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MEXICAN AGRICULTURAL PRODUCTION, 1896-1953:
AN APPRAISAL OF OFFICIAL STATISTICS

By

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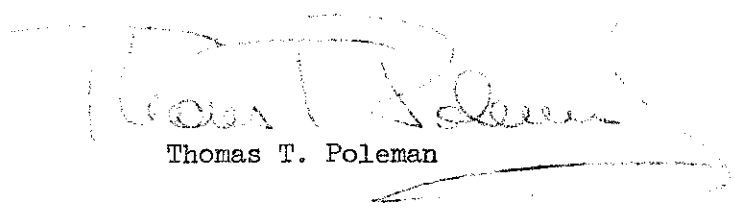
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It has long seemed to me that one reason that development studies have come to so little was that the mighty manipulators of data were manipulating mighty poor data. I have, therefore, devoted considerable effort to techniques of data analysis and improvement. Most of the specific studies have been published. An exception is the present paper on Mexico, done in the early 1950s when I was a student at the Food Research Institute.

The study is out of date now and the techniques I used then were primitive. But the conclusions have stood the test of time. The official revisions of annual data of *Economia Rural* agree rather closely with my guesstimates.

It was originally planned that Helen Farnsworth and I would prepare a journal article based on the paper. But something always got in the way. Professor Farnsworth died in 1974. And my Mexican students now are more interested in moving and shaking things than in contemplating the past.

So--better 25 years late than never.


Thomas T. Poleman

MEXICAN AGRICULTURAL PRODUCTION, 1896-1953:
AN APPRAISAL OF OFFICIAL STATISTICS

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The Mexican agrarian reform movement, which began in 1917 and continues even now, has been criticized by certain of its detractors on the grounds that it has reduced the agricultural productive capabilities of the country by breaking up large holdings and replacing them with less efficient small ejidos. In support of their argument these individuals cite the official statistical records of the Mexican government. These figures indeed show that for some crops, including corn and beans, the basic staples of the Mexican diet, production after 1925 until the most recent years has been well below the pre-revolution level. Since the population has increased rapidly since the Revolution of 1910, as Chart 1 shows, it follows, according to this argument, in spite of the recent upturn in farm production, that Mexican agriculture has not been able to provide the individual citizen with as many farm products since the agrarian upheaval as it did before.

The purpose of this paper is to examine critically the roots upon which this type of argument has grown; namely, the official crop production statistics of Mexico.

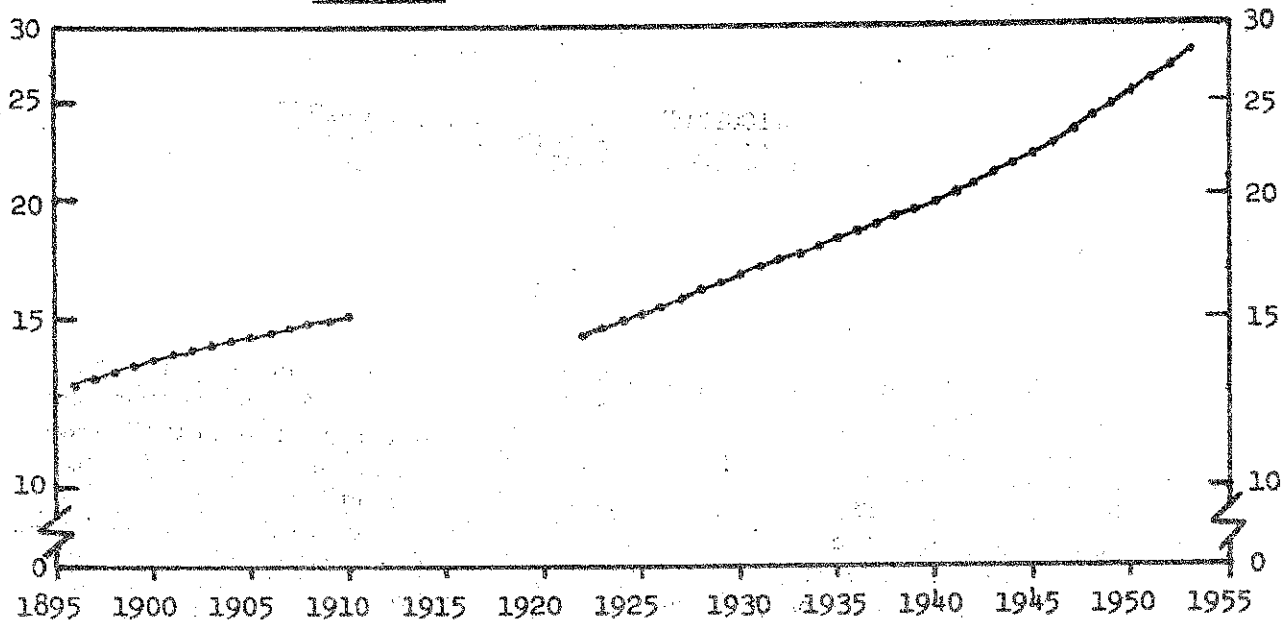
Crops Considered

As would be expected of a country so marked in its topographic and climatic contrasts, Mexico produces a variety of agricultural commodities which ranges all the way from the crops of trees thriving the humid tropics to those of the xerophytic plants of the desert. It is estimated that at least 81 different crops contribute in some measure to agricultural income (1, p. 195). To appraise critically the official production estimates for such a vast number of crops, if such statistics were available, would be a task of monumental proportions. This has not been attempted here, but rather I have confined my study to an analysis of only six crops. Such a limitation would imply at first glance that my analysis will deal with only a small segment of Mexican agriculture, but this is far from the case.

In spite of the diverse capabilities of Mexican agriculture, a relatively small number of crops completely dominate as major sources

CHART 1. MEXICO: ESTIMATED ANNUAL POPULATION, 1896-1953*

(millions; logarithmic vertical scale)



*Data in Appendix Table 1.

of agricultural income. In 1951, 70 percent of the returns to agriculture was derived from only five crops, while 38 secondary crops contributed 29 percent, and the remaining 38 minor crops together supplied but one percent (1, p. 195). The five leading crops in terms of value in 1951 were corn, cotton, wheat, sugar and coffee; and it is these crops to which the following analysis is confined. In addition, I have also considered the production of beans, because of this crop's important role in supplementing corn as the basic staple of the diet. Together these six crops contribute about three-fourths of Mexico's total agricultural income and hence trends in their production can be considered as fairly typical of the trends in total agricultural production.

Official Crop Production Estimates

Prior to the Revolution of 1910, crop statistics in Mexico were both meager and unreliable. In 1878 Emiliano Busto estimated production of the leading farm commodities, but in view of what is now known concerning crop production, his figures are too unrealistic to warrant consideration.^{1/} In 1886 the Dirección General de Estadística, under Dr. Antonio Peñafiel, made the first significant effort to collect a complete annual series of crop estimates. The production figures published by Peñafiel were aggregates of estimates supplied by the various municipal governments, and varied considerably from year to year according to the number of municipalities reporting and the degree of incompetence of the reporting officials. It is these figures on which much of the argument put forth by the foes of the

^{1/} Busto's estimations include the following: corn, 5,309,000 metric tons; wheat, 339,000 metric tons; beans, 210,000 metric tons; sugar, 70,000 metric tons; coffee, 8,000 metric tons; cotton, 25,000 metric tons (2, p. 125).

agrarian reform is based. As will be presently shown, Peñafiel's figures for the more widely grown crops were inaccurate to the extreme; but suffice it to mention here that in general they tended to overestimate actual production.

