in relation to those of the entrepreneurs, which do not always coincide. Long term factors are promoting productivity and the units of labour towards optimum levels, as is explained forthwith.

There are sufficient data to show that proportionately the increase of the products harvested is greater than that of the number of persons gainfully employed in agriculture. Thus, to the average per capita

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increase an annual increment of approximately 1 per cent has been added. Furthermore, it is recognised that throughout the country, the number of annual working days in agricultural production has decreased, as has the length of each working day. The total of human labour per harvested hectare has diminished, therefore, despite the introduction of certain new crops which absorb a considerable quantity of labour units. The reduction in the amount of labour utilised has occurred jointly with the exploitation of fertile lands and the introduction of improved techniques enabling the country to raise the real yields. An increase of productivity is thus obtained whilst the units of labour required tend to diminish in a measure established by other factors, some agricultural, others not. The measurement of such progress is of greater importance than its comparison with that of other countries, since this phenomenon in turn is a means of estimating the changes taking place in the purchasing power of the agricultural population.

During the 30 years prior to 1910, Mexico's population increased 53 per cent, reaching a total of 15 millions in that year. During the 30 years after 1920 the population increased 73 per cent, reaching a total of 25 million inhabitants. Moreover, the per capita requirements of goods and services are correspondingly greater and more diversified. Thus domestic demand for agricultural products has been substantially augmented and should continue to expand during the course of time. The agricultural workers, assisted by the government, have fulfilled an important task, though at certain periods they may appear to have produced an insufficient quantity of certain goods. It is to be hoped that the progress achieved will be consolidated and extended in the future.