The work of the Dirección General de Estadística was suspended at the beginning of the Revolution of 1910, and was not begun again until 1925. Between 1910 and 1925, the years of violent military conflict and consolidation of the first stable revolutionary administrations, no official crop estimates of any nature were made.

In 1925 the Dirección General de Economía Rural, the functions of which were in part to estimate agricultural production, was established as a part of the Ministry of Agriculture and Livestock. The estimates of the Dirección General de Economía Rural, in turn, were supplied to the reorganized Dirección General de Estadística and published as part of the official statistical records. As will be brought out presently, the estimates of the Dirección General de Economía Rural appear to enjoy considerably more basis in fact than those of the pre-revolution Dirección General de Estadística. However, they still show substantial area for improvement, especially with reference to crops grown primarily for domestic consumption.

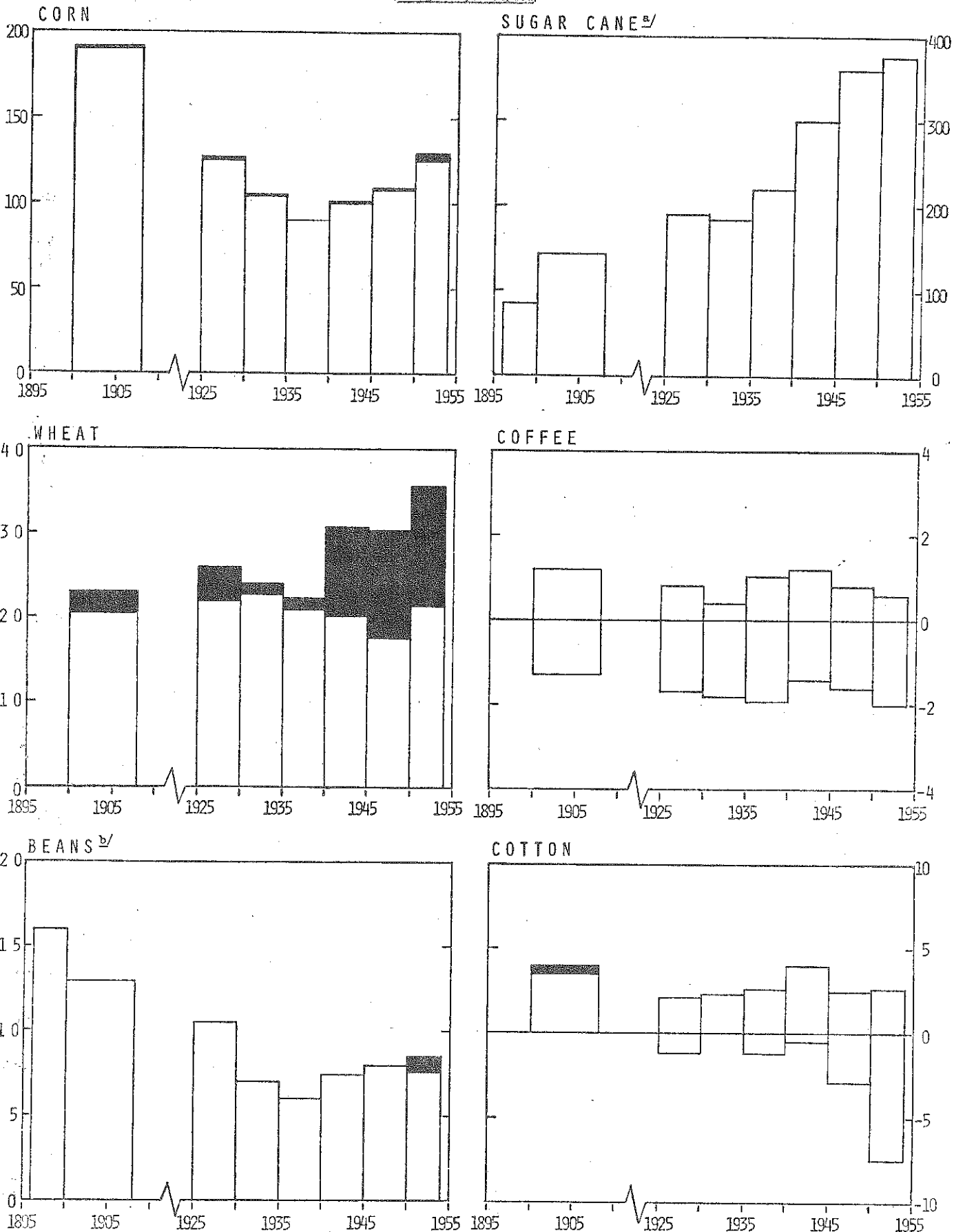
The official production estimates of Mexico's six principal crops are available to me for all of the years since 1925, but only from 1896 to 1907 for the period prior to the Revolution. These are given in full, along with annual harvested areas and yields, in Appendix Table 2 and are summarized as averages for various periods, mostly of five-years duration, in Table 1. A glance at these figures immediately makes clear the bases of the argument that the agrarian upheaval worked to the detriment of agricultural production. According to the official figures, the production of Mexico's two great food staples, corn and beans, did not recover the 1900-07 average level until 1950-53, at which time population was almost double that of the earlier period. No such post-revolution fall in production is indicated for wheat, sugar cane, coffee, and cotton, however.

Appraisal of the Official Production Estimates

In order to more closely examine the implications of the official production figures, I have converted them to a per capita basis and combined them with the official import and export figures, also on a per capita basis, to show the average supplies of the six commodities available to the average Mexican for the various average periods. The basic additional data employed in these manipulations are contained in Appendix Tables 3 and 4, and the results are presented in graphic form in Chart 2.

If one is willing to accept the official production figures at face value, one is also obliged to accept as factual certain unreasonable conclusions brought to light in Chart 2. Some of the more obvious

CHART 2. MEXICO: AVERAGE PER CAPITA PRODUCTION, NET TRADE, AND DOMESTIC SUPPLIES OF SELECTED CROPS AS CALCULATED FROM OFFICIAL ESTIMATES OF PRODUCTION AND TRADE, 1896/97-1906/07 AND 1925-1953*
(kilograms per capita)



*Data from Appendix Table 4. Unshaded areas represent average per capita production, while shaded areas represent per capita net imports. Areas of bars below the zero line represent per capita net exports, and hence areas above this line are per capita domestic supplies. No trade data are available for 1896/97-1899/1900.

a/ Production only. See note d to Appendix Table 4 for explanation of why per capita domestic supplies cannot be calculated.

b/ No trade figures are available for beans for 1896/97-1906/07, but trade in this commodity was probably of no great importance, and hence production data are taken as being entirely available for domestic utilization.

TABLE 1. MEXICO: OFFICIAL ESTIMATES OF THE PRODUCTION OF
SELECTED CROPS, AVERAGES FOR VARIOUS YEARS,
1896/97-1906/07 AND 1925-1953*

(metric tons)

Period ^{a/}	Corn	Wheat	Beans	Sugar Cane	Coffee	Cotton
1896/97- 1899/1900	2,616,787	278,975	222,168	1,109,615	24,612	30,886
1900/01- 1906/07	2,697,797	290,142	185,487	2,033,545	35,414	54,309
1925-1929	1,960,711	348,192	169,621	3,000,768	39,741	54,813
1930-1934	1,827,250	390,914	123,000	3,188,712	38,095	42,181
1935-1939	1,715,179	388,764	116,992	4,131,795	55,467	72,483
1940-1944	2,059,006	425,212	156,579	6,212,417	53,516	94,329
1945-1949	2,557,797	417,891	187,995	8,468,257	55,640	122,402
1950-1953	3,366,966	590,009	249,147	10,415,209	73,048	271,453

* Official estimates of the Dirección General de Estadística. Data from Appendix Table 2.

a/ From 1896 to 1907 years are July-June fiscal years; calendar years for 1925 to 1953.

of these are the following: (1) In spite of the higher national income during the 25 years following 1925 and with corn production per capita at roughly half the pre-1910 level, less corn per capita was imported annually between 1925 and 1950 than prior to the Revolution. (2) Again in the case of beans, per capita supplies were approximately double the post-1925 level prior to the Revolution, and yet trade both before and after the Revolution was insignificant. (3) Since 1925 Mexico has been a substantial net exporter of cotton and has annually consumed domestically but about 2.5 kilograms of cotton fiber per capita; yet prior to the Revolution, when incomes were lower, the country not only consumed the average domestic production of almost 4 kilograms per capita, but also imported an average of .6 kilograms per capita. The questionable validity of such conclusions clearly implies that something is wrong with the official statistics.

In addition to these considerations, the official figures, especially for the years prior to 1910, show such violent fluctuations from year to year for both harvested areas and yields as to cast considerable doubt on their feasibility. Such fluctuations include the harvested areas of sugar cane reported for the years between 1897/98 and 1899/1900. In

the first of these years cane was harvested on 24,600 hectares, while on only 700 hectares in the following year, and on an amazing 98,800 hectares in the last year mentioned. Similar fluctuations are also noted in the corn statistics. For instance, the harvested area was estimated in the neighborhood of 4 million hectares for all the years prior to 1906/07, but suddenly in that year the figures indicate corn was harvested on almost nine million hectares. Many other such unexplained fluctuations are contained in the official production estimates given in Appendix Table 2.

The unrealistic nature of some of the conclusions which must be accepted with the official crop estimates and the unexplainable year to year fluctuations in these figures indicate without a doubt that at least some of the official data are grossly inaccurate. On this fact all competent observers, both Mexican and foreign, are in agreement. Thus the arguments of the critics of the agrarian reform would appear to be based on very insecure grounds indeed. But in order to determine just how far these statistics deviate from the facts, and thus the degree of validity enjoyed by the argument under consideration, a revised set of production estimates must be constructed.

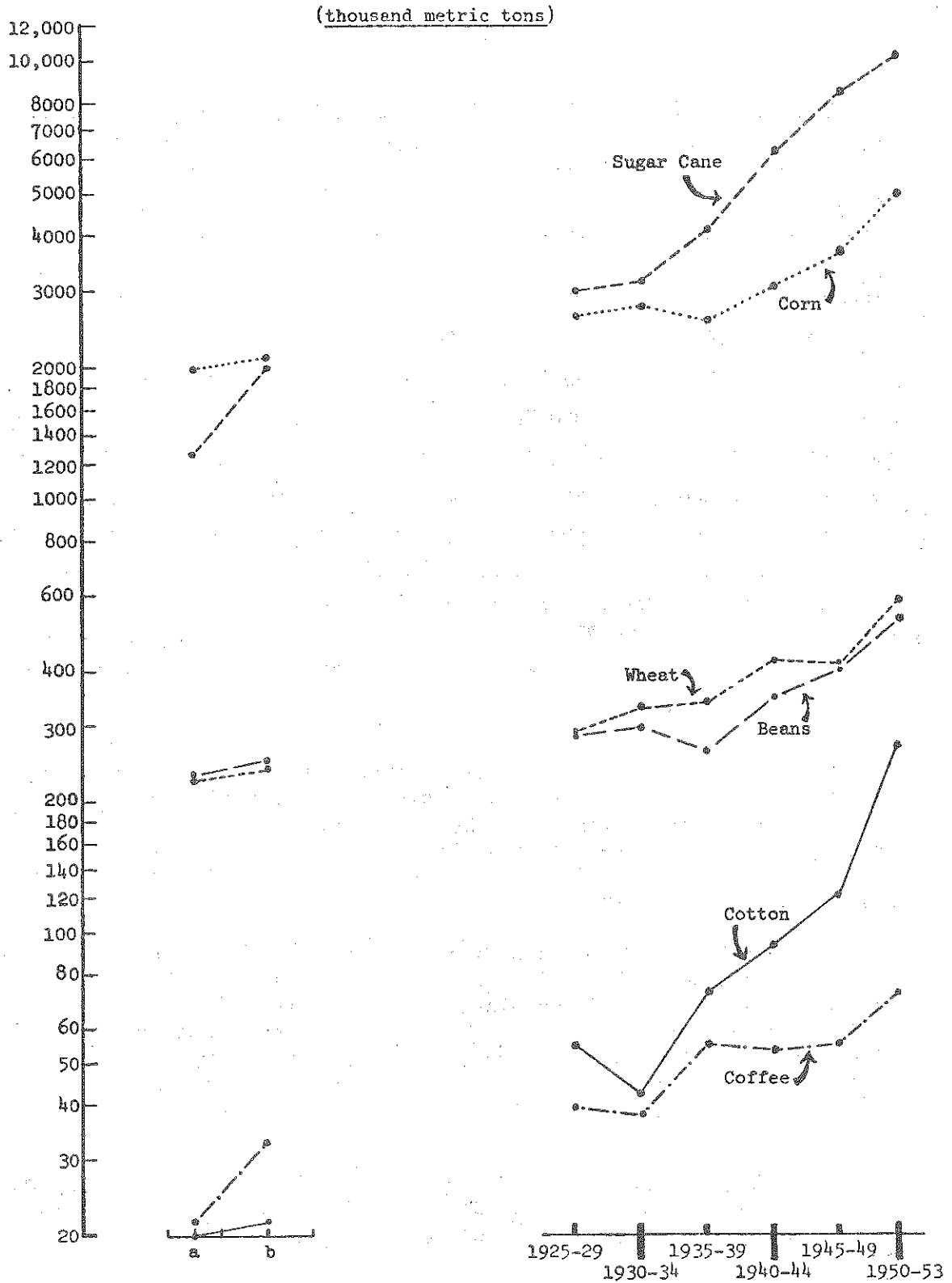
Revised Crop Production Estimates

I have put forth my revised production estimates for the six crops in detail in Appendix Table 5 and summarized these in Table 2. The sources and methods employed in obtaining this revised series are too complex for presentation here, but instead are discussed in some detail in the note to Appendix Table 5. Suffice it to say here that my revisions for one reason or another consisted of substantially reducing the average pre-1910 estimates and increasing the post-1925 figures for corn, increasing bean production data for both before and after the Revolution, but by different amounts, and reducing the wheat estimates for most of both periods. With a few exceptions, I did not alter the official figures for sugar cane, coffee, and cotton production.

To facilitate analysis and discussion, my revised estimates for all six crops are presented in graphic form in Chart 3. It is clearly evident from this chart that production of none of these crops after 1925 fell below the highest average level attained during the pre-revolution period. Thus, the thesis which holds that agricultural production in Mexico since the Revolution has fallen below the pre-1910 level, because of the redistribution of land from large haciendas to small ejidos, has no basis in fact.

This does not mean, however, that the redistribution of land, with its attendant uncertainty and strife, did not temporarily cause a reduction in production. The Mexican agrarian reform, which began in 1917 with the promulgation of a new constitution and continues even now, has not been accompanied by a gradual reallocation of land, but rather

CHART 3. MEXICO: REVISED ESTIMATES OF THE PRODUCTION OF SELECTED CROPS, AVERAGES FOR VARIOUS YEARS, 1896/97-1906/07 AND 1925-1953*



*Data in Appendix Table 5.

a - 1896/97-1899/1900

b - 1900/01-1906/07

TABLE 2. MEXICO: REVISED ESTIMATES OF THE PRODUCTION OF SELECTED CROPS, AVERAGES FOR VARIOUS YEARS, 1896/97-1906/07 AND 1925-1953*

(metric tons)

Period ^{a/}	Corn	Wheat	Beans	Sugar Cane	Coffee	Cotton
1896/97- 1899/1900	1,981,800	225,000	231,210	1,290,000	21,464	20,000
1900/01- 1906/07	2,120,400	240,000	247,380	2,033,545	32,964	21,500
1925-1929	2,627,000	292,800	285,500	3,000,768	39,741	54,813
1930-1934	2,742,000	328,800	293,800	3,188,712	38,095	42,181
1935-1939	2,573,000	340,600	260,400	4,131,795	55,467	72,483
1940-1944	3,089,000	425,200	347,300	6,212,417	53,516	94,329
1945-1949	3,640,000	417,900	402,900	8,468,257	55,640	122,402
1950-1953	5,050,000	590,009	533,000	10,415,209	73,048	271,453

*See Appendix Table 5 for area and yield estimates, as well as sources of revised estimates.

a/ From 1896 to 1907 years are July-June fiscal years; calendar years for 1925 to 1953.

the formation of new ejidos has been concentrated in a few years. Over half the 35 million hectares which have been redistributed since 1917 were redistributed during the six-year administration of President Cárdenas which began in 1934 (see Appendix Table 6). As is evident in Chart 3, production of the two principal food crops, corn and beans, declined sharply during this period.^{2/}

The critics of Mexico's official agrarian policy since 1917 would be on much sounder grounds if, instead of claiming that the redistribution of land reduced in absolute terms the productive capacity of Mexican agriculture, they would hold that the new ejidos are less efficient producers than some alternate type of farming organization which could have been set up in place of the discredited hacienda system. But an appraisal of this thesis is far beyond the scope of the present paper.

^{2/} The declines during the early 1930s in the production of coffee and cotton, both grown in large measure for export, are probably more associated with the effects of the Great Depression than with the agrarian reform.

SOURCES AND METHODS USED IN OBTAINING REVISED ESTIMATES

Corn

Corn, together with beans, is the most important component of the diet of the Mexican masses, but also the most difficult for which to obtain accurate statistics; this, because so much is consumed on the farms where produced. Import figures are of no great value in determining production, since in poor years people in the more remote areas merely reduce their consumption, and only occasionally is part of the deficiency made up for the urban residents through imports (1, p. 125).

In spite of the large unknowns regarding corn production, it is clear that either the official pre-revolution estimates are too high, those of the post-revolutionary period too low, or both. This is evident from Chart 2, which shows per capita supplies calculated from official data in the pre-1910 period to be from half to two-thirds the post-1925 level. Considering the higher national purchasing power of the post-revolutionary years, such a per capita supply picture is hardly conceivable.

Moises T. de la Peña, perhaps the outstanding agricultural economist in Mexico, feels that pre-revolution production is overstated and post-revolution production is understated in the official statistics. He estimates that production during the late 1940s varied between five and six million metric tons, depending on annual rainfall (1, p. 125). This is roughly double the official estimates. De la Peña's theory that official post-1925 statistics register but half the actual production is supported by Attolini's study of corn production in the basin of the Papaloapan River, an area fairly typical of the diverse geographical regions of Mexico (2, pp. 15-16).

The Combined Working Party of the World Bank, which in 1950 made the most significant effort thus far to prepare a complete set of reliable economic data for Mexico, refused to accept the official corn production statistics, but rather used estimates prepared by the National Income Section of the Banco de Mexico's Department of Economic Studies (3, pp. 224, 227). These figures show production from 1925 to 1949 to be 46 percent above the official estimates. In arriving at these estimates the official yield data were retained, a logical choice in view of the fact that under most crop reporting systems yield estimates are generally more accurate than those for acreage, while the acreage figures were increased by 46 percent. In addition, the Banco de Mexico's experts revised the 1945-49 average yield downward by ten percent to 682 kilograms per hectare, apparently in order to make the increase in average yields between 1940 and 1953 appear more gradual.

Determining whether to accept the estimates of de la Peña or the Banco de Mexico in revising upward the official post-1925 corn production figures is not unlike deciding from which blind man to ask directions. I have followed the estimates of the Bank more closely, since

de la Peña's estimates would appear to give too high a value to per capita caloric supplies (see 4, pp. 162-3). However, to stress the fact that the choice is rather arbitrary, I have increased the official average harvested areas, and accordingly production, by 50 percent, rather than 46 percent. In addition I have lowered the average yield for 1925-29 from 644 to 575 kilograms per hectare, since the latter figure appears more reasonable in view of future yield trends.

Even when compared with my revised post-revolution production estimates, the pre-1910 figures still appear to be too high when considered on a per capita basis. Apart from this consideration, the pre-revolution estimates appear to be extremely inaccurate; for instance, the five million metric ton figure listed for 1906/07, is approximately double the estimates given for other pre-1910 years.

I estimate that per capita production in the pre-revolution period was not unlike that of the years immediately following 1925, roughly 150 kilograms per capita, or an average of about 1,981,800 metric tons in 1896/97-1899/1900 and 2,120,400 metric tons in 1900/01-1906/07. Retaining the official average yield figure of 575 kilograms per hectare for both periods, the average harvested areas would be 3,447 and 3,688 thousand hectares, respectively, for the earlier and later pre-revolution periods.

Wheat

The problems associated with the revision of the official wheat production figures are minor in comparison with those confronted in the case of corn and beans, since the authorities are in agreement that the required adjustments are slight. De la Peña feels that the statistics published by the Dirección General de Estadística are reasonably accurate for both the period prior to the Revolution and the years subsequent to 1925 (1, p. 125). Since 1925 the official crop production figures published by the Dirección General de Estadística have been supplied by the Dirección de Economía Rural of the Ministry of Agriculture and Livestock. This organization has made certain minor revisions of their earlier wheat production estimates which have not as yet been picked up by the Dirección General de Estadística in their official production series. I have followed the example of the Combined Working Party in accepting these revisions, primarily because they tend to make the increase in wheat yields over time appear more plausible.

For 1925-29, 1930-34, and 1935-39 the adjustments consisted of holding the area constant and revising the yields, and hence production, downward. For 1940-44 no adjustment was made, while for 1945-49 production was held constant and the average area was revised upward and the yield downward (3, pp. 224, 227). These revisions indicate the Dirección General de Economía Rural feels its original estimates from 1925 to 1939 overstated both yields and production, were fairly

accurate from 1940 to 1944, and overstated area and understated yields from 1945 to 1949. The inability to recognize a definite bias in any one direction serves to illustrate the presence of even official misgivings concerning crop statistics, but is of no help in revising the official estimates for other periods. In the absence of any evidence to the contrary, I am obliged to accept the 1950-53 estimates as originally published.

Having accepted a downward revision in yields, and hence production, for the 15 years prior to 1940, I am compelled to make a further downward adjustment in the pre-revolution production estimates. The reasons for this revision are clear. If such an adjustment were not made, per capita supplies would be higher in the period prior to the Revolution rather than afterward. This is unreasonable in view of the fact that national income in Mexico after the Revolution was substantially higher than before 1910, and hence more, not less of the more expensive cereal, wheat, would be consumed after 1925.

To arrive at a reasonable revision for pre-revolution wheat production, I have estimated that per capita supplies in 1900/01-1906/07 averaged three kilograms less than in 1925-29, or about 19.5 kilograms per person. Subtracting from this amount the 2.5 kilograms per capita imported, I get an approximate per capita production of 17 kilograms, or a total of 240,000 metric tons. By accepting the official average yield of 537 kilograms per hectare for this period, which appears plausible in view of the future trend in yields, I have estimated that wheat was grown on an average of 447,000 hectares.

From the trend shown in the official figures I have approximated 1896/97-1899/1900 average production at about 225,000 metric tons. In view of the subsequent trend in yields, the official figure of 568 kilograms per hectare would seem to be too high a figure for this period. Therefore I have employed the average area harvested during 1896/97, 1897/98, and 1898/99 according to official data as a means of estimating area and yield. The area for 1899/1900 appears excessive and is omitted. The average area for the three years mentioned is 443,000 hectares. By dividing this figure into my estimate of average production, I get an average yield of 508 kilograms per hectare, not an unreasonable figure.

Beans

Official bean production estimates are unreliable for the same reasons as were mentioned above with reference to corn; namely, the crop is widely grown as a basic staple of the masses, much is consumed where grown, and production deficiencies are only partially compensated for by imports.

De la Peña feels that no more than 25 to 35 percent of recent bean production is recorded in the official statistics (1, p. 126).

The Combined Working Party refused to accept the official bean production estimates from 1925 to 1949, but rather, as was the case with corn, employed estimates made by the Banco de Mexico. The Bank's figures put the average production from 1925 to 1949 at 222 percent of the official figures, except for 1930-34 and 1945-49 when the official estimates were increased to 239 and 214 percent, respectively (3, pp. 224, 227). Since the Bank's estimates agree fairly closely to the rough guides set forth by de la Peña, I have accepted their production estimates, with one exception which is discussed below, for the years mentioned and following the Bank's example, I have increased the 1950-53 official figures to 214 percent to an average of 533,000 metric tons.

The Mexican practice of listing in their official publications the production of beans grown both with corn and alone, while publishing only the area on which they are grown as a single crop complicates immeasurably the analysis and revision of acreage and yield figures since 1896/97. Clearly such a practice understates bean area and overstates yields. Unfortunately, the Banco de Mexico retained this rather irregular practice, and in revising the official figures for 1925 to 1949, they merely increased the average areas by 28 percent and the average yields by 185 percent, except for 1930-34 and 1945-49 when the increase was 203 and 176 percent, respectively. Since these revisions retain the overstatement of yields and the understatement of areas of the official figures, I am unable to accept them.

According to the 1950 Agricultural and Ejidal Censuses, the most complete surveys of Mexican agriculture thus far made, and the only ones available to me, beans are grown together with corn on approximately 20 percent of the corn land, and the beans harvested from this jointly cropped area represent roughly 40 percent of all bean production, and, I assume, area (5, pp. 425-6). In the absence of any other data I am obliged to assume these ratios were in effect during all the years considered here. This is probably not the case, but the area and yield figures estimated from such an assumption are, in my opinion, far more accurate than those calculated by the official method. Average bean areas are thus calculated by taking 20 percent of the revised average corn areas and dividing the product by 40 percent. Average yields were then calculated by dividing the Banco de Mexico's production estimates by the areas thus obtained. The resulting yields do not appear impossible, but rather show a trend of improvement which is so similar to those exhibited by the other crops as to be rather remarkable. This fact, I feel, tends to substantiate the correctness of my method of estimating area and yield.

I mentioned above that I would accept all the post-1925 production estimates of the Banco de Mexico save one. This is the 1925-29 average figure. For this period the official acreage and production figures appear to be too high when compared to the data for subsequent years. Employing the Banco de Mexico's production revisions and my acreage revisions it is the yield of 165 kilograms per hectare which

appears too high. In my estimation, a more reasonable figure is 125 kilograms per hectare. This amount multiplied by my acreage estimate gives production at 285,500 metric tons, which is more in line with subsequent trends than is the 377,500 metric ton estimate of the Banco de Mexico.

I have estimated the pre-revolution average bean areas by the same method as for the years since 1925; that is, based on corn area. Production was estimated on a per capita basis; it being assumed that per capita production prior to the Revolution averaged about the same as between 1925 and 1934, or about 17.5 kilograms per person. By this method I arrived at the figures of 231,210 and 247,380 metric tons for 1896/97-1899/1900 and 1900/01-1906/07, respectively. The average yield which equates my production and area estimates is 134 kilograms per hectare for both pre-revolution periods. Although this figure is somewhat high in view of subsequent trends, I prefer to make no further downward revisions because of the very approximate method by which it was determined.

Sugar Cane

With the exception of the data for 1896/97-1899/1900, I have accepted the official sugar cane statistics. The Combined Working Party was apparently satisfied with the accuracy of these figures for the years subsequent to 1925 and de la Peña also feels they are of reasonable accuracy (3, pp. 224, 227 and 1, p. 125). In general, the per capita figures in Chart 2 based on official estimates do not look unreasonable.

The 1896/97-1899/1900 average figures are a different matter, however. With the exception of 1896/97, either the area or yield estimates for the various years appear entirely unreasonable, and therefore the average figures cannot be accepted. Judging from the trends in subsequent years I have estimated the average yield for the period to be in the neighborhood of 43 metric tons per hectare and the harvested area at about 30,000 hectares. From these data I have estimated average production at 1,290,000 metric tons.

Coffee

I have accepted the official coffee statistics for the years following 1925. De la Peña feels the official data are of reasonable accuracy and the Combined Working Party also seemed satisfied with the validity of the post-1925 estimates (1, p. 125 and 3, pp. 224, 227).

The official data when converted to a per capita basis do not appear unreasonable for the two average pre-revolution periods. However, for several years in these periods the annual areas harvested seem to fluctuate to an extent not likely for a tree crop. Therefore I have omitted these years, 1897/98, 1898/99, and 1906/07, from my averages. The revised average estimates are somewhat lower, and perhaps therefore appear creditable from the point of view of domestic supplies.

Cotton

I have accepted the official cotton figures for the years after 1925. The Combined Working Party felt these were sound enough to warrant publication without revision (3, pp. 224, 227). De la Peña feels the entire official series is of "reasonable accuracy up to a certain point" (1, p. 125). Judging from the per capita figures in Chart 2, I take this point to be prior to the Revolution. The pre-revolution per capita supplies shown in Chart 2 appear to be far too large, which would indicate that production is grossly overestimated. The fact that Mexico was a net importer of cotton during this period, while since the Revolution it has been a substantial net exporter, also substantiates the conclusion that pre-revolution production is overstated in the official series.

With the exception of the years of the Second World War, when the Mexican cotton textile industry enjoyed a boom of unprecedented proportions (6), per capita supplies of cotton since the Revolution seem to have fluctuated but little from the level of 2.5 kilograms per person. Assuming this per capita supply situation to have also been approximately the case prior to the Revolution, and given the level of per capita imports, I have estimated that production averaged about 20,000 metric tons during 1896/97-1899/1900 and about 21,500 metric tons during 1900/01-1906/07. Since under most crop reporting systems yields are more likely to be accurately estimated than harvested area, and since in this instance the yields appear reasonable when compared with the post-revolution trend, I have accepted the official yield figures for these periods. By dividing my production estimates by the official yields, I arrived at estimated harvested areas of 74,000 and 77,000 hectares for 1896/97-1899/1900 and 1900/01-1906/07, respectively.

APPENDIX TABLE 1. MEXICO: ESTIMATED ANNUAL POPULATION
MOVEMENTS, 1896-1953*

(thousands)

Years	Estimated Population ^{a/}	Annual Increase in Percent	Years	Estimated Population ^{a/}	Annual Increase in Percent
1896	12,822	-	1930	16,588	1.80
1897	13,014	1.50	1931	16,876	1.73
1898	13,209	1.50	1932	17,170	1.74
1899	13,406	1.50	1933	17,470	1.75
			1934	17,776	1.75
1900	13,607	1.50	1935	18,089	1.76
1901	13,755	1.09	1936	18,410	1.77
1902	13,905	1.09	1937	18,737	1.78
1903	14,056	1.09	1938	19,071	1.78
1904	14,208	1.09	1939	19,413	1.79
1905	14,363	1.09			
1906	14,519	1.09	1940	19,763	1.80
1907	14,677	1.09	1941	20,208	2.25
1908	14,836	1.09	1942	20,657	2.25
1909	14,997	1.09	1943	21,165	2.46
			1944	21,674	2.41
1910	15,160	1.09	1945	22,233	2.56
			1946	22,779	2.45
1911-21	... ^{b/}	... ^{b/}	1947	23,440	2.90
			1948	24,128	2.94
1922	14,444	-	1949	24,825	2.89
1923	14,693	1.72			
1924	14,945	1.72	1950	25,677	3.43
1925	15,204	1.73	1951	26,458	3.04
1926	15,468	1.74	1952	27,262	3.04
1927	15,738	1.75	1953	28,106	3.10
1928	16,012	1.74			
1929	16,296	1.77			

*Official estimates of the Dirección General de Estadística. Data for 1896 to 1950 from International Bank for Reconstruction and Development, The Economic Development of Mexico (Baltimore, 1953), p. 180; for 1951 to 1953 data are computed from monthly increments published in the Dirección General de Estadística's monthly, Revista de Estadística, as statistical series 61-27.

^{a/} For years 1896 to 1910 estimates are as of October 27; from 1922 to 1953 they are as of June 30.

^{b/} No data available.

APPENDIX TABLE 3. MEXICO: NET TRADE IN SELECTED AGRICULTURAL COMMODITIES, 1900/01-1906/07 AND 1925-1953*

(metric tons; + = net exports; - = net imports)

Year ^{a/}	Corn	Wheat ^{b/}	Beans	Sugar ^{c/}	Coffee	Cotton ^{d/}
1900/01	- 30,027	- 3,558	...e/	- 616	+15,382	- 9,442
1901/02	- 24,868	- 32,550	...e/	+ 595	+22,203	- 6,132
1902/03	- 3,610	- 42,180	...e/	+ 7,130	+18,977	- 16,920
1903/04	- 12,600	- 27,298	...e/	+ 15,026	+18,461	- 14,240
1904/05	- 12,096	- 5,279	...e/	+ 30,003	+18,985	- 18,429
1905/06	- 36,942	- 75,275	...e/	+ 1,962	+19,258	- 6,325
1906/07	- 52,823	- 62,692	...e/	+ 3,478	+14,160	+ 10,638
Average 1900-07	- 24,709	- 35,547	...e/	+ 9,368	+18,346	- 8,693
1925	- 66,235	- 43,758	+ 7,071	...e/	+23,782	+ 11,818
1926	-109,238	- 84,795	- 1,415	...e/	+21,176	+ 28,060
1927	- 28,421	- 37,706	+ 4,122	+ 3,273	+25,992	+ 25,518
1928	- 9,988	- 47,437	+ 9,405	- 316	+31,608	+ 25,442
1929	- 7,898	- 96,107	+ 8,753	- 1,923	+29,875	+ 16,477
Average 1925-29	- 44,356	- 61,961	+ 5,587	+ 2,758	+26,487	+ 21,463
1930	- 79,314	- 69,527	- 3,219	- 562	+30,683	+ 2,974
1931	-18,731	- 30,091	- 8,307	+ 26,719	+27,306	+ 11,003
1932	- 33	- 67	- 86	+ 18,925	+20,018	+ 3,879
1933	- 117	- 1,648	+ 5,550	+ 86,741	+41,255	- 6,828
1934	+ 71,063	- 220	+12,170	...e/	+37,812	+ 3,398
Average 1930-34	- 5,426	- 20,311	+ 1,222	+ 24,294	+31,415	+ 2,885
1935	+ 80,996	- 46	+ 5,390	- 284	+31,707	+ 26,581
1936	+ 4,443	- 93	+ 909	- 435	+42,827	+ 51,977
1937	- 3,661	- 4,931	+ 1,362	+ 61	+35,051	+ 9,056
1938	- 22,062	- 89,684	- 282	+ 569	+39,117	+ 21,727
1939	- 53,897	- 51,085	- 3,659	+ 5,504	+35,058	+ 6,730
Average 1935-39	+ 1,164	- 29,168	+ 744	+ 1,083	+35,952	+ 23,214
1940	- 8,271	- 1,304	+ 785	+ 8	+25,716	+ 5,063
1941	- 24	-121,775	+ 6,742	- 51,399	+27,809	+ 12,086
1942	- 437	-114,554	+11,925	+ 613	+21,752	- 412
1943	- 32,040	-288,522	+ 5,385	- 12,452	+34,354	+ 5,002
1944	-162,824	-504,298	+ 3,331	- 36,985	+35,664	+ 29,203
Average 1940-44	- 40,719	-206,091	+ 5,634	- 20,043	+29,059	+ 10,188
1945	- 48,586	-327,200	+ 23	- 92,556	+35,652	+ 8,203
1946	- 9,745	-316,366	+ 8	-111,196	+33,233	+ 47,514
1947	- 695	-306,157	- 2,042	+ 2,206	+32,253	+ 88,099
1948	- 305	-275,836	+ 10	+115,991	+31,291	+ 48,550
1949	+ 14,600	-253,000	--	+138,400	+49,000	+122,200
Average 1945-49	- 8,946	-295,711	- 400	+ 18,569	+36,286	+ 62,913
1950	- 300	-425,300	+ 800	+ 21,200	+46,000	+162,400
1951	-118,000	-364,400	- 7,505	--	+51,500	+177,800
1952	- 24,400	-443,800	-58,273	+ 8,100	+52,300	+228,600
1953	-372,600	-242,000	...e/	+ 56,000	+73,400	+234,300
Average 1950-53	-128,825	-368,875	-21,659	+ 21,325	+55,800	+200,775

* Official estimates of the Dirección General de Estadística (D.G.E.), from both official sources and unofficial publications citing official references. Sources by year, are as follows:

- 1900-1907: With the exception of sugar for the entire period and corn, wheat, and coffee for 1900/01, data from Mexico, D.G.E., Anuario Estadístico de los Estados Unidos Mexicanos--1941 (1943); corn, p. 883; wheat, p. 833; coffee, p. 835; cotton, p. 682. Other data from E. N. Simpson, The Ejido (Chapel Hill, 1937): corn, p. 679; wheat, p. 679; sugar, p. 682; coffee, p. 681.
- 1925-1939: With the exception of sugar, all data from various issues of Mexico, D.G.E., Revista de Estadística: corn, issue for Nov. 1942, p. 883; wheat, issue for Oct. 1942, p. 803; beans, issue for Oct. 1942, p. 804; coffee, issue for Aug. 1942, p. 645; cotton, issue for Aug. 1942, p. 646. Data for 1927-1933 for sugar from Simpson, The Ejido, p. 682. Sugar data for 1935-1939 and averages for 1925-29 and 1930-34 from Sept. 1941 issue of Revista de Estadística, pp. 488-9.
- 1940-1948: All data from Banco Nacional de Comercio Exterior, S.A., Comercio Exterior de México 1940-1948 (Mexico, D.F., 1949): corn and wheat, pp. 153, 304; beans and sugar, pp. 151, 305; coffee, pp. 151, 304; cotton, pp. 158, 340.
- 1949-1950: All data from Food and Agriculture Organization of the United Nations (FAO), Yearbook of Food and Agricultural Statistics--1952, part 2 (1953): corn, p. 46; wheat, p. 31; beans, p. 68, sugar, p. 60; coffee, p. 141; cotton, p. 168.
- 1951-1953: With the exception of beans, data from FAO, Yearbook of Food and Agricultural Statistics--1954, part 2 (1955): corn, p. 78; wheat, p. 62; sugar, p. 92; coffee, p. 177; cotton, p. 204. For beans data from Mexico, D.G.E., Anuario Estadístico del Comercio Exterior de los Estados Unidos Mexicanos--1952 (1953), pp. 28, 353.

a/ From 1896 to 1907 years are July-June fiscal years; calendar years for 1925 to 1953.

b/ Includes flour trade in wheat equivalent. c/ Includes both raw and refined sugar.

d/ Trade in cotton fiber only. e/ No data available.

APPENDIX TABLE 4. ABSOLUTE AND PER CAPITA SUPPLIES OF SELECTED CROPS ACCORDING TO OFFICIAL ESTIMATES OF PRODUCTION AND TRADE, AVERAGES FOR VARIOUS YEARS, 1896/97-1906/07 AND 1925-1953*

Period ^{b/}	C O R N			W H E A T			B E A N S			S U G A R			C O F F E E			C O T T O N		
	Production	Net Trade ^{a/}	Domestic Supplies	Pro-duction	Net Trade ^{a/}	Domestic Supplies	Pro-duction	Net Trade ^{a/}	Domestic Supplies	Production	Net Trade ^{a/}	Domestic Supplies	Pro-duction	Net Trade ^{a/}	Domestic Supplies	Pro-duction	Net Trade ^{a/}	Domestic Supplies
1896/97-1899/1900	2,616,787	...	...	278,975	...	...	222,168	...	...	1,109,615	...	...	24,612	...	...	30,886	...	...
1900/01-1906/07	2,697,797	24,709	2,722,506	290,142	35,547	325,689	185,487	...	...	2,033,545	(9,368)	17,068	35,414	(18,346)	17,068	54,309	8,693	63,002
1925-29	1,960,711	44,356	2,005,067	348,192	61,961	410,153	169,621	(5,587)	164,034	3,000,768	(2,758)	13,254	39,741	(26,487)	13,254	54,813	(21,463)	33,350
1930-34	1,827,250	5,426	1,832,676	390,914	20,311	411,225	123,000	(1,222)	121,778	3,188,712	(24,294)	6,680	38,095	(31,415)	6,680	42,181	(2,885)	39,296
1935-39	1,715,179	(1,164)	1,714,015	388,764	29,168	417,932	116,992	(744)	116,218	4,131,795	(1,083)	19,515	55,467	(35,952)	19,515	72,483	(23,214)	49,269
1940-44	2,059,006	40,719	2,099,725	425,212	206,091	631,303	156,579	(5,634)	150,945	6,212,417	20,043	24,457	53,516	(29,059)	24,457	94,329	(10,188)	84,141
1945-49	2,557,797	8,946	2,566,743	417,891	295,711	713,602	187,995	400	188,395	8,468,257	(18,569)	19,354	55,640	(36,286)	19,354	122,402	(62,913)	59,489
1950-53	3,366,966	128,825	3,495,791	590,009	368,875	958,884	249,147	21,659	270,806	10,415,209	(21,325)	17,248	73,048	(55,800)	17,248	271,453	(200,775)	70,678
PER CAPITA SUPPLIES ^{f/} (kilograms per capita)																		
1896/97-1899/1900	198.1	...	...	21.1	...	...	16.8	...	...	84.0	...	...	1.86	...	...	2.34	...	...
1900/01-1906/07	190.8	1.8	192.6	20.5	2.5	23.0	13.1	...	...	143.8	(.66)	1.20	2.50	(1.30)	1.20	3.84	.61	4.45
1925-29	124.5	2.8	127.3	22.1	3.9	26.0	10.8	(.35)	10.45	190.6	(.18)	.84	2.52	(1.68)	.84	3.48	(1.36)	2.12
1930-34	106.4	.3	106.7	22.8	1.2	24.0	7.2	(.07)	7.13	185.6	(1.41)	.39	2.22	(1.83)	.39	2.46	(.16)	2.30
1935-39	91.5	(.06)	90.9	20.7	1.6	22.3	6.2	(.04)	6.16	220.4	(.06)	1.04	2.96	(1.92)	1.04	3.87	(1.24)	2.63
1940-44	99.5	2.0	101.5	20.5	10.0	30.5	7.6	(.27)	7.33	300.2	.97	1.19	2.59	(1.40)	1.19	4.56	(.49)	4.07
1945-49	108.9	.4	109.3	17.8	12.6	30.4	8.0	.02	7.98	360.6	(.79)	.83	2.37	(1.54)	.83	5.21	(2.68)	2.53
1950-53	125.3	4.8	130.1	22.0	13.7	35.7	9.3	.80	8.50	387.5	(.79)	.64	2.72	(2.08)	.64	10.10	(7.47)	2.63

*Based on data of the Dirección General de Estadística as presented in Appendix Tables 2 and 3.

^{a/} In parentheses, net exports.

^{b/} From 1896 to 1907 years are July-June fiscal years; calendar years for 1925 to 1953.

^{c/} Includes flour trade in wheat equivalent.

^{d/} Trade figures are for raw and refined sugar only. Since these are not the only products of sugar cane entering trade, but rather are the only ones for which a statistical series is available, it is impossible to estimate domestic supplies knowing only trade in sugar. Nevertheless, it is useful to include sugar trade statistics in the Table as they at least give some impression of the net direction of trade in sugar cane derivatives.

^{e/} Trade in cotton fiber only.

^{f/} Average per capita supplies calculated from average absolute supply figures and average population estimations, found from Appendix Table 1. Average population figures used for the various periods are as follows: 1896-1900, 13,212,000; 1900-1907, 14,136,000; 1925-1929, 15,744,000; 1930-1934, 17,176,000; 1935-1939, 18,744,000; 1940-1944, 20,693,000; 1945-1949, 23,481,000; and 1950-1953, 26,876,000.

^{g/} No data available.

^{h/} No data available for domestic supplies of sugar cane.

APPENDIX TABLE 5. MEXICO: REVISED ESTIMATES OF PRODUCTION, AREA, AND YIELD OF
SELECTED CROPS, AVERAGES FOR VARIOUS YEARS, 1896/97-1906/07 AND 1925-1953*

(metric tons, thousand hectares, kilograms per hectare; except as otherwise indicated)

Period ^{a/}	C O R N			W H E A T		
	Production	Area ^{b,c/}	Yield	Production	Area ^{b/}	Yield
1896/97-1899/1900	1,981,800	3,447	575	225,000	443	508
1900/01-1906/07	2,120,400	3,688	575	240,000	447	537
1925-29	2,627,000	4,569	575	292,800	510	574
1930-34	2,742,000	4,760	576	328,800	503	654
1935-39	2,573,000	4,554	565	340,600	505	674
1940-44	3,089,000	5,140	601	425,200	564	754
1945-49	3,640,000	5,337	682	417,900	519	805
1950-53	5,050,000	6,706	753	590,009	642	919

	B E A N S			S U G A R C A N E		
	Production	Area ^{b,d/}	Yield	Production	Area ^{b/}	Yield
						(metric tons per hectare)
1896/97-1899/1900	231,210	1,724	134	1,290,000	30.0	43.0
1900/01-1906/07	247,380	1,844	134	2,033,545	43.1	47.2
1925-29	285,500	2,284	125	3,000,768	67.4	44.5
1930-34	293,800	2,380	123	3,188,712	71.7	44.4
1935-39	260,400	2,277	114	4,131,795	87.1	47.4
1940-44	347,300	2,570	135	6,212,417	123.9	50.1
1945-49	402,900	2,668	151	8,468,257	164.2	51.6
1950-53	533,000	3,353	159	10,415,209	203.5	51.2

	C O F F E E			C O T T O N		
	Production	Area ^{b/}	Yield	Production	Area ^{b/}	Yield
1896/97-1899/1900	21,464	48.6	441	20,000	74	271
1900/01-1906/07	32,964	74.1	445	21,500	77	278
1925-29	39,741	86.7	458	54,813	191	287
1930-34	38,095	87.1	437	42,181	141	299
1935-39	55,467	115.6	480	72,483	273	266
1940-44	53,516	126.8	422	94,329	346	273
1945-49	55,640	137.2	406	122,402	396	309
1950-53	73,048	177.8	411	271,453	795	341

*Sources and methods used in obtaining revised estimates are discussed in the text in considerable detail for each crop. References cited are:

1 Moises T. de la Peña, "Problemas Demograficos y Agrarios," Problemas Agricolas e Industriales de México, Vol. II, Nos. 3-4, July-September and October-December 1950.

2 Jose Attolini, Economía de la Cuenca del Papaloapan, Vol. I (Mexico, D.F., 1949).

3 The International Bank for Reconstruction and Development, The Combined Mexican Working Party, The Economic Development of Mexico (Baltimore, 1953).

4 Kathryn H. Wylie, "Food Consumption in Mexico," Foreign Agriculture, August 1955.

5 Mexico, Dirección General de Estadística, Anuario Estadístico de los Estados Unidos Mexicanos--1953 (1954).

6 Sanford Mosk, Industrial Revolution in Mexico (Berkeley, 1950).

a/ From 1896 to 1907 years are July-June fiscal years; calendar years for 1925 to 1953.

b/ Harvested area. c/ Includes area on which corn and beans are harvested together.

d/ Includes area on which beans are grown as a single crop and also together with corn.

APPENDIX TABLE 6. MEXICO: LAND DISTRIBUTED AS EJIDOS BY
THE VARIOUS ADMINISTRATIONS, 1917-1952*

Administration	Period Covered	Number of Hectares Distributed	Ejidatarios Affected
Carranza	1917-1920	132,639	39,373
De la Huerta	1920	33,695	6,330
Obregon	1920-1924	971,627	128,907
Calles	1924-1928	3,088,071	295,477
Portes Gil	1928-1930	1,173,118	126,525
Ortiz Rubio	1930-1932	1,468,745	113,520
Rodriguez	1932-1934	798,982	67,810
Cardenas	1934-1940	17,889,791	810,473
Camacho	1940-1946	5,518,470	152,220
Aleman	1946-1952	3,985,842	84,547
TOTAL		35,060,980	1,825,182

*Official data of the Departamento Agrario, given to the author by Mr. Paul Nathan.